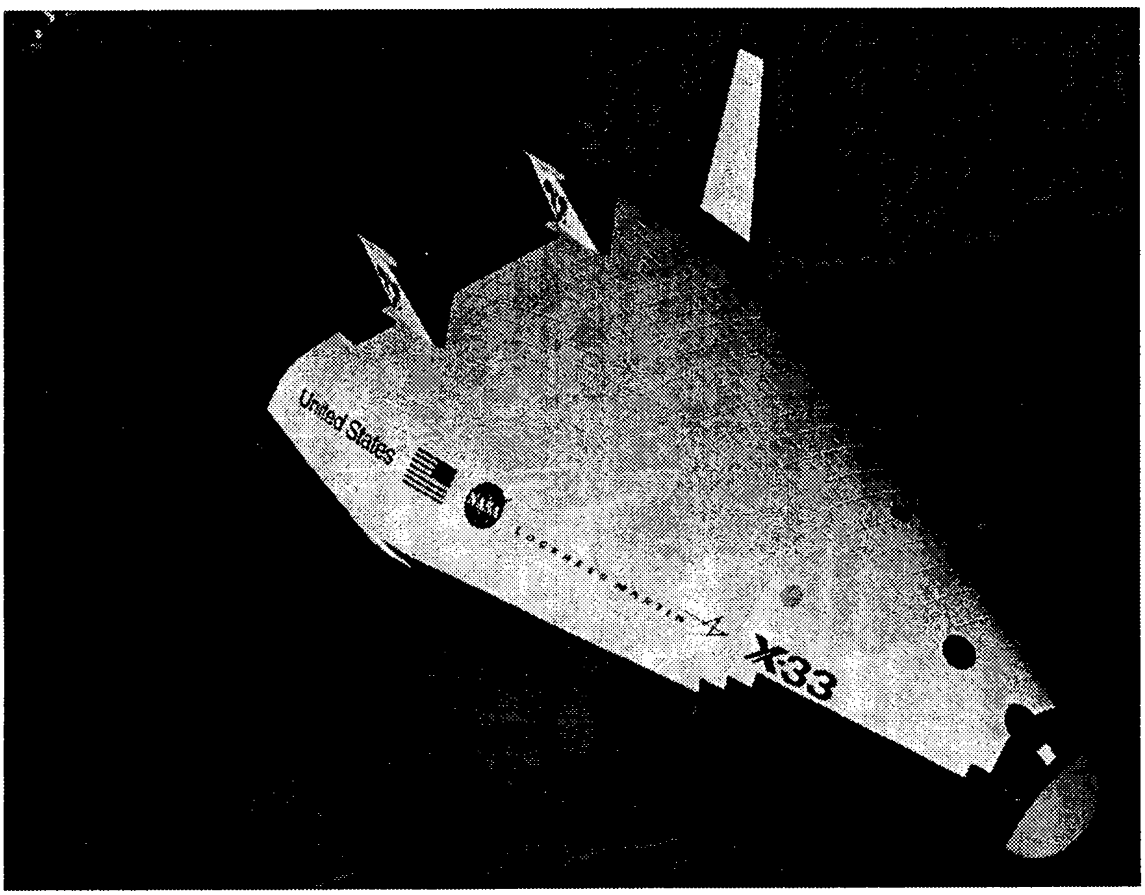
National Aeronautics and
Space Administration

X-33 Advanced Technology Demonstrator Vehicle Program

FINAL ENVIRONMENTAL IMPACT STATEMENT
Volume II



Prepared by:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

George C. Marshall Space Flight Center
Environmental Engineering and Management Office
Marshall Space Flight Center, AL 35812

and

John F. Kennedy Space Center
Environmental Program Office
Kennedy Space Center, FL 32899

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HISTORY OF THE X-PLANE PROGRAM

APPENDIX A

HISTORY OF THE X-PLANE PROGRAM

The U.S. X-Plane Program has evolved from being the first rocket-powered airplane to break the sound barrier (the X-1 on October 14, 1947) and included over 30 different major research designs, although not all were developed into flying prototypes (Hallion 1984, Miller 1988, DFRC/EAFB 1994-A/B, and DFRC/EAFB 1995). As the program progressed, other non-rocket-powered experimental aircraft were built and tested. These aircraft included: a range of vertical takeoff and horizontal landing vehicles; smaller, propeller-driven reconnaissance vehicles; and a series of unmanned missile testbeds of both single and multistage designs. Although the program grew to include conventional propeller-driven aircraft, all designs had in common the aspect of being highly valuable research tools for advancement of aerodynamics and astronautics.

Accomplishments of the X-Plane family have been many. The program included: (1) the first aircraft to break the sound barrier; (2) the first aircraft to use a variable-sweep-wing in flight; (3) the first to fly at altitudes in excess of 30,000, 60,000, and 90,000 m (100,000, 200,000 and 300,000 ft); (4) the first to use exotic alloy metals for primary structure; (5) the first to test gimbaled jet and rocket engines; (6) the first to use jet-thrust for launch and landing; (7) the first to fly three, four, five, and six times the speed of sound; (8) the first to test boundary-layer-airflow control theories over an entire wing at transonic speeds; (9) the first to successfully complete a 180 degree turn using a post-stall maneuver; and (10) the first missile to reach an intercontinental flight range.

The majority of testing for the X-Plane family has occurred at Edwards Air Force Base (formerly known as Muroc Army Airfield). Hosts within Edwards include the Air Force Flight Test Center and Dryden Flight Research Center. Other sites which have served as X-Plane testing sites include: Langley Research Center and Ames Research Center; various Government owned ships; White Sands Missile Range, New Mexico; Wright-Patterson Air Force Base, Ohio; Cape Canaveral Air Station, Florida; Pinecastle Air Force Base, Florida; Buffalo, New York; and the National Aviation Facilities Experimental Center in Atlantic City, New Jersey. Edwards has seen more X-Plane programs and test flights than any other similar facility in the U.S.

As with every research program testing prototype equipment, the X-Plane Program has not been without technical glitches and equipment failures. Since the beginning of the program's manned flight operations in 1946, approximately 15 major accidents and 4 fatalities (pilots) have been associated with manned vehicle tests. Three of these fatalities were from the X-2 Program, flown between 1952 and 1956, and the remaining fatality happened in 1967 during an X-15 research flight. Stringent range safety controls have resulted in no civilian property damage losses or fatalities being reported as a result of any X-Plane Program accident. Given the overwhelming number of test flights, the small number of accidents which resulted in loss of aircraft or life can be considered a remarkable program achievement. Table A-1 provides key information about each plane tested in the X-Plane series of vehicles.

Another member of the X-Plane Program would be the X-33. As a reusable spaceplane, the X-33 continues the research line developed by various components of the X-Program, such as the X-10 which tested cruise missile components; the X-12, the Atlas B missile which tested one-and-one-half propulsion staging and obtained the first intercontinental flight distance for a U.S. missile; the X-15 which explored the problems of space and reentry at high speeds (Mach 6) and altitudes; the X-17 which explored high Mach effects on reentry vehicles; and the X-23A which was the first maneuvering lifting reentry vehicle. The X-17 was a multistage rocket design which transported various reentry vehicle configurations to very high altitudes to examine their reentry characteristics. The X-23A was launched by a modified intercontinental ballistic missile and utilized a "lifting body" design to glide back to earth. Information acquired from the X-23A was instrumental in later development of the Space Shuttle.

Table A-1. Summary of the X-Plane Program.

Model	Manufacturer	No. of Vehicles Built	Years of Operation	No. of Flights	Primary Testing Facility	Research Goals	Program Achievements	No. of Major Accidents	Causes of Accidents	No. of Fatalities	Civilian Involvement
X-1	Bell Aircraft	3	1946-51	157	Edwards AFB	Investigate flight characteristics at greater than sonic velocities. Structural, physiological phenomena within transonic speed envelope	First Mach 1+ flight; Maximum altitude of 71,902 ft	1	Defueling Explosion	0	None
X-1A	Bell Aircraft	1	1953-55	25	Edwards AFB	Continue X-1 goals at higher speeds and altitudes	Obtained speed of Mach 2.44; Maximum altitude of 90,440 ft	1	Explosion during captive flight; vehicle jettisoned	0	None
X-1B	Bell Aircraft	1	1954-58	27	Edwards AFB	Exploratory aerodynamic heating tests; experimental reaction control system	First reaction controlled flight	0	Not applicable	Not applicable	Not applicable
X-1D	Bell Aircraft	1	1951	1	Edwards AFB	Continue X-1 goals at higher speeds and altitudes	No major milestones	1	Explosion during captive flight; vehicle jettisoned	0	None
X-1E	Bell Aircraft, Stanley Aircraft (wings)	1	1955-58	26	Edwards AFB	High-speed wing performance	Mach 2.24, altitude 73,458 ft; first flight with ventral fins	0	Not applicable	Not applicable	Not applicable
X-2	Bell Aircraft	2	1952-56	20	Edwards AFB	Swept-wing performance; higher speeds and altitude than X-1	New altitude record of 126,200 ft; new speed record of Mach 2.87	2	Gasket explosion destroys first X-2; second aircraft lost to inertial coupling	3	None
X-3	Douglas Aircraft	1	1954-56	20	Edwards AFB	High speed aerodynamic phenomenon; titanium construction; take off, land under its own power	Led to understanding of inertia coupling	0	Not applicable	Not applicable	Not applicable
X-4	Northrop Aircraft	2	1950-53	82	Edwards AFB	Test tailless, semi-tailless configuration at transonic speeds	Showed tailless craft not suited for transonic flight	0	Not applicable	Not applicable	Not applicable
X-5	Bell Aircraft	2	1952-55	133	Edwards AFB	Investigate aerodynamics of variable-seep-wing design	Successful sweep-wing operation	0	Not applicable	Not applicable	Not applicable
X-6	Convair Division, General Dynamics	1 shield-test aircraft (modified B-36H)	1955-57	47	Convair Testing Facility	Test feasibility of nuclear propulsion	Program terminated before prototypes constructed	0	Not applicable	Not applicable	Not applicable
X-7A, X-7A-3, X-7B, X-Q5 (unmanned)	Lockheed Missiles	61	1951-60	130	New Mexico	Test viability of ramjet engines for anti-aircraft missiles; modified to testing of powerplants	Obtained Mach 4.31, first air-breathing full-scale research aircraft designed as Mach 3 testbed	0	Not applicable	Not applicable	Not applicable
X-8A, X-8B, X-8C, X-8D Aerobees (unmanned)	Aerojet Engineering	108 (X-8 designation) 800+ (Aerobees)	1947-56	Unknown	White Sands, Holloman AFB	Upper air research, parachute recovery system	Peak altitude of 121 miles	0	Not applicable	Not applicable	Not applicable

Table A-1. Summary of the X-Plane Program.

Model	Manufacturer	No. of Vehicles Built	Years of Operation	No. of Flights	Primary Testing Facility	Research Goals	Program Achievements	No. of Major Accidents	Causes of Accidents	No. of Fatalities	Civilian Involvement
X-9 (unmanned)	Bell Aircraft	31	1949-53	28	Holloman AFB	Test air-to-surface missiles; guidance systems, etc.	First chemical warhead test vehicle to test supersonic clusterable dispersion	9 unsuccessful flights	Servo system failures	0	Not applicable
X-10 (unmanned)	North American Aviation	13	1955-59	15	Edwards AFB	Testbed for cruise missile components	Established technology base for remote control; first Mach 2-capable target drone	3 unsuccessful flights	Communications disruption; miswiring; autopilot malfunction	0	Not applicable
X-11 (unmanned)	Convair Astronautics Division	8	1956-58	8	Cape Canaveral	Provide flight data for Atlas missile	First ICBM prototypes	0	Not applicable	Not applicable	Not applicable
X-12 (unmanned)	Convair Astronautics Division	5	1958	5	Cape Canaveral	Test 1_-propulsion-staging guidance system, nose reentry configuration	First intercontinental range mission of 6,325 miles	0	Not applicable	Not applicable	Not applicable
X-13	Ryan Aeronautical Company	2	1955-57	Unknown	Edwards AFB	Test pure-jet vertical takeoff and landing	First successful VTOL flight on jet thrust alone	0	Not applicable	Not applicable	Not applicable
X-14, X-14A, X-14B	Bell Aircraft	1	1957-81	Unknown	Moffet Field	Test VTOL technology	First VTOL aircraft using jet thrust diverter system for vertical lift	0	Not applicable	Not applicable	Not applicable
X-15, X-15A-2	North American Aviation	3	1959-68	199	X-15 High Range (Wendover, UT, to Edwards AFB)	Explore problems of space and atmospheric flight at very high speeds and altitudes	First manned hypersonic flight vehicle; altitude of 354,200 ft obtained; Mach 6.7 reached	4	Mid-flight explosions (2); loss of control (1); collapsed landing gear (1)	1	Not applicable
X-16	Bell Aircraft	Canceled	None	None	None	High-altitude, long-range reconnaissance aircraft	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
X-17 (unmanned)	Lockheed Missiles	26	1955-57	26	Holloman AFB	Explore reentry characteristics	High Mach effects on reentry vehicles	0	Not applicable	Not applicable	Not applicable
X-18	Hiller Aircraft	1	1959-61	20	Edwards AFB	Explore large VTOL vehicles	First tilt-wing usage for VTOL	0	Not applicable	Not applicable	Not applicable
X-19	Curtiss-Wright	2	1964-65	50	Caldwell; NAFEC, NJ	Test VTOL technology using radial lift	Dual-tandem tilt propeller use	1	Equipment failure	0	Not applicable
X-20	Boeing	Canceled	None	None	None	Piloted orbital flight	Provided heat materials testing	Not applicable	Not applicable	Not applicable	Not applicable
X-21A	Northrop Corporation	2	1963-64	Unknown	Edwards AFB	Test full-scale boundary control on large aircraft	Proved Laminar Flow Control viable	0	Not applicable	Not applicable	Not applicable
X-22A	Bell Aerospace	2	1966-84	501	Bell, Calspan Test Facilities	Research dual-tandem-ducted propeller configuration; research V/STOL handling using variable stability system design	Ducted fan viability, advancement of VTOL technology	1	hydraulic system failure	0	None

Table A-1. Summary of the X-Plane Program.

Model	Manufacturer	No. of Vehicles Built	Years of Operation	No. of Flights	Primary Testing Facility	Research Goals	Program Achievements	No. of Major Accidents	Causes of Accidents	No. of Fatalities	Civilian Involvement
X-23A (unmanned)	Martin Marietta	4	1966-67	3	Vandenberg AFB/Pacific Ocean	Test configurations, control systems, and ablative materials for hypersonic reentry vehicles	First maneuverable reentry vehicle	0	Not applicable	Not applicable	Not applicable
X-24A, X-24B	Martin Marietta	1	1969-75	64	Edwards AFB	Research of aerodynamics, flight characteristics of manned vehicle with FDL-7 configuration	Verified theoretical advantages of lifting body configuration for hypersonic trans-atmospheric aircraft	0	Not applicable	Not applicable	Not applicable
X-25, X-25A, X-25B	Bensen Aircraft	3	1968		Raleigh, NC	Test discretionary descent vehicle designs	Insight on pilot training	0	Not applicable	Not applicable	Not applicable
X-26A, X-26B	Schweizer Aircraft, Lockheed Missiles	6	1967-88	Unknown	Vietnam	Develop ultra-quiet surveillance aircraft	Use as training vehicle; contributions to stealth designs	3	Training exercises	0	Not applicable
X-27	Lockheed-California	Canceled	None	None	None	Advanced, lightweight fighter	None	Not applicable	Not applicable	Not applicable	Not applicable
X-28A	George Pereira, Osprey Aircraft	1	1971	Unknown	Philadelphia Naval Base, PA	Explore usefulness of small, single-place seaplane for civil police patrol in Southeast Asia	Unique contribution as home-built aircraft in X-Plane program	0	Not applicable	Not applicable	Not applicable
X-29A	Grumman Aerospace	2	1984-90	Unknown	Edwards AFB	Test forward-swept wing design, advanced composites, other aerodynamic advances	First FSW aircraft to fly supersonically in level flight	0	Not applicable	Not applicable	Not applicable
X-30	None selected	None	None	None	None	Serve as testbed for sustained hypersonic speeds within atmosphere or as space vehicles for orbital payload delivery	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
X-31A	Rockwell International, Deutsche Aerospace	2	1990-95	523	Edwards AFB	Break "stall-barrier," examine angles of attack	180 degree turn post-stall maneuver	1	Failure of the pitot – static system: erroneous total pressure data	0	None
X-33	Lockheed-Martin Skunk Works	None	None	None	None	Develop reusable single-stage-to-orbit transportation vehicle	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Keyto Acronyms:
AFB = Air Force Base
FDL-7 = Flight Dynamics Laboratory-7 (a prototype test craft of the Air Force's Flight Dynamics Laboratory, a predecessor to the X-24B).
FSW = forward swept wing
ICBM = intercontinental ballistic missile
V/STOL = vertical/short takeoff and landing
VTOL = vertical takeoff and landing

APPENDIX B

PUBLIC INVOLVEMENT

Contents

APPENDIX B - SECTION B-1

SCOPING INFORMATION

APPENDIX B-SECTION B-1
SCOPING INFORMATION

Public participation is one of the hallmarks of the National Environmental Policy Act (NEPA) and is reflected in the Council of Environmental Quality's (CEQ) NEPA regulations. According to 40 CFR 1501.7: "Federal Agencies shall make diligent efforts to involve the public in the environmental review process..." There are several clearly defined steps in public participation, scoping being one of them.

The objective of scoping was to solicit input from the potentially affected public, agencies, and Indian tribes on the range of alternatives to be evaluated in the Environmental Impact Statement (EIS).

The first step of scoping was publication of the Notice of Intent (NOI) in the Federal Register on October 7, 1996. Personnel from each proposed site and overflight state provided NASA with a mailing list of agencies, organizations, and individuals to receive the NOI. The NOI alerted the public of NASA's intent to publish an EIS and announced the dates, times, and locations of proposed scoping meetings.

The number of scoping meetings held in each state, as well as their locations, were coordinated by NASA, based upon recommendations from local authorities and each state's individual needs and policies. Originally, 10 scoping meetings were announced. NEPA coordinating agencies of the three states involved in overflight, Nevada, Idaho and Oregon, were also contacted to determine their scoping needs and policies. Written comments were solicited. During scoping NASA received requests from the states of Nevada and Idaho for additional meetings and/or advertisements. Table B-1-1 contains the final and complete listing of public scoping meetings dates, times, locations, and attendance.

In addition to public meetings, special meetings were held at the request of state and local officials. These meetings included numerous Chamber of Commerce offices, mayors, and other political officials, Indian Affairs offices, and Port Authorities. A listing of special meetings is provided in Table B-1-2. No verbal concerns were offered as a result of these meetings. All parties involved in special meetings indicated a willingness to work with the X-33 program, a desire to support the draft comment period, and requested to view the landing of the vehicle in their respective areas.

NASA placed announcements in local and state newspapers several times during the scoping process. Table B-1-3 is a listing of original advertisements placed to announce scoping meetings and solicit comments. Additional advertisements seeking input were placed in the overflight states as shown in Table B-1-4. Other advertisements included ads placed to announce the end of the public scoping comment period, as shown in Table B-1-5 and ads to announce the additional meeting in Idaho Falls, Idaho, as shown in Table B-1-6.

Public comments were encouraged by offering a variety of opportunities in which to submit comments, including written comments sent through the postal system, e-mail, and fax, as well as verbal comments recorded on an answering machine receiving calls at NASA's X-33 "800" phone number.

Public issues and concerns collected during the scoping process involved the following areas:

- public safety/risk
- hazardous materials
- exact flight path(s)
- avalanche potential from sonic booms
- sonic booms/noise impacts on wildlife and endangered/threatened species
- disruption or suspension of airport services
- diminishment or disruption of flight corridors for private aircraft
- concern over crowds of spectators in neighborhoods in proximity to landing strip
- benefit
- accessibility and visibility to launch and landing;
- impact on "Wilderness Areas"
- reliability without human on board
- avoidance of sensitive military operations
- abort scenarios and procedures
- schedule

A significant number of comments were provided that endorsed the X-33 Program.

Table B-1-1. Scoping Meeting Information.

Location	Date	Time	Attendance
Helena, Montana Social Rehabilitative Service Auditorium Sanders Avenue Helena, MT 59601 406-444-3912	October 21, 1996	7:00 p.m.	77
Great Falls, Montana Great Falls High School 1900 Second Avenue, South Great Falls, MT 59405 405-791-2167	October 22, 1996	6:00 p.m.	125
Moses Lake, Washington Washington State National Guard Armory 6500 32nd Avenue, N.E. Moses Lake, WA 98837 509-766-2551	October 24, 1996	7:00 p.m.	70
Dugway, Utah US Army Dugway Proving Grounds Dugway Post Theater Dugway, UT 84022 801-831-3708	October 28, 1996	7:00 p.m.	60
Tooele, Utah Tooele Senior Center 59 East Vine Street Tooele, UT 84074 801-882-2870	October 29, 1996	7:00 p.m.	46
Salt Lake City, Utah Quality Inn Airport 5575 West Amelia Earhart Drive Salt Lake City, UT 84116 801-537-7020	October 30, 1996	7:00 p.m.	46
Wendover, Nevada Stateline Convention Center P.O. Box 789 Wendover, NV 84083 702-664-2221	November 7, 1996	7:00 p.m.	0
Lancaster, California Best Western Antelope Valley Inn 44055 North Sierra Highway Lancaster, CA 93534 805-918-4651	November 12, 1996	7:00 p.m.	37

Table B-1-1 (Continued). Scoping Meeting Information.

Location	Date	Time	Attendance
Ridgecrest, California Carriage Inn 901 N. China Lake Blvd. Ridgecrest, CA 93555 619-446-7910	November 13, 1996	7:00 p.m.	20
Boron, California West Boron Elementary School 12300 Del Oro Boron, CA 93516 619-762-5430	November 14, 1996	7:00 p.m.	20
Barstow, California Holiday Inn 1511 East Main Street Barstow, CA 92311 619-256-5673	November 16, 1996	7:00 p.m.	16
Idaho Falls, Idaho Shilo Inn 780 Lindsay Blvd. Idaho Falls, ID 83402 208-528-2613	January 23, 1997	7:00 p.m.	11

Table B-1-2. Special Meeting Information.

Party/Location	Date	Time	Comments
Montana			
Helena Mayor Colleen McCarthy 316 North Park City and County Bldg. Helena, MT 59601 406-441-7270	October 21, 1996	5:00 p.m.	Program Briefing
Great Falls Chamber of Commerce 710 First Ave., North City and County Bldg. Great Falls, MT 59405 406-761-4434	October 22, 1996	1:00 p.m.	Program Briefing to Community Leaders.
Washington			
Port of Moses Lake Grant County Airport 7810 Andrews Street Moses Lake, WA 98837 509-762-5363	October 24, 1996	9:00 a.m.	Briefing to Port Officials
Utah			
Goshute Business Council P.O. Box 6104 Ibapah, UT 84034 801-234-1138	October 28, 1996	10:00 a.m.	Confederated Tribes of the Goshute Reservation
Idaho			
Mayor of Idaho Falls Linda Milam 308 Constitution Way Idaho Falls, ID 83402 208-529-1235	January 23, 1997	10:00 a.m.	Program Briefing to Town Officials
Kiwanis Club Quality Inn Idaho Falls, ID 83402	January 23, 1997	12:00 a.m.	Program Presentation

Table B-1-3. Original Ads for X-33 Scoping Meetings.

State/Location	Name of Paper
A. California (Week of November 4, 1996)	
Ridgecrest	Ridgecrest Daily Independent (D)
Lancaster	Antelope Valley Press (D) Daily News (Antelope Valley Edition) (D)
Boron	Mojave Desert News (W)
Barstow	Barstow Desert Dispatch (D)
Bakersfield	Bakerfield Californian (D)
Edwards Air Force Base	Desert Wings (W)
China Lake Naval Air Weapons Station	Rocketeer
B. Utah (Week of October 21, 1996)	
Tooele	Tooele Transcript-Bulletin (W)
Salt Lake City	Ogden Standard-Examiner (D) Provo Daily Herald (D) Salt Lake City Desert News (D) Salt Lake Tribune (D)
C. Nevada (Week of October 24, 1996) Wendover	Deseret News (W)
D. Montana (Week of October 14, 1996)	
Helena	Helena Independent-Record (D)
Great Falls	Great Falls Tribune (D)
Malmstrom Air Force Base	Base Newspaper
E. Washington (Week of October 17, 1996)	
Moses Lake	Columbia Basin Herald (D)

(D) = daily
(W) = weekly

Table B-1-4. Ads Seeking Input During Scoping for Overflight Areas.

State	Name of Paper
A. Idaho	
Boise (capital)	Idaho Stateman
Idaho Falls	Post Register
Lewiston (Clarkston, Washington)	Lewiston Morning Tribune
Moscow (Pullman, Washington)	Moscow Pullman Daily News
Pocatello	Idaho State Journal
Twin Falls	Twin Falls Time-News
B. Nevada	
Carson City (capital)	Nevada Appeal
Elko	Elko Daily Free Presss
Ely	Ely Daily Times
Las Vegas	Las Vegas Review Journal Las Vegas Sun
Reno	Reno Gazette-Journal
Winnemucca	The Humboldt Sun
C. Oregon	
Portland	Portland Oregonian
Ontario	Daily Argus Observer
Salem (capital)	Statesman-Journal
D. Washington	
Walla Walla	Walla Walla Union-Bulletin
Pasco, Richland, Kennewick	Tri-City Herald
NOTE: All newspaper ads published the week of December 15, 1996.	

Table B-1-5. Ads to Announce the Ending of Scoping Comment Period.

State	Name of Paper
A. California	
Ridgecrest	Ridgecrest Daily Independent (D)
Lancaster	Antelope Valley Press (D) Daily News (Antelope Valley Edition) (D)
Boron	Mojave Desert News (W) The Boron Gazette (W)
Barstow	Barstow Desert Dispatch (D)
Edwards Air Force Base	Desert Wings (W)
China Lake Naval Air Warfare Center	Rocketeer
B. Utah	
Tooele	Tooele Transcript-Bulletin (W)
Salt Lake City	Ogden Standard-Examiner (D) Provo Daily Herald (D) Salt Lake City Desert News (D) Salt Lake Tribune (D)
C. Nevada Wendover	Deseret News (W)
D. Montana	
Helena	Helena Independent-Record (D)
Great Falls	Great Falls Tribune (D)
Malmstrom Air Force Base	Base Newspaper
E. Washington	Columbia Basin Herald (D)

(D) = daily
(W) = weekly
Note: Placed all newspaper ads the week of December 15, 1996.

Table B-6. Ads to Announce the Idaho Falls Scoping Meeting.

City	Name of Paper
Blackfoot	Blackfoot News
Boise (capital)	Idaho Statesman
Idaho Falls	Post Register
Pocatello	Idaho State Journal

APPENDIX B - SECTION B-2

DRAFT EIS COMMENT PERIOD

APPENDIX B - SECTION B-2.1

Public Participation Meetings

Appendix B-Section B-2.1
Public Participation Meetings

Public participation is one of the hallmarks of NEPA and is reflected in CEQ's NEPA regulations. According to 40 CFR 1501.7, "Federal Agencies shall make diligent efforts to involve the public in the environmental review process..." There are several clearly defined options in public participation, public meetings being one of them.

The objectives of public participation meetings were to provide information to potentially affected public, agencies, and Indian tribes on the alternatives evaluated and environmental impacts discussed in the Draft EIS and to receive input.

Following scoping, the next public step of this process was publication of the Notice of Availability (NOA) of the Draft EIS in the Federal Register on July 3, 1997. The Draft EIS and Executive Summary were distributed to the mailing list shown in Section 9.0 for comment and review. Personnel from each proposed site and overflight state provided NASA with a mailing list of agencies, organizations, and individuals to receive the Draft EIS. The NOA along with numerous local advertisements alerted the public to the availability of NASA's Draft EIS and announced the dates, times, and locations of proposed meetings.

The number of meetings held in each state, as well as their locations, were coordinated by NASA, based upon recommendations from local authorities and each state's individual needs and policies. Eleven meetings were announced by advertisements placed in state and local newspapers. Table B-2-1 contains the final and complete listing of meetings dates, times, locations, and attendance. Sign-in sheets for each meeting can be viewed in chronological order in Table B-2-2.

In addition to public meetings, special meetings were held at the request of state and local officials. These meetings included political officials, Indian Tribal Officials, and Bureau of Land Management officials. A listing of special meetings is provided in Table B-2-3. No verbal concerns were offered as a result of these meetings. All parties expressed appreciation for the information provided in the Draft EIS and a desire to continue working with the X-33 Program.

NASA placed announcements in local and state newspapers to announce the public participation meetings, with their dates, times and locations, and to solicit comments to the Draft EIS. Table B-2-4 is a listing of advertisements placed to announce meetings and solicit comments.

Public comments were encouraged by offering a variety of opportunities in which to submit comments, including written comments sent through the postal system, e-mail, and fax, as well

Table B-2-1, Appendix B-Section B-2
Public Meeting Information

Location	Date	Time	Attendance
Moses Lake, Washington	7 Jul 97	7:00 P.M.	34
Washington State National Guard Armory 6500 32nd Avenue, NE Moses Lake, WA 98837 509-766-2551			
Great Falls, Montana	8 Jul 97	6:00 P.M.	53
Great Falls High School 1900 Second Ave, South Great Falls, MT 59405 406-791-2167			
Helena, Montana	9 Jult 97	7:00 P.M.	36
Social Rehabilitative Services Auditorium Sanders Avenue Helena, MT 59601 406-444-3912			
Idaho Falls, Idaho	10 Jul 97	7:00 P.M.	6
University of Idaho/Idaho State University 1776 Science Center Drive Idaho Falls, ID 83402 208-526-9637			
Dugway, Utah	14 Jul 97	7:00 P.M.	16
US Army Dugway Proving Ground Old Post Headquarters Bldg. 5450/Command Conference Room Dugway, UT 84022 801-522-5402			

Salt Lake City, Utah	15 Jul 97	6:00 P.M.	35
Salt Lake City Public Library Main Library Lecture Hall 209 East 500 South Salt Lake City, UT 84111 801-524-8200			
Tooele, Utah	16 Jul 97	7:00 P.M.	12
Tooele Senior Center 59 East Vine Street Tooele, UT 84074 801-882-2870			
Lancaster, California	21 Jul 97	7:00 P.M.	50
Lancaster High School 44701 32nd Street West Lancaster, CA 93536 805-726-7649			
Boron, California	22 Jul 97	7:00 P.M.	20
Boron High School 26831 Prospect Street Boron, CA 93516 760-762-5121			
Ridgecrest, California	23 Jul 97	7:00 P.M.	12
Burroughs High School 500 East French Street. Ridgecrest, CA 93555 760-375-4476			
Baker, California	24 Jul 97	7:00 P.M.	25
Baker Senior Citizens Center 73730 Baker Blvd. Baker, CA 92309 760-733-4402			

Table B-2-2, Appendix B-2

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 7, 1997

LOCATION: Port of Moses Lake, WA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Al Anderson	7810 Andrews St. Moses Lake WA	Port of Moses Lake
2 Lucille Pruka	1032 Laguna Moses Lake	—
3 [illegible] E. Pruka	1032 Laguna Moses Lake	
4 Douglas Aguilar	403 Dow Moses Lake WA	Embry-Riddle Aeronautical Univ
5 Karl C. Kubo	6810 Rd D.5 NE Moses Lake WA	self
6 Andy Patrick	KBSN/KDRM Radio Moses Lake WA 98837	KBSN/KDRM Radio
7 Robin Kaye	Moses Lake, wa	KWIQ
8 Kim Wareham	7257 Boulder Crest [illegible] Moses Lake	—
9 Clyde Kindred	Air America Fuels Service 7810 Andrews St. N.E.	Grant Co. International Airport
10 Libby Bruce	3520 S. Eastern Road	
11 [illegible]	1246 Lowry Moses Lake WA 98837	Air America
12 John McS[illegible]	228 Larkspur St. Moses Lake WA 98837	Big Bend Aviation
13 Larry and Jeanette Paxton	348 Rainier View Lane Moses Lake	citizen
14 [illegible] Hill		C.Y.[illegible]
15 Delone Krueger		Port of Moses Lake

AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 7, 1997

LOCATION: Moses Lake, WA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Eric Lund	3156 Lakeside Drive Moses Lake WA 98837	myself
2 RICHARD H. BEESON	P.O. BOX 1938 MOSES LAKE, WA 98837	–
3 MICHAEL JEAR	Moses Lake	Columbia Basin Herald
4 Ike Ransford	1610 Monroe St Moses Lake, Wa.	"me"
5 Katé Lyons-Holestine	Wenatchee World P.O. Box 1149 Ephrata WA 98823	Wenatchee World.
6 Donald L. Adolfson	8524 HILLCREST DR NE MOSES LAKE, WA	SELF
7 Phil Copenhaver	1240 Pershing Moses Lake WA	Self
8 Joe Bruce	3520 S. Eastern Rd Spokane WA	Self
9 John McSweely	228 Larkspur Moses Lake	Big Bend Community College Aviation Program
10 Alan White	9332 Albert Way ML 98837	Myself
11 Eileen Kruger	622 [illegible]	
12 Cindee Lee	P.O. Box 593 Odessa, WA	Self
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AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/7/97

LOCATION: Moses Lake, Washington

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	DAVID M BAILEY	7810 ANDREWS ST MOSES LAKE WA NE	Port of Moses Lake
2	George & Margaret Schiffner	4840 Westshore Dr. Moses Lake	
3	Valerie Lund	3156 Lakeside M.L.	
4	W. J. Lund	PO BOX 822 Coulee City, WA 99115	
5	~~Ed Pagenfield.~~ JEFF AIKRIDGE.	7610 Andrews St Moses Lake WA 98837	Columbia Pacific Aviation Inc.
6	BJ Bruce	S 3520 E Road	
7	Bill Gross KHQ TV	S. 4202 Regal Spokane 99223	KHQ TV Ch. 6
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AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 8, 97

LOCATION: Great Falls, MT

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 MIKE BROWN	321 1ST AVE N G FALLS	SEN CONRAD BURNS
2 TED ROBERTS	1901 11th ST SW Great Falls, MT	
3 SEAN LAVIGNE	801 11th St SW Great Falls MT	
4 Clayton Ruff	808 42A ST N Great Falls MT	
5 Patty Goodover	1906 3rd St NW Great Falls, MT.	Goodover Enterprises Inc
6 E. J. WHALEN B/G (Ret) USAF	625 PK. GDN. RD.	SELF
7 T. Collopy		G.F. Tribune
8 A. MOORE		KFBB-TV
9 Harold Strunk	3440 4th Ave S Great Falls Mt.	
10 D'Arla R. Nilson	312-6 St N #35 Great Falls, MT 59401	
11 Phyllis Wight	400-3rd Ave SW Great Falls Mt 59404	
12 Don Patton	PO Box 42 SUN RIVER MT 59483	
13 Ray Jergeson	913 3 Ave N 59401	SELF
14 Dave Honchel	341 MW/PA	Self / Malmstrom
15 DAVE MADSON	308 3RD AVE N.	SELF. RETIRED

AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 8, 97

LOCATION: Great Falls, MT

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 ROY Keller ~~Pot~~	861 4th Ave N. Apt. 105 Gt Falls	Self
2 BARRY MILLS	3126 1st Ave. So. (6th?) GREAT FALLS, MT. 59401	MYSELF
3 TED LORENZ	GT FALLS 59405	MYSELF
4 Stephen N. Kubick	1249 Park Garden Rd Great Falls, MT 59404	MYSELF
5 John T. Stevens	1017 4th ave. So. Gt. Falls, Mt.	myself
6 Keith Pitt	1012 3rd Ave NW Great Falls MT	"
7 Carl Yaroslaski	4038 5th ave no.	"
8 Jean Yaroslaski	Great Falls Mt.	"
9 Alice Leland	3420 5th Av S Great Falls	
10 Dick Larsen	P.O. BOX 1692 GREAT FALLS, MT	"
11 Larry Wioreng	2900 Stagecoach Great Falls MT 59404	"
12 Laurel Hathaway	1117 ADOBE GREAT FALLS Mt	
13 Laverne C Hedall	2225 9th Ave So Gt Falls Mt 59405	
14 Jonathan Logan	2617 2nd Ave So Gt Falls MT 59405	
15 [illegible signature]	1130 Franklin Ave Great Falls MT 59402	Malmstrom

AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 8, 97

LOCATION: Great Falls MT

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Gregory Hodson	309 3rd Ave N. GF MT 59401	self
2 Jon Davis	739 33rd Ave NE GF MT 59404	Self
3 Tracy G. Tomich	132 RIVERVIEW 5 WEST GREAT FALLS MT 59404	SELF
4 TED NEUMAN	639 US Hwy 89 VAUGHN, MT 59487	MONTANA AIR National Guard
5 TERRY PEHAN	PO BOX 1027 GREAT FALLS, MT. 59403	GREAT FALLS AREA CHAMBER OF COMMERCE
6 Gene Davidson	4013 4th Ave S. GF, MT 59405	self
7 Jeremy Davidson	4013 4th Ave So GF, MT 59405	self
8 Bob Dencing	City of GT. Falls	MAYOR
9 Bud Rooney	"	CCPB
10 Larry K. Stimac	2312 8th Ave S. Great Falls MT 59405	Self
11 ROSS WENZLICK	2925 CARMEL GREAT FALLS, MT 59404	SELF AND CH-7 PUB ACCESS TV
12 Kathy Wight	400½ Third Ave SW Great Falls, MT 59404	self
13 ROBERT MORETTI	351 - 29th ST NW GREAT FALLS MT 59402	MALMSTROM AFB
14 ANTHONY POWERS		
15		

AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 8, 97

LOCATION: Great Falls, MT

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Shirley WEaver	3810 Lower River Rd GF 59405	Self
2	Marc Schawinski	444 4th Ave. N. Apt 23 Great Falls MT. 59405	Self
3	Donald Nilson	1009 2nd Ave S Great Falls MT 59405	self
4	Nancy Lewalker	1209 - 3rd AVE NO Great Falls MT	self
5	Jim Schilling	346 Tri Hill Frontage Rd. Great Falls MT 59404	self
6	Jeff W. [illegible]	243 Washington Blvd Great Falls MT 59404	Self
7	Jeff Brakke	312 28TH Ave NW Great Falls MT 59404	Self
8	CHAD WHITMORE	521 RIVERVIEW PARK GF 59404	SELF
9	Matt Ribich	210 - 22nd ST NE GF Mont 59401	Great Falls School Dist #1
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AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/9/97

LOCATION: Helena, Montana

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
*	1 ROBERT J. MORETTI	341 CES MALMSTROM AFB MT	
*	2 Anthony R Powers	341 CS MAFB	BASE VIDEO
*	3 Tim Ney	341 CES/CEV MAFB	MAFB
	4 Cheryl Romsa	Helena	Court Reporter
	5 Brian Tweet	3116 E. Lyndale Helena	Summit Design & Mfg.
	6 TOM HOFFMAN	3116 E. LYNDALE HELENA	SUMMIT D/M.
	7 DAVE ARBENZ	1215 HAUSER HELENA	
	8 LINDA LOZANO	401 Leslie Helena	
	9 Bob Calkins	3685 Riviera Helena MT 59601	Dreams!
	10 George Larson	1417 Broadway Helena	self
	11 BETTINA ARMSTRONG	303 N. HOBACK	
	12 GRANT SASEK	Independent Record Helena Mont	Independent Record
	13 ROSS MEHLHOSE	BOX 175 CLANCY MT	
	14 Jack Mehlhose	BOX 175 CLANCY, MT.	
	15 Stephen Kluati	3116 E LYNDALE Helena	Summit Design Mfg

AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/9/97

LOCATION: Helena, Montana

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Betsy Allen	3880 Kismet Dr Helena 59602	Senator Conrad Burns
2 LINDA WAll Ohson	6824 N. Montana Helena MT 59602	
3 Nathan Calkins	3685 Riviera	
4 K. Carpenter	PO Box 1082 Helena, MT 59624	
5 Gary Blair	2130 Highland Helena MT	
6 Brian Heckenberger	118 Gem St. Helena, MT. 59601	—
7 Bennett Flage	9 GAIL ST EAST HELENA	SELF
8 [illegible]		Self.
9 Conrad Flynn	600 Tubbie Rd. Helena, MT 59602	Boy Scouts
10 ROD MACDONALD	3575 RUNNING DEER HELENA MT. 59602	SELF
11 [illegible]	50 So. Howie HELENA, MT	City Commissioner
12 [illegible]	2733 N. MT. AVE Helena MT	KTVH Ch. 12 Story air 10p.m.
13 Raymond K Read	MT NG - Dept of Mil Affairs Helena	Mont NG -
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AE01-OT Form 2 (Jun 1997)

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 6-9-97

LOCATION: Helena, Montana

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Glenn Porte	4 So. Park Av #3 Helena, MT 59601	Self
2	Chris Randall	520 Logan Helena, MT 59601	
3	GhosBADO	301 ~~Stuar~~ Blaine MISSOULA MT 59801	The future voters of America
4	Dave Drynan	3 Michael Ct Helena 59601	MT. Ins. Dept.
5	~~Mike Purcell~~	~~Helena 59601~~	
6	William Strout	~~831 Orange~~	Troop 203
7	John Flynn	600 Tubbie Rd Helena MT	Troop 203
8	[illegible]	#30215 2405 W. Montana Helena, MT	Self
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 10, 1997

LOCATION: Idaho Falls, ID

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Jason Wanlass	1915 N. Yellowstone IDaho Falls, ID	KIFI TV 8
2 William R. Nelson	887 Mirage Ct. Idaho Falls ID 83404	Self
3 Dr. Charles S. Olsen	P.O. Box 3054 Idaho Falls, ID 83403-3054	Self
4 Stan Palmer	83402 2916 W. 17 S. Idaho Falls	Self
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 10, 1997

LOCATION: Idaho Falls, ID

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 P.P. Richardson Tanya Richardson	2904 Laguna Dr. Idaho Falls, ID 83404	
2 P Snyder	11210 Bellevue Idaho Falls Id	Self
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/14/97

LOCATION: Dugway Proving Ground, Utah

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Thomas A. See	Wilson Services Box 245 c/o Dugway Utah 84022	self.
2	James A. Theiss	6067 Box Elder Ln Hill AFB UT 84056	USAF
3	Larry D. Olsen	CLEARFIELD, UTAH	
4	Jill Ringel	Orem, UT	N/A (court reporter)
5	Darren Ringel	Orem UT	Court Reporter.
6	Frank Speizer	Channing Laboratory Harvard Medical School	Self.
7	Tony Yang	1760 Fremont Dr SLC UT	KTVX
8	Ron Delgado	Bldg 4575 - USADPG Dugway UTAH	PM-S-G
9	Melanie Moore	878 E. Deer Flat Tooele, UT 84074	Dugway PAO
10	Ross Gleason	3419 Eastwood Dr. S.L.C., Ut 84109	Self
11	Patrick Gleason	3419 Eastwood Dr. S.L.C. UT, 84109	Jacor Communications KZHT 94.9 KURR Rock 99
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/14/97

LOCATION: Dugway Proving Ground, Utah

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Michael G. Vigh	78 Park Ave, Tooele, Ut 84074	Tooele Transcript Bulletin
2	Martin Crane	2255 ogden Ave ogden, UT	
3	MAJ Bernie Stansbury	636A Pinger Dr. Dugway UT 84022	Dugway Proving Ground
4	MAJ Michael M Robinson	337 West School Dugway, Utah 84022	Dugway Proving Ground Army X-33 Project office
5	Kitsy Keetch	Bldg 5122, apt 123 Dugway Utah 84022	Self
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/15/97

LOCATION: Salt Lake City, Utah

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Alex Heward	70 South Wolcott SLC UT 84102	IBM
2 Kent Tregg	Paleopia: Great Basin N.A.	US.
3 J.C. Weeks	3716 Millcrest Rd SLC UT 84109	UTAH
4 Christopher Hogan	904 W Timber Creek Way #1601 SLC, UT 84119	
5 Dan Goldberger	Box 11999 SLC, UT 84147	FNA NEWS
6 Richard Luke	4629 S. Hemlock Dr. Taylorsville, UT 84123	
7 Frank Meinser	216 W. North Temple #6C Salt Lake City UT	
8 Fox News	SLC, UT	
9 JERRY O'BRIEN	435 W ARNOCK AVE. #1 SLC, UT 84115	
10 Camille Story	3234 S 500 E SLC UT 84106	
11 Steve Erickson	961 E. 600 S. SLC UT 84102	Downwinders
12 Haim Wenger	2146 Sherman Av SLC UT 84108	[illegible]
13 Ashby Giroux	750 Bueso Ave. SLC UT, 84102	KOPE
14 Jay Dalby	4515 S. 1175 W. #2 SLC, UT 84123	
15 HAFON Wolfe-Bowling + 3	1652 Apache Way Ogden UT 84403	Ogden City

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/15/97

LOCATION: Salt Lake City, Utah

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Scott Lee	8747 Kings Hill Dr. Salt Lake City, UT 84121	
2 H L DAVIES	29 S STATE ST #717 SLC UT-84111	SELF
3 M MARTEN	~	~
4 Winter Horton	4255 Parkview Dr SLC UT 84124	Young Oak Foundation
5 Tiffany Walters	1800 W. 100 S. Lehi, UT 84043	Court Reporter
6 Fred M Brunsvold	1059 Emerson Ave SLC UT 84105	A Video For Keeps
7 Melanie Moore	878 E. Deer Flat Tooele UT 84074	Dugway
8 Capt J.T Thoiss		USAF
9 JOHN OLSEN	405 "I" ST S.L.C. UTAH 84103	SELF
10 DAVID EILEEN BENJAMIN HARVEY	2486 E. WANDA WAY SLC UT 84117	SELF
11 KRIS LONG	1505 E. PLAZA WAY SANDY UT	SELF
12 BOYER JARVIS	2357 Blaine Ave SLC, UT 84108	
13 Kathryn C. Luke	4628 S. Hemlock Dr. Taylorsville, UT 84123	Self
14 FRANKLIN MONTES	2350 S 400E APT 6 SLC UTAH	SELF
15 TOM MATHIESEN	7997 E. 10701 LAYTON UT 84040	Self

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 15, 1997

LOCATION: Salt Lake City, Utah

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Don Christensen	3315 South 6400 W WVC Utah 84120	
2	Nati Grossman	601 E 9th Ave SLC, UT 84031	
3	Chris Menefee	1900 Grant st #1130 Denver, CO. 80203	AGEISS Environmental
4	Lauren LaClare	Channel 4	—
5	R. Larry Ashton	P.O. Box 526384 SLC, UT 84152	
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 16, 1997

LOCATION: Tooele, Utah

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 LaVon & Lynette Wheeler	471 W 1500 N Orem, Ut 84057	ERA Mt. Land Realty
2 MYRON LEE	47 S. MAIN TOOELE, 84074	TOOELE COUNTY
3 Capt Jim Thaiss		USAF
4 CLAY ZIMMERMAN	434 So Coleman Tooele	
5 Melanie Moore	878 S. Deer Flat Rd	
6 Cecil Wart	882 9000 696 Buttonwood	
7 Con Zaccardi	250 Upland	Tooele
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 16, 1997

LOCATION: Tooele, Utah

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 CARL VOSS	310 So 360 W TOOELE	NO ONE
2 Chris Menefee	P.O. Box 1229 Tooele Ut.	
3 Melinda Andersen	36 S. State SLC Ut 84074	Court Reporter
4 Carole Ebright	Box 1141 Roosevelt, Utah 84066	Aerospace Education
5 Vera Zaccardi	250 Upland Tooele, UT	DPG
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 21, 1997

LOCATION: Lancaster, CA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Louis Durnya	HSV AL	NASA
2 Bill Hicks	Decatur, AL.	Self
3 Terry Mahurin	Ojai, CA	Self
4 HOWARD BROOKS	44812 Elm Ave Lancaster, CA 93534	Antelope Valley BOARD OF TRADE
5 LARRY D. GRIFFIN, MAJ	43106 Bloomingpark St LANCASTER, CA 93536	USAFR
6 J.P. Brady	~~PO Box 4705~~ ~~Lancaster Ca.~~	Aerospace Office Inc
7 BARRON K. ODER	3919 Smith AVE SE ALBUQUERQUE NM 87108	
8 Dion P. Akers	38227 17th ST E Palmdale Ca.	Self
9 Chris Naftel	38427 5th St W. G125 Palmdale CA 93551	Nasa
10 Kristen Williams	DFRC	NASA
11 Gerard Hess	338 W. AVE J8-5 LANCASTER	SELF
12 Dan Coughlin	115 Andover Lane Huntsville AL. 35811	NASA
13 Joe Mueller	805 West Ave L #175 Lancaster	NASA Academy
14 Kyle Snyder	"	" "
15 Jessica Gonzalez	"	"

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 21, 1997

LOCATION: Lancaster, CA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Ross Dutton	2516 Brentwood Dr Lancaster	self
2 John Pernisco	153 Deblynn CT Palmdale, CA	
3 German Pernisco	153 Deblynn CT Palmdale, CA	
4 Neffer Pernisco	153 Deblynn CT Palmdale, CA	
5 R Lyle Talbot	633 W. J-4 Lancaster 93534	
6 [illegible]	P.O. Box 8152 Lane Ca	Aerospace Weekly
7 Jay Levine	A.V. Press →	
8 DAVID FLOYD	3235 EAST AVE H-6 LANCASTER CA	SELF
9 Blain Nelson	3615 Belle Arbor Cir Titusville FL 32780	Self
10 Walt Szwenik	44412 Palm Vista Lancaster, CA 93535	Self
11 RITA BLUZAS	43703 37th St. W LANCASTER CA 93536	CSC - CONTRACTING PA
12 PAM BIRGE	P.O. Box 446 ~~AF Base~~ EDWARDS LAKE LA CA	CSS - CONTRACTING PA
13 David Richardson	646 E. Pillsbury Lancaster, CA	
14 CINDY RICHARDSON	646 E. PILLSBURY LANCASTER, CA	
15 Jim GARNER	1866 E. GAVIOTA SIMI VALLEY 93065	IRONWORKERS LOCAL 433

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7-21-97

LOCATION: Lancaster, CA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 William H. Lawrence	44937 N. 5th St. East Lancaster, CA 93535	
2 Ranney Adams	41865 Barret Palmdale CA	
3 Greg Matranga	709 W. Lanc. Blvd Lanc., 93534	Assm. Runner
4 Marguerite Hess	338 W Ave J8-5 Lancaster	
5 Laura Thackray	10455 E. Bunco Rd. Athol, Idaho 83801	Dryden NASA Academy
6 Heath Roettig	6710 Wabash Ave #25 Terre Haute, IN 47803	"
7 D Andrisani	3608 Capilano Drive West Lafayette IN	"
8 D. Laye	PO Box 787 Barstow CA	US FWS
9 K & J Hepworth	518 Fairway Dr Palmdale	Self
10 Jimmy Black	2304 Kathy Ln Decatur, AL	NASA
11 James Allison	2624 E Nugent Lancaster Ca	
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/21/97

LOCATION: Lancaster, CA

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Del Richardson	1028 Oasis J-7 Lancaster, CA.	
2	JIM LINVILLE	 HV AL	NASA OFG
3	Dan Mullen	210 West Ave. K-9 Lancaster, CA 93536	NASA DFRC
4	Johnny Ontiveros	930 W. Pillsbury Lancaster CA	AFFTC
5	Arden Fjelsted	2800 VAHAN Ct. LANCASTER CALIF	SELF
6	Gary Letchworth	P.O. Box 2008 Lancaster, CA 93539	Self
7	Janet Letchworth	PO Box 2008 Lancaster CA 93539	self
8	Kim Fenton	29400 Greenwater Tehachapi CA 93561	self/AV Court Reporters
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/22/97

LOCATION: Boron, CA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Pamela Birge	PO Box 446 Edwards AFB CA	CSC for AFFTC/PAE
2 Dan Mullen	PO Box 273, MS D-2152 Edwards, CA 93523	NASA DFRC/SH
3 Elizabeth Waterbury	12471 Sierra View Boron CA 93516	Edwards AFB IRC/RAB - Boron Rep
4 Christopher Rush	21416 Belmont Dr Tehachapi, CA 93561	Edwards AFB Environmental
5 Steve Brackenridge	24171 Chapparall Boron CA	Self
6 Mr+Mrs Crain	27226 TMT Rd Boron Ca	Boron Donuts
7 John R Carter	Bakersfield Ca	U.A. Local 460 AFofL CIO
8 Sharon Burgess	27147 Vicinie St Boron CA 93516	
9 Terry Dill	12301 Sierra View Boron Ca.	
10 Caron Campbell	26915 Anderson St Boron CA	Boron Gazette
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/22/97

LOCATION: Boron, CA

PLEASE PRINT

NAME	ADDRESS	REPRESENTING
1 Rita Bluzas	P.O. Box 446 93523 Edwards AFB, CA	CSC Contracting "PA"
2 Pamela Birge	P.O. Box 446 Edwards AFB, CA 93523	CSC Contracting "PA"
3 Eldora Irving	P.O. Box 610 Boron CA 93516	Irvings Recycling
4 Michael Mullins	5116 Roy CT Bakersfield CA	Plumbers & Steamfitters Local 460
5 Fred Brown	NASA Dryden Edwards, CA	NASA PAO
6 Debby B[illegible]	21010 Winesap CT Cal City CA	Bakersfield Californian
7 [illegible]	25885 Cherryhill Ave Boron CA	Self,
8 Dorotha Campbell	26919 Anderson Boron CA	Boron Gazette
9 Michelle Burgess	27167 Jerome St Boron CA 93516	Boron, CA
10 Ken S. Yu	P.O. Box 506 Boron, CA 93516	Boron Food Mart
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/23/97

LOCATION: Ridgecrest, CA

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Dan Mullen	2117 West Ave K-9 Lancaster, CA 93536	NASA DFRC/SH
2	BOB PETERSON	350 E R/C RIDGECREST,	LOCKHEED MARTIN
3	STAN & JEANIE HAYE	230 LARKSPUR RIDGECREST, CA 93555	SIERRA CLUB
4	John LAMB	806 W Sonja Ridgecrest CA 93555	BOR Bennett Optical Research.
5	Ted Wheaton	7743 E. Ave U Littlerock, Ca 93543	NASA DFRC/FI
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/23/97

LOCATION: Ridgecrest, CA

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	JAN LAWSON	305 N. TRACI Ridgecrest	citizen
2	DON LANE	437 N. ALVORD RIDGECREST	ME
3	Pamela Birge	PO BOX 446 EDWARDS AFB CA 93523	CSC for AFFTC/PAE
4	Rita Biozas	PO BOX 446 EDWARDS AFB CA 93523	CSC for AFFTC/PAE
5	RICHARD C. BULLARD	1209 WINDY LYNN AVE RIDGECREST, CA 93555	SELF
6	Steve Booter	809 W. Coral Ave Ridgecrest, CA 93555	NAWCWPNS/NAWS
7	Ray Simmons	PO Box 866 Ridgecrest 93556	So. Cal Carpenters Union Local 743
8			
9			
10			
11			
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PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 24 Jul 97

LOCATION: Baker, CA

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Paul Holmes	P.O. Box 168 Baker, CA. 92309	Myself
2	Delvin Holmes	P.O. Box 188 BAKER CA. 92309	—
3	[illegible]	PO Box 24 Baker CA 92309	MY SELF
4	Burl Hubbard	Box 121 BAKER, CA - 92309	" "
5	DIRK SCHMIDHOFER	P.O. BOX 98518 Las Vegas NV 89193	DOE
6	JACK GREGY	309 BEL-AIR DRIVE LAS VEGAS, NV 89109	SELF
7	Mike DeKeyrel	27575 TRAVERTINE St. BARSTOW, CA 92311	BLM
8	Jesse Meyer	Doc Kill Rd BAKER CAL. 92309	CSD
9	GRIMSHAW	80 Cali CA BAKER	CSD
10	Lois Clark	Box 68 Baker, Ca	Baker Valley News
11	[illegible]	728 BAKER CA	CSD
12	BRIAN BROWN	Box 61 Shoshone Ca.	CHINA RANCH
13	WILLIAM A. FRANK LT COL USAF	AFREP. AWP-910 P.O. BOX 92007 LOS ANGELES, CA 90009-2007	USAF
14			
15			

PUBLIC MEETING FOR THE
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 24 Jul 97

LOCATION: Baker, CA

PLEASE PRINT

	NAME	ADDRESS	REPRESENTING
1	Le Hayes	Po Box 590 Baker, Ca 92309	Baker CSD
2	TONY ESPINOZA	P.O. BOX 97 BAKER CA 92309	MYSELF
3	Norman Boggs	POB 337 BAKER CA 92309	None
4	Dan Mullen	PO Box 273, MS D-2152 Edwards, CA 93523	NASA DFRC/SH
5	Charles Ayers	P.O. Box 703 Baker, CA 92309	my self
6	J.D. Ross	DOE - 232 Energy Way LAS VEGAS, NV 89118	DOE
7	RitA BLUZAS	P.O. Box 446 Edwards CA 93523	CSC/EM/AF PA
8	Chris Dekeyrel	Barstow CA 92311	
9	Shirley Dougherty	P.O. Box 44 Baker, CA 92309	Chamber of Commerce P.O.Box 131
10	Rebecca McCabb	6645 [illegible] [illegible] Huntsville, AL [illegible]	
11	Martha Watkins	PO Box 157 Shoshone, CA 92384	Death Valley Chamber of Commerce
12	CLARK BRYNER	BOX G BAKER CA 92309	BCSD
13			
14			
15			

Table B-2-3, Appendix B-Section B-2
Special Meeting Information

Location/Party	Date	Time	Comments
Utah			
Ibapah, UT/ Shoshone Tribal Leaders and Reservation area residents	15 Jul 97	10:00 A.M.	Meeting with Confederated Band of the Te-Moak Tribes of Shoshone Indians of Nevada
Salt Lake City, UT/ Senator Bennett's Staff	16 Jul 97	7:00 A.M.	Program Briefing
California			
BLM Office BLM & Ft. Irwin Personnel Barstow Office 150 Coolwater Lane Barstow, CA 92311	24 Jul 97	10:00 A.M.	Program Briefing

Table B-2-4, Appendix B-Section B-2
Ads Placed for X-33 Public Meeting Announcement

State	City	Newspaper Name	Run Date
WA	Moses Lake	Columbia Basin Herald	6/30/97
MT	Great Falls	Great Falls Tribune	6/30/97
MT	Great Falls	Malmstrom AFB Paper	7/3/97
MT	Helena	Helena Independent Record	6/30/97
ID	Idaho Falls	Post Register	6/30/97
ID	Pocatello	Idaho State Journal	6/30/97
UT	Ogden	Ogden Standard Examiner	7/7/97
UT	Provo	Provo Daily Herald	7/7/97
UT	Salt Lake City	Salt Lake City Desert News	7/7/97
UT	Salt Lake City	Salt Lake City Tribune	7/7/97
UT	Tooele	Tooele Transcript Bulletin	7/8/97
CA	Ridgecrest	Rocketeer	7/10/97
CA	Ridgecrest	Ridgecrest Daily Independent	7/14/97
CA	Ridgecrest	Ridgecrest Daily Independent	7/17/97
CA	Palmdale	Antelope Valley Press	7/15/97
CA	Palmdale	Daily News	7/15/97
CA	Mojave	Mojave Desert News	7/17/97
CA	Barstow	Barstow Desert Dispatch/ Barstow Daily Press	7/17/97
CA	Bakersfield	Bakersfield Californian	7/17/97
CA	Lancaster	Desert Wings/Aerotech News	7/18/97

APPENDIX B - SECTION B-2.2

ISSUES/QUESTIONS/CONCERNS RAISED DURING PUBLIC MEETINGS

Appendix B-Section B-2.2
Issues/Questions/Concerns
Raised During the Public Participation Meetings

All public participation meetings were documented using a court reporter. Official transcripts are on file at Code AE01, Environmental Engineering and Management Office, Marshall Space Flight Center, AL 35812. All comments and questions regardless of relationship to NEPA are included. Questions, comments, issues, and responses given during the meetings are summarized in Table B-2-5.

Comments and answers are near verbatum from transcripts except for information in brackets, which is provided for further clarification of answers. All comments and questions regardless of relationship to NEPA are included. The questions are organized in the following categories:

- Environmental Impact Statement
- Benefits of the X-33 Program
- Costs
- Damage Claims
- Economic Impacts/Employment Opportunities
- Flight and Lan ding Operations, and Vehicle Designs
- Follow-On RLV Program
- Missions/Goals/Future Plans
- Public Safety and Risk/Flight Termination and Vehicle Failures/Contingency Planning
- Public Viewing
- Road Closures
- Site Selection
- Sonic Booms
- Stratospheric Ozone
- Wildlife/Vegetation Impacts
- Other

Responses given are near verbatim except for bracketed information. Information in brackets is clarification of responses given in public meetings. At each of the public meetings the panel consisted of the following speakers:

1. Dr. Rebecca McCaleb, NASA/MSFC, Director, Environmental Engineering and Management

2. Mr. Gene Austin, NASA/MSFC, X-33 Program Manager

3. Mr. Dave Urie, Consultant to Lockheed Martin Skunk Works, Senior Aeronautical Engineer

4. Mr. Darren Reed, NASA/MSFC Aerospace Engineer/Acoustics Expert

Table B-2-5

Public meetings were held from July 7 through July 24, 1997, in the following cities: Moses Lake, Washington; Great Falls and Helena, Montana; Idaho Falls, Idaho; Dugway Proving Ground, Salt Lake City, and Tooele, Utah; and Lancaster, Boron, Ridgecrest, and Baker, California. Questions and issues of concern are summarized below. The questions are organized in the following categories:

- Environmental Impact Statement
- Benefits of the X-33 Program
- Costs
- Damage Claims
- Economic Impacts/Employment Opportunities
- Flight and Landing Operations, and Vehicle Design
- Follow-On RLV Program
- Missions/Goals/Future Plans
- Public Safety and Risk/ Flight Termination and Vehicle Failures/ Contingency Planning
- Public Viewing
- Road Closures
- Site Selection
- Sonic Booms
- Stratospheric Ozone
- Wildlife/Vegetation Impacts
- Other

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA				UTAH			IDAHO	MONTANA		WASHINGTON
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
ENVIRONMENTAL IMPACT STATEMENT													
1	How does one obtain a copy of the EIS?	**Dr. McCaleb:** There are a number of ways to obtain a copy of the EIS: (a) phone 1-800-833-0678; (b) e-mail to X33EIS@msfc.nasa.gov; (c) write to Dr. Rebecca C. McCaleb, NASA/MSFC/Mail Code AE01, Marshall Space Flight Center, Alabama 35812; (d) fax to (205) 544-8259; and/or (e) view the document or download it to your computer from Internet address http://eemo.msfc.nasa.gov/eemo/x33_eis.											X
2	Because of the scale on the exhibits in the draft EIS, it is difficult to see where the flight path comes across this part of Montana. Would it be possible to get the last 150 miles of the flight, the glide path, showing more detail, elevations, profile, speeds? Obviously, I'm interested in this area, not the whole thing, and it's hard to see it.	**Dr. McCaleb:** Yes, we can accommodate that. We have the information.										X	
3	What is the EIS schedule?	**Dr. McCaleb:** Four written documents are produced during EIS preparation: (1) Notice of Intent to Prepare an EIS, which was published on October 4, 1996. The NOI is published in the Federal Register and advertised locally to						X			X		

1

Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA				UTAH			IDAHO	MONTANA		WASHINGTON
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
		inform the public that the Government is contemplating an action. (2) The Draft EIS includes environmental analyses of alternatives the agency is considering and issues that the public asked during the scoping process. The Draft EIS was published in June 1997. (3) The Final EIS includes additional environmental analyses as required beyond the Draft EIS and answers comments received from the public and other Governmental agencies during the Draft EIS review. The Final EIS is scheduled to be released in October 1997. (4) And last, the Record of Decision (ROD) documents the decision made by the agency and the rationale for the decision. It includes mitigation actions to prevent or minimize environmental consequences of the chosen alternative. The ROD will be issued no sonner than 30 days after the Final EIS.											
	Normal EIS is between 18 and 24 months, a large one. This seems like an extremely aggressive schedule that you have.	It was challenging. It's a great project for the agency and it has been universally well received. I compliment everyone's responsiveness to our questions and consultations.											
4	I thank you again for being here. I remember your presentation last meeting. One has to be impressed from the flood of details. What does the complete statement weigh?	**Dr. McCaleb:** Five pounds.									X		
BENEFITS OF THE X-33 PROGRAM													
5	The original testimony was that the public was to take 82 percent of the risk of this project to demonstrate the viability. The contractor was to take 18 percent. But if, in fact, the Venture Star program also succeeded, we, the public, get none of the profit whatsoever as the commercial venture. Has there been any change in that? If we don't get any of the equity profit at the end, have we made a public investment simply for private gain?	**Mr. Austin:** When we went through Phase 1 with Lockheed Martin, Rockwell, and McDonnell Douglas and proceeded with the proposal for the X-33 Program and how they would publicly arrive at private financing of the second phase and the process structure for delivery of the payload intended, the government, by not having to update the Shuttle, by not having to build the vehicle using									X		

2

Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA Lancaster	CALIFORNIA Boron	CALIFORNIA Ridgecrest	CALIFORNIA Baker	UTAH Salt Lake City	UTAH Dugway	UTAH Tooele	IDAHO Idaho Falls	MONTANA Great Falls	MONTANA Helena	WASHINGTON Moses Lake
		public funds, would then result in having an opportunity to receive a substantial return on their investment. We do not obviously take the profits out of that, other than the tax revenue, but we would have a substantial return on our investment of the X-33 program around $900 million by being able to get significantly lower launch costs for our payloads. A secondary benefit is entrepreneurs in this country who are now constrained from doing business in space because of the cost of getting there would be able to reach out and take advantage of opportunities that do not currently exist. We talked to communications satellite industry leaders earlier this year. Mr. Goldin heard very strongly from them that they're on the verge of really having a communication satellite explosion, but they're being held back by the cost of getting into space. The country needs to have a competitive launch system.											
6	If Venture Star goes forward and reduces our costs of putting payloads into space from $5,000 a pound to $1,000 a pound (figures according to Aviation Week), who benefits from that reduction in payload costs? Bill Gates, or do we, the public, benefit in our phone bills going down? In other words, what specifically will we see?	**Mr. Austin:** NASA would benefit, the government, you the user of communications, of weather forecasting, and any of the services that you now take for granted that are made available through space access would be a beneficiary.									X		
7	You mentioned the commerce and exploration. What kind of scientific information could we anticipate getting back, not looking at the commercial side? I'm interested in who the private ventures would be or who NASA has contacted about the private financing in the future.	**Mr. Austin:** Since the Space Shuttle Program has been operating, NASA has offered opportunities for any number of industries to fly on the Space Shuttle in an experimental type program. We gave five flights free to allow industries to go up and develop techniques. If those techniques were profitable, or if they believed they could be profitable, then they started paying their own way. NASA's requirement was that they had to be safe to fly on the Shuttle. We are doing pharmaceutical										X	

3

Table B-2-5

Question/ Comment #	Question/Comment	Answer	California: Lancaster	California: Boron	California: Ridgecrest	California: Baker	Utah: Salt Lake City	Utah: Dugway	Utah: Tooele	Idaho: Idaho Falls	Montana: Great Falls	Montana: Helena	Washington: Moses Lake
		research, research in materials that cannot be produced in a one-gravity environment, communication technologies, and solar power. If you go through a typical process of developing a new product, you have the test tube phase, the pilot plant phase, and then production. The Space Shuttle gave us the test tube and some of the pilot plant phase. The Space Station is going to give us the opportunity for production of some of these products. But they're still going to be cost driven. A number of products will be limited by the cost of access to space.											
8	Hopefully, X-33 will bring some benefits to the community of Boron, spaceports, so we can send people to Mars and the Moon and all other places.	**Mr. Austin:** Thank you.		X									
COSTS													
9	Could you comment on the cost of the X-33? How much is government money and how much is private money? What is the projected budget on this? The EIS was obviously thorough. While impressed with that, I'm not overly impressed with living in a bull's eye. I have several questions that came up as I studied this from your testimony, the EIS, and things I read in Aviation Weekly and Wall Street Journal. Are we still on the funding pattern where Lockheed Martin and the other contractors will invest $212 million and the taxpayers will invest $759 million?	**Mr. Austin:** The cost of the X-33 program is roughly $1.14 billion, which is shared between NASA and our industry partners at a rate of about 82 percent government funding ($941 million) and 18 percent industry funding ($212 million) for this phase of the program. For 1997, approximately $300 million dollars of US funds. We have a fixed investment clause in our cooperative agreement with Lockheed Martin. The government's investment is fixed at a little over $800 million. Any type of overrun will be borne by the industry partners. The government is involved in producing some of the elements of the program, both engineering and testing. We will be working as partners. The $1.14 billion includes the X-33 vehicle and its test program, as well as some RLV or Venture Star technology demonstrations. It covers both the ground test demonstration phase as well as the flight program.	X				X				X	X	

4

Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA				UTAH			IDAHO	MONTANA		WASHINGTON
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
		It is anticipated that industry and private financial institutions will finance 100 percent of the next phase of the program.											
10	I read in the July 8 Aviation Weekly that the X-34 program, which was funded on a shared basis, likewise, was abandoned after the public money was spent but no contractor money was spent. What assurance will we have that this won't happen in the X-33 program? In other words, is Lockheed Martin spending parallel money with government money? And who is in charge of the audit?	**Mr. Austin:** Let me clarify on the X-34. $8 million of public funds were spent by the industry team and a good bit more than that was spent of their own resources, both Rockwell and Orbital Sciences Corporation. That was a business decision. They decided it was not a viable business decision to continue through the end of the X-34 program; therefore, they backed out of the program after a little over 6 months into the X-34 program. So it was a minimal amount of funds. The residuals from that were then put into a separate procurement where the X-34 becomes not a forerunner to a commercial vehicle, but an experimental vehicle to the technological research services. The remainder of those funds are under contract now to include an X-34 program, without the business venture aspect of it. The current X-34 program has a 15 percent clause in it for termination. For the X-33 program, we pay the industry team out of the government funds according to work accomplished, not according to time, not according to the standard cost environment. We have set milestones throughout the program, and we pay when the milestones are accomplished. If they are accomplished early, they get paid early. If they are late, they get paid late. No milestones can be paid out of sequence. If they miss a milestone and go ahead and succeed the subsequent milestone, that first milestone has to be cleared before any subsequent milestones can be paid. A termination situation would provide an opportunity for NASA to accept a default position by industry with essentially one									X		

5

Table B-2-5

Question/ Comment #	Question/Comment	Answer	California				Utah			Idaho	Montana		Washington
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
		remaining milestone payment that would have to be made, which is very favorable termination in terms of typical government procurement systems.											
11	Over the course the Space Shuttle's life span and the number of flights it takes, you plan on saving what kind of percentage of money annually, or over the course of its life, in using the new technology?	**Mr. Austin:** The real benefit comes from the fact that if you have a single airframe that leaves the ground and goes to space and returns to the ground, and you did not have to manufacture parts between every flight and bring them all together and assemble them and check them out before every flight, essentially having to certify a new vehicle every time you fly, then the costs would come down. We project the benefit to NASA, even allowing industry to make a reasonable profit, will be a very sizable savings, roughly 50 percent of what it costs us today to fly. The taxpayers don't even have to put up the money to fund the development of the Venture Star Program. So if we are successful in getting this program transitioned to the private sector, with only having to fund the part of the development of X-33, we will in fact have a grand return on the investment.										X	
12	Have you seen any cost savings in using parts from past programs?	**Mr. Austin:** We've costed both. I'm sure Lockheed Martin and the other two industry competitors researched historical costing methods. But this is a vastly different program management structure. During the Apollo Program, we did not have the contractual mechanism that we do now to accomplish a partnership. In this case, we're trying to accomplish a transition for a transportation system from the government to industry, and we're using this mechanism to help us achieve that national goal as well.										X	
13	Instead of spending money on the X-33 and Venture Star, couldn't NASA have spent the money modifying the current Space Shuttle?	**Mr. Austin:** The study we did in 1993 looking at the alternatives to achieving approved cost effectiveness and safety, we determined that since				X							

6

Table B-2-5

Question/ Comment #	Question/Comment	Answer	California: Lancaster	California: Boron	California: Ridgecrest	California: Baker	Utah: Salt Lake City	Utah: Dugway	Utah: Tooele	Idaho: Idaho Falls	Montana: Great Falls	Montana: Helena	Washington: Moses Lake
		the technologies were deemed to be available, that we could go to a single-stage-to-orbit, removing the requirement of staged solid rocket boosters and tanks and having to reassemble the vehicle once we got back to the ground. We believed the single-stage-to-orbit gave us both the safest approach to reach orbit as well as a much lower cost approach to getting to orbit. Therefore, we recommended that we pursue the option of getting to single-stage-to-orbit capability. Another aspect of that was driven by the fact that we've lost about 75 percent of the world market in terms of launch capability of other nations, and the approach of improving our current system did not appear to give us enough of a cost advantage in being able to launch satellites into space to regain that position. So our thrust at that point was to leap-frog the other nations using the United States' technological capability to get to a much lower cost type of launch system so that we could offer competitive launch rates and recapture much of that lost market that we have experienced over the last 25 years. So it was not just safety and a little lower cost. It was a matter of taking advantage of technologies that we believe we have in this country and essentially leap-frogging the rest of the world.											
DAMAGE CLAIMS													
14	Who is going to pay for the ceilings and windows when they break, NASA or Lockheed? We had a lot of trouble in the '60's with that. These ceilings at the mall were repeatedly broken and leaking. I also had repeated trouble at my home which I had built in 1966. All of us in the valley here had to write to Mansfield about this	**Dr. McCaleb:** We know that noise—vibrations—is a fact of life with this type of work. We have always done our modeling so that we know the conditions at the time. The damages are the responsibility of the project [Lockheed Martin]. It goes through our legal section. We will have a team to go out and evaluate any claims that come in. When the										X	

7

Table B-2-5

Question/ Comment #	Question/Comment	Answer	California: Lancaster	California: Boron	California: Ridgecrest	California: Baker	Utah: Salt Lake City	Utah: Dugway	Utah: Tooele	Idaho: Idaho Falls	Montana: Great Falls	Montana: Helena	Washington: Moses Lake
		Shuttle Orbiter lands, we have accepted full responsibility when it was verified. In my experience it has been done fairly quickly and the government issued a check to pay for the damages.											
15	You acknowledged that there will probably be damage claims as a result of these test flights and that the legal unit is going to handle these claims. What legal unit is going to be handling them? And two, what have you put in place for dispute resolution? You may have claims that you deny that consumers are going to believe are the result of these test flight. How does the consumer resolve that? Will that be a federal government agency or an independent agency? That's our concern—that this program might force some consumers to have to litigate in order to get a claim paid. That's a major concern, that we don't force consumers to have to sue the government in order to obtain some resolution.	**Dr. McCaleb:** At the Space Centers, it goes through the legal department for whichever Center is responsible for the program. With respect to Lockheed Martin, it would be approximately the same mechanism. There will probably be a single point where people can go in order to get claim adjustment. There will probably be some sort of adjudicating body [alternative dispute resolution] to handle disputes. **Dr. McCaleb:** We aren't sure. The claims that have been disputed thus far went through the local court systems. **Mr. Austin:** There is an issue on indemnification before Congress right now that will deal with how these claims will be handled. This particular program is unique in the sense that it is not a traditional contract between the government and industry. We have entered into a partnership. The bill before Congress will deal with the indemnification issue whether it's at Lockheed Martin or NASA. It will be resolved well ahead of the time we fly.										X	
ECONOMIC IMPACTS/EMPLOYMENT OPPORTUNITIES													
16	Has an economic impact study been done? In other words, will out-of-state personnel be coming in to do the construction work or will it be done with	**Mr. Austin:** There will be a mixture. Largely, the construction of the launch site will be done by local workers. There are some people who	X	X									

8

Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA				UTAH			IDAHO	MONTANA		WASHINGTON
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
	local people? There are a lot of construction companies and workers in the area. We want people from the local area instead of bringing in people from out of state. We need the jobs. We hope that is what you intend.	have moved in from out of state to work various aspects of the site preparation, but they are residents of the area now.											
17	Has any construction begun yet?	**Mr. Austin:** No, we are waiting for the Record of Decision on this Environmental Impact Statement to proceed with construction. **Dr. McCaleb:** The program is committed that if the decisions for some reason do not appear right, we have to go back to the drawing board. That's why we've held the line on building anything of that nature.	X										
18	Have you surveyed the property and gotten any type of surveyors?	**Dr. McCaleb:** Yes, we had to do some minimum details in order to do the Environmental Impact Statement, to understand the maximum scope. The general preliminary engineering work has been done so that we can understand and properly project what we need to do and what those impacts would be.	X										
19	If everything goes according to plan and the environmental impact is accepted, will construction begin in October?	**Mr. Austin:** Yes [but no sooner than the Record of Decision].	X										
20	Will employment information be on any Internet web sites? What is the projected time for that?	**Mr. Urie:** I believe that it will be through this media. It all hasn't been worked out yet.		X									
FLIGHT AND LANDING OPERATIONS, AND VEHICLE DESIGN													
21	If the X-33 is suborbital, the VentureStar, then, will be orbital?	**Mr. Urie:** Yes. [Only minimal and necessary activities on federal property that do not adversely affect the environemnt would be initiated prior to the Record of Decision.]					X						
22	Since the X-33 is about half the size of the Shuttle Orbiter, is the payload capacity greatly reduced?	**Mr. Urie:** The X-33 has no payload capability at all. It's an X-plane, a technology demonstrator vehicle. The ultimate VentureStar, which will be flying in late 2003 or early 2004, will have essentially equivalent payload capability to the Shuttle.					X						

Table B-2-5

			California				Utah			Idaho	Montana		Washington
Question/ Comment #	Question/Comment	Answer	Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
23	Each time the Shuttle lands, tiles have to be replaced. Would panels have to be replaced on the VentureStar after each flight?	**Mr. Urie:** Not normally. The metallic thermal protection aeroshell provides a tough outer material that can withstand normal operations just like the skin of an aircraft. The entire under surface of the VentureStar and the X-33 will be metallic, an inconel honeycomb panel, that can contain the insulation to keep the temperature low on the inside. The Space Shuttle has rigid ceramic tiles.					X						
24	Are both the X-33 and the VentureStar unmanned vehicles? Since it is anticipated to take the place of the Shuttle, will it eventually be manned?	**Mr. Urie:** They are both unpiloted vehicles. The Venture Star will carry Space Station personnel to and from their work place in orbit. The two vehicles will be directed by what we call supervised autonomy, where there will be human mission managers on the ground actively monitoring all the systems full-time to assure that they're behaving the way they're supposed to.				X							
25	During a normal flight, the vehicle will be operated autonomously, under the direction of the onboard flight control system, or will there be situations short of emergency where control will be exercised from the ground?	**Mr. Austin:** The vehicle, although it is under autonomous control at all times, is supervised autonomy. There is always a flight manager on the ground for normal operation of the vehicle who has options for selecting flight control should there be some problem short of a disaster. There will be a set of scenarios which will direct him or her what he/she should do in terms of changing flight control mode. Basically, it is an autonomous system that is supervised by a person on the ground, much like airlines are now. They are autonomous but supervised by people on board. **Dr. McCaleb:** There will be a tracking station here in Idaho near Mountain Home.								X			
26	What measures are you taking for the reliability of the flight control software?	**Mr. Urie:** We have extensive software evaluation programs that are intended to assure that the software has the same level of reliability as the hardware. We will in fact be doing tests at								X			

10

Table B-2-5

Question/ Comment #	Question/Comment	Answer	California: Lancaster	California: Boron	California: Ridgecrest	California: Baker	Utah: Salt Lake City	Utah: Dugway	Utah: Tooele	Idaho: Idaho Falls	Montana: Great Falls	Montana: Helena	Washington: Moses Lake
		Edwards Air Force Base. This fall we will start testing the flight software for the vehicle, and there will also be an independent verification and validation to back up that ground testing that will take place. We are trying to provide redundancy and oversight on those two processes before they go on the vehicle. When the vehicle rolls out of the assembly building next fall in Palmdale on the back of a 747, we will be testing the navigation systems on board during that and subsequent flights on the back of the 747. We will test out the on-board software and make sure it is functioning properly before we ever commit to the first powered flight.											
27	It looks like the flight path turns as it goes into Great Falls, so it's hard to project where it comes over this area. Does it make a left-hand turn into Great Falls? The glide path in the document shows it as a curve, not a straight line.	**Mr. Austin:** The X-33 comes in and essentially has an energy management maneuver at the end of the flight. We use this turn just before we line up with the runway to reduce excess energy. If we are at low enough energy we will just simply come straight into the runway without making that turn. We have this option at the end of the flight to use the aerodynamic control surfaces on the vehicle to fly into the airport like a glider because we don't have the power on board. But we do have the capability to control the flight path with the aerocontrol surfaces.										X	
28	The Air Force controls the airspace. That's restricted airspace.	**Dr. McCaleb:** The airspace will be sterilized—all aircraft will be removed from that zone—to get an adequate buffer zone for reentry, approximately 12 miles wide and 21 miles long. Airspace will be cleared beginning 1 hour in advance of scheduled launch time. If the mission goes on the planned schedule, airspace can be reopened 1 hour and 13 minutes later. The longest anticipated delay without scrubbing the mission for at least 24 hours will be 2 hours. So if it is launched close to the 2 hour delay time, the airspace could be closed in that corridor a					X						

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			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
		maximum of 4 hours.											
29	Have the engines to be used on the X-33 been proven in other systems?	**Mr. Urie:** Those engines have not flown, but they've been thoroughly ground tested. The difference between these engine and others is two-fold. One is that they have a large number of small engines. Second is that they have essentially an inside-out nozzle. Engines of the exact scale and virtually the same design as the X-33 engines were ground tested in 1971 on the order of 500,000 pounds thrust. The ground test runs have been far more than the total engine runs for our complete flight program by a factor of about three or four. It has not been used on a flight vehicle before because there hasn't been a new flight vehicle since then that we could put it on. **Mr. Austin:** We are using the turbo pumps that will power each of those thrust chambers that literally came from the Saturn second and third stage engines, called the J-2, that were used to fly the crews to the moon during the late 1960s and early 1970s. So they have a long history. We've taken them apart and inspected them. As we move down the line of adding hardware to the program, we will have an engine test program on the full engine for the X-33 that will go into test next March. We will be testing them for more than a year prior to the time we fly the X-33. We will also have spare engines so we can continue to test the systems and make sure they're safe.										X	
30	In the event the X-33 would have to restart its engines if there's a natural disaster or the computer program couldn't line up with the runway, would it be able to restart its engines to actually get to a safe landing? What about the VentureStar?	**Mr. Urie:** Once the fuel is expended on ascent, the X-33 engines will have no possibility for restarts because all the propellants would have been exhausted. The VentureStar's design is not yet complete.					X						

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31	What kind of damage control is being used on the aerospike engines?	**Mr. Urie:** We have approximately 20 thrusters per engine, 40 total. An instant after liftoff, we could lose one of those and it wouldn't matter. About 40 seconds after liftoff, we could lose one of the two engines and still complete the flight as planned. So again it's the redundancy. The basic philosophy is to test the approach to doing a fully reusable commercial launch vehicle. In order to do that, it has to be safe. To make it safe, we have to provide the same measures that we do on commercial aircraft. We have taken an aircraft approach to a vehicle that flies into Earth orbit. It is an airplane, not a missile. This is different from other X-planes that historically were developed to reach some new point in speed or altitude. This X-plane is being developed to demonstrate the successful integration of fairly mature technologies into a vehicle that can be the precursor of a successful commercial venture.										X	
32	These are combustion engines, right? Do they have an EPA-approved spark arrestor?	**Mr. Urie:** Actually, by the time it arrives here, the engine will have been shut down and the propellants exhausted except for that residual that we discussed earlier. And, we have a spark starter, but no spark arrestors that I know of. **Mr. Austin:** In the flight over here, we will operate the engines for about 2 minutes out of the 10 that it takes to get from Edwards over here. So for the last 8 minutes it will basically be gliding. **Mr. Urie:** The flight profiles are shown in the EIS. There is a rapid ascent to a very high altitude, and at that point the engines are through, they've done their job. So from the top of the hill there, it's a glider; it's capable of gliding all the way for the longest mission from				X							

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		essentially the California-Nevada border to north central Montana.											
33	I'm a student at Embry-Riddle down in Florida. I was just wondering on the descending flight path of the X-33, you said the engines are going to be cut off. Is it going to be gliding?	**Dr. McCaleb:** The total flight path from Edwards to Moses Lake is roughly 950 miles. The engines burn for the first 140 miles, and from that point on it's a glider.											X
34	I'm unclear about how it comes into the Silurian dry lake. Is it under power or is it gliding like the Space Shuttle at that point?	**Mr. Urie:** It's gliding the way the Space Shuttle Orbiter does, except it will be gliding a little slower. Its landing speed is considerably lower than the Space Shuttle Orbiter.				X							
35	If the vehicle is maneuverable, as you suggest it is, why doesn't it land where it takes off?	**Mr. Urie:** The VentureStar will land where it takes off. The only really good way to do this is by going into orbit. The X-33 has to reach speeds of about 60 percent of orbit, and it cannot generate enough lift energy to turn itself around and land at its launch site since it can't go into orbit. There are not enough aerodynamic forces available to turn it around. It is maneuverable in the sense that it can be controlled around the flight path and can make the conversions and excursions from the flight path, but not to do a complete U-turn and come back to Edwards Air Force Base. **Mr. Austin:** The only way we would be able to return to the launch site would be in an abort situation where we turn off the forward speed and then accelerate the vehicle back toward the site from which it was launched. That is not one of the desired test objectives in the X-33 program. We want to stress the entire protection system and all objects on board as if this vehicle were returning as nearly from orbit as possible. If we delete that particular kind of mission, we essentially have no vehicle.									X		

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36	The design of the vehicle is definitely not conventional. It sort of looks like a flattened bullet. Is it dependent on its velocity to stay airborne as opposed to a conventional aircraft like a plane or the Shuttle? Is that also true on its landing, is it dependent on its velocity to maintain control?	**Mr. Urie:** Yes, all aircraft are dependent on their velocity to maintain lift and control. This particular shape is called a "lifting body," which originated in the 1960s. Extensive flight test work has been done on lifting bodies of several different designs over the years by NASA and the Air Force. The lifting body is in effect a very thick wing; it acts like a Delta wing, like an old F-106 that has a thick, flat plate Delta wing. It generates lift, like a wing, and it has canted fin control surfaces, plus body flaps at the back of the body which provide the aerodynamic controls. So it glides like an airplane and comes into the runway just like the Shuttle Orbiter does, but at a slower speed. This vehicle will have a landing speed of about 180 knots, and it uses about 8,000 feet of runway from touchdown to full stop. So it behaves just like an airplane.										X	
37	How does the GPS affect radio waves that ham operators and other broadcasters use?	**Mr. Urie:** There should be no effect at all.										X	
38	You were talking about a reaction taking place, hydrogen and oxygen, to give water. Does this reaction take place before the launch? It is for the purpose of gaining altitude, right? How long does it take for this reaction to take place? Is this rate caused by temperature or does it have a catalyst?	**Mr. Urie:** No, this takes place as the vehicle is ascending, the vehicle is burning. That reaction is inside the engines. **Mr. Urie:** Yes. **Mr. Urie:** It will burn from just over 2 minutes for the shortest flight to a little over 3 minutes for the longest. **Mr. Urie:** No. Once it's ignited, just like a spark plug in a car, then the combustion continues on its own. It is a continuing reaction.	X										
39	Is there going to be a lifting stand or are you going to use the one for the current Space Shuttle for putting it on top of the 747? Since the X-33 will be flying back on a 747, do you need to construct another mate-demate device at the landing site?	**Mr. Austin:** We're looking at putting it on top or taking it off the 747 at Edwards and for putting it on at Palmdale Airport, by using the current Shuttle facilities. **Dr. McCaleb:** We will use two mobile cranes at the remote sites.	X	X									

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40	Will there be a "seismic" vibration with the thrust that it's going to provide on the ground?	**Dr. McCaleb:** No. What has been perceived as seismic levels of vibration from rocket thrust are actually acoustical vibrations transmitted through the air.		X									
41	I'm with the Sierra Club. I want to tell you I'm very impressed with the detailing of this document. I don't know how you did it in the time you had. I'd love to see it land here as opposed to Silurian because we have the infrastructure and wouldn't have to build anything whereas you would there. I think your analysis of air quality here is very good, but on page 3-63, Table 3-15, it mentions several cities in the Mojave but it doesn't mention data at China Lake. I don't know whether those weren't available or if it was a mistake. Some of the places those measurements were made are so far away, and we're different. Is that going to be a problem for you? It may also be true with some other sites where you've had to do tables by county. If we get one of our bad dust storms and we get Owens Lake coming down here on a day when you want to land, can you postpone it for a day without too much trouble?	**Dr. McCaleb:** We will shut down or discontinue non-essential activity when alert situations arise. Its very interesting about California, its microclimates and the situations change very quickly in short boundaries.			X								
42	Which runway are you going to be using? You didn't show it on the map. (Moses Lake)	**Mr. Urie:** The north/south runway. **Mr. Austin:** Actually, the runway may vary with the conditions of the day.											X
43	My name is David Bailey, and I'm the Executive Manager for the Port, and also the airport manager. I would like to just make a few comments. We've been studying this project for well over a year, and we've been watching the flight patterns because our primary concern also is not only community relations but public safety. Watching the flight patterns, everything is going to be primarily to the east of Moses Lake. You're not going to be over to the west. And what we're trying to do is influence	**Dr. McCaleb:** Thank you.											X

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	the flight pattern so they will be approaching from the north. Everything is predicated on winds, naturally. But due to the favorable weather conditions that we have here in Moses Lake, we feel the approaches are going to be coming in from the north.												
44	Why are you using Runway 14 instead of Runway 21? Runway 21 is longer; there's a lot more room off the end of the runway. There's also more separation between the buildings than there is on 14. (China Lake)	**Mr. Austin:** We got that information from the command out here last fall. They had a preference for us to use 14. Runway 21 is the predominantly used runway. Because of the short period of time we'd be on the runway after the landing for the vehicle to safe itself, they prefer us to be on 14 and it's adequate for our purposes. We only need 8,000 feet to land the X-33. There is also a mound, a berm-type area, at the end of Runway 21 that this vehicle could not withstand. It could run off into the dirt or sand on the other one.			X								
45	Does using Silurian lake bed mean a runway would have to be built to accommodate the landing of the X-33 and the 747?	**Dr. McCaleb:** No, the only thing we will be using is an acceptable temporary striping for the 747 to assist in its visual approach to the lake bed. The X-33 doesn't need that. We will only put that one stripe on [Some smoothing and/or hardening of the lake bed may be required.]				X							
46	I'm a member of the Chamber of Commerce. If Fort Irwin does not obtain Silurian Valley and the lake bed, will NASA still be interested in using this area for its tests?	**Dr. McCaleb:** That was never a consideration. We worked through BLM, not Fort Irwin. We've also provided these documents to Fort Irwin and it does not appear to have any effect on this project one way or the other. We will work with either one, and they indicated they will do the same with us.				X							
47	Are there going to be any flight tests with the vehicle itself?	**Mr. Austin:** Only after the powered flight phase. We will, in fact, use the guidance system as I mentioned before while it's flying on the back of the 747, but it will not be released from the 747.		X									

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FOLLOW-ON RLV PROGRAM													
48	You talked about it becoming more private and more commercialized. What kind of Quality Control will be implemented? Is NASA going to be overseeing this for a few decades?	**Mr. Austin:** The FAA will be the oversight. It moves from us to the Federal Aviation Administration. The Office of Commercial Space Transportation was formed a number of years ago in the FAA.										X	
49	Will the VentureStar need to be flight tested in a manner similar to the X-33 demonstrator?	**Mr. Austin:** No. Its flight test program will be orbital, and it will always return to its launch site.					X						
50	Can the VentureStar stay in space the same amount of time as the Space Shuttle?	**Mr. Urie:** Yes. The VentureStar will be designed to stay on orbit for 7 days. However, it will not be doing the research work that the Shuttle does. The Venture Star is a transportation system, not a laboratory.					X						
51	If the test program is successful, when will the full-scale model be done and where will it launch from?	**Mr. Urie:** We expect to fly the full-size model at the end of 2003. The flight test sites and the operating sites have not yet been selected.	X										
MISSIONS/GOALS/FUTURE PLANS													
52	What are the missions of the X-33? What was the mission when it was first developed?	**Mr. Urie:** The objective of the program is to demonstrate effort to support Government and private sector decisions by the end of this decade on development of an operational next-generation reusable launch system. Reduce the technical and business risks which are currently barriers to privately financed space transportation system(s) (current and future) through the use of sub-scale, state-of-the-art technology demonstrator vehicle; design and test (both ground and flight) a technology demonstrator vehicle's major components, subsystems, and full system in a manner that ensures tractability (technology and general design similarity) and scaleability (directly scaleable weights, margins, loads, design, fabrication methods and testing approaches) to a full-scale system; and verify full-scale systems operability and performance in "real world" environments.					X				X	X	

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53	Is one of the goals you're testing the X-33 for to go to the Space Station? Can you get the vehicle up to meet MIR? Are there any plans to build another vehicle like this one? Will there be a Space Station out there then?	**Mr. Austin:** The X-33 will only go part way to orbital space. So we will not be able to take payloads to the Space Station. The VentureStar will be the vehicle to take payloads to Space Station. Space Shuttle and Russians and the Europeans have launch systems that can take care of that. Well, the International Space Station, first element of the International Space Station is at the Kennedy Space Center right now and is expected to be launched with the next year or so.		X							X		
54	I'm a geologist and environmental scientist, and I support basically anything NASA does, especially things like the Pathfinder mission, and that includes what you're doing. But I have a few questions about what NASA envisions for this program. Do you plan on this vehicle being manned?	First comment acknowledged. **Mr. Austin:** This vehicle will not have human pilots even in the follow-on operational system, the Venture Star. The operational RLV will carry passengers. It will take crews to and from space stations. And eventually, people, may go to space for reasons that we cannot even now predict; one might be space tourism.										X	
55	What is the future of the vehicle beyond getting payloads in space? Is it meant to fully replace the Space Shuttle? * SIC means "not quite correct"	**Mr. Austin:** It is meant to fully [partially] replace the Space Shuttle and a number of our expendable launch vehicles. We have lost 75 percent of the market in launches in this country over the past 20 years. We have to regain that competitive nature so we can bring some of the resources back to this country that have been taken offshore from more competitive foreign launch systems. At a conference with the chief executive officers of major aerospace companies, Mr. Goldin stated that we want to turn the launch business over to other people. NASA is not an operational agency. NASA is a research agency that is										X	

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		chartered to explore space. Launch technology is now mature enough that we can achieve single-stage-to-orbit, which is what the X-33 is going to demonstrate. It will make it economical enough to be accomplished through the private sector.											
56	What will be done with the X-33 after the test program is completed?	**Mr. Austin:** When the X-33 objectives are met and a program is underway to develop the Venture Star, the X-33 will probably be on display somewhere. This is pure conjecture, but the X-33 will probably remain a viable test bed for various aspects of the operational program. Alternative applications that DOD are looking at may have a need for this particular size of vehicle. It is possible there are extra uses for the X-33 that we did not envision when we began the program.					X				X	X	
57	Is it possible that the Venture Star project could be abandoned and, if so, under what conditions?	**Mr. Austin:** Yes, the program could be abandoned. This is an experimental program. For the X-33 demonstrator, we can bring the risk, both financial and fiscal risk, within a reasonable range of uncertainty. We hope that with the lessons we're learning, we will be a smarter designer, a smarter builder, and we'll be able to picture the costs of the Venture Star. If those costs go up substantially and the business visibility is not there, it will probably be deferred to a later time. We're undertaking a bold new venture trying to get the government out of launching and let it go into private operation. We've been launching satellites and launch vehicles now for over 50 years, and it's time that this technology can be picked up by the private sector and let the government go back to doing research technology and exploration.									X		

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PUBLIC SAFETY AND RISK/FLIGHT TERMINATION AND VEHICLE FAILURES/CONTINGENCY PLANNING													
58	Public Law 60 was mentioned, and I know that was developed some time ago. You mentioned that there can be no greater risk to the public than that posed by general aviation. How has that changed in respect over the years, and are we dealing effectively with Public Law 60?	**Dr. McCaleb:** The guideline is developed by the Range Commanders Council. The Council meets regularly and reviews all flight and space systems and X-plane programs for safety purposes and resolution of problems. We put the history of the X-plane program in this document. Undoubtedly, some have gone down. Four pilots, over the years, have died. There was no harm to the public with these projects. Several times a year, the Range Commanders meet and discuss each project, what happened, and what needs to be fixed.										X	
	Were those downed X-aircraft related to mechanical failures? I assume these are things you are constantly working on. I was just wondering what was the primary cause of the four downed flights you mentioned.	**Mr. Austin:** X-planes and launch vehicles fail for a variety of reasons. Software, in the case of launch vehicles. Sometimes the guidance system would fail. Pilots sometimes have caused problems to occur simply because they're flying in a large area of unknown environments that never have been tested before. So there are many, many contributing factors to the failures that have occurred over the course of experimental plane and rocket programs. All of them are analyzed intensively to understand what happened and how to prevent it. There is a chart in Appendix A of the EIS that tells what the failure problems were.											
59	Where types of storage devices are those tanks? Are the hydrogen tanks above ground? Where does the supply come from? Will it be trucked in? What routes will the trucks be traveling?	**Mr. Austin:** Those tanks that hold hydrogen, liquid hydrogen and liquid oxygen are separated on either side of the launch pad. The hydrogen tanks are above ground. They get their fuel from commercial sources trucked in and it's not that great a quantity of hydrogen and oxygen. **Dr. McCaleb:** We do have a transportation route in the DEIS. All those details will be paid attention to. Edwards Air Force Base uses liquid		X									

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		oxygen in some of their testing activities and we anticipate following those same routes and using the same vendor sources.											
60	After the fuel is used within the first 140 miles of the flight, is there enough fuel left in either tank or both tanks to sustain an explosion—say 400 or 500 miles out, at which time the entire plane would be more or less destroyed and the parts scattered? Have you thought of that?	**Mr. Urie:** We have done analysis throughout the flight trajectory for as long as there is sufficient chemical energy on board to cause an explosion and the most critical point is just before main engine cutoff at about the 140-mile point. What we have done is look at scattering of a thousand parts. We have looked at what parts are likely to come off and what size, what shape, chunks, and given that they have a certain amount of kinetic energy, potential energy, whatever remaining explosive power there is, where those parts might fall. We have done a complete analysis of what kind of scatter pattern we have and I believe it was 400 miles, so yes, there is that potential. It is extremely remote, but it is real. **Dr. McCaleb:** At the maximum point the debris would gradually fall. It would gradually come down and go forward, but the least amount, 1,500 pounds of hydrogen that is on the vehicle when the engines cut off--that is where the vehicle would come nose down--that amount of hydrogen and oxygen on it--that debris--a larger area, close to 525 feet around the vehicle and we have provided that information.								X			
61	Are the engines the same as the Shuttle ? What happens if it one explodes?	**Mr. Austin:** The Shuttle engines are hydrogen and oxygen. Each of those are twice as powerful as the X-33 engine. We haven't had a liquid engine explode in flight since the '50's, that has been taken into account. The power packs for these engines were flown on the Saturn V and Saturn I, second stages. They were highly reliable engines that have been extensively in the program in the past and we had the same power packs that were used in that particular vehicle,		X									

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		the J-2 engines, the second and third stage on the Saturn V, the moon rocket, and the second stage on the Saturn I, the original Apollo flights were done on that, so we have a very reliable power pack for this particular engine and we feel very confident in the reliability of that particular system. **Mr. Urie:** Another thing is that there's been a lot of ground testing of an engine very similar to this in the late '60's and '70's, the liner aerospike engine of the same thrust capability as this, same size as this, using the same power packs, the same machinery. The engine had run a total of 20 times the entire duration of engine runs for the whole 15 flights of the X-33 Program without mishap, and even tried to fail it by drilling holes in thruster chambers and it didn't fail. **Dr. McCaleb:** Also, before liftoff in the weeks before that, once the vehicle is taken to the pad, it will be tied down in some way, mechanically held in place too, as a whole assembly and main propulsion system activated with engines fired several times before it is ever launched. **Mr. Austin:** This is called the flight readiness review firing. **Dr. McCaleb:** The debris patterns discussed in the document went into the probability factors that were discussed. If you'd like more information about it, at the near pad with maximum fuel levels right there on Edwards, it would be about a 300-acre impact if that were to happen with those fuel tanks. As it continues to lift off rather than rapidly gaining speed and altitude we have provided the details as it gets further down range, if it achieves the Mach 4 s it's headed to Silurian, one of those, if the vehicle were to break up, the pieces still have their momentum and they're going to follow along as the vehicle had intended to and would											

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		probably reach where the vehicle had intended to land. If it happened in that pattern and that randomness, the total debris at that point, probably being 20 miles long. As it heads to Dugway, achieving Mach 9 to 12, if it happened at that maximum altitude headed to Nevada, debris patterns would go for 100 miles with leading edges also headed to Dugway, the other would be 160 miles. After the propellants are expended, if we had to bring it down, because it's not lining up with the runway in the remote area and that land, the smallest being 10 acres.											
62	We know the X-33 is remotely piloted. In comparison to a private or commercial aircraft where the backup is the copilot should something happen. What is the backup to the primary landing system should something happen? Is there a secondary or tertiary that would automatically kick in?	**Mr. Urie:** Yes, the answer is that there are two complete systems which are on full-time. So we don't have to wait for it to kick in. Neither is a backup. There are two complete electrical power systems; two complete flight control systems; two complete sets of sensors of every kind, inertial sensors, air data sensors; two complete sets of antennas for receiving information, including ground radar, ground proximity radar; and three computers. So the backup is a completely fail-safe system, a completely dual system end-to-end in every respect. **Mr. Austin:** In addition to that, the flight will be monitored from the ground at Edwards Air Force Base by both the program personnel looking at the flight as it progresses through from launch to touchdown, and the range section function to verify that the vehicle is staying within the safety regions that the flight has been approved for. If it veers from the established path, the range safety officer can issue a command for an independent system, not one of the two just described, to terminate the flight and bring it down in a non-populated area, or have a controlled flight into the ground. This									X		

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		will depend on where the vehicle is, where the impact could be in a selection of an impact area or an alternate landing site. Training will be conducted on this aspect of the program long before the vehicle is flown. Several fall-back options are available, both for the automatic system and the ground monitoring from Edwards Air Force Base.											
63	In the range control area, if the guidance systems fail or the range control directions to the plane fail, are there independent command capabilities? And what kind of timeframe is this in the flight relative to when it's supposed to land?	**Mr. Austin:** Destroying the vehicle while it is flying would pose a far greater hazard to the population than guiding the system with essentially a spring-type system. When a command is issued to terminate the flight, the control surfaces are mechanically oriented in a direction to pitch the vehicle nose down. This way the vehicle would come into the ground and would provide roughly a 10-acre impact zone for the vehicle. Most of the trajectory from Edwards to the landing sites would not pose a hazard to anyone, but there are exclusion zones along the flight path where the range control officer will not issue the command to terminate the flight because it would pose a hazard to the population.					X						
	Of the exclusion area, would you be able to determine population areas, infrastructure, power stations, things like that to avoid?	**Dr. McCaleb:** Population and private property will certainly be considered as potential areas of exclusion. NASA and Lockheed Martin's intent is to protect the population and property to the maximum. Plans are being developed now, and details will be distributed in advance of any flight to every county and state in the flight path.											
64	I'm with the San Bernardino County Fire Department in Baker. You stated that when the X-33 lands it would have approximately 1500 pounds of hydrogen and oxygen still on board?	**Mr. Urle:** Yes.				X							

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	In the flight termination scenario, is that going to be vented prior to the controlled descent?	**Mr. Urie:** No.											
	Basically, would we be looking at something along the lines of …..	**Dr. McCaleb:** You'd be looking at a 10-acre impact area. There will be an Emergency Management Plan for any accident or controlled flight into the ground that may happen. It will be worked from the Lockheed/NASA part and to the satisfaction of the Air Force before any launch takes place. It will include how to secure the area and what needs to be done with any other materials, what material safety data sheets should be available, and so forth. This plan will be distributed to every county and state management organization within the flight paths and any variation of the flight vehicle, and we will ensure that there is an understanding of that plan before any flight takes place.											
65	In the event of a catastrophic mechanical failure, what is the potential of it actually falling or for getting debris fallout in this part of the country as opposed to the overall flight path?	**Mr. Urie:** There are several stages of flight where the nature of a catastrophic failure varies. On the powered ascent portion, where there is considerable fuel on board, we have potential for an explosion which would scatter debris. We have done debris pattern analyses for the full powered ascent range of flight. That data is available. But that range of flight goes to about 140 miles from Edwards Air Force Base, about to the Nevada line. In the most extreme case, it's possible that some pieces of debris might get a lot farther than that, possibly even to the Montana border. That analysis has been done on the basis of where the vehicle is, how much kinetic energy, at what altitude, how much chemical energy remains to scatter the parts, and so on. Once the vehicle is off, the nature of failure really translates into one of control systems, if you lose control of the vehicle. There are fully dual flight control systems, fully dual										X	

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		electric power, fully dual air data and inertial data systems to minimize that possibility. It takes a double failure to lose control of the vehicle. In the event that occurs, there is an independent flight termination system. That system is there so that the vehicle can be brought down and intentionally dived into the ground in some uninhabited place in one piece, rather than to blow it up and scatter pieces.											
66	How was the 10-acre impact zone on command to nose the vehicle into the ground determined?	**Dr. McCaleb:** By the amount of hydrogen and oxygen left onboard and its explosive potential on impact to throw fragments. At immediate impact, most of it will be within less than 2 acres, but because of the 1,500 pounds of hydrogen, the maximum radius for fragments would make up the 10-acre zone.					X						
	But in terms of your ability to nose it down at a specific location, what would be the circular area? We're talking circles here, I presume?	**Dr. McCaleb:** Yes, circles. The highest elliptical zone for fragments would happen if the vehicle broke up for some reason at its maximum height and speed; the pieces would still have the momentum intended to carry it to the landing site. At the maximum height on the Mach 9 to 12 flights, approximately 1,200 pieces would gradually come down over an ellipse up to 100 miles in length and maybe 20 miles wide. As its speed comes down, those ellipses become smaller and smaller, converging on the most minimal impact, straight whole body nose down at the 10 acres. Please refer to Section 4.3 and Appendix D.											
67	What do you consider the most critical part of the flight?	**Mr. Urie:** The most critical point is liftoff.								X			
68	I came here to offer my opinion. But in stating that there is a system design in case of a failure that you can bring the craft down, a machine traveling at Mach 15 is going to have a lot of heat generated. I take it you plan on launching seasonally, and we	**Dr. McCaleb:** We did put the debris patterns in the EIS, the most dramatic being where it has the most speed, and because the vehicle is no longer in one piece—it's an explosion—those pieces will continue to move forward. As its										X	

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	get some pretty arid summer times here, as well as fall. If it comes down in a wooded area, the potential of creating forest fires is high. Can you give us some feedback on that?	speed comes down, the values come down. And a nose-down impact is 10 acres of total zone. We will be working with the emergency management organizations. At my facility, we have large engines, a lot of hydrogen, oxygen, so forth. All of that information went into the careful planning of the flight paths. When we say the 1 in 100,000, it doesn't mean that we have to have 100,000 safe flights. We're assuming randomly 1 in 250 in the number of pieces that we have planned where to fly, so that the probabilities of even a piece hitting anywhere that would present harm is that remote. We will have, to the satisfaction of the range safety officers, like all the other X-planes in the Air Force, an emergency management plan that is coordinated not only with Edwards but also Malmstrom Air Force Base and the residents. It's all part of the Community-Right-To-Know Act. It will be distributed to every county organization and state agency in the flight path so they know exactly what response needs to be made with respect to the vehicle should it go down. At high altitude is when that might happen. Because of the hydrogen and oxygen, rapid combustion will take place and there won't be propellant that can reach the ground. But it could set off fires. We anticipate stabilizing the area immediately to prevent fire. We will ask for it to be cordoned off and response teams will be ready to go in and take care of the remains of the vehicle, like we have done with other systems. In this case, we will wax it down and remove it from the area. It is composite materials, the carbon fibrous materials, that are very lightweight, not like a typical metallic product. We have used this in other instances. We will accept total responsibility [to the extent specified in the cooperative agreement between NASA											

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		and Lockheed Martin], to do what we need to, to restore the area and make right the situation to the best extent we can. All of that will be in place and the plans will be available.											
69	If the ability exists to put the vehicle nose down in a central area, how will the area be controlled?	**Dr. McCaleb:** Emergency Management Plans will be in place with each of the sites and agencies involved.					X						
70	Dr. Urie talked about some kind of problems that might be anticipated in flight in using the GPS system. What kind of anticipated problems are we talking about?	**Mr. Urie:** I don't think I referred to problems using the GPS system. Flight control systems are physical electronic systems with human written software, so there are possibilities for failure. It happens on aircraft. What we do is provide multiple systems. As far as GPS, we have dual GPS.										X	
71	One of the concerns at Dugway is that they are still doing chemical weapons distribution there. It looks like from the schedule that they will still be doing that. Is there consideration of having that process done before you start flying into Dugway?	**Dr. McCaleb:** The major stockpile of chemical weapons that you are referring to and the chemical incinerator are at the depot, which is to the east of Dugway Proving Ground. Those agents and the stockpiles and the activities associated with them are not near the landing field that we are intending to use. That activity, as we understand it, will still be going on in 1999. The depot is about 60 miles or somewhat more from the field where we would be landing. The flight path will be well away from that area. The Proving Ground is a facility of 800,000 acres and extremely remote. There are small storage areas of chemical laboratories that are devoted to chemical warfare agents--as well as biological--that are contained. Those facilities will be considered in planning the flights paths and if there appears to be a problem, the flight will manage to avoid those areas. **Mr. Austin:** As the vehicle is in flight, the launch site is monitored by both the ground operation crew and a marine safety officer from the Air Force Flight Test Center. If the vehicle								X			

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		is operating outside the boundaries that we have agreed on are safe for whatever course in the flight path, the flight safety officer can instruct a flight termination which will either bring the vehicle down and land it on another runway or terminate the flight by simply turning. The vehicle will go nose down and move down in a controlled fashion into a non-populated region of the flight path. We will go through a number of training processes to be sure we understand where the population centers are along the flight path so we can avoid them. **Mr. Urie:** The two phases of flight give different concerns. Foremost, the power portion, which is about the first 2-1/2 minutes ascent to 250,000 feet, acceleration to Mach 13 to 15, under full propulsion from the two aerospike engines. The vehicle can withstand failure of one of those two engines at any time after 40 seconds of that 2-1/2 minutes and still complete a normal flight profile. All it does is lay the throttle back. After power off, after the peak performance point is reached, which is about 140 miles downrange from Edwards, just over the Nevada side of the California border, the airplane is then gliding, and in that portion of the flight the major concern is flight control. In order to provide the levels of safety that are historically standard, we have two forms of insurance. One is structural margin so that we don't break the vehicle within a margin. The other is redundancy in the flight control system. We have fully fail-safe, a fully dual flight control system with sensors, air data, inertial systems, and full dual communication systems and have three computers. So we can lose one of everything on either side of either, and we still have a fully operational vehicle. So											

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		those are supplemented with flight termination systems that Gene described, which is entirely independent from the primary system. The primary systems are all active at all times. It is a not primary and a backup. They are both primary systems. That's the major design measures we are making with the vehicle to minimize the possibility of a catastrophic event.											
72	We see a potential for problems at Dugway with mission incompatibilities, conflict with electronic warfare activities, and airspace utilization. There is also a possibility of a nuclear waste storage facility on the outskirts of Dugway about 10 miles from the gate.	**Dr. McCaleb:** NASA has been made aware of the nuclear waste storage facility. It's about 40 miles from the runway. Before the X-33 is launched from Edwards Air Force Base, we have to receive permission from both the Commander of the Air Force Flight Test Center at Edwards and the landing site installation managers before we initiate a mission. Concerns were noted. [See Section 4.3]					X						
73	I know birds can damage aircraft and they can damage the Shuttle. If a bird gets hit by the X-33, could it damage the vehicle?	**Mr. Urie:** Yes, of course, but not seriously. We would have to replace an outer shell panel. **Mr. Austin:** The outer shell is made up of a series of metallic panels that are attached to the structure with bolts. But they represent an external barrier to the fuel tanks inside, so we don't foresee a situation where penetration would occur all the way through to one of the more critical elements.					X						
74	I would like to compliment you on how you're running things. I came here with a real negative attitude tonight. I am very impressed. I thought it was going to impact property and a lot of things. And I think you've been candid with what you've done. I wish there were more people here to understand all of this.	Thank you for your comment.							X				
75	We have commented many times on solid rocket	Comment noted.					X						

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	motor programs both here and elsewhere in the country, and would like to applaud your design with the nonhazardous materials that lessen the environmental impact.												
PUBLIC VIEWING													
77	Will the media and general public be allowed in to see the launches and landings? I work with the school system, and it would be nice if an educational opportunity for the local students to see or get as near as possible, or if it could be shown to the local schools somehow.	**Dr. McCaleb:** NASA is a civilian activity which attracts a lot of attention. We will work that with the local authorities and communities. We have not yet finalized how that will be. It will be different for each site. Our intent is to allow the public a viewing opportunity, at least for one launch and one landing at each site. We probably will not have people going up and touching it, but it is equally interesting for most to see it hoisted to the back of the 747 and returned in a fashion that no other vehicle gets afforded.		X	X	X	X	X	X			X	
78	Will launch and landing times be made public?	Yes, they will be publicized well ahead of time. The launches will occur very early in the morning.					X						
ROAD CLOSURES													
79	I just wondered, when it lands, is it going to go across Highway 17; will the highway be closed for a while, or anything like that? (Moses Lake)	**Dr. McCaleb:** No. Road closures (at Moses Lake) will not be necessary.											X
80	What would this do toward public access to the Pony Express Trail that goes above Dugway? Will the roads stay open to the public?	**Dr. McCaleb:** Nothing, there will be no road closures at Dugway.					X						
81	At Silurian Lake, closing the road for an hour and a half is not enough time. People will be there the day before. What security measures will be taken to control access?	**Dr. McCaleb:** We will have to work those issues. I have seen significant motor firings, the extraordinary efforts that individuals will go to observe them at great risk. You will note in the document that we have anticipated having helicopter surveillance in the area beginning at whatever time we've deemed necessary to enforce that protection. And because we cannot anticipate the numbers, it is a desert area, we don't want anybody suffering from the water,		X									

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		it is a desert area, we don't want anybody suffering from the water, personal needs, a lot of other things that's why we will work very hard to make viewing possible and publicize that at the other places that will be mutually considerate to both sides so that we can accommodate those needs and we will try our best to encourage them through those other incentives to please help us in that one situation.											
82	How will it affect traffic on Highways 58 and 395 (Edwards Air Force Base)? Are there any plans for temporary closures of these roads?	We haven't completed the planning on that. We realize that there's going to be an interest in viewing it, but we have a lot of details to fill in. I think one of the objectives that we are currently thinking about is to provide an area that could accommodate parking for viewing that is west of Boron and south of the line east of the Haystack Butte site and that any traffic that's on the road north of that line or east of Boron would simply continue to move through the area. We want to keep the flow of traffic. We don't want to have people just pulling off the side of the road. We're going back to have to work with law enforcement in the area to make sure that we can keep the traffic moving and provide viewing areas that are away from the flight path of the vehicle, but off the highway. No plans for temporary closures of the two highways.		X									
SITE SELECTION													
83	Why was Dugway chosen and is there a possibility that you will decide not to use Dugway?	The decision was made to test the new vehicle using an envelope expansion process. First flights will be short and slow—Mach 4 to about 100 miles downrange, either at China Lake Naval Air Warfare Center in Ridgecrest, California, or Silurian dry lake bed north of Baker, California. The next landing site opportunity for a mid-range site, for mid-range					X						

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		velocities—about Mach 12—would occur at Dugway Proving Ground. There are no other sites in this particular corridor on the way from Edwards Air Force Base to Malmstrom Air Force Base in Montana or Moses Lake, Washington, that offered the attributes of Dugway. If it proves to be unacceptable to land at Dugway, the X-33 would not make a mid-range flight, but would go directly to the higher Mach number and longer-range flights after completing the short-range flights.											
84	I live in Lancaster and work at Edwards. Some people who work at Edwards who don't have anything to do with NASA are concerned about both launch site positions, both on the south end of the lake bed and at Haystack Butte because you have populated areas down range from the immediate launch area. Have you considered going to the other side of the intersection at Kramer's Junction. It is a desert area with a good desert road called Quartz Road. We get vehicles in there like tank movers and so forth, so it is accessible. Not a long way to move, but you're getting away from the populated area. It is all BLM property and it is still in Edwards' flight zone.	That is in the flight risk numbers and consideration that was discussed at the end of our presentation. All that information went into the modeling, including the debris patterns, and it's in the document. Because of the vertical takeoff, it is preferred to bring it in as far as possible within the Edwards Air Force Base range, and it will be at an extremely high altitude at the point being considered. Other considerations, called quantity distance, require that our launch facilities be in a sufficiently remote area where vehicles with this amount of propellants are exposed. Fragmentation zones do not overlap with other facilities and we had to take that into consideration on Edwards with the facilities that existed that also had those type arcs.	X										
SONIC BOOMS AND NOISE													
85	Has there been any study on the initial liftoff noise levels? How is this going to affect our area? What about the initial thrust? How will this affect the test stands? Why are we getting a lot of sonic boom from the SR-71?	Yes, there has been studies in the initial liftoff noise levels. With respect to the general sustained noise from the engines outside the sonic booms, to give you a perspective this is fairly small. The total thrust of propellant energy for this vehicle is equivalent to only one of the three main engines on the Oribter itself.		X									X

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		The Space Shuttle is 7.2 million pounds and this one is 400,000 pounds and its only one of those engines. With respect to the sonic booms when it's in the half to one psf, it sounds like a double boom. It's a quarter-second impulse. When it's around 120 and under on the decibel levels, generally there's not a problem with the cracking or most we'll get is a cracked window or two. The focus level on the higher booms will do that and in a smaller area. The damages will be the responsibility of the program. The noise at Boron should be between 90 and 95 db. You'll hear the rocket noise and further up north will be a little bit less. The Lemon Ridge test sights are considerably lower than the Haystack Butte site is. Plus the engines that were there are considerably larger thrust than the engines, either or both of the engines on the X-33. Again, we have 400,000 pounds total liftoff level on the X-33. That one was a million and a half pounds of thrust. A number of the engines of 180 to 400,000 pound class were tested over there. So while this is comparable to some of the engines they tested there, it's further away and the noise level should be diminished over what you heard from Lemon Ridge. Those from China Lake would be more typical. Silurian is far to the east. Around 5 psf you'll get a pretty good jolt, but the rest of them will be a lot lower than that. A lightning bolt is equivalent to a half psf. The SR-71 sonic boom is usually between 1 and 3 psf. So you'd have to be right in line to hear something that loud. Barstow is below the line. The F-1 is very strong and loud. Those rocket											

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		engines are much larger; therefore, they have a much more lower frequency and they tend to rumble and generate much lower frequency, more power. The X-33 engines are small, using hydrogen and oxygen, which generally make higher frequency noise which doesn't carry as well in distance. The level should be quite a bit lower than what you've experienced before.											
86	Is there really any difference between a sonic boom from the X-33 and a lightning strike close by, or is it basically about the same as far as the average person can tell? That happens where we live.	It's about the same. A thunder strike if you were about 50 feet away could go 3 to 5 pounds per square foot in the 130 plus decimal range. And that is what we're talking about. Those magnitude booms only happen on the focused areas. None of the smaller ones are capable of having that much energy. They're really just an audible clap, but they don't have the vibrations in overpressure that is associated with it. It would have to be close where you actually felt it. You're going to hear a bang, bang. There is a wave that comes off the front of the vehicle and a wave that comes off the back of the vehicle, but they'll only be a quarter of a second apart so it's bang, bang, real quick. Tooele and Grantsville are outside the half pound per square foot border and we don't anticipate they will be heard there. Inside the one pound per square foot range, you're basically on Dugway Proving Ground.							X				
87	What would psi sound like?	A double boom.							X				
88	Will you be taking data on acoustics, sonic booms, and any debris that happens throughout the program? And will it be extrapolated for the full-	We certainly anticipated most of it and certain key issues are undergoing verification. We have been doing noise acoustics since Apollo days,	X										

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	scale vehicle? Is it available to the public?	and once we go into flight and models have been approved, that will be followed very carefully. The Department of Transportation has been working with us on that so they can facilitate. Yes, it will be available to the public.											
89	My father was born a few miles from here in 1897, and my mother moved to Moses Lake in 1903, and I have lived here 99 percent of my life. I've seen the airplanes go and come. It started out to be an argument with a French pilot of, what's that supersonic plane, the Concord. I said it's nosy and he said no, it's a noise you've never heard before. After he had made a few landings, you just didn't notice it any more. Then, for a short time we lived over southeast of Ritzville, and we lived 2 miles from the Bombing Range where the bombers drop. They dropped bombs all day and all night and flew over our house. After a few days, why, you never hear them. And I thought, when the twin Mustangs moved in here, it would be 50 years ago they came here, and I thought, now we've had it. But when they landed, they backfired, it was a big popping noise, and every time we would change our planes here, now we are going for the noise again. But after you get used to it, there is no noise. You never hear these airplanes. And one other comment on noise. In World War I, the French needed soldiers badly, so they went to one of their colonies in Africa and gathered up--at that time they were rated the finest soldiers in the world, and they took them to France, done some war training, put them into trenches, and when those people heard those cannons go off, it just terrorized them. They had to just lay on the ground, they couldn't do anything. And as soon as the noise was over with, they got up, and they just	Thank you. Very interesting.											X

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	terrorized the Germans.												
90	Have you checked further into the possibility of avalanches and gotten any kind of results?	Yes, and that information is in the EIS. We reviewed the conditions that snow banks developed and had a propensity for avalanche. Roughly concluded that we need to take consideration at the _ psf vibrations in the flight path. In the document, we note the alpine and mountain passes that it will fly over. There are guidelines typically if those conditions exist. We have made the commitment to follow those conditions. It is our understanding that they do start stabilizing avalanche conditions, usually in the pre-dawn hours, prior to alpine skiers and people traveling through the passes. If that condition exists, launch will be delayed until we can confirm that the proper authorities have conducted those activities in the affected areas.										X	
91	In your statement on the avalanches, you kind of reflected only on the ski areas. Other places get avalanches too. Are you only going to reflect on the ski areas, or is there an overall goal?	Overall, not only the ski areas, but also mountain passes and other areas in the flight line where people would be, will be considered. There are also some places in the State of Washington. We don't anticipate much in Utah and Southern California. We will be following the advice of the authorities here and take that into consideration at launch time.										X	
92	The draft EIS mentioned some eagles up near Great Falls. The Canyon Ferry area is in the footprint of the sonic booms, and we have 2- or 3- or 400 eagles out there from Thanksgiving until February. I didn't see anything in there reflecting on those populations.	We have been working with Fish and Wildlife Service over this issue. With respect to the size of these booms and the infrequency, typically with a bird and our experience with eagles at the Kennedy Space Center, those that haven't been around the phenomena would possibly exhibit what's called a "startle" effect. If they were in a thunderstorm and they would be expecting a clap of thunder, they're not going to fly away from their nest. There is a slight possibility that with the brief noise, that it might cause them to have										X	

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		a "startle" effect and fly to see what it is and then shortly return to it. If this became a very routine part of the work in this region, with supersonic vehicles, they would soon not be concerned about that type noise. But it would be, at most, a startle effect, to leave the nest and see what's happening.											
	These are migratory flights. The Bureau of Reclamation and the wildlife people are worried about people getting too close because the click of a camera disturbs the birds. This is a little bit heavier than the click of a camera.	If it's perceived as threatening, they will fly. But it's a one-time impulse. As it settles, the birds settle down; and if they observe that there is not a threat, they will return to the nest. Those at Kennedy Space Center hear it all the time, and they don't fly off. At our engine test facilities, the animals don't usually even look up anymore unless someone is around watching them.											
	It might be a good idea to put that in your EIS.	We can make it more complete. We provided to the Fish and Wildlife Service our estimate of the type of impacts and requested them to identify the threat—particularly threatened and endangered species or species of concern. They indicated there should be no impact.											
93	Was Jay Bantam from Fish Springs from Fish Springs contacted? He was at the last meeting but I don't see him tonight. He was concerned about your sonic footprint because of the range down there.	We sent out more notices and advertisements for this meeting than we did for the scoping meetings last fall. Fish Springs was on the distribution list.						X					
	John Ryan was going to get in touch with him and give him more information on the focal points because of the birds. He indicated he would send that information to some of us also.	You did not receive that? (No.) I apologize. A biological assessment was prepared and submitted to the Fish and Wildlife Service comparing falcons and bald eagles and Utah listed birds, bats, owls, and so forth. The impact was anticipated to possibly be a startle											

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Table B-2-5

Question/ Comment #	Question/Comment	Answer	California: Lancaster	California: Boron	California: Ridgecrest	California: Baker	Utah: Salt Lake City	Utah: Dugway	Utah: Tooele	Idaho: Idaho Falls	Montana: Great Falls	Montana: Helena	Washington: Moses Lake
		effect because it would sound like a clap of thunder on a normally clear day. The birds would probably fly and move to see what caused it and then return back. It was not perceived to be a problem. We will provide you with that. The biological assessment is also in Appendix E of the EIS with notation to the species. We will be glad to give him a call also and follow up on that.											
STRATOSPHERIC OZONE													
94	You mentioned in the EIS that there was less environmental impact than in previous flights, and you mentioned some figures. What kinds of things were you talking about at that time?	I was referring to the global stratospheric ozone impact. Our current vehicle, the Space Shuttle, uses a combination of propulsion. The three main engines and use hydrogen and oxygen. The two solid rocket motors on either side are packed with a material that looks like a silver eraser. It is a rubber bond with aluminum chloride for the oxidizer. Aluminum is the fuel. The two solid rocket motors are hollow on the inside. They're ignited at the head of the propellant, causing all of the core to start burning. It's burning down and out to the sides and hot gas is coming out. Those engines continue to burn until approximately the near edge of the stratosphere, releasing chlorine, aluminum oxide particles, and so forth in their wake. The chlorine in particular is as equally damaging to an equivalent amount of the propellants, CFCs, and refrigerants that eventually make their way to the stratosphere. Except in this mode, it has a very efficient opportunity to get there through direct injection. On the ground impact, the combustion of the solid rocket motors produces hydrochloric acid. Other systems, Titans and so forth, use that same technology. It's called storable										X	

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Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	California: Lancaster	California: Boron	California: Ridgecrest	California: Baker	Utah: Salt Lake City	Utah: Dugway	Utah: Tooele	Idaho: Idaho Falls	Montana: Great Falls	Montana: Helena	Washington: Moses Lake
		technology. The X-33 will not have any of those materials. It is plain hydrogen and oxygen. It can affect the stratospheric ozone; there's still water up there. But it doesn't have the effect, the catalytic destruction, where one molecule is going to affect thousands of others like chlorine does. That is the big improvement, the elimination of acid deposition on the ground, dust in the lower atmosphere, and releasing chlorine products in the stratosphere.											
WILDLIFE/VEGETATION IMPACTS													
95	How will the seismic vibrations affect the turtles burrows? Is there going to be any impact on the Joshua trees and such in the flight pattern with the excess moisture that this is going to be producing or is that going to be so minimal? Will you actually walk the area to locate burrows?	No, what has been perceived as seismic vibrations are actually from vibrations from the air and acoustics, but the vibrations that will be perceived will be from the noise and not traveling through the ground. Regarding the turtle burrows, this has not been anticipated, but we have committed to certainly making sure they're excluded from the immediate area. A ground surveillance of a wider area to know where they are and to check to see if any have collapsed following any of the activities there. It's smaller than a lot of motors that have actually been tested in the area, but we will note where they all are in that proximity and make a ground walk of those areas. Regarding the Joshua trees it will be very minimal, because it goes it goes up. It's literally on the long range flights in three minutes with the vehicle at 265,000 feet. Very minimal amount of hydrogen and oxygen will come down around the launch site. Also, the water at the stand is intended to be drained, configured in such a way so that as much and all		X									

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Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA: Lancaster	CALIFORNIA: Boron	CALIFORNIA: Ridgecrest	CALIFORNIA: Baker	UTAH: Salt Lake City	UTAH: Dugway	UTAH: Tooele	IDAHO: Idaho Falls	MONTANA: Great Falls	MONTANA: Helena	WASHINGTON: Moses Lake
		of it that we can will drain back into the frame trench, and that we will, of course, filter it, return what remains there that didn't get evaporated off in steam to the storage tanks and used again. It could disrupt the ecology.											
OTHER													
96	For the record, I am Bob Demming, Mayor of the City of Great Falls. This is not a question. This is a statement. In reviewing your environmental impact statement, this preliminary draft, we find there are no environmental detractors for Malmstrom Air Force Base. This is an active military base with more than adequate security. We have access to and can obtain a 400-ton crane, make it available at Malmstrom Air Force Base to lift the X-33 onto the back of the 747. On behalf of the citizens of Great Falls, the City Commission, I urge you to use Malmstrom Air force Base for the X-33 test flights. Thank you.	Thank you. Statement noted.									X		
97	You mentioned that this is a result of Dan Goldin's vision. What *is* his vision?	Other than reinventing NASA, he has a vision to reduce the cost of getting into space to a reasonable level so that we can more fully explore and utilize space for the benefit of the people here on Earth. We have, over the past 30 or 40 years, been paying several thousands of dollars a pound to get a payload into low Earth orbit. What is happening today is that with launch costs being so expensive, high-priority government payloads and well existing commercial market payloads like the communications satellites are the only ones that can be afforded to be launched into space. There is a demand for a variety of new types of communications systems, commerce that can be conducted in space, and useful exploration and applications that can be accomplished. The										X	

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Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA				UTAH			IDAHO	MONTANA		WASHINGTON
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
		technology that we're demonstrating, using the X-33, will permit us to prove that we have the technologies in hand before we build the next launch vehicle, like Venture Star. The vision is to get the cost down so that it's more affordable for both commerce and exploration.											
98	Question for Lockheed-Martin: The individual companies before their merger had a long history of contractor fraud and no-contest fine payments. Do any of you know how many fines these companies paid in the last 15 years and what percent of that management 10 years ago is still in place?	I can't really comment on the legal points you raised since I don't have sufficient knowledge of them to make any comment. As to whether the same Lockheed management is still around the answer is no. The top management of the new Lockheed Martin Corporation is generally quite new. To my knowledge, no one who was involved in any past disputes is currently in a top position in Lockheed Martin.									X		
99	One of you mentioned at the last meeting that the people who were concerned about the unmanned nature of this craft, that we shouldn't be alarmed by that because we have had jumbo aircraft fly from Los Angeles to New York without the crew ever touching the controls from takeoff to landing. But, afterwards, I was wondering, have we just told all the young people in the country, no matter what your dream is about being a pilot, we are now so technically sophisticated that we don't even need highly trained people like pilots?	I don't believe pilots are an endangered species. We have to raise our sights and expand the scope of what we're looking at when we look at what people are going to be doing in the future and what today's grade school children are going to be doing when they grow up and what their children will be doing. As we progress in developing our technology, we tend to automate the things that have become familiar. One example is the elevator. If you go to Seattle and you want to go to the top of a 60-story building, you get in, push the button for the floor you want, and an automatic system takes you there, whereas 40 or 50 years ago, there was a human being who operated that elevator for you. We have been flying airplanes for nearly 100 years and flying the Earth's orbit for approximately 40 years. As these procedures become familiar, it enables us to automate more and more of them. So it's entirely feasible now to have a fully autonomous flight system such as the X-33 and ultimately the Venture Star. About the only									X		

Table B-2-5

QUESTION/ COMMENT #	QUESTION/COMMENT	ANSWER	CALIFORNIA				UTAH			IDAHO	MONTANA		WASHINGTON
			Lancaster	Boron	Ridgecrest	Baker	Salt Lake City	Dugway	Tooele	Idaho Falls	Great Falls	Helena	Moses Lake
		thing in those flight profiles that a human pilot is equipped for and has the sensory equipment to handle is the landing. It isn't practical to carry a pilot to perform nothing more than the landing and still have it be an economical vehicle that will allow us to lower the price. So the confidence level in automatic landings has gone up by leaps and bounds in the last 25 years since we first began depending on them. What Venture Star will do is provide a basis or a stage or a launching platform for the adventures that human pilots will undertake in the future. It simply raises the platform from which our grandchildren and their children will depart from to go explore our solar system and possibly even beyond.											
100	Is there going to be public access via an Internet web site during the duration of the testing phases? Will the public have access to some of the information? Will it be updated regularly, like the Pathfinder program is now?	There already is. The Internet address is http://rlv.msfc.nasa.gov. It is updated regularly now. There are several hot links because Lockheed Martin has a home page as well. Lockheed just started a Venture Star home page too, but there is not much on it yet. They intend to incorporate X-33 data in it to keep describing the vision for the Venture Star service and the Venture Star vehicle.										X	
101	You'll be around for 2 more public hearings this week, right? (Dugway)	Yes, Salt Lake City tomorrow night and Tooele Wednesday night.						X					
102	Is there a way for me to get a copy of the video you showed tonight?	Yes, we'll leave one tonight; we have some extras here.	X										
103	Is there any literature that tells the general public what space has given us to make our lives better, like fabric, teflon, numerous things?	Let me point out something that is always overlooked. Every time you make a long distance phone call, every time you turn on the television, you're benefiting from space because of the amount of telecommunications, and the amount of relay that is done by satellite is phenomenal and it's completely invisible to us.							X				

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		Annually NASA publishes a technology spinoff. It is a concise record of all the activities the previous year that have resulted in commercial spinoffs and applications in some way.											
104	By the way, congratulations on the Pathfinder mission.	Thank you. We're all very proud of that.										X	
105	I'm from Roosevelt, Utah. So I drove about three, three and a half hours to come to this meeting. I'm a first grade teacher and I've been teaching aerospace education. Nothing gives me more pride than to say this is coming to Utah. The SRB comes out of Utah. This is coming from Clearfield. I'm just excited. It gives a lot of pride in our state and it gives a lot of aspiration to young astronauts who are in first grade. I just thank you. And that's what all my notes are for, for them and the people in our community.	**Dr. McCaleb:** Thank you for your comments.							X				
106	The other thing is it's been so exciting to see NASA on TV. I've just been glued to it. Such pride.	**Dr. McCaleb:** Thank you for your support.							X				
107	I'm with the Baker Community Services. I don't have a question; I have a comment. We're adamantly opposed to Fort Irwin coming into the Silurian Valley. I have gone through the 700-page study that you have on the table tonight more than once. I am happy to say that the only thing that I see in there is good. I see that this little vehicle is going to put some mark on the dry lake bed. I see it will land an airplane on the lake bed and pick it up and carry it out and that they may hear some thunder claps. I think this is a fascinating project. I think it's on the same scale as the X-1, the U-2, the Black Bird, the Space Shuttle. Now we have the X-33; not only that, but we have the father of the X-33 sitting in our room tonight (and, Dave, I'm honored, I really am). I would like to personally say that I would welcome this project with open arms and I would love to see the X-33 land on the lake	Thank you for your comment.				X							

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	out here. Thank you.												
108	I'm the president of an engineering and manufacturing firm. Our background is the aerospace industry. My background personally is Lockheed Martin, the F-22 program. I'd like to offer our support. I know people here are anxiously waiting to see the X-33 fly by.	Comment acknowledged.										X	

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APPENDIX B - SECTION B-2.3

WRITTEN COMMENTS AND RESPONSES

Appendix B - Section B-2.3
Written Comments and Responses

The formal comment period extended from July 3, 1997 through August 18, 1997. However, all comments received through September 9, 1997, were accepted and addressed in the Final EIS. A composite of these comments and respective responses follows.

Letter No.	Commentor	Affiliation	Page No.
1.	Carolyn A. Shepard	Dept. of the Navy	109
2.	Allan P. Azcueta	Private Citizen	111
3.	Stan Wilmoth	Montana State Historic Preservation Office	113
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5.	K. Kubo	Private Citizen	117
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8.	John C. Drouin	Private Citizen	125
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10.	Rod MacDonald	Private Citizen	129
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22.	William A. Lawrence	Private Citizen	159
23.	Paul Holmes	Private Citizen	157
24.	Lt. Col. Frank	Private Citizen	159
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26.	Myron Lee	Private Citizen	164
27.	Dennis Manning	Dept. of Transportation, State of California	166
28.	Lyman C. Welch	Private Citizen	168
29.	Jolene Gosselin, P.E.	Washington State Dept. of Transportation	170
30.	Tim Dead	U.S. Dept. of the Interior	172

Letter No. 1

DEPARTMENT OF THE NAVY
NAVAL AIR WEAPONS STATION
1 ADMINISTRATION CIRCLE
CHINA LAKE, CALIFORNIA 93555-6100

IN REPLY REFER TO:
5090
Ser 83E000D/ 4319
30 Jun 97

Dr. Rebecca McCaleb
NASA/Code AE01
Building 4201, Room 624A
Marshal Space Flight Center
Huntsville, AL 35812

Dear Dr. McCaleb:

I have received your letter of 10 June 1997 requesting our concurrence with the findings of the U.S. Fish and Wildlife Service (USFWS) Section 7 Consultation completed for X-33 landings at the Naval Air Weapons Station, China Lake. I have reviewed the Section 7 findings and recommendations and concur that no impacts are to be expected at the China Lake landing site, Armitage Field.

1-1 I would however, like to suggest corrections to the findings presented in your letter. The South Range Tortoise Habitat Management Area was designated such by Navy and approved by the USFWS, rather than designated by the USFWS, as stated. We do not feel that X-33 landings would effect towhee nesting and suggest that you delete the section which discusses nesting season and renesting on the second page of your findings.

If you require further assistance from China Lake regarding biological resources, please do not hesitate to contact Ms. Susan Williams, Staff Biologist, Naval Air Weapons Station (NAVAIRWPNSTA), Environmental Project Office at DSN 437-3803, commercial (760) 927-3803, or via email at susan_e._williams@imdgw.chinalake.navy.mil.

Sincerely,

Carolyn A. Shepherd

CAROLYN A. SHEPHERD
Head, Environmental Project Office
Public Works Department
By direction of
the Commanding Officer

RECEIVED
JUL 03 1997

Responses to Letter No. *1* - **Depart of the Navy,**
China Lake Naval Air Weapons Station
Public Works Department
Carolyn A. Shepherd

1-1. We apreciate your concurrence with the "no impact" findings in the Biological Assessment. Your suggestions concerning the designation of the South Range Tortoise Habitat Management Area and towhee effects are noted.

Thank you for the comment.

Letter No. *2*

DELANO HIGH SCHOOL
TIGERS

Allan Azcueta
1302 Valencia
Delano, CA 9
Phone (805)7

RECEIVED
JUL 07 1997

June 27, 1997

Allan P. Azcueta
1302 Valencia Ave.
Delano, CA 93215

Dear Rebecca C. McCaleb,

Hello. I am writing this letter on behalf of a newspaper article that I read today about NASA's X-33 project. In the article it stated that to request a copy of the studies that I should contact you at Marshall Space Flight Center.

I am a high school junior and I hope to be in the aerospace or space program someday. I have been a fan of the space program ever since from the Gemini Space Missions, from Apollo, and to the current running Space Shuttle Program. I love every thing about space exploration and space travel. When it comes to space, I get hooked like a child playing a video game for the first time.

2-1 I am very concerned about the future of America's space program. Will it still be here fifty or a hundred years from now? Will the government continue funding the space program? I mean those are some of the questions that I want to know. We cannot possibly stop now. Space is endless and we have to know what is out there and who is out there. That is the reason why I would like more information about the X-33 project. If possible, I am requesting the 40 page executive summarys. Thank you.

Sincerely,

Allan P. Azcueta

FB-CA-147

Responses to Letter No. *2* - Allan P. Azcueta

2-1. Concern about the future of America's Space Program is noted. NASA is committed to strategically planning and managing the future of the Nation's space program. Current strategic planning for all NASA efforts call for projections for the next 25 years.

A copy of the Draft EIS was provided.

Thank you for the comment.

Letter No. *3*

MONTANA STATE HISTORIC PRESERVATION OFFICE
NHPA Section 106 \ Other Consultation
This form constitutes a record of your consultation with the Montana Historic Preservation Officer on a particular project and is the official SHPO reply. The dates of SHPO actions appear in the appropriate boxes.

<table>
<tr><td colspan="3">Please Route This Form To:</td><td colspan="4">Rebecca McCaleb
Nat'l Aeronautics & Space Admin.
George C. Marshall Space Center
Marshall Space Flight Center, AL 35812</td></tr>
<tr><td colspan="4">Your Agency Requested Consultation with the Montana State Historic Preservation Officer (SHPO) on this Project under this Law or Regulation:</td><td colspan="3">Section 106, MEPA</td></tr>
<tr><td>PROJECT NUMBER</td><td></td><td>AGENCY</td><td>NASA</td><td>OTHER Agency</td><td colspan="2"></td></tr>
<tr><td rowspan="4">PROJECT NAME and Other Descriptions</td><td rowspan="4">X 33 Demo Vehicle Program</td><td rowspan="4">Dates and Separate Requests to SHPO on This Project</td><td>07/01/97</td><td colspan="3">Stan</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td colspan="2">THIS FORM documents</td><td>1</td><td colspan="4">individual actions.</td></tr>
<tr><td>Memo(s) to Sender</td><td colspan="6">We agree that use of existing facilities appears to present no potential for Adverse Effects to Historic Properties. Thank you.</td></tr>
<tr><td colspan="2">DETERMINATION OF ELIGIBILITY
The SHPO Has Considered Whether, per Your Request, Sites Either Meet or Do Not Meet the Criteria of the National Register of Historic Places. The Finding of the SHPO is as Follows:</td><td>Sites which Meet National Register Criteria</td><td></td><td>Sites Not Meeting National Register Criteria</td><td colspan="2"></td></tr>
<tr><td>Criterion A Findings</td><td>Criterion B Findings</td><td colspan="2">Criterion C Findings</td><td colspan="3">Criterion D Findings</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="2" rowspan="2">DETERMINATIONS OF EFFECT
The shpo has considered whether this undertaking will have an affect on significant historic properties. The finding of the shpo is as follows:</td><td colspan="2">No Eligible or Listed Properties Are Within the Area of</td><td colspan="3">The Project Will Have NO EFFECT on These</td></tr>
<tr><td>Potential Effect</td><td>X</td><td>Eligible Properties</td><td colspan="2"></td></tr>
<tr><td rowspan="3">Descriptions of Effects on Eligible Property Using 36 CFR 800.9</td><td colspan="3" rowspan="3"></td><td colspan="3">The Effect on These Properties is:</td></tr>
<tr><td>Adverse</td><td colspan="2"></td></tr>
<tr><td>Not Adverse.</td><td colspan="2"></td></tr>
<tr><td colspan="7">Other Comments:</td></tr>
<tr><td colspan="2" rowspan="2">Reviewer Signatures</td><td colspan="2">Stan Wilmoth</td><td>07/02/97</td><td colspan="2">:Dates</td></tr>
<tr><td colspan="2">Stan Wilmoth, Ph.D., HPO</td><td></td><td colspan="2"></td></tr>
</table>

3-1

Response to Letter No. *3* - Montana Historic Preservation Office

3-1. Comment that existing facilities appear to present no potential for adverse effects to Montana Historic Properties is noted.

Thank you for the comment.

Letter No. 4

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/7/97

TO: **Dr. Rebecca C. McCaleb**
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: Phil Copenhaver
1240 Pershing
Moses Lake, WA
98837

COMMENT(S):

4-1 I'm one of the important parts of NASA "The Tax Payer". Most spinoff from NASA can not be measured because the impact is and has been so great, I've

4-2 been repayed over + over. I see no real Problem Landing here in Moses Lake. This is a program that is the "Right Stuff and Bright Stuff" go For it!

Responses to Letter No. *4* - Phil Copenhaver

4-1. Comment that NASA's services provide a great benefit to the taxpayers is noted.

4-2. Comment that no problems are seen with the X-33 landings proposed for Moses Lake, WA is noted.

Thank you for the comments.

Letter No. 5

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7-7-97

TO: **Dr. Rebecca C. McCaleb**
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: K. Kubo
6810 Rd D.5NE
MOSES LAKE WA 98837

COMMENT(S):

5-1 CORRECTION to X-33 DRAFT Env. Impact Statement
3.2.5.4 transportation Highway 17 is a 2-lane undivided
highway. It is only 4-lane from Patton Blvd to STRATFORD Road.

Letter No. *6*

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: July 7, 1997

TO: **Dr. Rebecca C. McCaleb**
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: Eric Lund
3156 Lakeside Dr
Moses Lake, WA
98837

COMMENT(S):

6-1 It sounds like ~~that~~ there will be no public viewing (on the ground) with normal operations. ~~If~~ If abnormal conditions (weather, last flight) occured, would a public viewing be possible?

Response to Letter No. *6* - Eric Lund

6-1. The question of public viewing of the X-33 has been raised many times during the environmental impact statement process. NASA is a civilian operation, open to the public, and its popular activities have attracted a lot of attention. NASA will work with each individual launch and landing facility to determine the extent to which viewing can be accommodated at each facility. The final decisions on public viewing, under both normal and abnormal conditions, will be made after the launch and landing sites are selected.

Thank you for the comment.

Letter No. 7

Order of Daedalians

Big Sky Flight 99

July 8, 1997

Great Falls, Montana

To: Dr. Rebecca C. McCaleb
NASA Environmental Engineering Office

From: Flight 99, Big Sky Flight
The Order Of Daedalians

Dear Dr. McCaleb,

Welcome again to Big Sky Country! We, the members of Flight 99, are delighted to have you and your group visit our community. As former military pilots, we hope you will forgive our obvious bias in strongly urging you and your scoping group to making Malmstrom your choice for the X-33's long range landing site. A recent announcement
7-1 from Montana's Congressman Hill to introduce legislation to provide funding to maintain Malmstrom's runway should also be factored into your decision. Besides having a base where community/base relations are outstanding, a number of our community leaders are former officers and NCOs from Malmstrom. Our weather is one of the best reasons for making Malmstrom your choice, it's CAVU most of the time. The attached list of Flight 99 fully support your decision, and wish you every success.

DUANE C. HEDAHL MAJ USAF (Ret) FLIGHT ADJUTANT

LtCol USAF Ret
G. J. (Skip) Adams
4138 5th Ave. South
Great Falls MT 59405

LtCoL USAF Ret
Bob Benson
10110 Tarragon Dr.
Riverview FL 33569

Col. USAF Ret
Franklin C. Crain
230 Pine Needle Lane
Bigfork MT 59911

LtC USAF Ret
Michael R. Crawford
384 Zimmerman Lane
Hamilton MT 59840

LtC USAF Ret.
Robert K. Dundas
140 Pebble Way
Bigfork MT 59911

Col USAFR Ret
I. Wayne Eveland
2312 Alpine Drive
Helena MT 59601

LtCol USAF Ret
Thom Granier
3906 Rolling Terrace Lane
Valrico FL 33594

Major USAF Ret.
Duane C. Hedahl
2225 9th Ave. South
Great Falls MT 59405-2843

LtCol USAF Ret
William W. Hewitt
110 Beach Road
Bigfork MT 59911

LtC USAF Ret
C.Y. Jack Holland, Jr.
704 Skyline Drive
Great Falls MT 59404

LtCol USAF Ret
John G. Joern
1259 E. Fork Rd
Sula MT 59871

Capt USAF Ret.
Robert E. Johnson
920 Ave. E. N.W.
Great Falls MT 59404

Col USAF Ret
David G. Kimball
4686 Harvest Ln
Billings MT 59106-3876

Major USAF
Joe Kuberka
10535 Paygor Rd.
Colorado Spring CO 80908

Col USAF Ret
Robert C. Laliberte
3024 Gloxinia Dr.
Billings MT 59102

Gen USAF Ret
Robert C. Mathis
120 Hitching Post Road
Bozeman MT 59715

LtC. USAF Ret.
Lloyd F. Meyer
1001 Saddle Dr.
Helena MT 59601-5646

Major USAF Ret
Don S. Miller
4111 5th Ave. South
Great Falls MT 59405

USAF Ret.
Ron R. Miller
5508 5th Ave. South
Great Falls MT 59405

Capt USA Ret
Harry B. Mitchell
4510 13th St. South
Great Falls MT 59405-8123

Col. USAF Ret.
Lee A. Mongeon
Five 16th Ave. So.
Great Falls MT 59405

Col USAF Ret
Robert C. Morris, Jr.
144 Parkway Ave.
Bigfork MT 59911-3705

WO4 USA Ret
Richard J. Munro
1022 Duranago
Great Falls MT 59404-3710

Capt. USAF Ret.
Earl W. O'Neil, Jr.
1115 34th St. So.
Great Falls MT 59405

Col. USAF Ret.
Jerry W. Russell
1101 Adobe Drive
Great Falls MT 59404

Major USA Ret.
Jack Smith
2027 9th Ave.
Helena MT 59601

LtCol USAF Ret
Laurel L. Statham
1117 Adobe Drive
Great Falls MT 59404

Capt USMC
Kendall S. Switzer
3018 Secor Ave.
Bozeman MT 59715-6150

Col USAF Ret.
Robert T. Williams
402 Chicken Creek Rd
Livingston MT 59047

LtCol USAF Ret
Jack Wilson
1201 Hilman Road
Helena MT 59601

Brig Gen USAF Ret
Rodger D. Young
2704 7th Ave. South
Great Falls MT 59405

Letter No. *8*

**REQUEST FOR
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
FINAL ENVIRONMENTAL IMPACT STATEMENT**

DATE: 7-8-97

ADDRESSEE:

John C. Drouin
645 Davidson Dr.
Idaho Falls, Idaho
83401-3303

☑ **EXECUTIVE SUMMARY. YES, I would like to receive only a copy of the Executive Summary for NASA's X-33 Advanced Technology Demonstrator Vehicle Program's Final Environmental Impact Statement.**

☐ **FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) AND EXECUTIVE SUMMARY. YES, I would like to receive a copy of both the Final Environmental Impact Statement, and the Executive Summary for NASA's X-33 Advanced Technology Demonstrator Vehicle Program.**

If you desire a copy of the FEIS or Executive Summary for the X-33 Program, please indicate above and return in the enclosed envelope. If you provide comments on the Draft Environmental Impact Statement, you will automatically receive the FEIS. In order to adequately plan the number of FEIS copies to be reproduced, we would appreciate your response by August 1, 1997.

Comment:
Page xxiii
8-1 1 kilometer per hour should equal
0.54 knots (nautical miles per hour
instead of 540 knots.

RECEIVED
JUL 17 1997

F6-ID-29

Letter No. 9

COMMENTS ON NASA's X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/9/97

TO: Dr. Rebecca C. McCaleb
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: Ross Mehlhose
P.O. BOX 175
CLANCY MT

COMMENT(S):

9-1 1) WHY NOT DO FLIGHT TESTING OVER THE PACIFIC OCEAN RATHER THAN LAND.

9-2 2) REGARDING THE COMMERCIAL ASPECT OF PUTTING MORE "DEVICES" UP IN ORBIT, MY QUESTION IS WHO IS RESPONSIBLE FOR THE ENVIRONMENT OF SPACE? THERE IS TOO MUCH JUNK OUT THERE NOW, AND SOONER OR LATER IT WILL COME DOWN.

9-3 3) WHY NOT SPEND MONEY ON FEEDING HUNGRY OR LOWERING TAXES.

Response to Letter No. *9* - Ross Mehlhose

9-1. The issues of flying over water versus land were considered early in the X-33 program. The determination to fly over land is still valid. Please refer to section 2.2.5 in the Environmental Impact Statement.

9-2. "The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," entered into force on October 10, 1967 (18 UST 2410, TIAS 6347), and commonly cited as The Outer Space Treaty, applies to the conduct of spacefaring nations who are parties to the treaty. In addition, NASA complies with NASA Policy Directive (NPD) 8710.3, dated May 29, 1997, "NASA Policy for Limiting Orbital Debris Generation"; and NASA Safety Standard (NSS) 1740.14, dated August 1995, "Guidelines and Assessment Procedures for Limiting Orbital Debris". (Note: UST is Unites States Treaties; TIAS is Treaties and other International Agreements Series.)

9-3. Our standard of living has been greatly improved by developments resulting from the space program. This can be seen through our electronics and telecommunications industry, and the rapid strides that are being made. All of these industries continue to contribute to increase the tax base for programs such as feeding the hungry. NASA uses less than 1 percent of the National budget. It returns many of those dollars to the nation's economy through new commercial products that come from its research.

Thank you for the comments.

Letter No. *10*

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7/8/97

TO: **Dr. Rebecca C. McCaleb**
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: ROD MACDONALD
3575 RUNNING DEER RD.
HELENA, MT. 59602

COMMENT(S):

10-1 PLEASE INCLUDE A LARGE (8½" x 11") MAP OF THE LANDING GUIDE PATH, OF THE LAST 100 MILES SHOWING PLAN WITH GEOGRAPHIC HIGHLIGHTS, ELEVATIONS & SPEED OF THE X33 DURING THIS LAST 100 MILES.

THANKS

FB-MT-79

Letter No. *11*

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7-9-97

RECEIVED
JUL 17 1997

TO: Dr. Rebecca C. McCaleb
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: PAT M. GOODOVER
GOODOVER ENTERPRISES, INC.
BOX 1725
GREAT FALLS, MT. 59403

COMMENT(S):

11-1 All of the people I've discussed the X33 program with are in full accord with the comments made at your meeting by our mayor Bob Deming. As a Broadcaster in Montana for 37 years, in Butte, Bozeman, Missoula and Great Falls, and as a State Senator from Great Falls for 12 years, operator of a Travel Agency for 11 years I can understand the benefits of using the Malmstrom Runway as your destination for X-33 flights. It's a real benefit for Tourism and National publicity for the State.

11-2 I also served as a B-25 pilot in the China, Burma, India portion of WW II and understand the need of developing ~~new~~ new technology to keep our Country up front in World affairs. We look forward to having X-33 land in Great Falls. Thanks —

Pat M Goodover

We are having our Squadron Reunion this Oct 19-20-21 at Wright Patterson Museum in Dayton, Ohio. If you have someone available to join us, please let me know.

E01-OT Form 1 (Jun 1997) FB-MT-125

Response to Letter No. *11* - Pat M. Goodover

11-1. Comment recognizing the benefit to tourism and publicity to the state of Montana and supporting the landing of X-33 at Malmstrom Air Force Base is noted.

11-2. Comment supporting the development of new technology is noted.

Thank you for the comments.

Letter No. 12

Bruce Chaney, 08:52 PM 7/9/97 -, EIS comment on X-33

Return-Path: <giantsprings@worldnet.att.net>
Date: Wed, 09 Jul 1997 20:52:22 -0700
From: Bruce Chaney <giantsprings@worldnet.att.net>
Reply-To: giantsprings@worldnet.att.net
To: X33EIS@msfc.nasa.gov
Subject: EIS comment on X-33

Dr. Rebecca McCaleb,

12-1 As a resident of Great Falls, Montana, home of Malstrom Air Force Base, I would like to add my comments about using Malstrom as the testing site for the X-33. I feel that the space program is one of the most important jobs facing this country in the present and in the future.

12-2 With the recent loss of the refueling wing at the airbase I feel that it would be the best place to use as a testing site. It would also be an economic benefit to the city.

Sincerely,

Bruce Chaney

RECEIVED
JUL 10 1997

Response to Letter No. *12* - Bruce Chaney

12-1. Comment recognizing the importance of the space program in the present and the future is noted.

12-2. Comment recognizing the economic benefit to the city of Great Falls, MT and supporting the landing of X-33 at Malmstrom Air Force Base is noted.

Thank you for the comments.

Letter No. 13

Return-Path: <pjdebene@clovis.esd171.wednet.edu>
Date: Thu, 10 Jul 1997 08:43:10 -0700
From: PJ DeBenedetti <pjdebene@clovis.esd171.wednet.edu>
Organization: mlsd
To: X33EIS@msfc.nasa.gov
Subject: X-33

Good Day,

I am the Faciliator of Community Relations for the Moses Lake School
District in Moses Lake, Washington. I am curious about the threat, if
13-1 any, that the X-33 poses to our school buildings. I understand that
the craft would be gliding and traveling quite fast as it approaches
Grant County Airport. Will it approach over Moses Lake or will it
approach the airport from the other side? Are any of our schools in
the glide path in either case? I am not opposed to the craft landing
13-2 here. In fact, I would love to see it. However, I feel that I have
asked a question that is responsible and of interest to our staff,
students and parents. I look forward to your response.

P. J.

Response to Letter No. *13* - P. J. DeBenedetti

13-1. The X-33 ground track would be to the east of Moses Lake. The vehicle would then make its final approach to the runway from the north. An expanded map of the X-33 flight track for the last 160 km (100 mi) is provided in Figure D-17 of the Final EIS.

13-2. Based on the planned approach to the Grant County Airport from the east of Moses Lake, there are no schools known to be in the X-33 ground track.

Thank you for the comments.

Letter No. *14*

PUBLIC INVOLVEMENT IN NASA'S ENVIRONMENTAL IMPACT STATEMENT PREPARATION PROCESS FOR THE X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: 7/14/97 ~~LARRY D. OLSEN~~

NAME: LARRY D. OLSEN

ADDRESS: 140 LINDEN ST.
CLEARFIELD,
UTAH
84015

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☐ YES ☒ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☐ YES ☒ NO

COMMENT TO BE READ:

14-1 VERY GOOD INFORMATION ON DUGWAY PROVING GROUND

AE01-OT Form 3 (Oct 1996)

Letter No. *15*

PUBLIC INVOLVEMENT IN NASA'S ENVIRONMENTAL IMPACT STATEMENT PREPARATION PROCESS FOR THE X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: 7/14/97

NAME: E. Speizer, M.D.

ADDRESS: Channing Laboratory
Harvard Medical School
181 Longwood Ave
Boston, MA. 02115

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☐ YES ☐ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☐ YES ☐ NO

COMMENT TO BE READ:

15-1 Interested in Population data for people "under" flight patterns exposed to sonic noise

AE01-OT Form 3 (Oct 1996)

Response to Letter No. *15* - F. Speizer

National Aeronautics and
Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of AE01/154-97

AUG 12 1997

TO: F. Speizer, M. D./Channing Laboratory

FROM: Rebecca C. McCaleb

SUBJECT: Request for X-33 Population Information

15-1. We appreciate your participation in the recent public meetings for the Draft Environmental Impact Statement on NASA's X-33 Advanced Technology Vehicle Demonstration Program. Per your request, please find enclosed a copy of NASA's X-33 Draft Environmental Impact Statement for Phase II of the program. Chapter 4.4.1 contains the information on population under the flight patterns, which you requested. Our environmental analysis considered the census county as the geographic analytical unit and looked at the population in each county affected by the ground tracks of the proposed X-33 flight patterns. The racial and income composition data necessary for our study was readily obtained from the 1990 Census Bureau, Summary Tape 3A. The summary tape is available aver the internet at http://venus.census.gov/cdrom/lookup.

Thank you for your interest in the X-33 program. If you have any questions, please call me at (205)544-4367 or Donna Holland at (205)544-7201.

Sincerely,

Donna L. Holland
for
Rebecca C. McCaleb
Director, Environmental Engineering
and Management Office

Enclosure

Letter No. *16*

R.N. GOLDBERGER
MANAGING EDITOR

FNA NEWS
FREELANCE NEWS AGENCY
OFFICE OF THE MANAGING EDITOR

P.O. BOX 11999
SALT LAKE CITY, UTAH 84147-0999

801-355-3336
CABLE/UTAH NEWS

PUBLIC INVOLVEMENT IN NASA'S
ENVIRONMENTAL IMPACT STATEMENT
PREPARATION PROCESS FOR THE
X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: 7 15 97

NAME: FNA News

ADDRESS: Bx 11999
SLC, UT
84147

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☐ YES ☐ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☐ YES ☐ NO

COMMENT TO BE READ: 30011

16-1 Copy Phase I
Budget
F/97
F/98

AB01-OT Form 3 (Oct 1996)

Response to Letter No. *16* - FNA News

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of: AE01/153-97

[illegible] 12 1997

TO: R.N. Goldberger/FNA News

FROM: Rebecca C. McCaleb

SUBJECT: Request for X-33 Budget Information

16-1. We appreciate your participation in the recent public meetings for the Draft Environmental Impact Statement on NASA's X-33 Advanced Technology Vehicle Demonstration Program. Per your request, please find enclosed a copy of NASA's budget for Phase I and II of the program. I have also enclosed a copy of the draft Environmental Impact Statement, which may provide a general understanding of the program.

Thank you for your interest in the X-33 program. If you have any questions, please call me at (205)544-4367 or Donna Holland at (205)544-7201.

Sincerely,

for Donna L. Holland

Rebecca C. McCaleb
Director, Environmental Engineering
and Management Office

Enclosure

Reusable Launch Vehicle Program
X-33/X-34 Industry Briefing

Reusable Launch Vehicle (RLV)
NASA X-33 Funding Plan

$ Millions

	FY95*	FY96	FY97	FY98	FY99	FY00	Total
X-33 Program							
• Concept Definition/Design (Phase I)	18.0	6.0					24
• Design/Build/Demonstrate (Phase II)		43.0	250	334	314	75	1016
• Total X-33	18.0	49.0	250	334	314	75	1040

* Note: FY95 DoD Funding Included

Response to Letter No. *16* - FNA News continued

This profile includes funding for all of the following:

a. Funds provided directly to the selected offeror under the resulting Cooperative Agreement, in conjunction with the payment milestones.

b. Funds required to pay for charges relating to the performance of Government responsibilities under the resulting Cooperative Agreement (Government responsibilities may require non-cash resources in the form of personnel, facilities, services, etc., made available through the various installations). These may include charges for program support, materials, facility modifications, etc., but do not include salaries or travel for Government personnel. Offerors are responsible for negotiating and obtaining commitment letters from participating installations and associated task agreements, which will define candidate installation responsibilities/contributions and the charges relating to the performance of these responsibilities. Payment of these charges will be made internal to the Government out of the available program funding.

c. Funds required for long term/high payoff technology demonstration and indirect Government program support.

Letter No. *17*

PUBLIC INVOLVEMENT IN NASA'S ENVIRONMENTAL IMPACT STATEMENT PREPARATION PROCESS FOR THE X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: July 15, 1997

NAME: Christopher Hogan

ADDRESS: 904 W. Timber Creek Way #1601
SLC, UT 84119

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☐ YES ☒ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☒ YES ☐ NO

COMMENT TO BE READ:

17-1 I've heard the X-33 could land at an airport. With that in mind; Could Salt Lake become a permanent Landing Site for VentureStar? and Could Salt Lake become a launch site? Also I Think This is a great Project that has been well Thought out. I hope NASA Continues with This. Will there be any public meetings over my previous Questions and could you notify me if you do?

AE01-OT Form 3 (Oct 1996) FB-UT-101

Response to Letter No. *17* - Christopher Hogan

17-1. Potential Venture Star operating bases have not been identified. Lockheed-Martin is developing the Venture Star business plan concurrently with testing of the X-33. Venture Star decisions would be made by the industry partner at the conclusion of the X-33 program. NASA has no plans to build or operate a full scale reusable launch vehicle and/or its operating base. No further public meetings are planned for the X-33 program. Questions received during the public comment period are answered in the Final Environmental Impact Statement

Thank you for the comments.

Letter No. *18*

July 11,1997

Dr. Rebecca McCaleb, Director
Environmental Engineering and Management Office
Code AE01
Marshall Space Center, AL 35812

Dear Dr. McCaleb:

I am a retired educator who lives 20 miles south and east of Malmstrom Air Base in Montana.

18-1 I wish to go on record as being opposed to the prototype X-33 spacecraft landing at Malmstrdm Air Force base.

The loss of lives from one crash isn't worth the risk of locating here, and I don't like the related side effects involved.

Sincerely,

J. Michael Fleming

J. Michael Fleming
57 Orr Coulee Road
Belt, Montana 59412

RECEIVED JUL 16 1997

FB-MT-126

Response to Letter No. *18* - J. Michael Fleming

18-1. The risk of developing a new technology is always an issue. NASA takes very seriously the concern for these risks. The X-33 program has and would continue to expend great effort to ensure that risk to the public, personnel, and property meet safety guidelines established by the National Test Ranges. The requirements and approvals for X-33 safety and risk analyses are documented in Section 4.3 of the Draft and Final EIS.

Thank you for the comment.

Letter No. *19*

REQUEST FOR
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
FINAL ENVIRONMENTAL IMPACT STATEMENT

DATE: 17 July 1997

ADDRESSEE:

Ray P. Beck
156 S 100 West
Tooele, Ut 84074-2057

☐ **EXECUTIVE SUMMARY. YES, I would like to receive only a copy of the Executive Summary for NASA's X-33 Advanced Technology Demonstrator Vehicle Program's Final Environmental Impact Statement.**

☐ **FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) AND EXECUTIVE SUMMARY. YES, I would like to receive a copy of both the Final Environmental Impact Statement, and the Executive Summary for NASA's X-33 Advanced Technology Demonstrator Vehicle Program.**

If you desire a copy of the FEIS or Executive Summary for the X-33 Program, please indicate above and return in the enclosed envelope. If you provide comments on the Draft Environmental Impact Statement, you will automatically receive the FEIS. In order to adequately plan the number of FEIS copies to be reproduced, we would appreciate your response by August 1, 1997.

19-1 (1) Thank you for the draft copy of the X-33 DEIS. I was impressed by its detail and scope. From my point of view the program is a GO. Expedite bringing it to fruition. I do not need a copy of FEIS.

Sincerely
Ray P. Beck

FB-UT-88

Responses to Letter No. *19* - Ray P. Beck

19-1. Comments that the Draft EIS contains impressive detail and scope is noted. Comment in support of the X-33 Program is also noted.

Thank you for the comments.

Letter No. *20*

RECEIVED
JUL 21 1997

REQUEST FOR
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
FINAL ENVIRONMENTAL IMPACT STATEMENT

DATE: 18 Jul 1997

ADDRESSEE:

(1) Marilyn Black
480 Pioneer Ave.
Tooele, UT 84074

(2) Waldo Black
4440 S. 4000 W.
Delta, UT 84624

[2] **EXECUTIVE SUMMARY. YES, I would like to receive only a copy of the Executive Summary for NASA's X-33 Advanced Technology Demonstrator Vehicle Program's Final Environmental Impact Statement.**

[2] **FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) AND EXECUTIVE SUMMARY. YES, I would like to receive a copy of both the Final Environmental Impact Statement, and the Executive Summary for NASA's X-33 Advanced Technology Demonstrator Vehicle Program.**

If you desire a copy of the FEIS or Executive Summary for the X-33 Program, please indicate above and return in the enclosed envelope. If you provide comments on the Draft Environmental Impact Statement, you will automatically receive the FEIS. In order to adequately plan the number of FEIS copies to be reproduced, we would appreciate your response by August 1, 1997.

To Whom It May Concern:
The Black Family still has concern abt. sonic booms because of cattle at our Ranch located 25 mi. So. of Dugway.

20-1 (1) KSC Bio AS
What abt. the environmental impact on the deer, rabbits, ducks, birds, & fish at our ranch? . . . besides people???
Would appreciate a response!

FB-UT-89

LTR

Response to Letter No. *20* - The Black Family

20-1. Studies that have been conducted on mountain elk and bighorn sheep indicate that there is a slight rise in heart rate after the initial sonic boom disturbance. Startle responses decrease with subsequent booms and are soon less than those evoked by persons walking into the animal pens. Studies of underground explosions on cliff-nesting raptors indicate that raptors are not startled off their nest by the noise. Based upon these studies, the impact of sonic booms on cattle is expected to be less than impacts caused by persons tending the cattle, and impacts on deer, rabbits, ducks, birds, and fish at your ranch are expected to be slight and become less with each test flight.

At approximately 25 miles south of the Dugway Proving Ground, noise levels from sonic boom overpressures would be in the range of 0.5 psf. This level is similar to a loud clap of thunder. The effect to wildlife would be a short-term, temporary startle effect. Sonic boom impact to mammals, birds, and reptiles is also addressed in the Biological Resources section of the Environmental Impact Statement, Section 4.2.3.6. Sonic boom impact to endangered species is addressed in the Threatened, Endangered, and Sensitive Species, Section 4.2.3.7.

Thank you for the comments.

Letter No. *21*

PUBLIC INVOLVEMENT IN NASA'S ENVIRONMENTAL IMPACT STATEMENT PREPARATION PROCESS FOR THE X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: 7/21/7

NAME: JAMES ALLISON

ADDRESS: 2624 E. NUGENT St
LANCASTER CA 93535

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☑ YES ☐ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☐ YES ☐ NO

COMMENT TO BE READ:

21-1 CONCERN OF THE TWO LOCATION POPULATED AREA IS DOWN-WIND FROM LAUNCH AREAS- WAS AN AREA NORTH-EAST OF KRAMER'S CORNER (58 & 395) ALONG ~~AN~~ A DESERT ROAD KNOW AS CORT'S ROAD CONSIDERED

AE01-OT Form 3 (Oct 1996)

Response to Letter No. *21* - James Allison

21-1. The area northeast of Kramer's Corner along a road known as Cort's Road was not considered as a launch site. This area is outside the jurisdiction of Edwards Air Force Base, and it would be difficult to secure the site and transport the X-33 vehicle to this location for launch.

In addition, X-33 launch facilities and propellant storage areas are required to be sited in areas that provide a surrounding government-owned safety zone. This safety zone cannot contain inhabited buildings and its size is dependent on the maximum explosive potential of the propellants in storage or fueled in the vehicle. Please refer to Section 4.1.11, and Figures 4-1 and 4-2 of the Final EIS for further details.

Thank you for the comments.

Letter No. *22*

PUBLIC INVOLVEMENT IN NASA'S
ENVIRONMENTAL IMPACT STATEMENT
PREPARATION PROCESS FOR THE
X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: 07/21/97

NAME: William A. Lawrence

ADDRESS: 44937 N. 5th St. East
Lancaster, CA 93535

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☒ YES ☐ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☐ YES ☐ NO

COMMENT TO BE READ:

22-1 1) During the X-33 flight Phase will you document the acoustic, sonic and debris phenomena & extrapolate that to the full-scale vehicle. Will that data be available to the public?

A801-OT Form 3 (Oct 1996)

Response to Letter No. *22* - William A. Lawrence

22-1. Acoustic and sonic data would be gathered during the X-33 test flights and used to verify modeling of acoustic and sonic patterns. These verifications of modeling would be useful in modeling for the full-scale vehicle. This data will be available to the public. Confirmation of debris dispersion would be done if necessary.

Thank you for the comment.

Letter No. 23

PUBLIC INVOLVEMENT IN NASA'S ENVIRONMENTAL IMPACT STATEMENT PREPARATION PROCESS FOR THE X-33 PROGRAM: DEVELOPMENT AND FLIGHT TEST

DATE: 7/24/97

NAME: ~~P~~ Paul Holmes

ADDRESS: P.O. Box 188
Baker, CA 92309

DO YOU WANT TO MAKE A PUBLIC COMMENT TONIGHT?
☐ YES ☑ NO

IF NO, DO YOU WANT A COMMENT READ ON YOUR BEHALF TONIGHT?
☑ YES ☐ NO

COMMENT TO BE READ:

23-1 Instead of spending money on a new ship could you have spent the money on modifying our current space shuttle?

AH01-OP Form 3 (Oct. 1996)

Response to Letter No. *23* - Paul Holmes

23-1. Technology for the Space Shuttle was developed 30 years ago. Modification of the system cannot be accomplished to provide the savings in launch costs that are anticipated with this new launch vehicle.

In 1993, NASA concluded a study to identify improvements needed to maintain the Space Shuttle fleet through 2030, and potentially viable new space launch vehicle concepts that could meet future space launch needs at significantly lower costs than the Space Shuttle. The report entitled "Access to Space" provided findings to support the decision to proceed with development of a fully reusable vehicle also referred to as "single-stage-to-orbit.". This single-stage-to-orbit vehicle would remove the requirement of a solid rocket booster and tanks stage, as well as the need to reassemble the vehicle once it gets back to the ground.

Thank you for the comment.

Letter No. 24

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 24 July 97

TO: **Dr. Rebecca C. McCaleb**
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: AFREP AWP-910
PO. BOX 92007
LOS ANGELES, CA 90009-2007
ATTN: LT COL FRANK

COMMENT(S):

24-1 In regard to the temporary restricted permit for airspace at the MT or WA landing sites, who's specific responsibility (by office symbol) is it to coordinate for this protected airspace, and when will that process begin?

Response to Letter No. *24* - AFREP AWP-910, Lt. Col. Frank

24-1. The Flight Operations Office of Lockheed Martin would be responsible for coordinating the application for protected air space. The point of contact would be Lockheed Martin Skunk Works in Palmdale, CA. The process would begin immediately following the Record of Decision.

Thank you for the comment.

Letter No. *25*

Larry Godden, 12:21 PM 7/25/97 , (no subject)

Return-Path: <airamerica@atnet.net>
Date: Fri, 25 Jul 1997 12:21:37 -0700
From: Larry Godden <airamerica@atnet.net>
Reply-To: airamerica@atnet.net
Organization: AIR AMERICA FUEL & SERVICE
To: X33EIS@msfc.nasa.gov
Subject: (no subject)

Rebecca C. McCaleb,

I attended the first briefing held in Moses Lake and am very excited about this program. You only have to visit my office to see my support for NASA and our space program.

Would it be possible to have an assortment of pictures (suitable for framing) so they may be displayed in our office and further pique the interest and support of people who visit us?

25-1

If you'd like to learn more about my company, located at Grant County Airport, please visit our home page at; airamericafuelservice.com.

I'm looking forward to the possibility that AIR AMERICA FUEL & SERVICE, INC. may be involved in providing support to the X-33 Program.

Thanking you in advance for anything that you may be able to send.

BEST REGARDS,

Larry Godden

Response to Letter No. *25* - Larry Godden

Date: Tue, 26 Aug 1997 17:28:39 -0500
To: airamerica@atnet.net
From: Donna Holland <DONNA.HOLLAND@MSFC.NASA.GOV>
Subject: X-33 Pictures

Larry,

Your request for pictures of the X-33 was forwarded to me by Dr. Rebecca McCaleb. I have obtained an assortment of pictures which I believe are suitable for framing. I would like to mail these to you. Please reply to me with your complete mailing address.

Thank you,

Donna Holland
Environmental Engineer
MSFC, AL

25-*1* Date: Wed, 27 Aug 1997 09:50:20 -0700
From: Larry Godden <airamerica@atnet.net>
Reply-To: airamerica@atnet.net
Organization: AIR AMERICA FUEL & SERVICE
To: donna.holland@msfc.nasa.gov
Subject: X-33 Pictures

Donna,

Thanks for your response to my request for X-33 pictures.

We have a new airport terminal building opening soon and my company, AIR AMERICA, will have a gallery of pictures as part of our new office design. It's our intent that the gallery will display pictures that are unique and not normally seen by the public. The Boeing Company is also participating in this project. The pictures you're sending will be a much welcome addition.

The mailing address is:

Larry Godden, President
AIR AMERICA FUEL & SERVICE, INC.

Response *25-1* continued

7810 Andrews St., N.E.
Moses Lake, WA 98837-3218
PH: 509-762-2222 / FX: 509-762-2299

Once again, thanks for your cooperation and support. We look forward to providing any and all support necessary for your Flight Test Aircraft if and when it arrives in Moses Lake.

BEST REGARDS,

Larry Godden

Letter No. 26

COMMENTS ON NASA's
X-33 ADVANCED TECHNOLOGY DEMONSTRATOR VEHICLE PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT

DATE: 7-1-97

TO: Dr. Rebecca C. McCaleb
NASA, MSFC
Mail Code AE01
MSFC, AL 35812

FROM: MYRON LEE
47 S. MAIN STREET
TOOELE, Ut. 84074

COMMENT(S):

26-1 (1) Where is the "Worst case" DISASTER FOOT PRINT IN RELATION TO THE GOSUTE INDIAN RESERVATION Particularly their Planned Nuclear Waste Facility.

26-2 (2) Where is the footprint in relation To Tooele County's West Desert Hazardous Industries area. And to Interstate Highway 80

FB-UT-96

E01-OT Form 1 (Jun 1997)

Response to Letter No. *26* - Myron Lee

26-1. The worst case footprints are described in the Section 4.3 "Flight Safety" of the Final EIS. The overall flight corridor proposed for flight to Dugway is shown in Figures 4-52 and G-5. The debris track for this scenario would be at least 24 km (15 mi) to the west of the Skull Valley Band of the Goshute Indian Reservation that has been proposed for use as a nuclear waste facility by the tribal leadership of this reservation; 45 km (28 mi) west of Deseret Chemical Depot, known as Tooele County's West Desert Hazardous Industries Area; and 68 km (42 mi) south of Interstate 80.

With respect to an abort and whole body impact of the X-33 due to a flight anomaly upon reentry for landing at the Michael Army Airfield, the debris field would be approximately 4 ha (10 ac) in area as indicated in Section 4.3. For a flight anomaly of this nature, the debris field would be within Dugway Proving Ground and in an area several miles west and/or south of the sites listed in your comment. The flight termination system, also described in Flight Safety Section 4.3, would be required to be deemed "fail safe" and would be a part of the Flight and Landing Safety Plans to be approved by the Air Force Flight Test Center (AFFTC) Chief of Safety for the Flight Safety Plan and the AFFTC and Dugway Chiefs of Safety for the Dugway Landing Safety Plan. The flight track and abort area(s) on Dugway must meet the requirements of the Utah Test and Training Range, which includes Dugway, and is covered in AFFTC Regulation 15-18 (March 1994); the Common Risk Criteria for National Test Ranges, Standard 321-97 (February 1997); and the AFFTC Test Safety Review Process, AFFTC Regulation 127-3 (September 1993). Final launch approval is the responsibility of the AFFTC Commander.

26-2. See response 26-1 above.

Thank you for the comments.

Letter No. *27*

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY PETE WILSON, Governor

DEPARTMENT OF TRANSPORTATION
500 SOUTH MAIN STREET
BISHOP, CA 93514

(760) 872-0658

July 28, 1997

File - Kern - 178- 100b
SCH 97074001

Dr. Rebecca McCaleb
NASA, Marshall Space Flight Center, Alabama
Huntsville, Alabama 35812

DRAFT ENVIRONMENTAL IMPACT STATEMENT

27-1 Thank you for the opportunity to review and comment on the X-33 Advanced Technology Demonstrator Vehicle Program. We have no comment at this time. If you have questions on this matter please call me at (760) 872-0658.

Sincerely,

Dennis Manning

DENNIS MANNING
Chief, Branch of IGR/CEQA Reviews

DM:mam
cc: SCH - Chris Belsky

RECEIVED
AUG 04 1997

Responses to Letter No. *27* - Department of Transportation; State of California

27-1. Receipt of letter of no comment is acknowledged.

Thank you for the comment.

Letter No. *28*

Lyman C. Welch, 07:57 PM 8/6/97, Comments on X-33 Test vehicle

Return-Path: <lwelch@mayerbrown.com>
Date: Wed, 06 Aug 97 19:57:16
From: "Lyman C. Welch" <lwelch@mayerbrown.com>
To: X33EIS@msfc.nasa.gov
Subject: Comments on X-33 Test vehicle

Dr. McCaleb,

28-1 I am writing in support of NASA's proposed X-33 program. NASA should act quickly to promote the X-33 and other commercially viable reusable launch vehicles.

28-2 I suggest that NASA consider methods of releasing information about the X-33 test flights to the public to build public awareness of the program. Such methods could include press releases, briefings, Internet web sites, interviews, etc.

Sincerely,

Lyman C. Welch
1319 W. Cornelia Ave
Chicago, IL 60657
(312) 701-7404

FB-MISC-88

Responses to Letter No. *28* -Lyman C. Welch

28-1. Comment in support of the X-33 program is noted.

28-2. Suggestions for building public awareness of the X-33 program are noted. The Program currently uses methods such as press releases, briefings, Internet web site, and interviews to build public awareness.

A listing of press releases, public meetings, special meetings, and other briefings to encourage and assist in public participation of preparation, review, and comment on the X-33 Draft and Final EIS can be found in Appendix B of the Final EIS.

The X-33 internet address is: http://eemo.msfc.nasa.gov/eemo/x33_eis.

Thank you for the comments.

Letter No. *29*

Washington State Department of Transportation
Sid Morrison
Secretary of Transportation

North Central Region
Office of Region Administrator
P O Box 98
Wenatchee, WA 98807-0098

(509) 663-9641
Fax (509) 663-9674

RECEIVED
AUG 11 1997

August 1, 1997

Dr. Rebecca C. McCaleb, Director
Environmental Engineering and Management Office
Mail Code AE01
Marshall Space Flight Center, AL 35812

Attention: Dr. Rebecca C. McCaleb,

Re: Environmental Impact Statement (EIS) of the X-33 Program.

29-1 Thank you for the opportunity to review and comment on the Environmental Impact Statement (EIS). We believe that the project should not create any significant vehicle or traffic impact to the local Washington State Routes.

29-2 Our office address remains the same as before, however, our office manager is now Jolene Gosselin, P. E. Her e-mail address is Gosselj@WSDOT.wa.gov. Please remove David Honsinger and his address of Honsind@WSDOT.wa.gov from your listings with our office: Fred Suter's e-mail address is suterf@WSDOT.wa.gov. Also, our office phone numbers have been changed to (509) 667-2906 for Jolene Gosselin or (509) 667-2908 for Fred Suter if you have any questions or need additional information.

Sincerely,

JOLENE GOSSELIN, P. E.,
Regional Planning Engineer

BY: FREDRICK M. SUTER,
Transportation Planner

JG:FMS
fms
files:i:t:usag:X-33pgm#2.doc

Response to Letter No. *29* - Washington State Dept. of Transportation

29.1 Comment that the Program should not create any significant vehicle or traffic impact to the local Washington State Routes noted.

29-2. The distribution list and point of contact for Washington State Department of Transportation was changed as requested.

Thank you for the comments.

Letter No. *30*

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Barstow Resource Area
150 Coolwater Lane
Barstow, California 92311

1791/2895
(CA-068.80)

Dr. Rebecca McCaleb
NASA/Code AE01
Building 4201, Room 624A
Marshall Space Flight Center
Huntsville, AL 35812

AUG 13 1997

Dear Dr. McCaleb:

We have completed a review of the June 1997 Draft Environmental Impact Statement for the X-33 Advanced Technology Demonstrator Vehicle Program. Our general comments are provided below, with additional page referenced comments also enclosed. The comments are intended to be focussed on the Silurian Lake landing site, although we have also offered a general review of the DEIS Executive Summary.

On August 12, 1997 Mr. Jack Pierce of Allied Signal provided us with more specific information on planned deployment of equipment and facilities at the Silurian Lake landing site. The scope and associated level of impact of the planned off-lakebed Range Systems is significantly higher than has been previously documented. There is insufficient time for my staff to provide you with detailed impacts descriptions and suggested mitigation before the close of the DEIS comment period. We request that your EIS staff contact appropriate specialists on my staff directly as the Final EIS document is assembled, in an effort to include as much detailed descriptions of the proposed action, impacts, indicated mitigation, and residual impacts as is possible.

30-1 The latest Range Systems site plan drawings, and any associated descriptive text, should be included in the "Proposed Action" and impacts associated with the uses described in the "Environmental Consequences" section of the Final EIS. The additional specific descriptions on the landing site operation at Silurian Lake should also be incorporated into the Biological Assessment (Appendix E). My staff has reviewed the new information provided to determine whether the landing site operation, as proposed and with the indicated mitigation measures, may affect the threatened desert tortoise or its habitat. Please refer to the specific comments provided on the biological assessment. Our determination is that, if the indicated mitigation is implemented, effects to the desert tortoise at the Silurian landing site would be mitigated to near zero. However, there is a slight change for a "may effect" situation to arise if a tortoise wanders into the work site and the biological monitor determines that moving the tortoise is necessary.

30-2 It is important to note that, even though impacts to the desert tortoise can be reduced to near zero as indicated, surface disturbing impacts and mitigation to other resources, associated with the Range Systems site use, need further review and must be fully documented in the Final EIS.

30-3 The Final EIS should also clearly describe any written concurrence/agreement with the California Department of Transportation, and any continuing permit acquisition process regarding the planned temporary road closures of State Highway 127. 30-4 Also, based on the comments received at the July 24, 1997 Baker DEIS public meeting, the planned closure point (Saratoga Springs Road) should be reconsidered. A closure point at Shoshone, with an indicated detour through Pahrump and Las Vegas, may be more suitable. It is our understanding that the detour routes indicated in the DEIS are mostly dirt roads, with some segments not maintained.

30-5 As noted in the specific comments, a right-of-way reservation under Section 507 of the Federal Land Policy and Management Act (43 U.S.C. 1767) can only be issued to another Federal Agency. NASA must be the applicant for the right-of-way reservation. A right-of-way reservation, once issued, allows the holder to authorize entry and use by its lessees, permittees and contractors. We will provide you a copy of the necessary application form and instructions under separate cover.

We appreciate the opportunity to provide comments on the DEIS. If the EIS schedule allows, we would like the opportunity to review an administrative copy of the Final EIS before it is printed and released. If you have any questions concerning our response, please contact Mike DeKeyrel of my staff at (760) 252-6030.

As of August 18, 1997 the Barstow Resource Area of the Bureau of Land Management will relocate to 2601 Barstow Road, Barstow, CA 92311. The general telephone number is (760) 252-6000. You can contact Mike DeKeyrel at (760) 252-6030.

Sincerely,

for Tim Read
Area Manager

Enclosure
Page Referenced Comments
Right-of-Way Application Form SF-299

X-33 DEIS Comments
Bureau of Land Management
Barstow Resource Area
August 13, 1997

	Page	Section	Comment
30-6	2-35 to 2-40	Tables 2-7, 2-8 and 2-9	these impacts summaries are not descriptions of the proposed action, and should be moved to the Executive Summary and Chapter 4
30-7	3-25	3.1.8	The first sentence describing the status of the Mojave Ground Squirrel should be changed. The Mojave Ground Squirrel (*Spermophilus mojavensis*) is a California State listed threatened species (it has never been de-listed)
30-8	4-54	4.2.1	most of the narrative text in 4.2.1 and 4.2.1.1 is description of the proposed action and should be moved to Chapter 2
30-9			Paragraph 3 should reflect any changes to the planned stop point for the temporary road closure
30-10	4-55	4.2.1.1	Paragraph 1 needs to be rewritten to clarify that NASA is the Federal agency applicant for a right-of-way reservation under Section 501 FLPMA; as a non-Federal entity, Lockheed Martin can not hold a right-of-way reservation
30-11	4-69	4.2.1.13	for Paragraph 1, see comment for 4.2.1.1
30-12	4-70	4.2.1.13	the detour route described in Paragraph 3 is likely not acceptable; suggest alternate reroute using all paved roadways; also suggest including a map to show the planned closure points and the detour route(s)

5-10	Table 5-2	for the Silurian Lake landing site, change the listed responsible entities as follows:
30-13		for the BLM R/W reservation: change from Lockheed Martin to NASA
30-14		for the Army COE Section 404 permit, change from BLM would submit to NASA would submit
30-15		for the Caltrans encroachment permit, change from BLM would submit to NASA would submit

Appendix E - Biological Assessment

30-16 **E-19 Summary:** It is stated that preparation and landings at Silurian Lake is not expected to have any impact on desert tortoise populations. This in conflict with the later statement that very little permanent habitat disturbance or destruction is anticipated. *No amount of habitat disturbance can occur without there being an impact to the desert tortoise.* One way to rectify this situation is to describe the area as unsuitable desert tortoise habitat, but recognize the slight chance a tortoise may wander into the area. Then, mitigation could be proposed to mitigate the potential impacts of such a situation to near zero.

30-17 **E-14 SILURIAN LAKE:** Need to further describe desert tortoise surveys so that it is not misleading, such as: *Surveys in the vicinity of Silurian Lake for the desert tortoise...*

30-18 **At end of paragraph:** No tortoises, tortoise burrows, or other evidence of tortoises have been documented from the lake bed or immediately adjacent area(Egan, pers. comm.). *Therefore the area is not designated in a BLM Desert Tortoise Category nor is it designated Critical Habitat.* (The most important addition here is that the area is not within a BLM designated Desert Tortoise Category. What this means is that currently, BLM does not have enough information to designate the area as tortoise habitat.
No tortoise sign has ever been found around the lakebed, therefore it has no BLM Designated Category).

Include the nearest tortoise sign recorded in this paragraph(can be found in the Fort Irwin Expansion DEIS). There have been tortoises located in areas both north and south of the proposed Range Area (approximately 3 miles both north and south).

With the above mentioned surveys and BLM documentation, it is safe to say that the Silurian Lakebed and immediately surrounding area is unsuitable habitat for the desert tortoise. This concept needs to be clearly stated. Therefore, the second sentence (stating it is potential desert tortoise habitat) may need to be omitted from the Silurian Lake Paragraph.

30-19 Recognizing that there is a slight chance of tortoises wandering into the Range area, an authorized desert tortoise monitor would be required to survey the proposed disturbance area prior to and during any surface disturbing activities. Additionally, there should be an authorized desert tortoise monitor on-site during landing activities to handle any tortoise situations, if they arise. Similar mitigation measures as proposed for the Haystack Butte launch site should be incorporated, such as education requirements, minimal vegetation removal, tortoise handling guidelines and the reporting requirement.

Similar changes concerning the desert tortoise should be made to the Silurian Lake portions within the EIS.

7/24/97

TO: PROJECT LEAD, NASA X33 PROJECT

FROM: EC

SUBJECT: COMMENTS ON PRELIMINARY DRAFT EIS FOR NASA X33 PROJECT

Executive Summary

30-20 ES-5: "Program must be compared to the current baseline conditions, called the "No Action"...". See 40 CFR 1502.14, which indicates requirements for comparative evaluation between proposal, other reasonable alternatives, and no action.

30-21 ES-6: Why were these alternatives chosen (indicate criteria in priority order, if appropriate--distance, common corridor for all sites, land ownership, surface, etc.).

30-22 ES-14 & 15: The basic components for launch complex and schematic are very good. Include a similar list of basic components and schematic for landing sites. (Some of the components are alluded to on ES-16.)

30-23 ES-18: The No Action alternative does not necessarily result "in the lack of development and verification of key technologies...". With respect to this EIS, the no action alternative means that these particular sites would not be used for launch and landing to test the X33 vehicle. Other strategies or sites could be found to address development and verification of these technologies. It would be accurate to say that doing so could cause additional time delays.

30-24 ES-18: As to elimination of Bicycle Lake on Ft. Irwin from consideration due to "significant surface preparation" needed, is my understanding that "surface preparation" will be required at Silurian also. What exactly makes Bicycle Lake need significantly more preparation than Silurian Lake and/or otherwise less appropriate?

30-25 ES-18: Silver Lake...was considered, but eliminated because most of it has been Congressionally designated as a Wilderness Study Area, and this type of activity would not be consistent with the management direction Congress set forth in designating legislation, not because it is under study by the Bureau of Land Management....

30-26 ES-20 & 22: When describing Silurian Lake and Armitage Airfield, use at least one common unit to describe size of the two landing areas, for ease of comparison.

30-27 ES-21: The surrounding terrain is relatively flat and is designated as a Multiple-Use Class M (Moderate Use) area by the Bureau of Land Management. Moderate Use provides for a wide variety of present and future uses and is also designed to conserve desert resources and to mitigate damage to those resources which permitted uses may cause.

30-28 ES-29: What is the expected risk (1 in X) for landing sites?

30-29 ES-33: There is both an annual (100 tpy) and a 24-hour (150 $\mu g/m^3$) de minimus standard for PM_{10}. In addition, the Bureau uses the AQMD standard for imposition of RACM (15 tpy, 150 lb/day), as per our Emissions Control Strategy (required by the SIP). This mitigation is referred to on page ES-36.

30-30 ES-33: Table ES-6. Indicate this is Federal Attainment Status and Conformity. State attainment status is different for Silurian Lake (as you point out in text).

ES-39 Table of Impacts: Use quantifiers where feasible.

30-31 Infrastructure: If surface disturbance of undisturbed areas off of the lakebed is proposed (and I believe it is for ancillary facilities), there will be long-term impacts (desert recovery is very slow), though to a relatively small acreage (approx. x acres). Overall impacts would be minor.

30-32 Hazardous Materials/Waste: Are LH_2 and LOX, as well as He and N, not considered hazardous? Release into atmosphere at the landing site would cause some short-term impacts.

30-33 Air Quality: There would be some short-term air quality impacts to visibility, and from fugitive dust, including PM_{10} (x tpy and y lb/day max.). These impacts can be mitigated through implementation of Reasonably Available Control Measures.

30-34 Airspace: Indicate how long restricted airspace would be in effect (x hours/event).

30-35 Biological Resources: Ancillary facilities will destroy a minor amount of vegetation and wildlife habitat (approx. x acres).

30-36 T&E Species: Launch site is not within critical habitat for any federally or state listed species, including desert tortoise. No T&E species were found during surveys or are likely to occur at the site.

30-37 Water Resources: Activities would not occur when ephemeral flows are present and such flows would not be affected. There would be no water quality impacts. Would the infiltration potential be affected by soil compaction from heavy vehicles on lakebed?

30-38 Soils: Indicate kinds of impacts: soil displacement, erosion, compaction. The extent of these impacts is consistent with other activities authorized to occur on the lakebed in the past, except that compaction could be greater.

30-39 Health and Safety: Some small p-potential for explosion or other risk to public health has been identified, and an appropriate safety zone set up.

30-40 Operational Noise: Double negative. Delete "not"?

30-41 Land Use: The use of the lakebed as a landing area would be consistent with Bureau zoning for the area. The use would temporarily displace other users, and could affect potential for safe future use of the lakebed by motorized vehicles without appropriate reclamation.

30-42 The Bureau has additional issues for which consideration is required, with a negative declaration if there is no affect. Those with no affect can be addressed in text--Special Designations (such as ACECs), Farmlands, Wild & Scenic Rivers, Wilderness, and possibly Native American Religious Concerns. Floodplains (in 100 year floodplain?), solid waste (some will be generated), and Wetlands/Riparian (NASA has already said they intend to assume the area is a jurisdictional wetland) should be addressed in the Table.

Chapter 1

Response to Letter No. *30* - U.S. Dept. of the Interior, Bureau of Land Management

30-1. The updated site layout and descriptions are included in Appendix I of the Final EIS and Sections 2.2.2.1 and 4.2.1 modified. The Final EIS has been revised to include appropriate site plans and descriptions, and associated impacts. Sections 4.2.1.7 and 5.6 have been modified to include additional desert tortoise mitigation committed to in attached letter of August 25, 1997 to the U.S. Fish and Wildlife Service.

30-2. Surface disturbing impacts to Silurian Lake have been updated in Sections 4.2.1 and 4.2.1.1. Surface disturbance would be minimized and any additional mitigation deemed necessary by BLM in the "Right of Way Reservation" permit would be implemented.

Attachment Letter to Response *30-1*

National Aeronautics and
Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of: AE01(164-97) AUG 25 1997

Mr. Ray Bransfield
Division of Permits and Consultations
Ventura Field Office
U.S. Fish and Wildlife Service
2493 Portola Road, Suite B
Ventura, CA 93003

RE: Biological Opinion for NASA's X-33 Program

Dear Mr. Bransfield:

30-1 As required under Section 7 of the Endangered Species Act, any federal agency whose actions may affect federally protected plant or wildlife species is required to assess the effects on those species and enter into a formal consultation with the U.S. Fish and Wildlife Service (FWS). NASA's X-33 project is considering Silurian Lake, north of Baker, California, as an alternative short-range landing site, and a biological assessment has been prepared which indicates a potential for the X-33 to impact the desert tortoise by construction activities and sonic boom at the landing site.

The Silurian Lake bed landing site is usually dry and devoid of vegetation, and wildlife usage is very rare. The creosote bush scrub surrounding the landing area is potentially suitable to support the desert tortoise, but no tortoises, tortoise burrows, or other evidence of tortoises were documented in surveys conducted in 1979-80 and 1992 on the lake bed or immediately adjacent to the region. The population density of the desert tortoise at Silurian Lake has been estimated to be very low, ranging from 0-8 tortoises/sq km (0-20/sq mi), and the area has not been designated as critical habitat for the desert tortoise.

Sonic booms between 0.2 and 1.2 psf are expected to occur with the X-33 approximately 96.5 km (60 mi) from the landing area. Recent studies found that desert tortoises exposed to a series of simulated sonic booms ranging from 0.25-6.0 psf showed no startle responses or significant changes in their heart rates. Also, no temporary hearing loss was noted with these sound levels.

To mitigate any impacts at the Silurian Lake bed and surrounding areas, steps will be taken as described for mitigation of impacts at the proposed launch site within Edwards Air Force Base known as the Haystack Butte site.

Attachment Letter to Response ***30-1*** continued

If you have any questions, please call me at (205) 544-4367 or Mr. Wayne Wilson at (205) 544-6089.

Sincerely,

Rebecca C. McCaleb

Rebecca C. McCaleb, Ph.D.
Director, Environmental Engineering
and Management Office

Response to Letter No. *30* continued.

30-3. The California Department of Transportation reviewed the DEIS and provided guidance concerning matters relating to an Encroachment Permit in letter No. ***31*** included in this Appendix.

30-4. Section 4.2.1.13 has been modified to provide two detour alternatives: (1) one with all paved roads; and (2) a second shorter one with paved and unpaved roads.

30-5. NASA would acquire the right-of-way reservation as necessary.

30-5a. Point of contact acknowledged. Document was forwarded to Mr. Mike De Keryl. Address change is noted.

30-6. As indicated by "NASA Procedures and Guidelines for Implementing the National Environmental Policy Act and Executive Order 12114", Section 2 of the EIS shall be a description and comparison of alternatives and shall include a summary of environmental impacts of the proposed action and reasonable alternatives.

30-7. Comment noted. Text modified in Section 3.1.8. The Mojave ground squirrel was delisted by the California Fish and Game Commission in 1993. The California Supreme Court ruled in August 1997 that the delisting was not proper.

30-8. Information provided in the referenced sections was included to assist readers and reviewers in understanding the specific details of the proposed project.

30-9. There are no changes or new constructed facilities at the proposed stop points for the temporary road closures.

30-10. Text modified in Section 4.2.1.1 and Table 5-2 to address the comment.

30-11. Text modified in Section 4.2.1.13 and Table 5-2 to address comment.

30-12. See response ***30-4***. NASA has provided a narrative discussion of detour routes in Section 4.2.1.13 and does not feel a map is necessary.

30-13. Table 5-2 revised to address comment.

30-14. BLM would sign authorization for NASA to acquire the Section 404 permit. Table 5-2 revised accordingly.

30-15. Table 5-2 revised to address comment.

30-16, 30-17, 30-18, and 30-19.
Text modified in Sections 3.2.1.8 and 4.2.1.7 to address comments. Please see response ***30-2*** for further information.

30-20. Details of reasonable alternatives, including the No Action Alternative, are provided in Section 2.2.4 of the Draft and Final EIS.

30-21. Criteria for identification of alternatives are provided in Section 2.2.2 of the Draft and Final EIS.

30-22. Landing site operations would be performed with the portable equipment and temporary facilities. Appendix I has been added to the Final EIS to provide additonal site layout details.

30-23. A selection process was followed whereby several alternative sites were reduced to those that are reasonable. The reasonable alternative sites are presented in detail in the EIS. The No Action alternative is properly stated.

30-24. Surface preparation at Bicycle Lake would have included removal of rocks, boulders, and undulations. Silurian Lake is flat and devoid of rocks and boulders. In addition, a berm was constructed around Bicycle Lake several years ago by the U.S. Army. This process resulted in the lakebed having unnatural characteristics which prevent its use by NASA as a landing site.

30-25. Text modified in Sections ES.2.3 and 2.2.5 to address comment.

30-26. Dimensions provided in meters in Section ES.3.2.

30-27. Comment noted on designation of area surrounding Silurian Lake.

30-28. Risk projections specific to landing sites are provided in Appendix G of the Final EIS.

30-29. Table 4-8 modified to include additional standard. Conformity determination would remain unchanged.

30-30. Text modified on Tables ES-6 and 4-8 to address comment.

30-31 thru 30-42.

Note: These tables are designed to provide summary information and do not contain the details of all impacts for each alternative. Quantitive measures are used where available and able to be presented consistantly. Full details are provided in the Draft and Final EIS.

30-31. These impacts are addressed in detail in Section 4.2.1.1. Comment noted as to overall impact.

30-32. Text modified in Section 4.1.2 to provide additional information on these hazardous materials.

30-33. Dust control measures would be implemented as prescribed in appropriate permits.

30-34. Table ES-8 and 2-8 modified..

30-35. These impacts are addressed in detail in Section 4.2.1.1 of the Final EIS.

30-36. According to EAFB biologists, 13.3 ha (33 ac) of the total 19 ha (47 ac) of habitat disturbed for the X-33 launch facilities at Haystack Butte occurs in designated critical habitat in Desert Tortoise Management Zone 1, as designated by the U. S. Fish and Wildlife Service. Desert tortoise surveys conducted at the Haystack Butte site and adjacent areas found tortoise densities of 13 tortoises/2.6 km^2 (13/mi^2). Although this is considered to be very low density, the possibility exists that tortoises could be affected by X-33 launch operations, and appropriate mitigation measures have been proposed.

30-37. No long-term impacts to infiltration potential are expected due to soil compaction. One of the reasons the lake bed was selected was because of its existing, relatively hard surface condition. The only modifications proposed would be to grade the surface to eliminate ruts and holes as necessary. The lake bed has been permitted by BLM for years for filming movies and other activities which would permit heavy vehicles on the lake bed. X-33 impacts to compaction are not expected to be any greater.

30-38. See response to ***30-37***, above. Comment noted as to consistency with other authorized activities.

30-39. Comment noted on proposed safety zone.

30-40. Tables ES-8 and 2-8 modified.

30-41. Plans have been made to repair damages to the lake bed since the damages would also impact safe landing of the X-33 vehicle.

30-42. Impacts on Special Designations are due to noise as noted in Table 4-9. Wetland and floodplain impacts are addressed in Section 4.2.1.6. No effect declarations are provided in Section 4.2.1.15 for all other areas noted in comment. There are no impacts to Areas of Critical Environmental Concern (ACEC). See Figure 3-19 for details.

Thank you for the comments.

Letter No. *31*

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY PETE WILSON, Governor

DEPARTMENT OF TRANSPORTATION

DISTRICT 8, P.O. BOX 231
SAN BERNARDINO, CALIFORNIA 92402
TDD (909) 383-5959

August 15, 1997

08-SBd-127-Var.

Ms. Rebecca C. McCaleb
National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Environmental Engineering and Management Office
Marshall Space Flight Center, Alabama 35812

Dear Ms. McCaleb:

X-33
Advanced Technology Demonstrator Vehicle Program

We have reviewed the above referenced project and offer the following comments:

31-1

- This project will require an Encroachment Permit for the proposed temporary closure of State Route 127. The Department of Transportation would be a responsible agency, and may require that certain measures be provided as a condition of permit issuance. All matters relating to the Encroachment Permit process should be sent to:

  Mr. Basem Muallem
  California Department of Transportation
  Office of Permits
  P.O. Box 231
  San Bernardino, CA 92402
  (909)383-5955

31-2

- We urge continuous liaison with Caltrans on proposed plans as they affect state highways. Early coordination on this project is essential so that appropriate highway advisories can be established to warn motorist of the temporary closures on State Route 127.

If you have any questions, please contact Chris Herre at (909) 383-4227 or FAX (909) 383-7934.

Sincerely,

DOUGLAS HOGUE, Chief
Office of San Bernardino
County Transportation Planning

Responses to Letter No. *31* - **Department of Transportation;**
County Transportation Planning
San Bernardino County Office

31-1. Requirement for an Encroachment Permit for the proposed temporary closure of Highway 127 is noted and the Point-of-contact given is added to out mailing list.

31-2. There would be continuous liaison with Caltrans on proposed plans as they affect state highways. Continuous coordination would begin following the Record of Decision.

Thank you for the comments.

Letter No. *32*

ALLEN C. JORGENSEN
HCR 2, BOX 271
COULEE CITY, WA 99115

8-10-97

Dear Mme:

32-1 I am writing this letter to help get NASA to select Moses Lake, WA as the sight for the 1999 X-33 test landings. I live in the area and am a follower of the space program.

To do this my four piece musical band will write and record at least one outer space promotion song to coincide with the Moses Lake landings. It will not be about UFO's or aliens, but human and science related. Appropriate music can have a big impact on public relations.

RECEIVED AUG 18 1997

On request I can send you a quick cassette sample of a space song as it is now being written and also references for my band "SKYWARD", including the local Chamber of Commerce.

Lift off and Yours truly,

Allen [signature]

Responses to Letter No. *32* - Allen C. Jorgensen

32-1. NASA notes support for the X-33 Program.

Thank you for the comment and enthusiasm.

Letter No. *33*

FAX

To: Dr. Rebecca C. McCaleb
Company:
Fax number: +1 (205) 544-8259
Business phone:

From: Bill Helmer
Fax number: +1 (520) 795-1767
Business phone:
Home phone:

Date & Time: 8/17/97 9:43:54 PM
Pages: 1
Re: X-33 EIS

RECEIVED
AUG 18 1997

Dr. McCaleb:

I am responding to the Draft EIS for the X-33 Advanced Technology Demonstrator Vehicle
33-1 Program. I strongly suggest not using Silurian Lake as a proposed landing site for the X-33.
Since there are so many alternatives for landing sites already within existing military bases,
public land should not be used for these purposes. The impacts may be of short duration, but
33-2 they are extensive. It also should not be assumed that Fort Irwin will expand to Silurian Lake. *33-3*
33-4 Sonic booms and low-flying aircraft are already impacting the Mojave Desert. Please do not
extend these impacts when it is not neccessary to do so.
Under the cumulative impacts section, no mention was made of other projects (such as Fort
33-5 Irwin expansion) which would cumulatively add to the impacts of the X-33 project. What other
projects are proposed in terms of non-civilian use of public lands?

Thank you,

Bill Helmer

Responses to Letter No. *33* - Bill Helmer

33-1. Comment suggesting that Silurian Lake not be used as a proposed landing site for X-33 and to consider using existing military land is noted. Silurian Lake provides better "first flight" landing conditions for the X-33 than China Lake, the only other reasonable short range alternative. The lake bed provides a softer landing situation and longer range than the airstrip at China Lake. Silurian Lake is also in a more remote setting.

33-2. Impacts to the Silurian Lake area are addressed in section 4.2.1 of the Environmental Impact Statement. Analyses have shown that the impacts are short term, temporary and similar to other activities already occurring on the lakebed (e.g. off road vehicle usage, movie production, wind sailing, etc.)

33-3. NASA does not assume that Fort Irwin will expand to include Silurian Lake. The proposed use of Silurian Lake as a landing site does not depend on the Fort Irwin expansion decision.

33-4. Sonic boom and noise impacts to the majority of the affected area in the Mojave Desert would be minimal. Most of the area receiving sonic booms would be subject to boom overpressures of 0.1 kPa (2 psf) or less. These overpressures are equivalent to a loud clap of thunder. There is little probability of damage at these low overpressures. Higher overpressures would occur primarily in a small region of BLM-administered property between Edwards AFB and China Lake Naval Air Weapons Station, and any impact would depend on the structures that are located in the focal region. A more complete analysis of noise impacts to the Mojave Desert area can be found in section 4.2.1.12 of the Final EIS. It should also be noted that no more than 3 landings at Silurian Lake are currently planned.

33-5. Proposed projects in terms of non-civilian use of public lands, specifically the Silurian Lake, would be coordinated through the Bureau of Land Management (BLM). The BLM actively monitors public land use to avoid cumulative impacts due to overuse. NASA is not aware of any other non-civilian uses proposed for Silurian Lake other than the Ft. Irwin expansion.

Thank you for the comments.

Letter No. 34

OWENS PEAK GROUP

KERN KAWEAH CHAPTER

SIERRA CLUB

Post Office Box 1569, Ridgecrest, CA 93556

Aug.12, 1997

Dear Dr. McCaleb,

Thank you so much for coming to Ridgecrest again for further scoping on the X-33. It was a pleasure to see you again, and we wondered the next day how you found Baker! Thank you too for sending us the color version of the Draft Environmental Impact Statement.

This letter follows up on comments I made at the meeting and adds other points. As I said, I'm impressed by such a fine document. It can't be easy to gather so much data and present it well in the time you had.

34-1 Though Edwards to China Lake is a shorter flight than Edwards to Silurian Lake, our group supports the use of China Lake because the infrastructure is already in place, and environmental impacts would probably be less here. I should have asked at the meeting if Silurian provides a better test opportunity for your needs. Otherwise, we hate to see the lake disturbed, even though you have planned careful use of all potential landing sites.

34-2 There is a question about avalanches that I thought of recently. It's true that the land under the proposed flight paths in Southern California is not avalanche terrain, but some of the sonic boom maps seem to indicate that parts of the Sierra Nevada could be affected by booms. Those areas are avalanche-prone. I doubt that there is a real problem but believe it can't be dismissed without more consideration. It would be interesting to superimpose boom maps on topographic maps to see if any of the high Sierra could be impacted.

There are some minor concerns with the document which you may or may not choose to change.

34-3 Table 3-15 on page 3-63 does not include China lake. These data may also be shown on other tables. I'm pretty sure the data are available for China Lake and could be useful because I suspect they are quite site-specific, given the distances between measuring stations out here. We'd hate to see a test grounded because of air quality problems somewhere else on a given day. Trona, for instance, has bad air quality problems different from those at China lake much of the time.

34-4 Figure 4-54 on page 4-139, showing Kern County Census Tracts, shows a little town labeled Bodnish. The town is actually called Bodfish. Of course this does not change any of your conclusions.

34-5 Some of the charts and/or tables refer to Death Valley as a National Monument (ie Fig.4-55, page 4-142). In 1994 Death Valley became Death Valley National Park. You probably acquired figures or tables that were created before 1994.

Thank you for making it so easy for us to comment and for caring about the views of our group.

Sincerely,

Jeanie S. Haye

Jeanie Stillwell Haye
Conservation Chair

RECEIVED
AUG 13 1997

Responses to Letter No. *34* - Sierra Club;
Kern Kaweah Chapter, Owens Park Group

34-1. Comment supporting the use of China Lake Naval Air Weapons Station rather than Silurian Lake as a landing site for the X-33 is noted. Environmental impacts would likely be less at China Lake. Silurian Lake is a better "first flight" landing area for the X-33. The lakebed provides a softer landing situation and longer flight range than the airstrip at China Lake. Silurian Lake is also in a more remote setting. Further information on this subject is also provided in Section 2.1.6 of the EIS.

34-2. Based on the analysis for sonic booms, there is little potential for boom occurrence in this area. Also, avalanche potential has never been an issue in other documented supersonic flight programs.

34-3. Per conversation with the China Lake Environmental Management Office, no air quality data is acquired on the China Lake Naval Air Weapons Station. They use the existing surrounding site monitoring data.

34-4. Text modified on Figure 4-54 to address comment.

34-5. Text modified on Figure 4-55 to address comment.

Thank you for the comments.

Letter No. *35*

PLANNING DEPARTMENT

COUNTY OF SAN BERNARDINO
PUBLIC SERVICES GROUP

385 North Arrowhead Avenue • San Bernardino, CA 92415-0182 • (909) 387-4131
Fax (909) 387-3223
15505 Civic Drive • Victorville, CA 92392 • (619) 243-8245 • Fax (619) 243-8...

VALERY PILMER
Director of Planning

August 18, 1997

Post-it® Fax Note 7671 | Date 8-18-97 | To Dr. Rebecca M... | Co./Dept. Envir. Eng Mgmt | Fax # 205 544-8259 | Phone # (909) 387-4...

Dr. Rebecca C. McCaleb, Director
Environmental Engineering and Management
NASA/Code AE 01
Marshall Space Flight Center, AL 35812

VIA U.S. MAIL & FAX

Dear Dr. McCaleb:

Thank you for the opportunity to review and provide comments on the draft environmental impacts for the proposal to test the X-33.

35-1 The County is concerned with one site: the proposed use of Silurian Dry Lake. We have confined our comments to that alternative. We were unable to locate a preferred alternative in the document, so we were unable to determine your preference for the short range testing, Silurian or China Lake NAWS. The final EIS should indicate the environmentally preferable alternative. While NASA's providing of physical and environmental data on the two sites was comprehensive, we could not determine the criteria which would be used to make the final selection, if both might be used depending upon conditions, or if a preference already exists. The FEIS should address this issue.

35-2 The County recently commented on the US Army's proposed withdrawal of the area around Silurian Valley associated with the proposed expansion of Fort Irwin. A copy of the County's formal comments and Board of Supervisor's Resolution are attached. While the County recognized the Army's need to meet it's training mission, we raised issues and concerns regarding the eastward expansion of Fort Irwin. The use of Highway 127 and air quality issues were paramount. Concern would be similar with any project which has the potential to close a major access highway or impact one of our communities.

35-3 The NASA project, by comparison, is of much smaller scope, much shorter duration, and appears largely reversible in terms of environmental impacts. Therefore, while less concerned over the long term potential for impacts, we do wish to indicate that the Silurian site's remoteness in no way lessens the County's interest in the project if that site is selected.

35-4 Our first concern relates to hazards if the vehicle disintegrated. The trajectories indicated show that launch to Silurian will be over relative unpopulated areas, and thus of little danger to residents or land users. The tables in Appendix G are helpful, but should be expanded to also indicate the risk and probability if the vehicle should go off course. For example, there appears to be no risk to Barstow to Baker from falling debris, but what is the risk and probability to those communities for a misdirected flight?

Dr. Rebecca C. McCaleb
August 18, 1997
Page Two

35-5 The NASA proposed closures of Highway 127 appear to be of short duration, and an alternate route appears to be available. For those who are stopped during a landing or during ferrying, we suggest that the closures themselves might become tourist attractions. NASA should provide mitigation for public use during such closures (indicated as being up to 4 hours), by providing at the Saratoga site portable latrines at the barricade site. The FEIS needs to address the impacts of this public use, which will be at least equal to the staff use at the lake bed, and which will have mitigation through waste management and disposal.

35-6 Further, at the proposed Saratoga closure point, if any testing is done during warm weather (May to October), NASA should be in a position to provide potable water for the period of closure.

35-7 We presume that after the initial test flights at short range, the Silurian site will not receive further use. The FEIS should state that the right-of-way which NASA's contractor will hold (page 5-10), will be relinquished at the conclusion of the tests. Since the lakebed receives use for various commercial activities, we feel that there should be explicit release language so that there will be no permanent closure or encumbrance upon future use of Silurian Lake. If the right-of-way were held for a longer period, or permanently, the FEIS should indicate the long-term consequences.

This letter, in addition to providing comments of the County of San Bernardino, confirms the telephone conversation between our public lands consultant, Gerald Hillier, and Donna Holland of your staff regarding providing for comments from the County's Industry Advisory Council. Thank you for permitting their consideration of the project, and being able to comment on August 19, 1997 following their meeting on the 18th. They meet on the 3rd Monday of the month, and since the July meeting was canceled, that will provide their only opportunity to formally input the project. A letter will be submitted to your office regarding any further input from them on August 19.

Please include us on the mailing list for the FEIS.

Sincerely,

Valery Pilmer
Planning Director

VP/GH/mt

Attachment

cc: Supervisor Davis
Gerald Hillier

Attachment included with Letter No. *35*

'LANNING DEPARTMENT

COUNTY OF SAN BERNARDINC
PUBLIC SERVICES GROUP

35 North Arrowhead Avenue • San Bernardino, CA 92415-0182 • (909) 387-4131
Fax (909) 387-3223
;505 Civic Drive • Victorville, CA 92392 • (619) 243-8245 • Fax (619) 243-8212

VALERY PILMER
Director of Planning

June 2, 1997

NTC Land Acquisition Project Manager
Barstow Resource Area
BUREAU OF LAND MANAGEMENT
150 Coolwater Lane
Barstow, CA 92311

Re: Comments on Draft Environmental Impact Statement for the Army's Land Acquisition Project for the National Training Center, Fort Irwin, California, and Proposed Amendment to the California Desert Conservation Area Plan

Gentlemen:

You have already received a resolution from the San Bernardino County Board of Supervisors regarding the proposed action. That statement was passed in regular session on May 20, 1997. The resolution recognizes the value of training US Army troops and the important role that Fort Irwin plays in that process. However, it also identifies significant issues which need additional analysis and mitigation. The primary issue raised in the resolution is the need to explore other expansion alternatives, including expansion into Mojave B or an alternative expansion configuration to the south, which could result in a reduction of the overall environmental impacts to the region.

That there will be impacts from the expansion is without doubt. While the DEIS in general seems to discount many potential impacts, there is a general recognition that vegetation and wildlife resources will be significantly affected, and that on the bajadas, there is little that can be done to mitigate for these losses. These losses translate into other impacts as well: greater dust movement reducing visibility on I-15 and SSR 127 and the reduction of flight visibility in the vicinity of the supersonic air corridor. We do not feel that an adequate analysis of these impacts has been made, nor do we feel that the full cost of mitigation has been stated, which could involve costs of moving the State Highway.

In addition to the comments made within the resolution adopted by the County Board of Supervisors, the following comments on the impacts and mitigation proposed, and suggested items which should be expanded upon in the Final EIS, are offered for your consideration:

1. Economic Impacts.

   While not necessarily associated with the environment, economic impacts may well affect the citizens of the County. We see no note, nor recognition that:

   - The County of San Bernardino will lose an estimated $17,400 per year of property tax revenue based upon land acquisitions.
   - The loss of the Cronese Lake Grazing Allotment is not mitigated by buy-out or other compensation, thus losing revenue, income production, and employment.
   - The Silver Lake Iron Mine would likely be closed, and while there would be compensation for the valid existing rights, the income stream and employment are lost.
   - Despite the affirmative statements in the EIS, we do not see that the DuMont Dunes recreation use could co-exist over a long period of time with Army operations if the Silurian Alternative were selected. That recreation use brings thousands of visitors to the County each year, with associated expenditures and sales tax receipts to local businesses.
   - We are not at all confident that the underpass proposals associated with Highway 127 will work in the long run. We feel that there should be an analysis of the costs associated with moving it to the east should the Silurian Alternative be selected and the mitigation does not work as planned.
   - We are concerned about the long-term air quality issues. Specifically we are concerned that if the dust levels exceed the estimates, and cannot be mitigated, the burden of future mitigation to ensure regional compliance with PM-10 standards will be borne by private industry and local jurisdictions.

2. Water resources (4.4). We do not agree there would be limited impact. With heavy use surrounding waters, there is likelihood that erosion will increase. Fencing of springs and seeps is probably not adequate to assure their continued functioning, and will reduce their value for wildlife whose habitat is being utilized.

3. Biological resources (4.5). We accept the candor that most of the vegetation and wildlife impacts cannot be mitigated. Eliminating hunting, placing springs off limits and restricting access to Salt Creek ACEC will not be adequate. Does the Army propose to "compensate" for lost habitat in the same way that a private proponent would be required to do?

4. Cultural resources (4.6). Virtually nothing is stated as known. Mitigation is deferred. Planning and commitment are deferred. This section is simply inadequate for analysis.

5. Paleontological resources (4.7). As with Cultural, there is little known. While there is a commitment to study later or upon exposure, this simply lacks detail sufficient to analyze. Further, it is unlikely that a tank operator and crew would, even with the pre-operation briefings, be able to identify these resources if they did become exposed.

6. Air quality (4.8). This section has serious shortfalls. We are extremely wary of the mitigation which states "subject to funding." We believe the mitigation proposed is inadequate, and we do not believe the Army has adequately evaluated the true potential for impacts along the highways.

   In addition, the EIS commits for a potential for chemical treatments or asphalt chip sealing if dust does become a problem. Again, the source of funding is not stated. Further, the paving of significant dust generation zones produces a new set of potential environmental impacts that have not been evaluated.

7. Land use (4.10). We believe that the public access policy must be spelled out in the EIS. To defer it until after approval leaves the public unable to analyze it.

   We are very concerned that there is no compensation for the loss of the grazing lease, future income or displacement of the leasee.

   We also believe that the operation of the Saint Anthony Coptic Orthodox Monastery should be allowed to remain or full compensation made for the cost of relocation.

8. Utilities (4.13). While LADWP will be commenting in detail about the impact upon their power lines, we add our voice to expressions of concern about the 4 lines within the Boulder Corridor. This is a significant part of the entire power supply to Southern California. We believe that the EIS must address the costs and impacts of moving the lines should the mitigation

prove inadequate. We do not believe the flight markers and other proposed mitigation will be sufficient to handle the risk of crash of low-flying support craft during intense training. Nor we believe that the barriers around tower bases will provide adequate protection.

The summary indicates that mitigation reduces the impacts to less than significant. In this specific resource, saying so does not make it so.

9. Transportation and Access (4.14). Again, we raise the dust issue, already described under air quality. Dust storms could have a significant effect on the use of I-15 and Highway 127.

10. Air space (4.18). Again, we raise the dust issue. Basically the DEIS says no impacts, thus no mitigation. Yet commercial craft begin descent near Barstow on their approach to Ontario International Airport. Is there a possibility that dust from the expanded maneuver area could affect visibility?

We appreciate the opportunity to comment on this project. We believe that the US Army has played a significant role in the economic expansion of the desert region of the County. We also recognize that neither we, nor citizens, can adequately judge training requirements given the sophistication of current military operations and readiness. But we feel there are many issues of concern which must be addressed, and the commitment for mitigation must be clear and specific in the EIS. In many areas, the appropriate degree of specificity was lacking.

Yours truly,

Valery Pilmer
Planning Department

VP/GH/mt

Attachment

cc: Kathy Davis, First District Supervisor
Tim Kelly, AAO - PSG
Randy Scott, Planning Manager
Gerry Hiller

MINUTES OF THE BOARD OF SUPERVISORS
OF SAN BERNARDINO COUNTY, CALIFORNIA

May 20, 1997

FROM: **VALERY PILMER**, Director
Planning Department

SUBJECT: **RESOLUTION REGARDING THE FORT IRWIN EXPANSION PROJECT**

RECOMMENDATION: ADOPT a resolution recommending that the appropriate federal agencies prepare a Supplemental Draft Environmental Impact Statement for the proposed Fort Irwin expansion that specifically addresses various environmental concerns and fully analyzes an alternate siting of the proposed expansion project.

BACKGROUND: In December 1996, the Bureau of Land Management released for public review and comment a Draft Environmental Impact Statement (DEIS) for the proposed expansion of the National Training Center at Fort Irwin and the proposed amendment to the California Desert Conservation Area Plan. The expansion is necessary to ensure the continued viability of Fort Irwin as a strategic training facility. However, the First District and the County Planning Department believe that the DEIS should be revisited in order to adequately address certain environmental concerns, such as possible adverse impacts to air quality, transportation/circulation patterns, minerals values, and power transmission lines that affect the residents and users of public lands in San Bernardino County. Also, the DEIS should adequately analyze the alternative of siting the expansion of the training center to the west, an area that is already committed to military use. Such an expansion would minimize conflicts with other land users, public infrastructure and utilities. Therefore, the Board of Supervisors is requested to adopt a resolution to recommend a Supplemental Draft Environmental Impact Statement be prepared by the appropriate federal agencies that specifically addresses these environmental concerns and fully analyzes the alternative of siting of the proposed expansion project to the west.

REASON FOR RECOMMENDATION: The First District Supervisor requests the support of the Board of Supervisors for the adoption of this resolution.

REVIEWED BY: This item was reviewed by Kathy A. Davis, First District Supervisor, on May 13, 1997.

FINANCIAL IMPACT: N/A

PRESENTER: Valery Pilmer

cc w/resolution:
Planning
BLM c/o Planning
PSG
File

rdm

Action of the Board of Supervisors
RESOLUTION NO. 97-111
APPROVED BOARD OF SUPERVISORS
SAN BERNARDINO

MOTION | MOVE | AYE 3 | SECOND 4 | ABSENT 5

EARLENE SPROAT, CLERK OF THE BOARD
BY

DATED : May 20, 1997

ITEM 033

14-9607-000
Rev. 01/96

RESOLUTION NO. 97-111

A RESOLUTION OF THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, MAKING RECOMMENDATIONS TO THE UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, AND THE UNITED STATES DEPARTMENT OF DEFENSE, UNITED STATES ARMY, REGARDING THE PROPOSED EXPANSION OF THE FORT IRWIN NATIONAL TRAINING CENTER AND THE DRAFT ENVIRONMENTAL IMPACT STATEMENT IN SUPPORT OF THE PROPOSAL.

On motion by Supervisor Davis, and duly seconded by Supervisor Walker, and carried, the Board adopts the following resolution:

WHEREAS, the Board of Supervisors of the County of San Bernardino expresses its overall support for the National Training Center and its contribution to training an efficient and effective armored fighting force; and

WHEREAS, the Board of Supervisors recognizes the contribution which the personnel of the National Training Center make to the economy of San Bernardino County; and

WHEREAS, the Board of Supervisors is not in a position to assess or question the US Army's need for expansion to meet the training needs of soldiers and units for combat readiness of the future; and

WHEREAS, the Board of Supervisors has concerns over environmental impacts and consequences of the expansion of the training center as proposed in the various alternatives presented in the Draft Environmental Impact Statement, as issued in December 1996; and

WHEREAS, the Draft Environmental Impact Statement did not fully analyze the possible expansion onto lands controlled by other Department of Defense agencies, such as the Mojave B Range, for the expansion of the training center; and

WHEREAS, the Board of Supervisors has concerns regarding the proposed expansion's impacts on multiple uses of public lands in and around the proposed expansion, and has further concerns over the impact of the proposed action alternatives, as contained in the Draft Environmental Impact Statement, regarding access to popular recreation sites such as DuMont Dunes and Death Valley National Park, and has other concerns over the proposed expansion's effect upon infrastructure in the region, such as Highway 127 and the lines contained in the Boulder Transmission Corridor;

THEREFORE, BE IT RESOLVED, by the Board of Supervisors of the County San Bernardino that:

1. A Supplemental Draft Environmental Impact Statement (DEIS) should be issued for additional public review and comment dealing specifically with siting the proposed expansion to the west which would utilize the existing Mojave B Range which is under US Navy jurisdiction. The Mojave B alternative was dropped as discussed in Sections 2.5 and 2.5.8 of the DEIS without explicit analysis and environmental assessment, yet it is land that is already committed to military use and could be utilized with minimum conflict with other land uses, public infrastructure and utilities.

2. The effects of siting the expansion to the south be more completely analyzed, especially as regards to the total impacts upon the Boulder Transmission Corridor, loss of energy should there be an accident, and the costs of moving the transmission lines to the south if a conflict occurs.

3. A Supplemental DEIS make a more complete analysis on the loss of mineral values, including economic consequences, which may result from the elimination of the potential to mine large areas of land in the Superior-Goldstone and Avawatz areas.

4. A Supplemental DEIS make a more complete analysis on the operational practicality of the underpass proposal associated with the utilization of the area east of Highway 127, including the cost and environmental impact of moving the highway beyond the proposed expansion area if either the underpass proposal does not prove workable or if subsequent changes in training exercises would dictate a more intensive use of the Silurian-Avawatz area than is now contemplated. Such analysis should also reflect the effects of the use of the area and potential conflicts regarding highway access to Inyo County communities and to Death Valley National Park.

5. A Supplemental DEIS make a more complete analysis of air quality issues, including an expanded discussion of the effects of increasing dust in the region, which is classified as a non-attainment area, and assurances that air quality degradation by present and expanded military operations will not adversely effect and cause additional regulatory burdens to existing or future non-military operations and developments (e.g. mining), or would not adversely effect and require additional mitigation related to the County's infrastructure.

6. The staff of the County provide to the project sponsors more detailed analysis, assessment and comment on the substance of the DEIS document and its compliance with the full disclosure requirements of the National Environmental Policy Act.

7. The Clerk of the Board of Supervisors send a copy of this resolution to the Bureau of Land Management, Barstow Resource Area. In addition, copies should be sent to: District Manager, California Desert District, BLM, Riverside; the Commanding Officer, National Training Center, US Army, Ft. Irwin; Congressman Jerry Lewis; Senator Dianne Feinstein; and Senator Barbara Boxer.

PASSED AND ADOPTED by the Board of Supervisors of the County of San Bernardino, State of California, by the following vote:

AYES: SUPERVISORS: Davis, Mikels, Hansberger, Walker

NOES: SUPERVISORS: None

ABSENT: SUPERVISORS: Eaves

STATE OF CALIFORNIA)
) ss.
COUNTY OF SAN BERNARDINO)

I, EARLENE SPROAT, Clerk of the Board of Supervisors of the County of San Bernardino, State of California, hereby certify the foregoing to be a full, true and correct copy of the record of the action taken by said Board of Supervisors, by vote of the members present, as the same appears in the Official Minutes of said Board at its meeting of May 20, 1997.

EARLENE SPROAT
Clerk of the Board

Deputy

Responses to Letter No. *35* - Planning Department; San Bernardino County, California

35-1. The preferred alternatives are provided in the Final EIS Section ES.2.4 and 2.2.6. Criteria used to make final selections would include this EIS, as well as X-33 constraints and program needs. The environmentally preferred alternatives will be addressed in the Record of Decision.

35-2. Concerns over the proposed closure of Highway 127 and air quality issues are noted. See response 35-5 below.

35-3. The county's interest in this project is noted.

35-4. Please see response ***40-9A***.

35-5. Road closures at points well north and south of Silurian dry lakebed would indicate detour routes around the proposed landing site. The road closure points are not intended to accommodate people for long periods of time and therefore should not become tourist attractions. Persons with emergency or critical situations would be escorted through the area; all other persons would use the detours. The barricade points are at a distance from Silurian Lake such that any NASA activities would not be visible, also adding to the unlikelihood of the site becoming a tourist attraction.

As listed in Table 5-2, an Encroachment Permit would be obtained. All permit requirements would be implemented by the Program. If latrines and/or potable water are required by the permit, they would be provided at the closure points.

35-6. Please see response ***35-5***.

35-7. Text modified in Section 4.2.1.15 and Table 5-2.

Thank you for the comments.

Letter No. *36*

Ronald K. Rosepink
6634 S. Atchison Way
Englewood, CO 80111-6606

August 18, 1997

Dr. Rebecca C. McCaleb
NASA/Code AE01
Marshall Space Flight Center, AL 35812

Dear Dr. McCaleb:

I reviewed the X-33 Advanced Technology Demonstrator Vehicle Program Draft Environmental Impact Statement. I commend you and your staff for putting together such a comprehensive and complete document.

36-1 I have some questions that I would like answered or addressed in the final version of the statement. My primary concern is for public safety throughout this flight test program. I am a test pilot at Edwards AFB and I believe the risk of failure for this demonstrator program is being under estimated and the level of risk to the public is being mis-represented.

36-2 I do believe the benefit of this program far outweighs the cost of doing nothing. In fact I would like to see the actual numbers in the Executive Summary Section ES.2 for the levels of pollutants for the existing fleet of launch vehicles. The comparison of an environmentally friendly vehicle like the X-33 to the existing systems would make the no-action alternative a lot less plausible. 36-3 I would also like to have the real numbers for all of the X-33 emission levels be made known to the public. Specifically in paragraph 4.1.4 there is a reference to the emission levels, but the numbers are not revealed. This has the appearance that someone is trying to hide something. If the numbers fall below the federal mandated standards then why are they not stated.

36-4 I am concerned about the level of safety being described and then assumed to be accepted by the general public. In appendix C it is stated, "historical reliability: historical failure probability 1/250, derived from

36-4 220 seconds of powered flight from comparable expendable launch vehicles (Atlas, Delta, and Titan II) and Space Shuttle LH2 and LOX main engines." Is this to assume that 1/250 is the number used to make all further analysis and is only based on main engine failures. The majority of launch accidents are not caused by main engine failures. I believe the historical failure rates for the components and subsystems on the X-33 in current operational use can be used to establish reliability. However, the remainder of the systems must undergo a full systems level reliability analysis. In section E.S.4.2 Flight Safety, there is a reference to X-planes and the flight test safety record. By looking at the data provided in Appendix A it shows 27 major accidents in about 2910 flights (100 flights assumed for those considered unknown) which is a failure rate of 9.2 X 10-3 or 1/108. This is 2.3 times worse than the rate assumed in appendix G and is certainly worse than 30 X 10-6. Without historical data on a given aircraft or launch vehicle then using the X-Plane average of 1/108 is more appropriate. In addition the comparison of a per flight risk to annual risks in Table 4-16 is invalid. A 15 flight test program over a one year period with 9.2 X 10-3 risk per flight, this relates to an annual risk of 1.4 X 10-1, which is much worse than the annual risk for driving a motor vehicle.

36-5 I am also concerned that, "The basic standard for the general public is not more than the risk voluntarily accepted in normal day-to-day activities." I believe the general public should never be assumed to accept more risk than involuntarily exposed to, which is documented in many federal sources to be about 1.0 X 10-6, or the rate of death by natural causes. I certainly do not believe the general public voluntarily accepts the risk of accidents like a lightening strike the same way they accept the risk of motor vehicle driving, for which they derive significant benefit.

I appreciate your continued public service and the effort NASA and the federal government make to keep the world a safer and cleaner place for us all.

Sincerely,

Ronald K. Rosepink

Ronald K. Rosepink

Response to Letter No. *36* - Ronald K. Rosepink

36-1. We appreciate your concern, especially with your background as a test pilot. As you clearly recognize, there is always some degree of risk in a developmental process. However, based on analysis, the estimated level of risk to the public is not being underestimated. NASA is committed to full disclosure to the public.

36-2. NASA compared atmospheric effects of the planned successor spaceplane based on the X-33 design to comparably sized conventional launch vehicles in Section 4.5 of the Draft and Final EIS. It is noted that long-term environmental positive impacts from substantially less stratospheric ozone depletion and surface acid deposition could result with the use of the X-33 technology.

36-3. These numbers are provided in Appendix C of the Draft and Final EIS. Emissions from the vehicle itself are water and are documented in Section 2.1.2 of the Final EIS. All other emissions are from construction, generators, vehicles etc. were provided in Section 4.1.4 and Appendix.

36-4. The risk analysis through main engine cut-off (MECO) used the conservative number of 1/250 as noted in the comment. Additional risk analyses from MECO to landing relied on engineering reliability factors and used component data, degree of redundancy and comparable component data to establish a failure probability of 1/6823 for MECO to landing. Please see Section 4.3 in the Final EIS for commitments of updating the risk assessments with actual flight data. Updated risk numbers are also provided in Appendix G of the Final EIS.

36-5. Your views are appreciated. NASA recognizes the potential hazards associated with conducting the X-33 flight test program as noted in Section 4.3 of the Draft and Final EIS. NASA is committed to minimizing the flight risk to the lowest possible extent consistent with AFFTC launch risk guidance. The X-33 Program, through the AFFTC Range Safety program would ensure that launch and flight of the X-33 would present no greater risk to the general public than that imposed by overflight of conventional aircraft.

Thank you for the comments.

Letter No. 37

State of Utah

GOVERNOR'S OFFICE OF PLANNING AND BUDGET
Resource Development Coordinating Committee

Michael O. Leavitt
Governor
Brad T. Barber
State Planning Coordinator
James L. Dykmann
Committee Chairman
John A. Harja
Executive Director

116 State Capitol Building
Salt Lake City, Utah 84114
(801) 538-1027
Fax: (801) 538-1547

August 15, 1997

RECEIVED
AUG 19 1997

Dr. Rebecca C. McCaleb
NASA/Code AE01
Marshall Space Flight Center, AL 35812

SUBJECT: X-33 Advanced Technology Demonstrator Vehicle Program DEIS
State Identification Number: UT970707-090

Dear Dr. McCaleb,

The Resource Development Coordinating Committee (RDCC), representing the State of Utah, has reviewed this proposal. The Department of Environmental Quality comments:

> The Utah Department of Environmental Quality has reviewed the X-33 Advanced Technology Demonstrator Vehicle Program Draft Environmental Impact Statement (DEIS) for issues pertinent to our regulatory authority. We have found no impacts to land, water or air resources. The following comments are suggested corrections to the DEIS.

37-1

1. General. The document references U.S. Army 1982, throughout the Dugway section and also on page 6-13. This is the Dugway Installation Environmental Assessment which is 15 years old and woefully out of date. The power grid, transportation facilities, wastewater treatment facilities, and test facilities have been completely upgraded since this document was produced (most of the upgrades happened from 1988 to present). We are uncomfortable with describing present day conditions with an outdated document.

37-2

2. Page 3-78. Water Supply and Distribution. Should be annotated that drinking water in the test areas (Carr, Baker, and Ditto areas) is trucked in bottled water. The taste of the groundwater in these areas precludes internal consumption due to the high solids and chlorides.

37-3

3. Page 3-78. Wastewater. Should be annotated to reflect that the lagoons are permitted by the Department of Environmental Quality. Also, replace the reference to the Department of Health standards (page 3-79) with Department of Environmental Quality standards.

37-4 4. Page 3 -79. Hazardous Materials and Hazardous Waste. The last full line of the first paragraph. There is no longer a Facilities Engineering Directorate. The correct name is Public Works Directorate.

37-5 5. Page 3 -80. Hazardous Materials and Hazardous Waste. The second to the last full line of the last paragraph should be coffected to either read Department of Environmental Quality or Division of Solid and Hazardous Waste, not Department of Solid and Hazardous Waste.

37-6 6. Page 3 - 94. Snow Conditions. The document spends an entire page talking about avalanches in ski areas and at the end, make mention to California. I think they can safely say there is no avalanche danger at Dugway Proving Ground based on the remoteness and lack of accumulated snowfall. The DEIS needs to be more Dugway specific on this issue. Their statement on page 4-98 covers this. Page 3-94 should also be similar.

37-7 7. Page 4 -92. Noise and Sonic Boom Footprints. Tooele City, Grantsville, Stockton, and the Goshute Indian Tribe should be shown on Figure 4-39, Sonic Boom Contours for Nominal Trajectory to Dugway.

37-8 8. Page 4 -95. Figure 4-40. The map seems to indicate the landing site for the Dugway trajectory to be on BLM land, not on the Dugway Military Reservation.

37-9 9. Page 4 - 96. Figure 4-41. The map does not show the Dugway trajectory.

If you have any questions, please call Leah Ann Lamb at (801) 536-4476.

The Committee appreciates the opportunity to review this proposal. Please direct any other written questions regarding this correspondence to the Utah State Clearinghouse at the above address or call Carolyn Wright at (801) 538-1535 or John Harja at (801) 538-1559.

Sincerely,

for Brad T. Barber
State Planning Coordinator

BTB/ar

Response to Letter No. *37* - State of Utah, Governor's Office of Planning & Budget

37-1. This document was the only comprehensive environmental document provided by the installation. Given the temporary and limited number of test flight landings proposed for this site, the information was sufficient for the purposes of the X-33 Program. It is our understanding that Dugway intends to update this documentation in the future.

37-2. Text modified in Section 3.2.3.1 to address comment.

37-3. Text modified in Section 3.2.3.1 to address comment.

37-4. Text modified in Section 3.2.3.2 to address comment.

37-5. Text modified in Section 3.2.3.2 to address comment.

37-6. Text modified in Section 3.2.3.17 to address comment.

37-7. Figure 4-42 modified to address comment.

37-8. Figure 4-40 depicts the initial trajectory from Edwards to Dugway. The flight trajectory does not show the complete flight into Dugway, but focuses on the launch phase. The landing scenario for flight from Edwards to Dugway is shown in Figures 4-39 and 4-42.

Figure captions were modified for clarification.

37-9. Figure 4-41 modified to address comment.

Thank you for the comments.

Letter No. *38*

INDUSTRIAL ADVISORY COUNCIL
COUNTY OF SAN BERNARDINO
c/o Gerald E. Hillier, Chairman
P.O. Box 480
San Bernardino, CA 92402-0480

August 19, 1997

Dr. Rebecca C. McCaleb
Director, Environmental Engineering and Management Office
NASA/Code AE01
Marshall Space Flight Center, AL 35812

VIA FACSIMILE (205) 544-8259

Dear Dr. McCaleb:

Thank you for allowing the County of San Bernardino's Industrial Advisory Council to consider the Draft Environmental Impact Statement for the X-33 Project at their August 18 meeting and submit comments today, after the close of the comment period.

As it has turned out, the Council had only minor comments, generally feeling that the document was well prepared and a full disclosure of the project and the anticipated impacts associated with the project.

38-1 *The citizens of Baker, who will be most concerned with direct impacts of the short range tests, if the Silurian Alternative is adopted, have not expressed concerns over the use the lakebed for the short duration projected. The Highway 127 closure, while a minor inconvenience, is manageable.*

38-2 *The Council also felt that the testing aspects could well become a short-term tourism attraction, and that that fact, and its associated impacts probably needs some expansion of discussion in the FEIS.*

38-3 *If there is any aspect of permanent use of the Silurian site, if selected, by NASA, which might have any impact on the commercial filming now taking place on the lakebed, that fact should be made in the FEIS. Reading the DEIS would indicate that after the short-term use, if successful, NASA's use would cease and the lakebed revert to its present state as to use and condition.*

38-4 *The Council could not find an analysis or indication of preference between Silurian or China Lake NAWS, nor could we determine whether criteria have been developed for making that choice. The Final EIS should indicate both which is NASA's preference, and the criteria by which that selection is, or will be, made.*

Please include the IAC, at the above address, on your mailing list for a copy of the FEIS Again, thank you for the helpfulness of Ms. Donna Holland for allowing our consideration and opportunity to comment.

Yours truly,

Gerald E. Hillier

Gerald E. Hillier, Chairman

cc: Valery Pilmer, Director, SB County Planning
Tom Laurin, Director, SB County Econ. & Comm. Development
Lois Clark, Baker Valley News

RECEIVED
AUG 19 1997

Responses to Letter No. *38* - **Industrial Advisory Council**
San Bernardino County, California
Gerald E. Hillier, Chairman

38-1. Comments noted concerning Baker residents' not expressing concerns over proposed X-33 landings on Silurian Lake. The temporary closure of Highway 127 would be a minor inconvenience, but manageable as noted in comment number ***38-1***.

38-2. The Council's concern over possible short term impacts from tourism is noted. Road closures at points well north and south of Silurian Lake would indicate detour routes around the proposed landing site. The road closure points would not be intended to accommodate people for long periods of time; and, therefore, should not become tourist attractions. Persons with emergency or critical situations would be escorted through the area; all other persons will be encouraged to use the detours. The barricade points would be at a distance from Silurian Lake such that any NASA activities would not be visible, also adding to the unlikelihood of the site becoming a tourist attraction.

38-3. The proposed use of Silurian Lake is to be temporary. A temporary Right-of-Way Reservation, issued through BLM under Section 507 of the Federal Land Policy and Land Management Act, would be relinquished at the conclusion of the short range test flights. Impacts to commercial filming would also be temporary.

38-4. Sections ES.2.4 and 2.2.6 were added to the Final EIS to reflect NASA's preferred alternatives.

Thank you for the comments.

Letter No. *39*

PLANNING DEPARTMENT
TED JAMES, AICP, Director
2700 "M" STREET, SUITE 100
BAKERSFIELD, CA 93301-2323
Phone: (805) 862-8600
FAX: (805) 862-8601 TTY Relay 1-800-735-2929
E-Mail: planning@kerncounty.com

RESOURCE MANAGEMENT AGENCY
DAVID PRICE III, RMA DIRECTOR
Community Development Program Department
Engineering & Survey Services Department
Environmental Health Services Department
Planning Department
Roads Department

August 18, 1997

National Aeronautics and Space Administration
Environmental Engineering and Management Office, AE01
Attention Dr. Rebecca C. McCaleb
Marshall Space Flight Center
Alabama, 35812

Re: **Environmental Impact Statement; X-33 Program Vehicle Design and Flight Demonstration Program**

Ladies and Gentlemen:

This correspondence is in response to your request for comments on the Environmental Impact Statement (EIS) prepared for the above-referenced project. Both of the proposed flight operation alternatives are located at Edward Air Force Base, while one of the alternative landing sites involves China Lake Naval Air Weapons Station, all of which are located in eastern Kern County. Major issues addressed in the environmental study include noise and sonic booms, flight safety, and the affects on airspace and air traffic patterns. Implementation of any the project alternatives would result in overflights over portions of public or private lands in Kern County. The information has been reviewed as part of the Home Rule Program, and the following comments have been prepared in response.

39-1 This Department takes no exception to the conclusions drawn in the document regarding possible environmental consequences as they relate to the proposed action and alternatives. **39-2** In accordance with Section ES-5 (Mitigation, Monitoring and Permitting) potential flight safety impacts and emergency response plans will be mitigated through careful selection of flight corridors and coordination with emergency response agencies in affected states and localities. The agency responsible for coordinating emergency response plans in Kern County is the Kern County Office of Emergency Services. Your point of contact at that agency is Charles H. Conner. You can reach Mr. Conner at (805) 868-3000.

39-3 The Kern County Board of Supervisors views the X-33 program as an asset to the economy of eastern Kern County and Antelope Valley. The Kern County Planning Department appreciates the opportunity to work with the National Aeronautic and Space Administration to assure a thorough, yet timely, NEPA process for the X-33 Program.

Very truly yours,

Scott F. Denney, Associate Planner
Home Rule Program Coordinator

cc: Board of Supervisors
Resource Management Agency
Kern County Office of Emergency Services

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AUG 1[illegible] 1997

Responses to Letter No. *39* - Planning Department; Kern County, California

39-1. Comment that the Kern County Planning Department takes no exception to the statements in the Draft EIS is noted.

39-2. We appreciate the early designation of a point of contact for emergency planning. NASA will ensure that Mr. Conner is provided notifications of emergency planning meetings and review copies of X-33 emergency plans. Thank you.

39-3. Comment that the Kern County Board of Supervisors view the X-33 Program as an asset to the economy of Eastern Kern County and the Antelope Valley is noted.

Thank you for the comments.

Letter No. *40*

U.S. Department of
Transportation

Federal Aviation Administration

Office of the Associate Administrator
for Commercial Space
Transportation

Date: August 18, 1997

The following pages, cover + 9
are for: Dr. Becky McCaleb
Company name: NASA/MSFC

Fax Number: (205) 544-8259
Phone Number:(205) 544-4367

The following pages are from: Chuck Larsen
Phone Number: 202-366-2935
Fax Number: 202-366-9945
Comments/Instructions:

Becky,

Here are the FAA/Air Traffic, and Western Pacific Region and our AST (my office) environmental contractor folks comments to the X-33 DEIS. I myself have to review appendixes D and G and I am running out of time today, so I will give you my comments in the morning.

Thanks,
Chuck Larsen

If you do not receive all pages for this facsimile, please call (202) [illegible]-2929 promptly. Thank you.

400 Seventh Street, S.W. Room 5402a
Washington, D.C. 20590
(202) [illegible] (Office)
(202) [illegible]-9945 (Fax)

August 18, 1997

ATA-200 Comments on X-33 Advanced Technology Demonstrator Vehicle Program, Draft Environmental Impact Statement

40-1

1. To ensure through coordination, please ensure that ATA-300 (environmental) and ATA-400 (Airspace and Rules) are aware of this program and are afforded the opportunity to comment.

Due to numerous environmental issues that have been brought forward lately it is vital they, ATA-300, are prepared for the numerous issues that may come their way.

Airspace rules, ATA-400, will probably need to be involved when it comes to issues with Temporary Restricted Areas and FAA Special Use Permits.

40-2

2. Is there an avenue available for Air Traffic to be able to track and communicate with the X-33, realizing the initial phase of flight testing is unmanned.

40-3

3. Flight Safety is stressed as the overall most important issue, but there are some concems that have been raised throughout the Draft Environmental Impact Statement.

40-4

4. Concerns and Issues:

a. Guidance and Navigation system reliability factor
b. Public safety/risk
c. Exact flight path(s)
d. Disruption/suspension of airport/air traffic services for all users
d. abort scenarios, consequences and procedures
e. scheduling

40-5

5. ES.3.1: Edwards AFB, very positive to ensure the operations remain within the confines of Restricted Areas.

40-6

6. ES.3.2: Silrian Lake, the airspace is located within the confines of a MOA. Civilian aircraft can operate within the MOA under visual flight rules.

40-7

7. ES.3.5: Malmstrom AFB, At the time of the proposed flights, the airspace will be under FAA control.

40-8

8. ES.3.6: Grant County Airport near Moses Lake, Washington, similar to Malmstrom, this is another civilian airfield with no imposed flight restrictions.

9. Flight Safety.

The national range system, established by Public Law (PL) 81-60, was originally sited based on two primary concerns: location and public safety. Hopefully, "was originally" still remains the important issue and this statement has not changed.

40-9A Have all options been taken to ensure "the launch and flight vehicles present no greater risk to the general public than that imposed by overflight of conventional aircraft." We have clear historical data to document conventional aircraft, whereas all we have on the X-33 is nice computer animation and modeling at this time.

40-9B Hazards resulting from an uncontrolled situation, such as, (1) high-altitude explosion downrange of the launch site while the vehicle is still in powered flight; and (2) loss of vehicle control resulting in either vehicle breakup or a whole body impact. Air Traffic obviously has major heartburn with these potential scenarios occurring.

10. Airspace and Air Traffic

40-10A NOTAM for up to four hours per landing as approved by the FAA in a Special Use Permit. As mentioned above in comment # 9, would there be a total restriction to all air traffic within the confines of the entire flight region (liftoff to landing, including the overflight phase even though it is above FL600)? The potential hazards could out weigh the consequences until historical data is obtained. This is only a question, I am aware of the trajectory risk analysis process that is continuing.

40-10B Moses Lake, the operation would "generate moderate disturbances in air service." This is an airport that is a significant training aviation center and provides commercial air service to the region.

40-11 11. "Risk projections specific to final descent and landing of the X-33 are not available."

40-12 12. Table ES-8: Air traffic has concerns with the wording, "majority," of the trajectory. "Minimal effect on general aviation."

40-13 13. Table ES-9: "Moderate impact to airspace and air traffic,... 1 to 2.5 hours."

40-14 14. 1.3.2 Phase II

ATA agrees with the program strategy: "minimize affected national airspace, the airspace in which private and commercial aircraft fly and the FAA controls."

40-15 15. 2.1.8 Contingency Planning and Abort Scenarios
The wording of this paragraph leads one to believe we are venturing off into uncharted waters and all precautions in relation to flight safety need to be insured. Numerous occasions the flight profile refers to flight above FL600, above FAA's control jurisdiction, but might we need to ensure flight safety to all aircraft operating below the flight path in lieu of this concept.

40-16 16. 3.1.6 Airspace and Air Traffic
On page 3-14 of the draft, there appears to be a mistake as to the dimensions of the R-2508 complex, the width appears to be correct; but the length based on the map scale shows to be slighty longer than 200 miles (not 140 miles).

40-17 17. Table 3-2 and Table 3-16
From reading these tables, it depicts the vertical limits of R-2508 from 20,000 feet to unlimited. This could be a mistake, since the break down of the restricted area complex indicates the base altitude as 200 feet.

40-18 18. Appendix D - Effects on Air Traffic
The major question is, exactly what data source was used. We have ETMS data archived here at ATA, it would be interesting to see what figures of traffic we would extract.

There also appears to be a lack of explanation as to missing data, it seems odd to find fifteen sectors that have no data reports for Mondays, Wednesdays, Fridays and Sundays, while two sectors have no data reports at all.

40-19 19. As this is going to be a commercial venture, has a cost benefit analysis been done on the program? What are the effects, cost benefit, on air traffic? Why should the X-33 have priority over commercial aviation, a.k.a., the other users (air carrier, ga, military)? This appears to be a NASA program, or is it really a DOD program?

40-20 20. 5.2 Flight Safety and Appendix G
Air Traffic 's major concern is obviously safety.

Author: BILL JOHNSTONE at AWP500
Date: 8/13/97 1:15 PM
Priority: Normal
Receipt Requested
TO: Chuck Larsen at AST1PO
CC: George Wiewiora, LEONARD MOBLEY
Subject: X-33 EIS Comment

August 13, 1997

Chuck,

At the request of George Wiewiora of our staff, I have reviewed part of the NASA EIS on the X-33 project. The document is clearly professionally prepared. My only comment is on the "Alternatives Considered But Not Carried Forward" section.

40-21

A assume over water (ocean) launching has been considered in the early planning of this project. The obvious benefits of avoiding population and land resources could hardly go unnoticed. The draft EIS does not address this alternative in a substantial manner. The reasons given are not technical, and in fact - are political. I suggest this alternative be explored more fully and the reasons for lack of feasibility explained.

I hope this is of some use to you.

Bill Johnstone, AWP-520.5

Comments on the X-33 Advanced Technology Demonstrator Vehicle Draft Environmental Impact Statement

General Comments

40-22 Potential impact on public health and safety is probably the most critical issue to consider and discuss in depth in this impact analysis of the X-33 Vehicle Demonstration Program. Proposed flight and ground operations for an RLV that is intended to overfly four states at speeds up to Mach 15 appears to be an unprecedented action, especially in terms of flight safety issues.

40-23
- More information on vehicle failure scenarios would be useful, specifically, more details on most probable failure modes and systems, the likely location and extent of debris patterns in the event of a catastrophic vehicle failure and explosion, and how alternate "safe" landing areas would be determined in the event of an anomaly.

40-24
- Please clarify the extent of local, county, and state agency participation in emergency response planning, notification mechanisms; any Memoranda of Understanding or Agreement regarding response authorities and responsibilities; and any special response needs in terms of training or equipment.

40-25
- We are concerned about the validity of using historical reliability and failure probability data from ELVs and STS main engines for risk determination. Please provide the values for the parameters used in the risk modeling performed by ACTA, Inc. in Appendix G, along with any simplifying assumptions. Additional detail on the safety analysis would be useful, especially in the appendix.

40-26 Discussion on seismicity should be included in the "Description of the Affected Environments" and in the "Environmental Consequences" sections to ensure a thorough environmental analysis. Specifically, the EIS should address the potential impacts of seismic events on fuel storage facilities, ground support infrastructure, and pre-flight ground operations.

Generally, recommend clarifying the discussions on air quality. Suggestions include:

40-27
- Define key air quality and regulatory terms to facilitate understanding by laypersons.

40-28
- Include references in the text to where the reader can find the calculations for air emissions and how they are comprised of. It is not apparent what operations /activities were considered in calculating the emissions for the sites. Appendix C Conformity Analysis has much information that could be included in the body of the text for clarification. Appendix C also needs some clarification, renumbering its appendices to avoid confusion.

40-29 Please ensure that all maps have a North designation on them.

40-30 The text is extremely redundant throughout. More back referencing could be used to streamline the document to help the reader understand where the differences in the alternatives really lie.

40-31 More information about previous X-vehicles would be helpful in judging to what degree the X-33 is unprecedented and untested. The DEIS should indicate if there have been other unmanned CONUS overflights and whether environmental analyses exist on other X-vehicles.

40-32 The Cumulative Impacts (Section 4.6) should be expanded to address the impact of the proposed action in conjunction with all reasonably foreseeable actions. Most notably, recommended is a discussion on the compounding effects of emissions when considered with ELV and RLV emissions worldwide. Section 4.5 begins to address this issue, but the discussion should be expanded. Further, suggest discussing whether use of the various landing sites impact those sites beyond the life of the test program.

Specific Comments

40-33 **Page 1-10, Section 1.5, 8th line.** Replace "along" with "long".

40-34 **Page 2-8, Section 2.1.4, 2nd line of first full paragraph.** Suggest replacing the parenthetic remark "cannot burn" with "unreactive and will not burn."

40-35 **Page 2-10, section 2.1.5, fourth and fifth sentences of paragraph.** Suggest rewording these sentences and possibly expanding it to clarify its meaning. EO 11988 does not reference "'critical action' facilities."

40-36 **Page 2-12, section 2.1.5.4.** Suggest adding information on where the J-2S aerospike engines will be tested.

40-37 **Page 2-30, first paragraph on page.** Repeat of same paragraph that is on page 2-25. Second paragraph should probably be deleted.

40-38 **Page 2-37, Table 2-8, Operational Noise Issues at Silurian Lake.** Should this read, "Non-flight operations are not expected to produce impacts due to the lack of noise receptors." (as opposed to "produce minimal impacts")?

40-39 **Page 3-5, first full paragraph.** Should JP-8 be removed from the list of fuels brought in by tank truck because the prior sentences indicated that JP-8 in brought on base via pipeline?

40-40 **Page 3-5, section 3.1.2, second paragraph.** What is the reason for disposing of hazardous material? Out-of-date? Contaminated?

40-41 **Page 3-6 and throughout document.** When using a plural acronym, the apostrophe is not needed, e.g., "operable units (OUs), polychlorinated biphenyls (PCBs), air pollution control districts (APCDs)."

40-42 **Page 3-12, top paragraph.** Second sentence should read "In 1993 there were two exceedences of the federal O_3 standards, and in 1994 and 1995 no federal exceedences occurred."

40-43 **Page 3-12, section 3.1.6, third paragraph.** In the second sentence add "under" before visual flight rules. In the next sentence change conduct to conducting..

40-44 **Page 3-20, Section 3.17, 1st line of last paragraph.** Recommend rewording to " Rosamond Boulevard is the main access route to Edwards, and is threatened with possible flooding by Rosamond Dry Lake every winter," for clarity.

40-45 Page 3-42. Table. The text references this table as Table 3-8 Areas of Potential Environmental Concern in the Silurian Valley - the table number and title are incorrect. Also add a cite for the BLM 1996.

40-46 Page 3-48, third paragraph. Second sentence should read "Insufficient data exist..."

40-47 Page 3-59, Table 3-13. Recommend deleting this table and including verbiage that Runway 21 is the most frequently utilized runway at China Lake Naval Air Warfare Center. The table contains extraneous information.

40-48 Page 3-62, section 3.2.2.4, first paragraph. Third line should read "little cloudiness or visibility.."

40-49 Page 3-71, section 3.2.2.9, 2nd paragraph. Change the parenthetical notation on the Saratoga Springs period to "AD 500 to AD 1200."

40-50 Page 3-79, section 3.2.3.2, first paragraph. Are the seven tanks contiguous within the same diked area? Is the "total spill" that will be contained 110% of the total capacity of seven tanks?

40-51 Page 3-80, fourth paragraph. In the fifth line the verb "are" should be "is."

40-52 Page 3-97, section 3.2.4.2, first paragraph. At the end of the paragraph add "there is" before "a scheme to substitute..."

40-53 Page 3-104, top paragraph. This paragraph is a repeat from page 3-102. Recommend deleting.

40-54 Page 3-112, section 3.2.4.13. A period at the end of the section is needed.

40-55 Page 3-114, section 3.2.5.1, first paragraph. In the last line, the figure called out should be 2-15, not 2-16.

40-56 Page 4-3, second paragraph. Delete the "impacts" from the first sentence.

40-57 Page 4-3, 3rd paragraph. Recommend replacing "volatilized" with "vaporized" and at the end of the paragraph, suggest adding "treatment systems" before "are expected."

40-58 Page 4-5, first paragraph. Suggest rewording to eliminate the use of "relatively" and reword the last line to "therefore, no impacts from using hazardous materials would be expected."

40-59 Page 4-5, section 4.1.3. Delete "site preparation" from the end of the first line of the paragraph.

40-60 Page 4-6, Table 4-2. The words "moderate", "severe", and "serious" should be defined.

40-61 Page 4-7, Table 4-3. In footnote *a* in the table "San Bemadino" should be "San Bernardino."

40-62 Page 4-11, last paragraph. In the fourth line from the end, "outlined" is misspelled.

40-63 Page 4-16, Section 4.1.11, first line. What about transport accidents and releases of hazardous materials?

40-64 **Page 4-21, paragraph.** This paragraph for Spaceport 2000 is exactly the same as the one on 4-19 for Haystack Butte except for the first line. Perhaps the paragraphs could be collapsed and reference made to the noise contours for each.

40-65 **Page 4-48, Section 4.1.12, 1st line of 1st full paragraph.** Please clarify what "launch vehicles" the X-33 is being compared to in this sentence.

40-66 **Page 4-48, Section 4.1.12, 14th line of 1st full paragraph.** Please clarify that the SR-71 was designed as a reconnaissance vehicle capable of hypersonic speeds that is currently used for high-speed, high-altitude aeronautical research.

40-67 **Page 4-54, section 4.2.1, second paragraph.** In the seventh line, delete the second "potable water." In the next line, "temporary stripping" should be "temporary striping."

40-68 **Page 4-57, fourth full paragraph.** Suggest deleting "estimated."

40-69 **Page 4-59, first paragraph.** What about accidental releases of hazardous materials from transport accidents?

40-70 **Page 4-60, Section 4.2.1.6, second line of second full paragraph.** Suggest rewording to read "to be able to have the airspace at Silurian Lake temporarily restricted during the tests.

40-71 **Page 4-68, next to last line.** "is" should be "are."

40-72 **Page 4-72, last paragraph.** Suggest deleting impacts after wastewater from this section and other Wastewater sections..

40-73 **Page 4-100, first paragraph.** The last sentence should read "Therefore, the existing communications system would not be impacted."

40-74 **Page 4-101, last paragraph.** Next to last line should read "paths and approaches from the west..."

40-75 **Page 4-102, last line.** Last line should read "..no effects to cultural sites or facilities are expected."

40-76 **Page 4-117, second line.** Westinghouse Hanford Company no longer runs DOE's Hanford Site. The contract was won by Fluor Daniel.

40-77 **Page 4-124, Table 4-16.** Recommend listing the accident types in descending order of the approximate risk.

40-78 **Page 4-124, first paragraph.** Rather than use "equates" to discuss the relationship between a risk number 30×10^{-6} and 1 in 33,000, it might be more clear to say that a risk of 30×10^{-6} can be expressed as the likelihood of an event occurring that would result in an injury to the public once every 33,000 flights.

40-79 **Page 4-127, third paragraph.** Spell "trmination" as "termination."

40-80 **Page 4-128, first paragraph.** In the second line, reword to "light debris would fall essentially.." Add a comma after "3 min" and before "respectively."

40-81 **Appendix B, X-33 Flight Track Activity County and Generalized Commercial/General Aviation Flight Corridors.** Throughout the appendix the verbs should be made plural with "data." Initial text (pages D-1 through D-3) is repeated on page D-26 through D-28. The numbering system needs to be redone.

40-82 **Appendix C, Conformity Analysis**. Check spelling throughout of San Bernardino on pages C-4, C-5, C-9.

40-83 **Appendix G Flight Safety Analysis.** On page G-2 fourth line at end change "provide" to "provided." In the fourth bullet change "an Edwards" to "on Edwards." Page G-4, line five, "identify" should be "identified."

Response to Letter No. *40* - U.S. Dept. of Transportation, Federal Aviation Administration

40-1. Comment noted on coordination with ATA-300 and ATA-400. NASA would ensure that these FAA organizations are involved in preparation of airspace related permit applications.

40-2. Lockheed Martin would develop a task agreement or some other acceptable formal agreement with the FAA to establish a communication link between the X-33 Operations Control Center on Edwards and the affected Air Route Traffic Control Centers described in the Airspace and Air Traffic sections for the proposed launch, landing, and intervening flight corridors in Chapter 4 of the Draft and Final EIS. This communications link would permit real time tracking of flight events and movement of the X-33 and facilitate rapid notification of any NOTAMs that would be required in the event of a flight anomaly.

Clarification has been added to Section 4.3.

40-3. Comment noted. Flight safety is paramount. Concerns related to flight safety have been adequately addressed in Section 4.3 of the Final EIS.

40-4. Comment noted regarding concerns and issues. These concerns and issues have been addressed in the Draft and Final EIS. As data continues to be acquired on the X-33 program, evaluation of these issues would be updated.

40-5. Comment noted on ensuring X-33 operations remain within restricted airspace in the launch phase.

40-6. Comment noted. Surveillance of the area would be performed from the air, as well as, from the ground to ensure that the area is secure for the X-33 landing.

40-7. Comment pertaining to Malmstrom is noted. Coordination with the FAA and other agencies will continue in order to obtain proper approvals and to make proper notifications.

40-8. Comment pertaining to Moses Lake is noted. Coordination with the FAA and other agencies will continue in order to obtain proper approvals and make proper notifications.

40-9A. Risk assessments of proposed test flights tailored to X-33 potential flight corridors were the result of the same rigorous risk and safety analysis process required of all experimental flight test vehicles to date. It is recognized that these values are not the final ones that would be used for determining acceptability for launch by the AFFTC Chief of Safety and the AFFTC Commander. The analyses would be periodically updated with actual component and systems test data as it becomes available. The Program would continue to update these determinations flight-to- flight with actual flight test data. The Program has planned an incremental test program for the X-33 in order to cautiously subject it to progressively more rigorous "real world" conditions by initially flying it at speeds and altitudes which would provide stresses and heating rates well under the vehicle's design specifications. Computer animation has assisted engineers in visualizing the vehicle's performance and flight characteristics. The animation often seen on diagnostic flight programs represents extremely sophisticated and complicated analyses being performed by powerful computing systems and software that are standards in the field of aeronautical design today.

The FAA Associate Administrator for Commercial Space Transportation was recently one of the supporting organizations that participated in preparation of "Common Risk Criteria for National Test Ranges," Standard 321-97, February 1997, issued by the Range Commanders Council. Criteria was defined to protect personnel, aircraft, ships, and spacecraft from potentially lethal debris. The policies and criteria are intended for use by Department of Defense National Ranges and Major Range and Test Facility Bases. The policies and criteria apply to debris generated by endo- and exoatmospheric missile intercepts, aeronautical system testing, ballistic missiles, anti-satellite missiles, air-to-air missiles, surface-to-air missiles, air-to-surface missiles, cruise missiles, space launch vehicles and unmanned aircraft.

Undoubtedly the national test ranges are well established organizations now, and public safety is still their number one concern. Current statistical data for accidents was compiled in the Supplement to Standard 321-97, "Common Risk Criteria for National Test Ranges - Inert Debris." The data includes a variety of accidents and actual accidental risk to people on the ground from commercial aircraft to determine the applicability and need for updating risk criteria to ensure that safety criteria is still consistent with the language in Public Law 81-60, "From a safety standpoint (test flights of missiles) will be no more dangerous than conventional airplanes flying overhead." On page 3-3 of the supplement, it is noted that "the commonality criteria contained in the document compare favorably with generic accident experience data for categories which correlate with potential range accidents. The history of risk from falling debris shows no fatalities. We are comparing potential accidents from falling debris to real accidents in other categories which have a much larger statistical base to form an upper limit or boundary at a risk level which should be unacceptably high in normal circumstances."

The guideline risk criteria noted in Section 4.3 of the Draft and Final EIS remains the same. The risk criteria for non-mission aircraft is 1×10^{-9} . The collective per flight risk for people is projected to be in the 10^{-6} to 10^{-7} range. General aviation data provided in Appendix D would continue to be updated to make a final determination of risk to general aviation and develop test flight plans protective of general aviation to be included in the X-33 Safety Plan(s). Considering that population densities are considerably higher than aircraft densities, it is fully expected that final risk analyses protective of personnel, the public, property, as well as aircraft would be well within acceptable, protective limits.

40-9B. We fully appreciate your position and views. NASA is committed to only conduct the X-33 Program with risks no greater than those that have been established and proven effective to protect personnel, the public, property, and general aviation. Please refer to response ***40-9A*** for further details. FAA has been represented at X-33 Flight Safety meetings, and we would continue to seek your advice and input as well as approval for essential permits for temporarily restricting airspace in the vicinity of the airfields should the Program continue to go forward and a landing area and/or airfield(s) be selected in the Record of Decision requiring such permit.

40-10A. The Program does not expect, due to current risk analyses, that any airspace would require restriction except in the vicinity of landing.

40-10B. All flights would be coordinated through the Airport Executive Manager, who has indicated that there would be moderate impacts to the flight training activities.

40-11. Comment noted. Risk projections for final descent and landing were developed and are included in the EIS.

40-12. Comment noted. The X33 would achieve altitudes above FAA's positive control airspace while still within military restricted airspace of Edwards Air Force Base. Reentry would potentially affect only a few miles of the National Air Space for landings at Silurian Lake, Malmstrom, and/or Moses Lake.

40-13. Table ES-9 and Table 2-8 modified to address comment.

40-14. Comment noted. Efforts would be made to minimize impacts to commercial airspace.

40-15. NASA agrees that flight safety for all aircraft operating below the flight path should be considered and has been considered through evaluation of the potential X-33 flight corridors. One of the Program's criteria for evaluating potential flight corridors to determine those considered reasonable alternatives and carried forward for further evaluation in the Draft and Final EIS was minimizing effect on National Air Space. Data for air traffic patterns and densities of potential flight corridors was provided in Appendix D. This data and aircraft risk analyses with determination of any further prudent and necessary mitigation measures would continue in development of final Flight Safety Plans. Clarification has been added to the text in Section 4.3 of the Final EIS.

40-16. Text modified in Section 3.1.6 to address the comment.

40-17. Table 3-2 modified to address the comment.

40-18. As noted in the Introduction of Appendix D, data was collected "to the extent readily available." Also noted in this introduction, general aviation which does not use Air Route Traffic Control Center services are not included in the counts. Data for certain sectors was not readily available. The relative activity levels that were readily available through the FAA are sufficient to permit reasonable determinations of general and commercial flight operations which might be potentially impacted by the proposed X-33 flights.

40-19. Please review Section 1.1 of the Final EIS. A comparative cost benefit analysis was included in Access to Space, issued in 1993 by NASA. Effects on air traffic have been considered in appropriate sections of Chapter 4 of the Final EIS. The X-33 project is considered an essential part of NASA's technology development and demonstration program. The X-33 Program is a cooperative program between NASA and Lockheed Martin Corporation.

40-20. Comment noted. NASA is firmly committed to safety in implementing the X-33 program.

40-21. Section 2.2.5 of the Draft and Final EIS adequately addressed NASA's evaluation and findings which precluded over water flights as reasonable objectives.

40-22. Comment noted. The X-33 Program is concerned with all relevant flight safety issues.

40-23. Comment noted. Appendix G provides flight safety analyses details.

40-24. The emergency response plans referred to in Section 4.3 of the Draft EIS would be prepared as noted. However, additional clarification of involvement by local, county, and state agencies has been provided in the Final EIS. The Program would prepare a draft emergency response plan to be used as a template to facilitate discussions and consultation. Input and advice would be solicited through the state and county-level emergency response organizations. The final emergency response plan(s) would be distributed to all county and state emergency organizations along the flight tracks prior to flight. Special response needs, precautions, training, and/or equipment would be the responsibility of Lockheed Martin. Local emergency response authorities would be required to stabilize the impact site, as part of their charter to assist in emergencies, using method(s) described in the emergency response plan. Lockheed Martin would be prepared to rapidly mobilize, encapsulate the debris, and remove it from the site.

40-25. Details of the safety analyses were summarized in Appendix G. The input parameters, software, and modeling run data are voluminous and beyond reasonable reduction to provide in an EIS.

40-26. Edwards is in a geologically active area. Text has been modified in Section 3.1.11 of the Final EIS to provide seismic information.

In accordance with Edwards Air Force Base and California construction standards developed for potentially active earthquake zones, X-33 launch facilities would be built to California Zone 4 earthquake standards to minimize damage from a significant seismic event in the region. In addition, containment facilities around propellant, fuel, and any other hazardous material storage area would be designed and built to contain potential spills from tank ruptures due to seismic or any other natural or physical event. The launch facilities are located with respect to each other as well as other facilities on Edwards to prevent damage from propagating from one area to another in the event that a fire and/or explosion were to occur. Text in Section 4.1.10 has been modified in Section 4.1.10 of the Final EIS.

40-27. Comment noted. Key air quality and regulatory terms with definitions are included in the glossary.

40-28. Comment noted. References to Appendix C-Air Conformity are included in Chapter 4-Environmental Consequences. Clarifications are provided in Appendix C, such as better table labels.

40-29. Comment noted. Additional north designations provided.

40-30. Comment noted. Redundancy in text was deliberate to minimize reviewer cross referencing.

40-31. Please refer to Success of the Risk Management Procedures and Guidelines as noted in the reference cited as Range Commanders Council 1997A and B of Section 6 in the Final EIS. There have been no other CONUS overflights using unpiloted X-vehicles. A preliminary Draft EIS was prepared for X-30 by the Air Force, with NASA as a cooperating agency (USAF 1992C).

40-32. Comment noted. NASA has reviewed the information provided in Sections 4.5 and 4.6 of the Draft EIS and considers it adequate for this proposed action.

40-33. Text modified in Section 1.7 to address comment.

40-34. Text modified in Section 2.1.4 to address comment.

40-35. See Section 2.1.5 to address comment, in part. While EO 11986 itself does not mention "critical action" facilities, federal guidance to agencies on implementing EO 11988 defines "critical action" facilities and requires use of the 500-year floodplain standard for such facilities.

40-36. Comment noted. Discussion of facilities available for J-2S engine testing is provided in Section 2.2.3.

40-37. Paragraph deleted in Section 2.2.2.3 to address comment.

40-38. Table 2-8 modified to address the comment.

40-39. Both methods of JP-8 fuel transportation are used.

40-40. Hazardous Waste Disposal is anticipated for such materials as spent solvents, cleaning fluids and other chemicals used in servicing the vehicle.

40-41. Comment noted on grammatical designations of plural acronyms.

40-42. Text modified in Section 3.1.5 to address the comment.

40-43. Text modified in Section 3.1.6 to address the comment.

40-44. Text modified in Section 3.1.7 to address the comment.

40-45. Text modified in Table 3-8 to address the comment.

40-46. Text modified in Section 3.2.1.7 to address the comment.

40-47. Comment noted. NASA prefers to leave this information in the document.

40-48. Text modified in Section 3.2.2.3 to address the comment.

40-49. Text modified in Section 3.2.2.9 to address the comment.

40-50. Comment noted. A determination of the final tank configuration has not been made. Containment would be appropriately provided to meet pertinent regulatory requirements.

40-51. Text modified in Section 3.2.3.2 to address the comment.

40-52. Text modified in Section 3.2.4.2 to address the comment.

40-53. Text modified in Section 3.2.4.7 by deleting paragraph.

40-54. Text modified in Section 3.2.4.13 to address the comment.

40-55. Text modified in Section 3.2.5.1 to address the comment.

40-56. Text modified in Section 4.1.1 to address the comment.

40-57. Text modified in Section 4.1.1 to address the comment.

40-58. Text modified in Section 4.1.2 to address the comment.

40-59. Text modified in Section 4.1.3 to address the comment.

40-60. The degree of seriousness in relation to these terms is indicated by the *de minimis* levels included in Table 4-2.

40-61. Text modified in Table 4-3 to address the comment.

40-62. Text modified in Section 4.1.7 to address the comment.

40-63. Additional information regarding hazardous materials and transportation has been provided in Sections 4.1.2 and 4.1.11.

40-64. Comment noted. Text remains unchanged.

40-65. Text modified in Section 4.1.12 to address the comment.

40-66. Text modified in Section 4.1.12–Sonic Boom From X-33 to address the comment.

40-67. Text modified in Section 4.2.1 to address the comment.

40-68. Text modified in Section 4.2.1.1 to address the comment.

40-69. Please refer to response **40-63**.

40-70. Text modified in Section 4.2.1.5 to address the comment.

40-71. Text modified in Section 4.2.1.12 to address the comment.

40-72. Text modified in Sections 4.2.2.1, 4.2.3.1, 4.2.4.1, and 4.2.5.1 to address the comment.

40-73. Text modified in Section 4.2.4.1 to address the comment.

40-74. Text modified in Section 4.2.4.5 to address the comment.

40-75. Text modified in Section 4.2.4.8 to address the comment.

40-76. Text modified in Section 4.2.5.12 to address the comment.

40-77. Text modified in Table 4-16 to address the comment.

40-78. Comment noted. NASA prefers to leave the discussion of risk as written.

40-79. Text modified in Section 4.3 to address the comment.

40-80. Text modified in Section 4.3 to address the comment.

40-81. Text modified in Appendix D to address the comment.

40-82. Text modified in Appendix E to address the comment.

40-83. Text modified in Appendix G to address the comment.

Thank you for your comments.

Letter No. *41*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 19 1997

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Dr. Rebecca C. McCaleb, Director
Environmental Engineering and
Management Office (AE01)
NASA
Marshall Space Flight Center, AL 35812

Dear Dr. McCaleb:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act, the Environmental Protection Agency (EPA) has reviewed the National Aeronautics and Space Administration's (NASA) Draft Environmental Impact Statement (EIS) for the X-33 Advanced Technology Demonstrator Vehicle Program. Our concerns and request for additional information focus on noise, water and air quality impacts/issues.

This draft EIS discusses the environmental impacts associated with the final design, construction and testing of the X-33, which is intended to demonstrate the feasibility and practicality of Single-Stage-To Orbit (SSTO) launch vehicles. The action will involve static/flight readiness firings and 15 launches. The launch site is proposed for Edwards Air Force Base, California, with landing sites which would accommodate incremental advances to Mach 4,9 and 15.

Noise Issues

41-1 Due to the infrequent noise events from static/flight readiness firing and the proposed 15 launches, we believe that the noise analysis should emphasize single event noise levels using either Maximum Sound Level (Lmax) or the Sound Exposure Level (SEL) metrics. Day-Night Noise Level contours (L_{dn}) are not useful in these situations. We also recommend that the noise analysis be separated into static/flight readiness firing noise and launch noise.

41-2 Specific noise contours for the static/flight readiness firings should be provided. The total number (estimate) of these events should be provided. The document indicated that 3 flight readiness firings are planned, but there was no indication of the number of static firings. In addition, the length of each event should be provided, since it appears likely that the events will be for different durations. For example, on page 4-20 it discusses a test firing of 20 seconds, but page 2-12 states that a static test will last 1.5 times engine firing duration. Since page 2-12 gives the various estimated time to main engine cutoff, at least one event will last 423 seconds (282 seconds x 1.5).

41-3 With regard to the launch noise discussion, we recommend that the description of the launch be more detailed and include information on how long and to what altitude the X-33 remains in a vertical position before it moves to a more horizontal position. Individual L_{max} contours should be provided for the short-range, mid-range and long-range launches. A table/discussion of duration times should also be provided. Depending upon a person's location, it would be expected that at ignition the noise level would increase to a specific L_{max} and then slowly decrease as the X-33 gains altitude and moves on. A discussion of this characteristic should be provided, so that the reader has some understanding of the duration and levels of each launch.

41-4 Regarding the X-33 overflights of mountainous areas, we recommend that NASA provide a general public notification of future operations. This would provide notice to backcountry users of the potential for increased avalanche danger during operations, so that uncontrolled avalanche danger areas could be avoided.

Water Issues

41-5 It appears that stormwater permit authorization is needed for the proposed project under Section 402 of the Clean Water Act. A discussion of this issue and a storm water prevention plan, if required, should be included in the final EIS.

41-6 If the Silurian Lake alternative landing site is selected, an expanded discussion of Clean Water Act Section 404 regulated resources will need to be provided, including mitigation for any unavoidable loss to Section 404 resources.

Air Issues

41-7 The X-33 will use two aerospike engines. These engines burn liquid hydrogen and liquid oxygen, releasing only water vapor into the atmosphere. While this is considered a clean engine from an emissions point, water vapor does impact the global climate, due to its warming affect. We recommend that the final EIS discuss this issue and provide supportive modeling data, as appropriate.

41-8 We also recommend that NASA provide some analysis of water vapor impacts associated with the operation of the future full size version of this vehicle. While the development of the full scale version will not be a NASA action, this NASA action clearly is related to any future commercial production of the vehicle.

41-9 In conclusion, based on our review and in accordance with EPA policy, we have rated this draft EIS as EC-2, indicating that we have environmental concerns (EC) about the project's potential impacts and additional information is requested (2). The staff contact for this review is Ken Mittelholtz; he can be reached at 202-564-7156.

Sincerely,

Richard E. Sanderson
Director
Office of Federal Activities

3

Response to Letter No. *41* - US Environmental Protection Agency

41-1. All the A-weighted sound level contour maps are maximum levels or L_{max}. Captions on Figures 4-4 and 4-7 were modified to indicate that the contours are maximum noise levels.

Two different models were used to predict engine noise contours. Noise generated by the engines before the vehicle reaches an altitude of 305 m (1000 ft) above the test stand is discussed in section 4.1.12, Launch Noise. Engine noise generated above 305 m (1000 ft) above the test stand is discussed in section 4.1.12, Moving Rocket Noise. Maximum A-weighted sound level contours are provided for the launch and ascent portions of the flight for all launch and landing site combinations, Figures 4-5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25,and 27.

41-2. A description of static engine testing sites is provided in section 2.2.3 Alternative Engine Test Facilities. Static engine tests will be performed at Stennis Space Center, Mississippi. Engine noise impacts are addressed in the Final EIS: "Final Environmental Impact Statement of Engine Technology Support for NASA's Advanced Space Transportation Program", August, 1997.

Up to three Flight Readiness Firings will be made at the launch site with a maximum duration of 20 seconds. Flight Readiness Firing test far-field noise would be almost identical to the launch far-field noise, Figures 4-5 and 4-7.

41-3. Text modified in section 4.1.12 and added to Appendix G to address comment.

41-4. Comment noted. NASA and Lockheed Martin would work with state and local authorities to develop a notification process concerning this issue, as appropriate.

41-5. A stormwater permit under the National Pollution Discharge Elimination System (NPDES) would be required for construction and operation of the launch site. These permits would be submitted and maintained by Edwards' Environmental Management Office. The Pollution Prevention Plan, which includes a storm water plan, for the site would be part of the permit applications.

41-6. In relation to the Clean Water Act, Section 404, the lake bed is considered a 404 resource, but there are no biological resources present. The proposed activities are not expected to produce any long-term impacts to biological resources on the lake bed. Mitigation for this project would consist of removal of all equipment and structures from the lake bed and regarding of the lake bed to its natural contours. Additional mitigation may be required by the US Corps of Engineers in the Section 404 permit.

41-7. Global warming, also known as the "greenhouse effect," is the warming of the Earth's surface and troposphere, as described in Section 3.3.1 of the Draft and Final EIS. The greenhouse effect tends to intensify with an increase in atmospheric carbon dioxide, water vapor and other gases such as nitrous oxide, methane, and chlorofluorcarbons (commonly known by such terms as Freon and CFCs). The approximate maximum amount of water vapor that would be released in the troposphere per flight of the X-33 would be 49,000 l (13,000 gal). This amount of water is approximately equal to 0.4 percent of the water vapor entering the lower atmosphere from one hectare (2.5 ac) surface of water body that has evaporatively lost 1 cm (0.4 in) of water. A planned successor vehicle based on X-33 technology, if constructed and operated, would release approximately 8 times more water vapor per flight than the X-33. Evaporative losses in tropical and subtropical zones such as along the southern coastal areas of the United States would be approximately 150 cm (60 in) per year. Therefore, water vapor contribution to the troposphere that would contribute to global warming is extremely minute in comparison to natural sources. This information has been added to Section 4.5.1 of the Final EIS. Mathematical atmospheric modeling is not deemed appropriate given the relatively minute amount of water vapor produced.

41-8. Water vapor impacts of the potential full-scale vehicle based on X-33 technology are compared to conventional space launch systems in Section 4.5 of the Draft and Final EIS. Until the test program is complete, any other estimate at this time would be speculative.

41-9. NASA acknowledges the EPA rating of EC-2 for the Draft EIS.

Thank you for the comments.

Letter No. *42*

Chuck Larsen,8/19/97 3:30 PM,X-33 Draft Eis FAA Comments Through 8-19-97

Conversion: Allowed
Priority: normal
Disclose-Recipients: Prohibited
Alternate-Recipient: Allowed
Date: 19 Aug 1997 16:30:46 -0400
From: Chuck Larsen <Chuck.Larsen@faa.dot.gov>
To: rebecca.mccaleb@msfc.nasa.gov (Return requested),
donna.holland@msfc.nasa.gov (Return requested)
Cc: Herbert Bachner <Herbert.Bachner@faa.dot.gov> (Return requested),
Stewart Jackson <Stewart.Jackson@faa.dot.gov> (Return requested),
Nick Himaras <Nick.Himaras@faa.dot.gov> (Return requested)
Subject: X-33 Draft Eis FAA Comments Through 8-19-97

Becky and Donna,

Attached are the FAA comments that I have been able to make. I will get the remainder of my comments to you in the morning, but these are the bulk of them.

Thanks,
Chuck Larsen
FAA/AST-100
202-366-2935

x33deis.doc

To: Dr. Becky McCaleb - NASA/MSFC 8-19-97

From: Chuck Larsen - FAA/AST-100

Here are the remainder of my comments to the Draft EIS for the X-33;

42-1 1. page ES-24, paragraph ES.4, the statement that "all projected environmental impacts would be moderate or less", may not be accurate. The impact to air space and air traffic could be Major.

42-2 2. page ES-24, paragraph ES 4, in the sentence that talks about Silurian Lake, insert the word "ground" between "to" and "transportation".

42-3 3. pages ES-31 to -32, paragraph ES4.3, refers to NOTAMs and restricted air space for up to 4 hours per landing as approved by the FAA in a Special Use Permit for Silurian Lake, NOTAMs for Michael Army Airfield in Dugway, Utah, a Special Use Permit for Malmstrom AFB as well as NOTAMs for up to 4 hours, and NOTAMS and a Special Use Permit for up to 4 hours at Moses Lake's Grant County Airport. It characterizes these disruptions as minor to moderate in the last case (Moses Lake). How were these conclusions drawn (i.e. what is the rational?)? Was the FAA consulted for their opinion? If so, was the FAA opinion documented? If so, please refer to this. If the FAA was not consulted, these impacts could possibly be major (see comment #1).

42-4 4. page ES-36, paragraph ES.4.9 the last paragraph says "Risk projections specific to the final descent and landing of the X-33 are not available." These could result in Major environmental impacts. When are they scheduled to be complete? How do you plan to get this information out to the public? Do a supplemental EIS?

42-5 5. pages ES-39 and -41, Tables ES-8. and ES-9., under the issues Airspace and Air Traffic, the impacts minimal, minor and moderate may not be accurate. (see comment #3).

42-6 6. page 2-12, paragraph 2.1.6 , the fist paragraph, next to last sentence reads "Flight path alterations, abort, etc. would be made by command signals from the Operations Control Center." Please explain how this would be coordinated with the FAA.

42-7 7. page 2-17, paragraph 2.1.8, How will the public be protected from each of the X-33 flight failures listed here?

42-8 8. page 2-37 and 2-39, Tables 2-8 and 2-9, same comment as #5.

42-9 9. page 3-86, paragraph 3.2.3.6, insert the word "nominal" between "The" and "X-33" in the second sentence of the paragraph, "The X-33 flight path would remain above 18,000 m (60,000 ft) when over FAA-controlled airspace." What about the case of a contingency or abort, where the X-33 would fly into the National Air Space (NAS) below 60,000 ft? How is this being accommodated?

42-10 10. pages 3-101 and 3-121, paragraphs 3.2.4.6 and 3.2.5.6, same comment as #9. Also, for the nominal case for Moses Lake, it appears that the impact upon airspace and air traffic may be Major.

42-11 11. page 4-9, paragraph 4.1.5, insert the word "Nominal" between "All" and "ascents" in the first sentence of the paragraph. Although the second paragraph talks about a detailed analysis of civil and commercial aviation potentially affected by X-33 flight testing in Appendix D, the analysis did not draw any conclusions as to the impacts on airspace and air traffic for Michael Army Airfield, Malmstrom, or Moses Lake trajectories(pages D-31 and D-32). Also, the conclusion that "There are no commercial or general aviation operations impacted" for both Silurian Lake and China Lake landing sites (page D-31) is contradicted by the entries for these landing sites for "Airspace and Air Traffic" issues in Tables ES-8. and Table 2-8. on pages ES-39 and 2-37, respectively.

42-12 12. page 4-60, paragraph 4.2.1.5, What is the rational used to reach the conclusion in the very last sentence of "Impact to airspace is expected to be minimal."?

42-13 13. page 4-88, paragraph 4.2.3.5, the conclusion of the last paragraph that "…minimal impact to airspace and air traffic is expected." appears to assume a nominal flight. What about the case for a contingency or an abort, where the X-33 would fly into the NAS?

42-14 14. page 4-101, paragraph 4.2.4.5, referring to the second paragraph which states in part "…Due to the need for temporary restricted airspace and the fact that Malmstrom base airport would no longer be used as an active facility for military aircraft, impact is considered minor.", it is questionable whether the rationale supports the conclusion. Why isn't the impact Major, if somewhere between 346- 4328 flights may be impacted by delays which may be implied from the first paragraph's data? Also, the last sentence says "Some flight paths and approaches from the west might have to be diverted for a short period." is an impact but no attempt to quantify it is made (e.g. minor, moderate or major?).

42-15 15. page 4-114, paragraph 4.2.5.5, in the last sentence, please amplify on the rationale that led to the conclusion that " Due to the need for temporary restricted airspace and the temporary disruption of both commercial landings and pilot training activities, impact is considered moderate."

42-16 16. page 4-125, paragraph 4.3, in the first paragraph at the top of the page, the statement is made "…Using the historical failure rate would be considered to produce conservative risk projections." The following comment is made regarding this statement: This section dealing with flight safety assessment made assumptions regarding the failure probability (rate) of this vehicle. The assumptions were based on failure rates of established ELV vehicles. Historically, new vehicle development has

42-16 initially resulted in higher failure rates than those of "mature" vehicles like Delta or Atlas. Given that X-33 is comprised of many new hardware and software systems and systems that have never been integrated together before, what analyses, tests or other supporting material is there to ensure that the failure rates used in the flight safety are conservative?

42-17 17. page 4-127, paragraph 4.3, the last paragraph on this page talks about "Mitigation to aircraft in the event of vehicle failure would be through the use of NOTAMs supplying information on vacating the flight track in the vicinity of potential debris." Has this proposed procedure been coordinated with the FAA? How long does this procedure take? How long will it take for debris to enter an area where air traffic may be affected? Are these times compatible, such that the mitigation of the risk to air traffic due to X-33 debris resulting from a vehicle break up would be effective using this procedure? Are there other risk mitigation techniques that should be considered for this risk?

42-18 18. page 4-128, paragraph 4.3, the flight safety discussions on this page dealing with debris needs to be put into a study of the entire problem with FAA air traffic and FAA operations people involved. Perhaps this could be handled by the X-33 Operations Working Group that Lockheed Martin and NASA has established to work on air traffic issues with the FAA.

42-19 19. page 4-128, paragraph 4.3, In the next to last paragraph, the last sentence states that "...small aircraft in the event of X-33 failure at altitudes of approximately 18,300 m (60,000 ft) might be at some risk but risk would not exceed the levels previously discussed." What are the levels previously discussed? Are they adequate to ensure safety of the public? What is the rationale behind this statement?

42-20 20. page 4-128, paragraph 4.3, referring to the last sentence, I am not aware that the Range Commanders' Council approval (of what?) is required by the X-33 Program prior to launch. Also, I question the conclusion that the risk to the public would be minimal. Please discuss more specifically the "substantial efforts with defined risk mitigation goals that must be satisfied before launch".

42-21 21. page 4-147, paragraph 4.9, same comment as comment #4, above.

42-22 22. Page 5-5, paragraph 5.2 dealing with Flight Safety says in part "Flight planning combined with the high reliability requirements of the vehicle are considered as mitigating factors to potential public safety concerns." Specifically, what are the details of flight planning and the vehicle reliability requirements that leads to this conclusion? Do they provide adequate mitigation to ensure public safety? Specifically, what are the potential public safety concerns for which mitigation is required?

42-23 23. page 5-11, Table 5-2, under the Michael Army Airfield Alternate, the Requirement column assumes a nominal flight, but if there are contingencies or an abort happens where the X-33 could get into the NAS, there may be an additional requirement to have a Special Use Airspace designated by the FAA for the Flight Test Operation (same as Moses Lake or Malmstrom in this table).

42-24 24. page D-1, in Appendix D, there are assumptions made for which there is little or no rationale presented. The last sentence in the third paragraph of the Introduction states "…we believe that the relative activity levels presented will allow reasonable decisions to be made concerning the impacts to commercial and general aviation activity along the X-33 flight tracks." To what are these activity levels compared? Relative to what? What criteria are you using to evaluate the impacts? What constitutes a minor or moderate or major environmental impact?

42-25 25. page D-2, in Appendix D, the second bullet down says that activity counts were retrieved for one week in March 1997. How is this representative of activity levels for commercial and general aviation during an X-33 Flight Test program that will cover 9 to 10 months and start in June of the year 2000? Was this a worst case week for the year? Are the activity levels lower during the summer? How about growth in flight activity over the next 3 years? Was it factored in?

42-26 26. page D-35, to what is the last sentence which reads " 'Trajectories being furthered analyzed and value is expected to be approximately 16-21 km (10-13 mi.)." referring?

42-27 27. page D-43, the first paragraph talks about "adequate margin of safety". What is this value? For factor (5) does expanding the zone to 150% provide adequate safety margin?

42-28 28. Here are some concerns of the other people in Aircraft Operations that were expressed; 1)how will Air Traffic be able to track and communicate with the X-33?, 2)the process to get a Temporary restricted area can take a minimum of 8 months and establishing Special Use Airspace (SUA) is a time intensive process requiring public comment and is planned to take a minimum of 18 months. Because of all the agencies involved in this (NASA, FAA, USAF, US Army, Contractors and others), it is recommended to start this process as soon as possible.

Response to Letter No. *42* - Chuck Larsen

FAA/AST-100

42-1. Comment noted. The impact analyses to date indicate that airspace and air traffic impacts would be no more than moderate.

42-2. Text modified on page ES-24 to address comment.

42-3. Rationale for the impact projections were derived by NASA in consultation with the Moses Lake Airport Executive Manager, Military Air Base officials from Malmstrom AFB, Hill AFB, Dugway Proving Ground and China Lake NAWS. It was determined that the flight schedules of the affected areas were very small in comparison to many other airports, with the overall number of flights into the proposed landing sites being very low. In addition, officials indicated that training could be delayed with little impact to operations or missions. The FAA participated in the development of the Draft EIS.

Mr. Gary Varga, W.K. Dickson Company, was contracted by NASA to assist with addressing FAA issues in preparation of the X-33 Draft EIS. Mr. Varga contacted Mr. Jeff Griffith, FAA/ATO-1 and Mr. Johnny Walker, FAA/ATA-1, who advised that there would be a requirement for issuance of a Notice to Airmen (NOTAM) for X-33 flights outside of restricted airspace. Request for the NOTAM would provide the FAA and military all information related to the test flights, such as dates and times, duration, altitudes along entire flight path, exact route, landing points, speeds; and latitude and longitude of start, apex, and stop points. The NOTAM issued for the X-33 would affect several Air Route Traffic Control Centers. Other contacts who would also be notified would include the Airplane Owners and Pilots Association and the Air Traffic Association (ATA). The ATA would have input into the assessment of potential effects on commercial and general aviation as the NOTAM process proceeds. Section 4.2.4.5, and 4.2.5.5 have been modified to include the information above.

42-4. Risk projections specific to final descent and landing of the X-33 have been updated in Appendix G of the Final EIS. The last paragraphs of Sections ES.4.9 and 4.9 have been deleted in the Final EIS which indicated that this information was unavailable in the Final EIS.

42-5. See response ***42-3***.

42-6. NASA acknowledges the need to coordinate any flight path alterations, aborts, etc. with the FAA. Text has been modified in Section 4.3 of the Final EIS to clarify X-33 Program Coordination with the FAA.

42-7. Please refer to Section 4.3, Appendix D and Appendix G for details concerning this comment. The rigorous flight safety review process developed by the National Test Ranges which include Edwards Air Force Base, Utah Test and Training Range (Dugway Proving Ground and Hill Air Force Base), and many other installations have developed and successfully used these procedures for approximately 50 years, as noted in the reference cited as Range Commanders Council 1997 A and B in Section 6 of the Final EIS.

42-8. The significance definitions used by NASA are defined in Table 4-1. These definitions are subjective definitions which NASA has tried to use consistently throughout this EIS. The use of these definitions were intended to provide EIS reviewers with a qualitative estimate of impact. Based on the data, consultation with local airport authorities, and documented reception of the residents in the potentially impacted areas, the impact projections referenced in your comment appear to be accurate and remain unchanged in the Final EIS.

42-9. Text modified in Section 3.2.3.6 as requested. Clarification of abort procedures with respect to FAA-controlled airspace provided in Section 4.3. Lockheed Martin would develop a task agreement or other acceptable formal agreement with FAA to assist and provide consultation in development of Launch and Landing Site Flight Safety Plan(s) which would include contingency and abort plans. If an abort were to occur that required the X-33 to enter National Air Space below 18,300 m (60,000 ft) in an area not already covered by a temporary restricted airspace permit for X-33 flight, the X-33 Operations Control Center under direction of the AFFTC Range Safety Officer would request emergency/priority airspace for a "soft" landing (landing as intended) at a pre-arranged/approved landing area or a controlled crash in a safe and unpopulated area. All decisions would be made only with approval and direction of the AFFTC Range Safety Officer in consultation with FAA Air Route Traffic Control Center Authorities.

See response ***40-2*** for details of how FAA involvement would be assured.

42-10. No text edits are necessary on pages 3-101 and 3-121. The word "nominal" is already in place. Comment also addressed in responses ***42-8*** and ***42-9***.

42-11. Text modified on page 4-9 to address the first part of this comment. "Nominal" was inserted in noted sentence in Section 4.1.5. In second paragraph of same section, "A detailed analysis..." has been changed to "An analysis..." Conclusions that no commercial or general aviation operations are expected to be impacted for trajectories to China Lake or Silurian Lake have been deleted from Sections 4.2.1.5 and 4.2.2.5 and

Appendix D. Airspace and Air Traffic entries in Tables ES-8 and 2-8 have been modified.

42-12. See response ***42-3***.

42-13. Please refer to response ***42-9***. In addition, the X-33 risk assessments used in the Launch and Landing Flight Safety Plan(s) must also consider risk to general aviation and meet non mission aircraft risk criteria established by the Range Commanders Council, "Common Risk Criteria for National Test Ranges," Standard 321-97, February, 1997. The FAA-Office of Associate Administrator for Commercial Space Transportation was a supporting organization for development of these criteria. Additional text has been added to Section 4.3 of the Final EIS to clarify several other related comments.

42-14. The total number of flights referenced in your comment were over a 24 hour period with the least number of flights occurring between 1 a.m. and 6 a.m. X-33 launch times would be scheduled at or very close to dawn when air traffic is lowest. The temporary restriction of airspace would occur beginning one hour prior to the scheduled launch time. Therefore, it is anticipated that X-33 test flights would most probably occur at a time when air traffic is light. Also, approximately 5 flights would be planned into Malmstrom if selected. This airfield has been closed, and its reopening, if approved through proper DOD authorities and/or Congressional action, would only be for NASA's temporary operations to support X-33 landings at the facility. No other use of this runway is known or anticipated.

Approximately 6 takeoffs and landings, each, would be expected daily from commercial airlines at the Great Falls International Airport from 5 a.m. till 11 a.m. General aviation use would also be anticipated during this same time period. The majority of flight services at the Great Falls International Airport are accommodated at 9:00 a.m. and later each day.

The impact significance for landings at Malmstrom Air Force Base has been changed to moderate which is anticipated to be the maximum potential that would be expected for all air traffic concerns in the vicinity of X-33 landing activities. The text in Section 4.2.4.5 has been modified to include the first two paragraphs of this response along with a new paragraph to recognize the potential for small private planes using grass fields for takeoffs and landings in the vicinity of Malmstrom. The need for notifications to aircraft owners is also recognized. Similar language has been added to the Moses Lake Airspace and Air Traffic Section 4.2.5.5.

42-15. See response ***42-3***.

42-16. The rigorous flight safety planning, review, and approval processes prior to any flight of the X-33 are detailed in Section 4.3 with supporting details in Appendices D and G. Each respective airspace and air traffic section for proposed launch and landing sites also provides additional considerations that have been part of the safety and environmental considerations.

The National Environmental Policy Act requires that environmental evaluations, which include all factors necessary to be considered to protect the public, be conducted early in a program's decision process. The X-33 Program has done so using the best data and estimations available at this early part of the Program. The Program is committed to continue to refine and update the risk assessments with actual component and systems test data as it is generated throughout development and fabrication of the X-33 up through flight readiness firings of the assembled vehicle on the launch pad. If the data results in acceptable risk assessments and the AFFTC Chief of Safety and the AFFTC Commander approve launch, actual flight data would then be acquired and used to update flight test plans, risk assessments, and launch approvals. Launch approval for a particular flight plan may be denied at any time if actual flight data produces updated results which indicate that the vehicle would possibly operate unacceptably outside of design and flight specifications.

42-17. The use of NOTAMs to supply information on vacating the X-33 flight track in the vicinity of potential debris has been discussed with the FAA per Susan Moore, AFFTC, Safety Office (personal communication to Dr. Rebecca McCaleb, NASA/MSFC, Sept. 2, 1997). Three methods of communication between FAA and X-33 flight operations would be used to assist with the potential of a vehicle emergency such as abort with a controlled "soft" landing; abort with a controlled flight resulting in a whole body or nose down crash; and breakup of the vehicle. These communications methods would be: (1) a real time display of the potential debris pattern and impact area for AFFTC Range Safety Officers and FAA representative; (2) an open communications net between AFFTC Chief of Safety or designated representative, Range Safety Officers at the X-33 Operations Control Center, and FAA representatives at Edwards and the potentially affected Air Route Control Centers would be established prior to launch time and remain open until deemed unnecessary by the Range Control Officers; and (3) NOTAMs would be issued wherever potential for the vehicle and/or debris to enter National Air Space occurs.

Estimated times for debris to enter National Air Space are provided in Section 4.3. The length of time for emergency procedures to be initiated depends whether the FAA chooses to limit or restrict all air traffic within the confines of the entire flight region within airspace under FAA control and length of time for debris to enter an area where air traffic may be affected. With real time data and flight decisions being made available to FAA along with an open net being maintained throughout flight to facilitate rapid communication, X-33 emergency procedures for the protection of general aviation are anticipated to be fully adequate to ensure protection of all aircraft that might be using National Air Space under the flight track of the X-33.

The use of NOTAMs and/or other risk mitigation techniques would be reviewed when final trajectory risk analyses are provided following conclusion of development, fabrication, and systems testing of the X-33. These issues would be discussed at X-33 Flight Working Group meetings in which the FAA participates along with Range Safety Officers from Edwards, Lockheed Martin flight safety experts, and NASA flight and safety representatives. Recommended results would be coordinated with the R-2508 Complex Control Board; landing site safety offices; affected FAA Air Route Traffic Control Centers; regional offices and headquarters officials; and any other appropriate authorities and officials.

Text has been modified to provide additional clarification above in Section 4.3.

42-18. Please refer to response ***42-17***. Coordination with the FAA and other appropriate authorities will continue to ensure protection of users of the National Air Space.

42-19. Text modified in Section 4.3 to address comment.

42-20. Text modified in Section 4.3 to address comment.

42-21. Please refer to response ***42-4***.

42-22. Flight safety is of highest priority to the X-33 Program. Trajectory planning considers personnel and public safety by ensuring that risk levels are the lowest possible and consistent with National Test Range risk criteria. Flight tracks must also avoid overflight of sensitive facilities such as the weapons storage area on Malmstrom and the chemical/biological warfare laboratories on Dugway. The final approved flight termination system must ensure that flight can and would be effectively terminated in a fail safe manner and would ensure that the vehicle does not present danger to the public or potentially impact a sensitive facility in the event of an abort. Details of these requirements, review processes, and approvals were provided in the Draft EIS. Significant clarification of flight safety has been provided in Section 4.3 of the Final EIS.

Mitigation of risk and impact from an emergency resulting from an X-33 test flight are:

- Periodic updates of risk assessments using component and/or systems test data as available.
- Final approved flight termination system must ensure that flight can and would be effectively terminated in a fail safe manner and would ensure that the vehicle does not present danger to personnel, public, property or a sensitive facility in the event of an abort.

- Avoidance of overflight of sensitive facilities such as the weapons storage area on Malmstrom and the chemical/biological warfare laboratories on Dugway.
- Update of risk assessments flight-to-flight with actual test flight data
- Emergency response plans prepared in advance of first flight with input from potentiallyaffected agencies and approved by the AFFTC Chief of Safety and landing site safety offices.
- Special emergency response precautions, training, and/or equipment included in emergency response plan(s) and provided by Lockheed Martin.
- Agreement with FAA to be formalized to provide for consultation in safety planning, real time communication with Air Route Traffic Control Centers during flight operations, and issuance of appropriate NOTAMs in the event of an emergency.

Section 5.2 has been replaced with the more detailed mitigation listed above.

42-23. Comment noted. Therefore, emergency plans will be coordinated with the FAA and other appropriate agencies. There are no plans to obtain Special Use Airspace due to X-33 aborts or emergencies. If the vehicle were to break up, emergency procedures as described in Section 4.3 of the Final EIS would be put into effect in real time.

42-24. See response ***42-3***.

42-25. As stated in the Introduction to Appendix D, "we believe that the relative activity levels presented will allow reasonable decisions to be made concerning the impacts to commercial and general aviation activity along the X-33 flight tracks." The data presented in this appendix was not intended to provide the comprehensive level of information stated in your comment. NASA recognizes that the level of detail indicated in your questions are necessary to support final test planning and decisions. The data was collected to recognize current aviation activities and determine potentially affected FAA control centers and regional offices. NASA believes that the relative activity levels presented would allow reasonable decisions to be made concerning the impacts to commercial and general aviation along the X-33 flight tracks. If the X-33 Program continues with launch and landing sites selected in the X-33's Record of Decision, the Program would immediately initiate an effort to prepare necessary FAA permit applications and consult with FAA to determine final mitigations deemed necessary and prudent to protect the public, property, and general aviation along the flight track(s) of the X-33.

Please also refer to response ***42-16*** for guidance on the timing of National Environmental Policy Act documents, e.g. an EIS, with respect to data availability.

42-26. Text modified in Appendix D, Section 4.7.5 to address comment.

42-27. The "adequate margin of safety" referred to the additional airspace estimated to be cleared that would facilitate monitoring this zone for unauthorized aircraft and safely initiating flight termination procedures, if necessary. No precedent was available as a guideline for this estimation. NASA recognizes that a substantial amount of data evaluation and consultation would be required in order for the FAA to process a temporary restricted airspace permit and develop acceptable permit requirements.

42-28. Tracking of the X-33 would be performed by the lead range at Edwards Air Force Base and its support ranges (e.g., Nellis Air Force Base, Hill Air Force Base, etc.) along the flight track. The Range Control Officers at Edwards would use a display showing the X-33's position as well as all air traffic both above and below 18,300 m (60,000 ft). The air traffic information for the National Air Space below 18,300 m (60,000 ft) would include data from the FAA Air Space Detection System. The FAA Air Traffic representative as noted in Section 4.3 would monitor one of the Range Control Officers' monitors and use an open communications network with appropriate FAA Air Traffic facilities along the flight track.

The Range would establish and maintain communication links to and from the X-33 for: (1) the Range to track the X-33; (2) the AFFTC Chief of Safety or his/her designated representative (one of the Range Safety Officers on duty) to command the X-33 via the flight termination system in the event of an emergency; and (3) the Program's Operations Control Center to provide primary command and control of the X-33. Although FAA Air Traffic would not be able to communicate directly with the X-33, FAA would have real time tracking data and a communications network for National Air Space below 18,300 m (60,000 ft) in the event of an emergency.

NASA recognizes the long lead time required to obtain Temporary Restricted Airspace permits and establish Special Use Airspace and would proceed immediately to prepare these applications, as necessary, following issuance of the Record of Decision for the X-33 Program. Consultation with FAA officials concerning these issues has begun.

Thank you for your comments.

Letter No. *43*

BOB MILLER
Governor

STATE OF NEVADA

JOHN P. COMEAUX
Director

DEPARTMENT OF ADMINISTRATION
Capitol Complex
Carson City, Nevada 89710
Fax (702) 687-3983
(702) 687-4065

RECEIVED
AUG 20 1997

August 11, 1997

Dr. Rebecca C. McCaleb
NASA/Code AE01
Marshall Space Flight Space Center, AL 35812

Re: SAI NV # E1998-003 Project: DEIS – X-33 Advanced Technology Demonstrator Vehicle Program

Dear Dr. McCaleb:

Thank you for the opportunity to review the above referenced project.

43-1 The State Clearinghouse, as per Executive Order 12372, has processed the proposal and has no comment. Your proposal is not in conflict with state plans, goals or objectives. If you have any questions, please contact me at (702) 687-6367.

Sincerely,

Julie Butler

Julie Butler, Coordinator
Nevada State Clearinghouse/SPOC

Response to Letter No. *43* - **State of Nevada**
Department of Administration

43-1. No comment from Nevada State Clearinghouse is acknowledged.

Thank you for the comments.

Letter No. 44

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

Office of the Assistant Secretary

U.S. AIR FORCE
1947 - 1997

22 AUG 1997

SAF/MIQ
1660 Air Force Pentagon
Washington, DC 20330-1660

Dr. Rebecca C. McCaleb
National Aeronautics and
Space Administration (NASA)
Director, Environmental Engineering
and Management Office
Marshall Space Flight Center, AL 35812

Dear Dr. McCaleb

We appreciate the opportunity to provide comments on the X-33 Advanced Technology Demonstrator Draft Environmental Impact Statement (DEIS). Attached are our review comments as well as those of the Army and Navy. We have also sent these via electronic mail.

The 1995 Defense Base Realignment and Closure Commission's recommendations required the Air Force to cease active runway operations at Malmstrom. The Malmstrom runway officially closed on 31 Dec 96. Presently, no long-term or recurring maintenance is being conducted on the former runway and none is planned between now and its possible use by NASA in 1999. Any future use of the runway will require Secretary of the Air Force approval as well as user funding to return the runway to a usable landing surface.

Our major points of concern include ground/weapon safety issues and the need to better define the existing environment. We strongly recommend NASA complete a revised risk assessment at the conclusion of each phase of program development. We also recommend an X-33 memorandum of agreement between your office and each of the three military services.

We would like to remain engaged in this environmental analysis and look forward to future coordination with your office.

Golden Legacy, Boundless Future... Your Nation's Air Force

If you have any questions please call Ms. Patty Vaught, AF/ILEV, (703) 695-8942. My point of contact is Ms. Jean Reynolds, (703) 693-7706.

Sincerely

Terry A. Yonkers

TERRY A. YONKERS
Acting, Deputy Assistant Secretary
of the Air Force
(Environment, Safety and
Occupational Health)

Attachment:
As stated

cc:
SAF/MII
SAF/SXP
AF/XOR
AFSC/SEW

#	Section	Comment
44-1.	General	This is the first unmanned reusable space launch vehicle to be flown over and landed at populated locations. Please ensure appropriate safety steps are developed and then followed.
44-2.	General	It is proposed that this vehicle has a predicted reliability one order of magnitude greater than comparable launch vehicles. We strongly recommend a revised risk assessment be accomplished at the conclusion of each phase of development. Please submit additional risk assessments to HQ USAF/ILEVP (Headquarters, United States Air Force, Environmental Planning Branch, Installations and Logistics)
44-3.	General	Please notify HQ USAF/ILEVP of safety review meetings and risk analysis and assessments.
44-4.	General	Please include your plan of action on how you will pursue use of Malmstrom AFB (Memorandum of Agreement). The Malmstrom AFB flightline is closed, except for helicopter traffic. The Air Force Space Command (HQ AFSPC) advises there is no control tower, no instrument landing system and no on-going maintenance of the Malmstrom flight line. They also advise that within 4-6 months there will be significant deterioration of the flightline, and that the Air Force has no plans or budget to operate an active runway at the base. Please note that NASA will be required to fund any or all personnel and infrastructure repairs/upgrades necessary to support the landing of the X-33 and 747.
44-5.	General	Please ensure the noise analysis is complete. Recommend an appendix explaining noise analysis in more detail be added.
44-6.	General	In several areas, it discusses the wide range of debris associated with catastrophic failures, but it does not specifically address the impact if close to an active installation. This needs to be addressed.
44-7.	General	Edwards Air Force Base already has an extensive existing infrastructure and support services based on current mission operations which can be utilized with little or no augmentation. As development of the X-33 continues, there will undoubtedly be changes in design and support needs. The current infrastructure will need to be monitored to determine if it remains compatible with the X-33.
44-8.	General	Edwards AFB currently routinely conducts test flights of experimental aircraft and has comprehensive occupational and flight safety programs and plans in place. These will need to be modified and updated throughout the development of the X-33.
44-9.	General	The impacts from sonic booms and the X-33 liftoff need to be monitored and possible financial claims should be expected due to possible window/glass damage.
44-10.	General	All criteria pollutants need to be addressed in EIS other than those covered in the conformity requirement. Please determine if significant impacts to the state implementation plan (SIP) occur
44-11.	General	Title 10, United States Code, Section 2692, states "the Secretary of Defense may not permit the use of an installation of the Department of Defense for the storage or disposal of any material that is a toxic or hazardous material and that is not owned by the Department of Defense". According to DoD Directive 6050.8, the Assistant Secretary of Defense may grant an exception where "essential" and where such assistance does not compete with private enterprise. The AFFTC Commander may initiate the waiver process.

44-12.	General	In the executive summary, please convey what are the preferred alternatives for the launch site, and the short/long term landing sites. Also include the number of yearly launching and landing numbers and the schedule.
44-13.	General	Recommend the document address whether the severe cold weather conditions at Malmstrom could adversely impact the selection of the installation as a landing site.
44-14.	General	Please ensure the risks and restrictions of the X-33 in regards to the Malmstrom Weapons Storage Area (WSA) are addressed and included in the EIS. Please expand the risk assessment to include the WSA area. The current WSA overflight restrictions will apply to the X-33 also.
44-15.	General	The alternative landing location of Great Falls airport is not discussed. Explain why it was eliminated
44-16.	General	References to Larson AFB should indicate its current status (closed). Suggest inserting the word "former" where applicable.
44-17.	General	Since the Malmstrom airfield has closed, their crash and rescue vehicles and assets have been reassigned. NASA should be prepared to provide all necessary crash and rescue assets required to support their landings of the X-33 and the 747..
44-18.	General	From MAFB General Plan, "The 11,500 foot runway is too short to allow fully loaded KC-135R aircraft to take off on hot days when pressure altitudes are reduced." Please include these requirements to the Boeing 747/X-33 piggyback operations, if they apply.
44-19.	General	a. Should the X-33 program be located at MAFB, NASA and the AF must continue to work closely together with the City of Great Falls as they have with the AICUZ program to ensure future land use proximate to the Base is compatible with the proposed mission.
44-20.	General	Please ensure any evacuation procedures are included in this plan. (Alike programs at Cape Canaveral AS and Vandenberg AFB during launch windows.)
44-21.	General	The document indicates that risk projections specific to final descent and landing of the X-33 are not available. When the program matures and a final risk corridor is determined, please forward this information to Headquarters US Space Command Environmental Planning (HQ AFSPC/CEV). Malmstrom will need this information to update their Future Land Use Plan. Long term considerations might include designation/ development of a safe observation area for the general public to view landings of the X-33.
44-22.	General	Please include a test flight calendar in the EIS to ensure flights aren't impacted by the current BRAC laws.
44-23.	Figure ES-7, ES-11	Recommend using a Boeing 747 for comparison since it will be used as an integral part of the X-33 mission. Information on the 747 would be used to determine support requirements and impacts.
44-24.	ES.2.1.5, ES16, para 1, line 8	Please include the X-33 flight plans in respect to the city of Great Falls, populated areas of Malmstrom and the Weapon Storage Area.

44-25.	ES.2.1.5, ES-16, para4, line 1-2	Please ensure contingency plans for abort are addressed in regards to civil air safety and ground safety.
44-26.	ES 4.3, ES 32, para 7-8	Please ensure all flight corridor size and pattern are established and coordinated with the Great Falls International Airport.
44-27.	ES 4.5, 4.2.4.13, & 5-5, ES 34, 4-109 5-6	Provide mitigation for transportation at Malmstrom AFB. Highway 89 at the south end of the runway may require closure for safety or spectator crowd control.
44-28.	ES-21 ES-36	Confirm, rather than "assume" that Silurian Dry Lake is a wetland and a Section 404 permit will be required.
44-29.	ES-22, 5th para.	Last paragraph on Page 2-25, Section 2.2.2.2 should be added to the end of Section ES.3.4 as the last paragraph.
44-30.	ES-23, 2-27/28 2-39/40 3-95	Please clarify the description of Malmstrom AFB and the flightline situation. Please show the current conditions of Malmstrom on 2.2.3, pages 2-27/28, and especially the flightline. There is no control tower, no instrument landing system, and no on-going maintenance of the Malmstrom flightline. Similarly, Table 2-9 on pages 2-39/40 indicates no modification to infrastructure at Malmstrom would be required, that existing systems can accommodate the X-33 program needs, and that the base is considered to support similar activities. Given the current operational status and condition of the flightline at Malmstrom, that information is incorrect. Likewise, the description of conditions at Malmstrom at 3.2.4.1, page 3-95 is similarly deficient. Also, all navigational aids have been removed and snow removal operations have ceased.
44-31.	ES-23, 3.5, 1st para. And Page 3-112, 2d para. & page 4-103, section 4.2.4.11.	Recommend the executive summary address if explosive safety quantity distance waivers would be required for the X-33 to utilize Malmstrom. The health and safety findings on 4-103 need to be verified.
44-32.	1.4.3, 1-9	Table B-2 of Appendix B: Amend this section to delete the reference to individual military installations, or indicate which installations did meet with NASA in Table B-2.
44-33.	2-9, 2nd para. 1st line 3-7, 2nd para., 1st line 3-8	Indicate that the OCC will be located at Building 9800. It is not shown on Figure 2-7. It is stated on page 4-2 that the OCC will be in Buildings 9800 and 9804 at the Phillips Laboratory. A sentence should be added here to clarify this issue.
44-34.	2-9, 3rd para., lines 1-2	The office and storage space locations in the vicinity of the launch site should be identified. It is not shown on Figure 2-7 on page 2-8.
44-35.	2-10, 1st para., 5th line	The paragraph states that the facilities are not "critical action" facilities under the Floodplain Management EO. Define what "critical action" facilities are and how they affect requirements under Floodplain Management legislation.
44-36.	2-10, 4th para., 2nd line	This is the first mention of methane. State how methane is to be used.
44-37.	2-12, 1st para., 1st line 2-19, 1st para., 1st line	The X-33 will be transported overland within the confines of Edwards AFB.

44-38.	2-12, 2nd para., 1st line, 3rd para., 8th line	Change "The J-2S aerospike engines must be static tested", to "will be static tested". Also, change "J-25 engines" to "J-2S engines"
44-39.	2-16, Last para.	Consider referencing the excellent national safety record for overland transportation of Liquid Hydrogen.
44-40.	2-16, Table 2-3, lines 2-4	Consider replacing GO2 with the more common usage of GOX. GH2 and GO2 (GOX) are not defined in the Abbreviations and Acronyms or explained in the text following Table 2-3. In general, the text, figure and tables referring to propellants and gases used in the program should be checked for consistency, and for definition of abbreviations and explanation of uses.
44-41.	2-17, Last para., 2nd to last line	The Air Force Flight Test Center needs to be added to the list of participating government organizations operating under task agreements. Phillips Lab should be eliminated from the list as they have no task agreements with the X-33 program. They are working as agents for the Air Force Flight Test Center.
44-42.	2-19, 1st para., 8th line	The project description should discuss widening the curve at the intersection of Lancaster Boulevard and Avenue B (connecting to Mercury Boulevard) to permit towing of the X-33 along Lancaster Boulevard to the site.
44-43.	2.2.2.3, 2-27	Airfield noted as closed. Needs elaboration of measures necessary to reopen.
44-44.	2-26, Fig 2-13	In legend change "potentially unexploded ordnance" to "potential unexploded ordnance".
44-45.	Page 2-28.	Recommend this section address the current USAF use of Moses Lake.
44-46.	2-35, 4th para., 2nd line	The analysis in chapter 4 does not clearly explain why this site is the lowest risk from launch and powered flight.
44-47.	2-36, 4th para., 3rd line	Revise to state the "project would produce a **positive** impact on the local economy".
44-48.	2-37, 12th para., 5th line	Add that State Highway 127 is the primary access to Death Valley National Park.
44-49.	3.2.4.1, 3-95	Runway- for equal comparison provide information similar to that developed for Grant County Airport. Specifically, include data on runway characteristics, and the significant lack of runway lighting and navigational aids. (Substantive)
44-50.	3.2.4.14, 3-112	Transportation- provide a map showing Great Falls highways, since "Great Falls is the transportation hub of the region." Map and description of highways was provided for Grant Lake Airport- i.e. divided 4 lane highway. Proximity of the highway to the runway may be critical for spectators, safety evacuation, emergency response planning.
44-51.	3.2.4.14, 3-112	Transportation is heaviest during early week day mornings. Recommend operations are scheduled considering traffic flow.
44-52.	3.2.4.16, 3-113	Land use- Discuss the land use near the runway, similar to Grant Lake. Child development center within 1 mile, bulk fuel, hangars, helicopter operations, WSA, etc.
44-53.	3-3, 5th para., 4th line	The proposed project description for the Haystack Butte site does not include sewer lines or explain how effluent will be disposed.

44-54.	3-51, 1st para., lines 2-6	3.2.1.9 Cultural Resources. Delete the first paragraph and add the following paragraphs: "In 1995, a geomorphological study was conducted, which included an archaeological investigation. This survey of approximately 5,140 ha (12,700 ac) resulted in the recordation of 92 archaeological sites. These sites are comprised of 79 prehistoric sites, 9 historic sites, and 4 sites containing both prehistoric and historic components. None of these sites are on or adjacent to the lakebed, which has been proposed as an alternate landing site for the X-33 during flight testing." A survey of 1,740 ha (4,300 ac) was completed in late 1995, and a survey of an additional 16,188 ha (40,000 ac) was conducted in January 1996 (BLM 1996). Add the results of this survey if known.
44-55.	3.2.4.12 and 4.2.4.11, 3-112 and 4-103	Please define "limited crash coverage available" to handle aircraft crashes? Please ensure all money and training for specialized fire protection equipment and crews to handle possible crashes are provided by NASA.
44-56.	3.2.4.1, 3-95	Section 3.2.4 needs to include Runway characteristics, runway lighting, and navigational aid analysis similar to 3.2.5 for Grant County Airport, Moses Lake, Washington.
44-57.	3-112, 4-103	These pages note the risks associated with landing at Malmstrom due to significant facilities in the vicinity of the runway. This needs to be addressed further.
44-58.		4.2.4.11 Health and Safety says that at Malmstrom, there is a weapons storage bunker 1000ft from the north end of the runway. 4.3 Flight Safety states smallest potential debris field is approx. 4ha (10ac) if the vehicle crashes nose down short of the runway. 4 ha = 2,065 by 2,065 feet. 3.2.4.1 Site Infrastructure says the runway orientation at Malmstrom is 03/21 with most aircraft using 21. Thus, if the X-33 is planning to use 21, then under the best of circumstances a crash could result in a debris spread twice the distance needed to hit the weapons storage bunker. Please clarify
44-59.	4.3 Flight Safety, 4-127	Mitigation to air traffic discussion is incomplete and inadequate. NOTAMs would not clear the hundreds of airways crossed by the longer flight trajectories.
44-60.	4.3 Flight Safety, 4-128	Discussion on aircraft performance is good but the statement "Jet aircraft should be fully capable to clear the potentially affected airspace in the event of X-33 failure" is inacurate. The flight trajectory to Malmstrom crosses virtually hundreds of airways and the major airways to both the LA basin and the San Francisco Bay area. It would be virtually impossible to clear these airways. Also, the procedure of notifying aircraft, aircrews determining if they are effected, then maneuvering to avoid would not be possible. Large civilian aircraft would take two minutes to make a 180 degree turn out of an effected area. Combined with the notification time and the fact that many small civil airplanes do not even have radios would make it virtually impossible to clear an area in the event of an anomaly.
44-61.	4-6	The Air Quality discussion at 4.1.4, pages 4-6, et seq., does not address the impact, if any, of any increase in emissions which may occur as the result of increased vehicle traffic at Edwards AFB from the proposed action.
44-62.	pg. 4-6	Air Quality. Explain how conclusion was reached. Explain direct and indirect sources, etc.
44-63.	4-6/7	Haystack Butte is located in an area designated as severe federal non-attainment for ozone and moderate federal non-attainment for particular

		matter less than 10 microns in size. Space Port 2000 is located in an area designated as a federal "serious" non-attainment for ozone. Specifics are highlighted in Tables 4-2 and 4-3 at pages 4-6 and 4-7. Studies done have indicated that maximum estimated emission levels for ozone and particular matter are less than the de minimus regulatory threshold levels. This would conform to the California State Implementation Plan (SIP) but this would need to be carefully and continuously monitored to ensure compliance with the SIP and prevent further degradation of ambient air quality.
44-64.	4—9, 2nd para.	Clarify the period of time that all aircraft would have to be diverted from a 6-7 mile area around the X-33 flight track.
44-65.	4-10, 2nd para., line 1	Add the following: "If the Spaceport 2000 site is selected as the launch site, construction within this probable floodplain may result in flooding out the launch site during an extremely heavy rainfall period. Construction of the launch facilities would require coordination with the U.S. Army Corps of Engineers to determine the need for any permits, or other Federal or State requirements (prior to the beginning of construction activities).
44-66.	4-11, paras. 2-5	This section should address potential impacts to the desert tortoise from deluge water release.
44-67.	4-13, Sect. 4.1.11, 4-51, Sect 4.1.13	The current X-33 Draft EIS document does not adequately address the potential environmental or safety impacts resulting from the large populations of spectators which can be anticipated in the launch and landing areas. Considering the huge numbers of people who have typically come to witness major aviation related events in the local area and throughout the country (Shuttle launch/landings, air shows, etc.) It is reasonable to assume that the launch of the X-33 will attract equal if not greater numbers. It should be noted that none of the risk calculations contained in this document account for this increased population. From an environmental standpoint this could be catastrophic as the proposed launch and landing areas are within or in close proximity to sensitive areas and species. The safety implications of this scenario are even more critical from a programmatic standpoint as excessive numbers of people in critical safety areas could result in launch delays/cancellations and program slips.
44-68.	4-16, para. 6, line 1	Identify the potential hazards associated with propellants during fueling, storage, transportation and purging, and with the use of other gases associated with the project.
44-69.	4-16, para. 6, line 9	The main body of the document should address the hazards to base personnel and the general populous from a catastrophic inflight breakup of the X-33.
44-70.	ES, 2.1.3 ES-15, 3, 9-12	"In addition, coordination with and approval by landing site safety organizations and installation authorities would be required for use of their respective facilities." Coordination and approval with HQ USAF and HQ AFSPC must be obtained for use of Malmstrom AFB.
44-71.	4-21, para. 1	Should address noise levels at the Space Port 2000 facility and how this may affect other facilities or operations at South Base, not just residents living on Base as per line 2, paragraph 1 of page 4-22.
44-72.	4-21, 4-34, 5-1	The comment in 4.1.12, page 4-21, that "A small on-base residential area south of the Edwards main runway could be exposed to levels up to 105 dB which has a very low probability of potentially causing some damage in the form of a cracked window". Please address the quantity - will it be one window or will <u>all</u> of the windows in the residential crack? What about fragile personal property of the residents, such as fine crystal, etc.? Also, this statement appears to be inconsistent with that on page 4-34, which states that same residential area could be exposed to noise levels up to 105 dB, "which could potentially cause some

		structural damage." (emphasis added) This statement implies that walls and/or foundations might crack. The Mitigation, Monitoring and Permitting section (5.0, page 5-1, et seq.) makes no mention of what, if anything, can or will be done to mitigate such damage.
44-73.	4.2.4.13, 4-109, para 1, line 5	Disagree that "no roadway impact is expected." Address transportation and parking impacts of spectators. Also address any possible road closures, on and off-base for the Landing Safety Plan. (Critical)
44-74.	4-125, para. 1, line 6	This section refers the reader to Appendix G for information on risk and probability. Figure G-1 Powered Flight Debris Ellipses Launch from Haystack to Landing Sites is to small to read as four figures are shown on one page. The figures should be shown at a readable scale in order to provide information on the communities and areas under the debris ellipses to the public.
44-75.	4-125	This page indicates that the trajectory risk analysis would continue to be performed. This needs to be complete, including all risk assessments, prior to making the final decisions.
44-76.	Table 5-2, 5-11	This chart somewhat incorrectly lists the Regulatory or Authorizing Agency as Air Force for Malmstom (sic) landings. That entity is currently the U.S. Congress. Also, the requirement would be for congressional approval via statutory authorization (and funding).
44-77.	Appendix D, D-2, para 4, line 1	For X-33 flight activity counts, why has "all military data been subtracted for the activity counts?"
44-78.	Glossary, H-9	Add the word "Program " as the last word in the definition of IRP.

Responses to Letter No. *44* - DOD Comments

44-1. Comment noted. Flight Safety for the X-33 is addressed in Section 4.3. NASA and Lockheed Martin are committed to ensuring that the X-33 test flight portion of the X-33 Program is conducted safely. Further clarification of safety policies, requirements, procedures, reviews, and launch approval is provided in Section 4.3. Final launch approval would be the responsibility of the AFFTC Commander.

44-2. The Program has always committed to periodically updating the X-33 risk assessments with a final risk assessment performed prior to first launch. A copy of updated and final risk assessments would be provided to HQ USAF/ILEVP as requested. Notation of this commitment has been added to Section 4.3.

44-3. HQ USAF/ILEVP will be added to safety review meeting notifications as requested.

44-4. Should the airfield at Malmstrom Air Force Base be selected as the long range landing site, formal permission, as appropriate, would be sought from the USAF for the use of the facility. The Program would fund maintenance of the runway and costs incurred by the Program for use of existing and replacement of necessary equipment removed due to closure of the airfield. The Program anticipates using mobile equipment to the maximum extent possible. These costs have been baselined into the X-33 funding profile.

44-5. Changes to various sections discussing noise impacts have been expanded to provide a more complete analysis (see Section 4.1.12 and Table 3-4).

44-6. A very large number of scenarios would have to be evaluated to address comment. Should debris impact close to an active installation (facility), impact would be dependent on the size of the debris and type of facility. See response ***44-1***, above for further details.

44-7. Comment noted. Due to the close relationship of NASA and Lockheed Martin with Edwards Air Force Base, infrastructure monitoring for continued compatibility with the X-33 can be accommodated.

44-8. Flight safety plans would be approved by AFFTC Chief of Safety. See Section 4.3 for further details.

44-9. Comment noted. Noise and sonic boom monitoring and/or modeling would be used to verify damage claims potentially attributable to the X-33 test flight program.

44-10. Emissions inventories for all criteria pollutants due to X-33 activities were projected and included in air quality subsections of Section 4. No material impacts to state implementation plans would occur. Actions conform to State Implementation Plans (SIPs) in affected states.

44-11. Appropriate requests for waivers for storage or disposal of toxic or hazardous materials on Edwards would be made through the AFFTC Commander.

44-12. Preferred alternatives are provided in ES.2.4 and Section 2.2.6. The test flight baseline and schedule are provided in ES. 2.1.5 and Section 2.1.6.

44-13. Severe cold has no impact to the vehicle, and ground operations would be standard operating procedures for the flight line during severe cold weather. Adverse weather (rain, snow etc.) may affect launch operations; however, this is not a factor in landing site selection.

44-14. Risk assessment and protection of this facility would be addressed in detail in the Landing Site Safety Plan for Malmstrom. This plan would be prepared by Lockheed Martin with NASA participation and must be approved by the AFFTC Chief of Safety and Malmstrom safety officials. The risk assessments would be updated periodically prior to first flight and following the first flight, actual flight data would be used to update risk assessment and landing safety plan prior to any flight into Malmstrom.

44-15. Potential alternative landing sites considered but not carried forward were addressed in Section 2.2.5 of the Draft EIS. Great Falls International Airport was not considered at any time due to commercial business at this airport and potential flight tracks directly over the city of Great Falls.

44-16. Text modified in Section 3.2.5.16 to address the comment.

44-17. Comment noted. Commitment to ensure adequate crash and rescue equipment and personnel was made in Section 4.2.4.11.

44-18. It is anticipated that takeoffs for ferry flight operations would occur during the early morning hours when the air is most dense and not during the middle of hot days. Consequently it is not anticipated that the X-33 ferry flights would be subject to the same constraints as the KC-135R aircraft at Malmstrom.

44-19. Comment noted. Recommendation would be accommodated if Malmstrom is selected.

44-20. Comment noted. Final Safety Plans specific to each selected site would address this issue. At this time, the only personnel evacuation projected at this time is at Edwards Air Force Base for immediate area under initial flight track within the base. No public or other personnel evacuation requirements are anticipated. Final Safety Plans would be approved by AFFTC Chief of Safety and the landing site safety organizations.

44-21. Collective (total) per flight risks for all phases of test flight have been included in Section 4.3 and Tables D-3 through D-6. Updated and final risk assessments would be provided to appropriate launch and landing sites as available and prior to flight. The final risk assessments would be used by the Chief of Safety and the AFFTC Commander for final launch decisions.

44-22. Test flight schedules have been included in ES. 2.1.5 and Section 2.1.6.

44-23. Figures ES-7 and Figure 2-2 were modified to include the Boeing 747 data in the Final EIS.

44-24. See response to ***44-14***. In addition, the Safety Landing plan would address any safety and overflight issues for the City of Great Falls. It should be noted that the flight for landing at Malmstrom would not take the vehicle over either the City of Great Falls or the Weapons Storage Area.

44-25. Detailed contingency plans for abort would be addressed in the comprehensive X-33 Safety Plan required to be submitted to and approved by the AFFTC Chief of Safety. Requirements and sections potentially affecting other installations and regions would be coordinated with and approved by local authorities.

44-26. Comment noted. Coordination with the Great Falls International Airport would be accomplished during the permitting process through the FAA for temporary restriction of the airspace described in Appendix G for landing of the X-33 at Malmstrom Air Force Base.

44-27. No public road closures in the vicinity of the runway at Malmstrom Air Force Base is projected. The X-33 Program would work with base and local authorities along with highway officials to ensure that traffic flow is maintained on the highway and safe viewing of X-33 landings would be provided should this long range landing site alternative be selected.

44-28. It is a time consuming process to acquire sufficient data for a jurisdictional wetlands determination. The current knowledge of Silurian Lake indicates that the outcome would be a classification as such. Therefore, NASA has elected to consider the lake bed as a wetland and accommodate protective measures of it through the permitting process for any alteration of the lake bed.

44-29. Comment noted. Last paragraph of Section 2.2.2.2 added to end of Section ES. 3.4.

44-30. Sections noted in comment were updated to include current closed status of the runway at Malmstrom Air Force Base, the current status of the runway and flight support systems, and the X-33 Program's position to ensure that all necessary facilities are in adequate condition or in place to support X-33 and Boeing 747 landings and takeoff should the airfield be selected for long range landings.

44-31. No explosive safety quantity distance waivers at Malmstrom are anticipated.

44-32. Reference to Dugway in Table B-2 deleted. The X-33 Program met with authorities at all installations under consideration in this EIS.

44-33. Figure 2-7 in the Final EIS is a generic layout and not site specific. The Operations Control Center does not have to be at the launch site, and therefore, it is not indicated in the figure. Both buildings 9800 and 9804 on Phillips Laboratory within Edwards Air Force Base would be used for the Operations Control Center if the Haystack Butte site is selected for the launch site.

44-34. Office and storage space areas and/or buildings are not shown in the generic layout shown in Figure 2-7 because part of the Program's strategy is to maximize use of existing facilities and infrastructure as stated in Section 1.3.2 of the Draft and Final EIS. The Program would work with selected launch and landing site officials to utilize empty, underutilized and available space, buildings, and infrastructure required for office and storage space in order to minimize costs to the Program and ultimately the taxpayer.

44-35. A "critical action" as defined in NASA regulations (14 CFR Subpart 1216.203(d)) is "any action for which even a slight chance of flooding would be too great, such as storing lunar samples or highly toxic or water reactive materials." For the X-33 program, it has been determined that none of the launch or landing facilities would meet this criterion.

44-36. Reference to methane has been deleted in the Final EIS.

44-37. Comment noted. Text clarified in Sections 2.1.5.3 and 2.2.1.

44-38. Text changed from "must" to "would" in first line of Section 2.1.5.4. "J-25" changed to "J-2S" in 8th line of Section 2.1.6.

44-39. Manufacturers of LH_2 have had an excellent transportation record. One supplier reported only one incident in 30 years. Reference to this safety record has been added to Section 4.1.11.

44-40. Missing abbreviations added to list of Abbreviations and Acronyms.

44-41. Text modified in Section 2.1.9 to address the comment.

44-42. Clarification provided in Section 2.2.1 concerning roads proposed for use in towing the X-33 within Edwards Air Force Base from DFRC Orbiter mate/demate facility to launch site.

44-43. Status of airfield clarified and reopening considerations provided in Section 2.2.2.3.

44-44. The map in Figure 2-13 was reproduced "as is" from an Edwards document. Legend will remain as originally published by the USAF.

44-45. Text modified in Section 2.2.2.3 to address the comment.

44-46. Input data requirements for modeling risks were provided in Appendix G. All parameters considered collectively in the modeling protocol provided the basis for the risk numbers. The main parameter contributing to the difference is the population densities along the flight tracks.

44-47. Addition of "positive" to Table 2-7 and ES-7 made as requested.

44-48. Description of State Highway 127 as the primary access to Death Valley National Park added to Tables 2-8 and ES-8, and Silurian Lake descriptions in Sections 3 and 4.

44-49. Additional runway data provided in Section 3.2.4.1.

44-50. See Appendix E, Figure E-10.

44-51. Discussions already provided in Sections 4.1.4.11 and 4.2.4.13 of the Draft and Final EIS.

44-52. The runway at Malmstrom is located in the center of the facility; therefore land use adjacent to the runway is for military facilities. Please refer to section 4.2.4.11 for facilities in the vicinity of the runway.

44-53. Description of sewer lines provided in Section 4.1.1 of the Draft and Final EIS.

44-54. Text modified in Section 3.2.19 to address the comment.

44-55. "Limited crash coverage available" means that these facilities do not currently have the full range of emergency equipment and personnel to handle aircraft accidents that might be available at most commercial and military airfields. NASA and Lockheed

Martin would ensure that emergency capability which meet applicable DOD standards is available at these facilities to support landings of the X-33 vehicle.

44-56. Text modified in Section 3.2.4.1 to address the comment.

44-57. See response to ***44-14***.

44-58. A four hectare area is approximately 200 m (660 ft) x 200 m (660 ft) if perfectly square. The debris field would tend to be somewhat elongated with the length along the line of forward movement of the vehicle being slightly longer than the width. A detailed energy analysis would be completed for this facility and used for preparation of the Landing Site Safety Plan. However, the weight of the X-33 on landing would be substantially less than a fully fueled KC-135 aircraft that used to routinely takeoff and land on this runway. Consequently, damage potential to a hardened weapons storage area from the X-33 would be much less than damage potential from aircraft that formerly used the runway prior to closure of the airfield. In addition, the weapons storage area was designed and constructed after the airfield was built and active.

Please refer to responses ***42-16*** and ***42-22*** for further details concerning flight safety planning with respect to the Weapons Storage Area.

44-59. Please refer to responses ***42-17*** and ***42-28*** to address this comment.

44-60. Section 4.3 in the Final EIS has been modified to address comments from the FAA concerning this same issue. Please review the revised section.

44-61. These impacts are addressed in Appendix C of the Draft and Final EIS.

44-62. See Appendix C for a detailed discussion of the Conformity Analysis.

44-63. NASA agrees that monitoring must continue to ensure no degradation to air quality. Existing air quality monitoring stations would be used to perform this function.

44-64. Aircraft would be required to be diverted for approximately 1 to 4 hours beginning approximately 1 hour in advance of scheduled flight time. Since this airspace is entirely within military control, it is expected that the AFFTC would exercise more flexibility in minimizing the time for diverting aircraft than could be afforded in civilian airspace.

44-65. Text modified in Section 4.1.6 to address the comment.

44-66. No water deluge release to the desert is planned. Therefore, no impacts to the desert tortoise are expected.

44-67. The X-33 Program would work with selected installations, and state and local authorities as appropriate, to establish viewing areas outside of any areas of concern for launch and landings. In addition, Lockheed Martin through NASA would work with highway authorities to keep traffic moving and not pulling off on roadsides to try to view flight or landing activities in undesignated areas. The X-33 activities would only take place on installations capable of maintaining security as needed for both their activities as well as this one. Unauthorized, non-flight related personnel would not be permitted inside critical safety areas.

44-68. Descriptions of potential hazards associated with the propellants and other cryogenic gases were added to Section 4.1.2 of the Final EIS.

44-69. Hazards to the base personnel and the public are discussed in Section 4.3 of the Draft and Final EIS.

44-70. Text modified in Section 4.2.4.11 to address comment.

44-71. Space Port 2000 noise levels and potential effects are discussed in Appendix H of the Final EIS.

44-72. The statement "..in the form of a cracked window.." was used as an example. It is highly unlikely that all the windows in any residence would crack as a result of exposure to the noise levels expected. Lockheed Martin would establish procedures to process any damage claims resulting from the noise levels. Each claim would be investigated and a determination made if the damage was actually caused by X-33 Program activities.

44-73. Any accommodation for spectators would be fully coordinated with base personnel and local traffic control authorities. Additional assistance from the State Highway Department would be requested if necessary, to ensure that spectators do not park along Highway 58 and create a safety or environmental hazard and additional risk.

44-74. Expanded debris patterns are provided in Appendix G of the Final EIS. Each flight test would have a slightly different flight path based on the specific flight objectives and the landing site. Therefore, placing these projections on land cover maps would be inappropriate and could be misleading. In addition, the debris patterns are only for specific "events" along the flight path. It is not feasible to put all the debris patterns on any one model.

Flight safety analyses would continue to be performed throughout the life of the program and modeling would be performed prior to each test to ensure minimum risk to the public. See Section 4.3 of the Final EIS for a more detailed discussion of this issue.

44-75. See response to ***44-74***.

44-76. NASA and Lockheed Martin would request approvals from all appropriate agencies and provide information pertinent to initiatives for Congressional approval. Text modified in Table 5-2 to address the comment.

44-77. The number of air sorties for the R-2508 Complex were noted in Section 4.1.5. Approximately 4 to 50 flights per week occur on the Utah Test and Training Range. This data has been added to Section 3.2.3.6 of the Final EIS. Malmstrom Air Force Base's runway is closed, and only helicopters are permitted to use the facilities. Military flights in National Air Space are included in Appendix D charts.

44-78. Text modified in Appendix H to address the comment.

Thank you for the comments.

Comment *45* deliberately left blank.

Letter No. *46*

August 18, 1997

Dr. Rebecca C. McCaleb
Director
Environmental Engineering and Management Office
Code AE01
NASA
George C. Marshall Space Flight Center
AL 35812

Dear Dr. McCaleb,

Downwinders, Inc. hereby submits its comments on the DEIS for the X-33 Advanced Technology Demonstrator Vehicle Program. Our comments are specific to the "baseline" alternative for the mid-range landing site, Michael Army Air Airfield, Dugway Proving Grounds, Utah.

46-1

No alternative to the Dugway landing site was considered for the mid range landing site alternative, though alternative sites (2 each) were considered for the short and long-range landing sites. This biases the DEIS by posing a Dugway or nothing alternative for mid range landings. The DEIS therefore predisposes the selection of the Dugway landing site, since the no mid range landing alternative is clearly not preferrable to the project proponents. This was made clear in verbal statements made by the proponents at the DEIS hearing held in Salt Lake City.

Dugway as a landing site was not considered as an alternative in comparison with other short or long range landing options. The DEIS states that only "if the use of Dugway is detemined to not meet environmental and/or Program needs or suitability, test objectives for flying the X-33 to the long-range sites will be modified..."(2.2.2.2). This decision-making process creates an un-level playing field for analyzing alternatives under the spirit and letter of NEPA. (See also Table 2.5). The Dugway alternative is thus held to a different standard of analysis than all other options.

46-2

Given this approach, it is not surprising that the DEIS glossed over potential hazards associated with abort or nose down scenarios unique to the Dugway installation. In fact, we note that the DEIS blithely states that "personnel are **studying** proposed flight corridors to identify safe (unpopulated) areas in the event of an abort (emphasis ours)" We thought that the DEIS process, de facto, means that those studies have been conducted and should have been presented in this document.

The document shows, but does not comment on the fact that the Michael landing strip is within 3 miles of the Carr facility and within 4 miles of the Baker laboratories. These facilities contain biological agents, chemical agents, and hazardous wastes. There are no probabilities, no risk analyses and no impact or migitation analysis associated with a "nose down" on or proximate to these facilities. While it does not appear that either could be hit by debris from an abort (within the 100 mile long by 25 mile wide powered flight debris pattern for mid air break up which would affect the

46-2 western section of Dugway), either could fall within the 10 acre debris field of a nose down It's hard to tell from the data presented, because we could find no data indicating the "circular error probable" for a nose down. How accurately can the X-33 program gauge the crash point of the vehicle? This is a critical question not addressed in the DEIS. Without this information, we can't calculate the odds of any particular facility being within the 10 acre debris field. It's not an idle question with an historical failure probability of 1 in 250, given 5 or 6 flights to Dugway.

46-3 Regarding the Ditto Area at the end of the runway, we find the use of the term "unusual circumstance" (in assuring that the vehicle would stop 1000 to 5000 feet short of crashing into this facility containing hazardous waste) to be vague and not a great confidence builder. The vehicle will travel some 450 miles to Dugway. To be off by less than a mile may be an "unusual circumstance", but would still be a small error. It would be helpful if the DEIS gave some data here, some historical failure probabilities or other risk measures. Likewise, with the ammunition storage facility 1 mile from the runway. (4.2.3.11)

46-4 The following environmental impacts which we suggested in scoping comments should have been considered in the DEIS were not: (1) the cost of repairs to the airstrip at Dugway in preparation for

46-5 X-33 landing, and (2) the impact on housing at Dugway for X-33 support groups/personnel.

46-6 As expected, as apparently is usual and customary, this DEIS failed to include a thorough analysis, a cumulative impact analysis, of this program as it pertains to other programs, missions, installations, and environmental problems and issues of current and planned at Dugway. The EIS should address potential conflicts or mission incompatibilities of the X-33 program and each and all activities at Dugway. As we noted in scoping comments, there has never been an adequate cumulative impacts analysis done in any EIS ever done for operations of U.S. Army Dugway Proving Grounds. The X-33 DEIS made this same error of omission, in disregard of CEQ implementing regs for NEPA.

Given all of these concerns and the lack of specificity in the document on critical areas of possible risk and hazard, Downwinders urges rejection of the Michael Army Airfield as an alternative for X-33 landings.

Thank you for the opportunity to comment on this DEIS.

As Always,

Steve Erickson

Steve Erickson, for Downwinders
961 E. 600 S., Salt Lake City, UT 84102

Response to Letter No. *46* - Steve Erickson for Downwinders

46-1. Given the criteria for identifying reasonable alternatives to meet the incremental objectives of testing the X-33 vehicle at approximately one half its design specifications, and the criteria for the mid-range site in a common corridor with the short and long-range landing sites, there was no other reasonable alternative site identified. If Michael Army Airfield was unavailable, the test program would be modified to select the long range landing site.

46-2. With respect to an abort and whole body impact of the X-33 due to a flight anomaly upon reentry within the Dugway Proving Ground, the debris field would be approximately 4 ha (10 ac) in size as indicated in Section 4.3 Flight Safety. The flight termination system, described in the Flight Safety section, would be required to be deemed "fail safe" and would be a part of the Flight and Landing Safety Plans to be approved by the Air Force Flight Test Center (AFFTC) Chief of Safety for the Flight Safety Plan and the AFFTC and Dugway Chiefs of Safety for the Dugway Landing Safety Plan. The flight track and abort area(s) on Dugway must meet the requirements of the Utah Test and Training Range, which includes Dugway, and is covered in AFFTC Regulation 15-18 (March 1994); the Common Risk Criteria for National Test Ranges, Standard 321-97 (February 1997); and the AFFTC Test Safety Review Process, AFFTC Regulation 127-3 (September 1993). Final launch approval would be the responsibility of the AFFTC Commander.

Risk assessments of proposed test flights tailored to X-33 potential flight corridors were the result of the same rigorous risk and safety analysis process required of all experimental flight test vehicles to date. It is recognized that these values are not the final ones that would be used for determining acceptability for launch by the AFFTC Chief of Safety and the AFFTC Commander. The analyses would be periodically updated with actual component and systems test data as it becomes available. The Program would continue to update these determinations flight-to-flight with actual flight test data. The Program has planned an incremental test program for the X-33 in order to cautiously subject it to progressively more rigorous "real world" conditions by initially flying it at speeds and altitudes which would provide stresses and heating rates well under the vehicle's design specifications.

The National Environmental Policy Act requires that environmental evaluations, which include all factors necessary to be considered to protect the public, be conducted early in a program's decision process. The X-33 Program has done so using the best data and estimations available at this early part of the Program. The Program is committed to continue to refine and update the risk assessments with actual component and systems test data as it is generated throughout development and fabrication of the X-33 up through flight readiness firings of the assembled vehicle on the launch pad. If the data results in acceptable risk assessments and the AFFTC Chief of Safety and the AFFTC Commander approve launch, actual flight data would then be acquired and used to update flight test plans, risk assessments, and launch approvals. Launch approval for a particular flight plan may be denied at any time if actual flight data produces updated results which indicate that the vehicle would possibly operate unacceptably outside of design and flight specifications.

46-3. The Flight Termination system, which must be approved by the AFFTC Chief of Safety, must be considered "fail-safe" from launch to wheel stop. Therefore, the Flight Termination System must also be capable of controlling the vehicle once the wheels are on the ground in case the vehicle cannot stop on the runway. The same aeronautical systems that would redirect the X-33 in flight, if necessary, would also be used to direct the X-33 to deliberately "veer" off the runway, stop its forward movement, and possibly crash to prevent the X-33 from endangering personnel and property.

46-4. The airfield is currently operational and is anticipated to remain in that status throughout the life of the X-33 program. Therefore, any such repairs would be part of the normal maintenance. The X-33 program is not expected to impact this activity.

46-5. Given the short duration and small numbers of personnel associated with the X-33 Program, housing availability is not expected to be impacted. Impacts to potable water, wastewater treatment and other utilities were addressed in Sections 4.2.3.1 through 4.2.4.16.

46-6. The short-term duration of the program and small number of flights into Dugway lead to the conclusion that the X-33 program would not contribute substantially, if at all, to cumulative impacts to the environment at this site. The X-33 Program is within the overall mission of Dugway, i.e., flight testing and operations. The number of proposed operations is insignificant compared to other operations at the site. No personnel would be stationed at Dugway for more than several days. No new facilities would be constructed, and no modifications to existing facilities would be required. The natural and cultural resource baseline data for Dugway was adequate for the Draft and Final EIS. These considerations have, therefore, led to this determination.

Dugway has initiated plans to prepare a base installation EIS which would address the cumulative impacts and current missions of the installation. Concerns with Dugway operations should be addressed in this upcoming project.

Thank you for your comments.

Letter No. *47*

robert m larson, 06:22 AM 8/23/97 , x33 landing site at Malstrom A

Return-Path: <rlarson@sound.net>
Date: Sat, 23 Aug 1997 06:22:23 -0500
From: robert m larson <rlarson@sound.net>
Reply-To: rlarson@sound.net
Organization: RML Associates
To: X33EIS@msfc.nasa.gov
Subject: x33 landing site at Malstrom AirForce Base

47-1 Do you have a web site that I may access with info. on the x33 and the possible landing site at Malstrom Air Force Base?
Thank you, Robert Larson rlarson@sound.net

Response to Letter No. *47* - Robert Larson

Date: Wed, 27 Aug 1997 09:02:55 -0500
To: robert m larson <rlarson@sound.net> (by way of X33EIS <x33eis@msfc.nasa.gov>)
From: Donna Holland <DONNA.HOLLAND@MSFC.NASA.GOV>
Subject: Re: x33 landing site at Malstrom Air Force Base

Robert,

47-1. The internet address for the X-33 Draft EIS is: http://eemo.msfc.nasa.gov/eemo/x33_eis. This web site will provide you with information on the X-33's possible landing at Malmstrom AFB, MT, as well as general info on the X-33 program.

The internet address for RLV is: http://stp.msfc.nasa.gov/ This web site will provide you with general information on the X-33.

If we can be of further assistance, please do not hesitate to contact our office.

Thank you,

Donna Holland

Letter No. *48*

Date: Mon, 30 Jun 1997 17:16:11 -0600
From: Charles Magraw <cmagraw0@counsel.com>
Mime-Version: 1.0
To: Donna.Holland@msfc.nasa.gov
Subject: x-33 deis

I do not believe that the deis has sufficently taken into account
avalanche risks. Nor do I belive that the mitigtion measures identified
by the deis in this regard are adequate to address the risk. Simply
put, it is not realistic to hold up the flight "in the event" there is
an avalanche risk and expect that the threat will be taken care of as a
result of human intervention. For one, it is not a simple matter to
48-1 determine when there is a risk of an avalanche. Indeed, the better
course is to assume that in the winter, over mountainous terrain there
is always such a risk. This risk may or may not be addressed on the
ground. In the west, and particularly in the mountains of southwest
montana, with which I am familar, individuals use the mountains in
wintertime so I believe the flights of the x-33 over such terrain
creates a potentially dangerous situation.

Has NASA considered weather generally at the landing sites and
48-2 specifically weather over areas with relief? Relatedly has NASA
considered the difficulties asssocited with retrieving the craft should
it go down over the mountains.

Thank you for considering these comments.

RECEIVED
AUG 26 1997

Response to Letter No. *48* - Charles Magraw

48-1. Snow avalanche conditions are addressed in Section 3.2.3.17 of the Draft and Final EIS. NASA appreciates your position and has committed to follow snow conditions along proposed X-33 flight tracks with State officials responsible for public safety with respect to this issue. Flights of the X-33 would be delayed if advised by State officials in order for appropriate authorities to implement early morning avalanche control measures.

48-2. NASA has considered weather at the landing sites. Information on climate is provided in the Draft and Final EIS for each proposed alternative. For "day of launch" decisions, weather would be evaluated for the entire flight track to determine its effect on the X-33 as it descends from its maximum altitude to landing. Weather specifically over areas with relief, i.e., mountainous areas, have not been evaluated. However, this issue would be considered in further detail in the Flight Launch and Landing Safety Plans as deemed necessary by flight controllers familiar with site specific conditions and ground impacts of supersonic vehicles.

During overflight of Nevada and Idaho of the X-33 on a flight path to Malmstrom, the X-33 would be at altitudes too high to cause sound overpressures from sonic booms that could conceivably cause snow avalanches. In the latter part of flight, the X-33 would cause sound overpressures equivalent to a 16 km per hour (10 mph) wind gust which is an overpressure level experienced on a regular basis in winter in mountainous areas whether or not the X-33 overflights occur. Winds of this speed and higher up to 40 km per hour (25 mph) are common in Montana. Please refer to climate and data provided in Section 3.2.4.4 of the Draft and Final EIS. Other factors such as thunder, animal motion and noise (e.g., birds or deer) are equally capable of triggering avalanches and occur much more frequently than X-33 overflights. Therefore, additional risk of human injury as a result of snow avalanche in remote areas from X-33 operations would be expected to be minimal.

NASA is aware of the challenges that would be faced to retrieve the X-33 from remote mountainous areas. These challenges would be equivalent to prior recovery efforts under similar conditions by military, aviation, and other authorities. To date, recovery operations have been generally successfully. NASA would seek advise from experienced personnel should this situation occur.

Thank you for your comments.

Letter No. 49

20.8.97

Dear Dr. M. Caleb.

Thank You for sending me a copy of the X-33 Impact Statement. It was also a pleasure meeting you at Dugway field,

49-1 I would like to have more info on the X-33 if possible. I have been following the progress for along time.

49-2 I would like to know more about the X-33 skin composition. What kind of material it is made of and What kind of paint it has.

Please forward my request to someone who can help me.

Thank You so much.

Martin Cano
2255 ogden ave
ogden, Utah 84401

RECEIVED
AUG 26 1997

Response to Letter No. *49* - Martin Cane

49-1. Request for additional information on the X-33 program has been provided to Mr. Cane through Public Affairs Office, NASA/MSFC.

49-2. The Thermal Protection System (TPS) makes up the X-33 skin. The TPS is a metallic material made from a combination of inconel (an alloy of iron, nickel and cobalt) or titanium panels and carbon epoxy panels.

Thank you for the comments.

Letter No. *50*

From: Chuck Larsen[SMTP:Chuck.Larsen@faa.dot.gov]
Sent: Tuesday, August 26, YYYY 3:50 PM
To: Mccaleb, Rebecca
Cc: Esta Rosenberg<OST>
Subject: Re: Comment to X-33 DEIS

______________________________ Forward Header ______________________________

Subject: Re: Comment to X-33 DEIS
Author: Esta Rosenberg<OST> at CCHUB
Date: 8/26/97 2:00 PM

50-1 The following statement on page 4-147: "the potential for long-term positive impacts on the environment from substantial stratospheric ozone and surface acid deposition reduction impacts with the planned successor spaceplane based on the X-33 design would be major" should be clarified. If the term "positive impacts" is intended to mean "beneficial" impacts on the environment please add the term "beneficial" to the text.

Response to Letter No. *50* - Chuck Larsen

50-1. Text modified in Section 4.8 to address the comment.

Thank you for the comment.

Letter No. *51*

STATE OF WASHINGTON

DEPARTMENT OF FISH AND WILDLIFE

1550 Alder Street NW • Ephrata, Washington 98823 • (509) 754-4624 FAX (509) 754-5257

RECEIVED SEP 09 1997

August 29, 1997

Dr. Rebecca C. McCaleb
NASA/Code AE01
Marshall Space Flight Center, AL 35812

Dear Dr. McCaleb:

SUBJECT: "X-33" Advanced Technology Demonstrator Vehicle Program Draft EIS

The Washington Department of Fish and Wildlife (WDFW) appreciates the opportunity to comment on the Draft EIS for the X-33 Demonstrator Vehicle project. Our comments and recommendations are limited specifically to the wildlife habitats and species at the proposed landing site at the Grant County Airport at Moses Lake, Washington.

Comments.

51-1 Chapter 3.0, Description of Affected Environments. We found the summary of the Biological Resources (3.2.5.7) to be accurately portrayed. As stated, the habitats at the landing site are mainly composed of shrub steppe vegetation. The species of most concern are long-billed curlews and possibly a few pairs of burrowing owls (not mentioned in the EIS). Parts of the area have been mapped by the WDFW under the Priority Habitats and Species (PHS) program as a priority habitat for long-billed curlews.

Due to the PHS designation, the area may also be considered as a critical area by the Grant County Planning Department through their Critical Area Ordinance of the growth management act. The comments and recommendations in this letter should satisfy any requirements the County may have for this project through their critical area ordinance.

51-2 The long-billed curlew is no longer considered a federal candidate species as stated in the Draft EIS (3.2.5.8). You may want to verify this with the U.S. Fish and Wildlife Service at their Moses Lake office at (509) 765-6125.

Also, as briefly summarized in the EIS, rich wetlands occur in the Crab Creek corridor approximately two miles east from the center of the proposed landing area. The creek corridor, which is part of the Columbia Basin Wildlife Management Area, has also been mapped as priority habitats for wetlands and concentrations of waterfowl, shorebirds and other species. The area serves both as breeding habitats and as a migration corridor. Significantly, large numbers of birds can occur in the area during the migration periods. Depending on weather patterns, crop rotations and possible other factors, several thousand ducks and geese may be in area during the spring and fall months.

51-3

Environmental Consequences 4.0. As stated under Biological Resources (4.5.6), no on site preparation would be necessary. Therefore, there would be no direct impacts to habitats. The concern would then center on indirect impacts or losses of habitat effectiveness through increase disturbance levels, primarily from noise with sonic booms being of most concern.

The Draft EIS states impacts from sonic booms are difficult to predict due to lack of studies. We also have no information to contribute to this unknown. Based on the assumption impacts would be mostly limited to the immediate area of the airport, the noise factors may then only interfere with the nesting cycle of several pairs of long-billed curlews and possible a few pairs of burrowing owls, although the subterranean habitats used by the owls would likely help protect them from the noise disturbance.

Regardless of the above assumption, it also seems conceivable that large numbers of waterfowl and other species could be disturbed, if only temporarily, along the Crab Creek corridor by sonic booms, particularly during the migration periods. Some impacts could potentially occur to nesting ducks and shorebirds that would be the within two mile radius of the airport.

Even though potential impacts from noise can't be quantified from current knowledge, the potential impacts could be mitigated by timing the landings during less critical times. The curlews and burrowing owls usually complete their incubation period by the end of May. The peak of the nesting effort by ducks and shorebirds along Crab Creek would probably be around the end of June. The waterfowl migration periods peak during the months of March-April and October-November. By using these general dates as guidelines, potential impacts to birds could be minimized by scheduling the landing for mid to late summer, which is suggested as a possibility in the Draft EIS under Wildlife (4.2.5.7).

51-4

Under the heading of Flight Safety (4.3) there is no mention of a risk assessment for the vehicle having midair collisions with birds. If this is a potential problem, then scheduling the flights during low periods of bird activity could conceivably lower the risk.

Recommendations. Based on the available information, it appears potential impact to wildlife from this proposed project would not be serious in nature, particulary if the project is short term (one series of five landings). However, due to some uncertainty on the impacts from noise (sonic booms), we offer the following two recommendations:

51-5
- schedule the landings for periods of lesser avian activity to minimize potential impacts, (mid to late summer) and;

51-6
- regardless of when the landings would occur, monitor the impacts to wildlife through a planned monitoring scheme. We could possibly assist in the development and implementation of a monitoring program.

We hope this information is helpful. Please call if you have any questions on our comments.

Sincerely,

Ron Friesz

Ron Friesz
Habitat Biologist

cc: Tracy Lloyd, WDFW Ephrata
Jane Banyard, WDFW Olympia
Ron Sell, Grant County Planning Department, Ephrata

Response to Letter No. *51* - State of Washington Department of Fish and Wildlife

51-1. Text modified in Section 3.2.4.7 to address the comment.

51-2. Text modified in Section 3.2.5.8 to address the comment.

51-3. As stated in Section 4.2.5.7 of the Draft EIS, sonic booms resulting from X-33 landings are not expected to produce long-term impacts to any receptor species found in the area. As for mitigating impacts by scheduling flights from mid-to-late summer given the expectation of minimal impacts and the ambitious flight schedule, this may not be possible.

51-4. Due to the configuration and construction of the X-33, collisions with birds are not anticipated to be a potential problem.

51-5. See answer to ***51-3***.

51-6. Given the expected minimal impacts and the short duration of the program at Moses Lake, no monitoring of wildlife is proposed at this time.

Thank you for the comments.

Letter No. *52*

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

SEP 15 1997

RECEIVED
SEP 18 1997

In Reply Refer To:
ER 97/386

Dr. Rebecca C. McCaleb
NASA/Code AE01
Marshall Space Flight Center
Alabama 35812

Dear Dr. McCaleb:

The Department of the Interior has reviewed the Draft Environmental Impact Statement (DEIS) for the X-33 Advanced Technology Demonstrator Vehicle Program. We have the following comments.

The DEIS identifies two proposed launch sites for the X-33 within Edwards Air Force Base (EAFB) and numerous proposed long, medium, and short-range landing sites. The DEIS also includes an analysis of the "No Action" alternative. Short-range landing site alternatives include China Lake and Silurian Lake, both dry lake beds.

China Lake is within China Lake Naval Weapons Station, approximately 20 miles west of Death Valley National Park (DEVA) and approximately 90 miles northwest of Mojave National Preserve (MOJA); both units of our National Park System. Silurian Lake is about 15 miles south of DEVA and about 10 miles north of MOJA. These comments express our concerns with potential project related impacts to these parks and their natural resources.

General Comments

52-1 In 1994, the Desert Protection Act (DPA) was signed into law changing DEVA's designation from Monument to Park and adding thousands of acres to existing holdings. The DPA also created Mojave. Portions of the DEIS refer to DEVA as "Monument." Also, some maps, including Figures 3-5 and 4-31 on pages 3-15 and 4-65 respectively, show boundaries for both parks as they existed prior to the passage of DPA. We recommend revision of these errors in the Final Environmental Impact Statement (FEIS).

Specific Comments

52-2 **Page ES-7, Figure ES-4** This figure outlines the DEIS alternatives, including selection of landing sites. For the mid-range landing site, the figure provides the alternative of modifying flight objectives to a long-range landing site. However, similar adjustments for short-range landing sites, perhaps to mid-range sites, are not considered. In the FEIS please review all feasible operations modifications for short-range distances, as well as modifications considered but rejected.

52-3 Also, the two proposed launch site alternatives in the DEIS are within EAFB in southern California. The selected launch sites have a strong influence on where landing sites will be located and which environments may be affected. Please provide additional information regarding consideration of launch sites besides EAFB and White Sands Missile Range, an alternative considered but not carried forward.

The above information is necessary in order to determine whether options may exist to avoid or minimize potential impacts to our nearby parks.

52-4 **Page ES-33, Table ES-6** As required by the Conformity Rule in the Clean Air Act as Amended (1990), Federal agencies must reveal air pollution emissions in non-attainment areas. Page ES-21 shows that the Silurian Valley's PM_{10} (fugitive dust) levels are in non-attainment for both State and Federal standards and O_3 (ozone) are in non-attainment with State standards. Table ES-6 states O_3 is in attainment for Silurian Lake but does not clarify the standards referenced. Please provide this information in the FEIS.

The PM_{10} conformity *de minimis* column includes nitrogen oxide (NO_X) and volatile organic compounds (VOC). However, the PM_{10} table need not reference NO_X and VOC. Table ES-6 should be corrected in the FEIS.

52-5 **Page ES-33, Section ES.4.4** This page indicates that no further "detailed analysis and demonstration of compliance with the State Implementation Plan (for O_3 and PM_{10}) is required under the conformity regulations" as one year *de minimis* thresholds are not exceeded. However, the cited Conformity Analysis in Appendix C has different data for PM_{10} emissions. In the FEIS please clarify these PM_{10} discrepancies.

52-6 **Page ES-34, Section ES.4.5** This page states that State Highway 127 will be temporarily closed up to 4 hours for each of three X-33 landings, plus a shorter time for 747 landings and takeoffs. This highway is a major access route to DEVA and to the gateway communities of Shoshone, Death Valley Junction, Amargosa Valley and Lathrup Wells. We request that NASA re-evaluate the need to close the highway for flight operations and provide alternatives for State Highway 127 closure in the FEIS. In the event that temporary closure is unavoidable, we request that the FEIS contain information regarding the responsibilities of the parties

52-6 closing State Highway 127 to notify Federal, State and local agencies as well as the public and to allow for a minimum of seven (7) days advance public notice.

52-7 **Page 2-17, Section 2.1.8** This page discusses X-33 flight abort considerations, but is inadequately analyzed. We request that precautions to prevent harm and mitigation measures to reduce or eliminate abort impacts be addressed. If the Silurian Lake landing site is selected, we request that the dry lakes, salt pans, playas or unpopulated flat sites within DEVA and MOJA not be considered for abort sites.

52-8 The Racetrack Valley Playa, a unique dry lake in Death Valley, was investigated by NASA in the mid-1970s as an alternate landing site for the Space Shuttle. The investigation consisted of the landing, taxiing, and takeoff of a large NASA airplane. The aircraft's tire tracks are still visible in Death Valley National Park, a condition which adversely affects the experiences of 1.2 million annual park visitors.

52-9 **Page 3-42, Table 3-4** This table should be identified as "Table 3-8."

52-10 **Page 3-46, Table 3-10** We request that DEVA's air quality monitoring data be included with the examples of regional air quality in the DEIS. Please contact park Superintendent Dick Martin at (619) 786-2331 regarding NPS air quality information for the area.

52-11 **Page 4-54, Section 4.2.1** This page mentions three Silurian Lake landings, but page C-20 in the Conformity Analysis indicates two proposed landings for the X-33. Please clarify in the FEIS.

52-12 **Page 4-58, Section 4.2.1.1** This page indicates cellular telephones would be used at Silurian Lake. In the FEIS, please address how NASA plans to install cell phone antennas in or near DEVA so as to avoid affecting it's world renowned scenic vistas.

52-13 **Page 4-79, Section 4.2.2.12** This section addresses noise and sonic booms generated by the X-33. We wish to protect natural quiet as a park resource for park visitors, wildlife, and fragile landforms at these desert parks. Please identify mitigation measures in the FEIS to decrease sonic boom impacts on park visitors and resources.

52-14 **Page 4-147, Section 4.7** This page indicates long-term positive benefits from the X-33 program (reduce ozone and surface acid deposition) once the technology leads to the planned full scale successor space plane based on the X-33. We concur with these positive impacts, especially the use of liquid oxygen and liquid hydrogen fuel, nontoxic to stratospheric ozone and the biosphere.

52-15 **Page 4-146, Section 4.6** No mention is made of the long-term impacts the successor craft and program would have on Silurian Lake. We request that the FEIS indicate the potential of the selected X-33 site to become a base of frequent operations of the successor, a full-scale commercial space plane, as well as to identify and analyze fully the future long-term impacts.

52-16 In addition, this section does not reference other regional projects which are planned or permitted, such as the Fort Irwin National Training Center Expansion or the Molycorp Mine Expansion. Please provide information in the FEIS that addresses cumulative impacts from these projects with other planned or permitted projects in the region.

52-17 **Page C-52, Table C-1** This table indicates the PM_{10} emissions generated from grading and smoothing the estimated 5,000 sq. ft. of the Silurian Lake bed to prepare it for X-33 landings. However, pages 4-56 and 4-57 indicate that 10-15 percent of the 3,000,000 sq. ft. Silurian Lake landing area "may require minimal leveling, fill and/or compaction." This equates to approximately 300,000 to 450,000 sq. ft. of lake bed disturbance. We request clarification of the quantity of PM_{10} emissions generated from the grading and smoothing of the Silurian Lake bed since this activity may impact air quality and visibility at Death Valley and Mojave.

52-18 The wind rose in Figure 3-14, page 3-44, indicates a prevailing strong SE wind that transports Silurian Lake PM_{10} emissions directly into DEVA. Wind patterns also indicate that MOJA would receive PM_{10} emissions as a result of Silurian lake bed disturbance. Therefore, we are concerned with Silurian Lake PM_{10} emissions and their impacts on regional air quality.

Summary Comments

We are concerned with potential project related impacts to DEVA and MOJA affecting park access, air quality, visual quality and natural quiet. In view of the many drawbacks of the Silurian Lake short-range landing site alternative we strongly recommend the China Lake short-range landing site be selected. Public access to China Lake is limited as it is within a Naval Air Weapons Station and is within restricted air space thereby decreasing air safety concerns.

We appreciate the opportunity to comment on this important

DEIS. If you have any questions regarding these comments, please contact Ken Havran in the Office of Environmental Policy and Compliance at (202) 208-7116.

Sincerely,

Kenneth L. Hacer
for

Willie R. Taylor
Director
Office of Environmental Policy
and Compliance

Response to Letter No. *52* - US Department of the Interior Office of Environmental Policy and Compliance

52-1. Text modified in Figures 3-5 and 4-31 to address the comment.

52-2. Comment noted. Alternatives considered but not carried forward are considered in Section 2.2.5 of the Draft EIS.

52-3. See response ***52-2***.

NASA and its industry partners carefully considered potentially reasonable alternatives for proposed launch site alternatives. Alternatives now under consideration were the only ones meeting technical, programmatic, safety, and other essential X-33 test flight criteria. Also see Section 1.4 for further information.

52-4. Tables ES-6 and 4-2 modified to address the comment.

52-5. Please refer to Appendix C in the Final EIS for complete details.

52-6. Road closure recommendations were carefully evaluated and considered unavoidable. NASA has been in contact with Caltrans. Also, Lockheed Martin, through NASA, will be responsible for maintianing contact with Catrans and continuing to coordinate road closures and public notice.

52-7. Comment noted. Final abort considerations will be made with Air Force Flight Test Center and other organizations and agencies as necessary.

52-8. Comment noted. The information on Racetrack Valley Playa would be considered in environmental permits and mitigation concerning the potential use of Silurian Lake.

52-9. Table 3-4 renumbered to Table 3-8.

52-10. The additional air quality data from Death Valley would be acquired and used to update information provided to environmental regulatory authorities for developing conditions within required permits for the use of the Silurian Lake if selected. These conditions would ensure protection of the air quality of Death Valley which is the intended use of the data.

52-11. Conformity Analysis was based on two landings. The data was extrapolated to three landings in Section 4.2.1 of the Final EIS.

52-12. Program operations personnel now recognize the lack of cellular telephone service in the vicinity of Silurian Lake. Any necessary antennae to assist in field communications with Edwards Air Force Base would be installed on a temporary basis within the infrastructure footprints described in the Draft and Final EIS sections for Silurian Lake. Text modified to reflect these communications changes in Section 4.2.1.1 of the Final EIS.

52-13. Sonic boom impacts for the Death Valley National Park are the lowest quantified level of impact in the Draft and Final EIS. The sonic boom levels are expected to be very low and cause little, if any, impact. X-33 test flights would be conducted very early in the morning before significant numbers of park visitors arrive. Only one sonic boom per flight would be heard at any one point in the park. Projected sonic booms cannot be mitigated.

52-14. Comment noted on long-term positive benefits to the environment, specifically the stratosphere and biosphere.

52-15. The potential planned successor spaceplane to the X-33 would land on a runway near to its launch facility. There is no expectation that the full scale vehicle would ever use Silurian Lake for landing or any other operation. No additional X-33 test flights to Silurian Lake are planned other than those analyzed in the Final EIS.

52-16. Text modified in Section 4.7 of Final EIS to include notes of potential Ft. Irwin expansion. X-33 operational impacts would be insignificant compared to a long term mining operation, or the expansion of Ft. Irwin.

52-17. Particulate calculations for landing operations at Silurian Lake are provided in Appendix C. Potential grading of the lake bed for landing area preparation would cause the additional release of approximately 0.12 metric tons per year (0.13 tpy) for 1999. The X-33 Program recognizes the need for active measures to prevent disturbance of dust at the lake bed and transport of particulates to other areas in the vicinity. Standard dust control measures such as water would be implemented. This activity would be addressed in appropriate permits to ensure protection of the regional air quality and the environment. Text in Section 4.2.1.4 has been modified to include this information.

52-18. Comment as to the preference of China Lake is noted. NASA would be particularly sensitive to projected impacts on environmentally sensitive areas such as the Death Valley National Park and Mojave National Preserve. See response to **52-13** above.

Thank you for the comments.

Letter No. *53*

PORT OF CHELAN COUNTY

__COMMISSIONERS:__
James H. Knapp, District No. 1
John R. Stoltenberg, District No. 2
Bonnie L. Cannon, District No. 3

September 4, 1997

RECEIVED SEP 08 1997

Dr. Rebecca McCaleb, Director
Environmental Engineering Management Office
George C. Marshall Space Flight Center
Alabama 35812

VIA FACSIMILE – 205-544-8259

Dear Dr. McCaleb:

53-1 As a neighboring jurisdiction to Moses Lake (and one potentially in the fly over area), we are writing to express our support for the Port of Moses Lake's Grant County Airport as the site for the landing of the X-33 aircraft. We in eastern Washington are accustomed to and supportive of the use of the Grant County airport for aircraft testing. We are proud of this facility and of the team that operates and manages it, and are confident that it will meet NASA's needs in this very exciting program.

Washington state very clearly understands the degree to which it and the nation benefit from aerospace, and it is entirely appropriate to make use of one of our premier aviation facilities for this program. We know your considerations will be guided by sound, scientific analysis, and we are confident that you will choose the Grant County airport as the landing site for the X-33.

No matter what the outcome of the site selection process, we wish you the best of luck in this endeavor.

Sincerely,

Bonnie L. Cannon
Commissioner

John R. Stoltenberg
Commissioner

James H. Knapp
Commissioner

cc: Congressional Delegation

P.O. Box 849 • 125 Easy Street • Wenatchee, WA 98807
(509) 663-5159 • Fax (509) 662-5151 • email ccpd@ccpd.com

UTAH

Myron Lee
Larry D. Olsen
R. N. Goldberger
Zach Hampton
Ashby Girous
Carl H. Voss
Ross Gleason

VIRGINIA

Theodore D. Kronmiller

Request for Draft EIS

Upon request, the following individuals were provided a copy of the Draft EIS:

CALIFORNIA

Matthew Ryan
R. Lyle Talbot
Aerotech
Steve Brekenridge
Tammy Santos
Le Hayes
Brian Brown
Lois Clark
Tamera Boils
Jim Garner
J. B. Roberts

COLORADO

Asa Reed, Jr.

MONTANA

Joseph W. McGregor
Ros W. Kelly
Lynnette Briggs

NEW JERSEY

Peter Allan

SOUTH CAROLINA

Gary Varga

APPENDIX B - SECTION B-2.4

COMMENTS RECEIVED BY PHONE

Appendix B - Section B-2.4
Comments Received by Phone

A number of verbal comments were also recorded on an answering machine receiving calls at NASA's X-33 "800" telephone number. A complete history of these calls and the responses follows in Table B-2-6.

Table B-2-6
Comments Received by Phone

Messages received from Phone Tape 6/28 - 8/18

1. Charles Stoudt, 2171 SE Moores, Portland, OR 97222

Comment: GREAT!
Response: Comment is noted.

2. Michael Dowish, Boise State University, Senior in Chemistry, 208-367-1296

Comment: Fantastic Idea!
Response: Comment is noted.

3. Rick Stamps, Rucksburg, ID

Comment 1: Excellent Program.
Comment 2: Believes this program will have minimum impact in the state of Idaho.
Response: Comments are noted.

4. Unidentified caller from Oregon.

Comment 1: Believes that the X-33 has already been flying for 10-15 years without the public's knowledge.
Comment 2: Only concern is that she hopes the X-33 does not get shot down.
Response: Comments are noted.

5. Lance Ben, Helena, MT

Comment 1: X-33 is a great idea.
Comment 2: Happy to have X-33 fly over the city of Helena.
Response: Comments are noted.

6. Steve Ladnier, 208 East 8th Avenue, Sun Valley, NV 89433

Comment 1: Would like to address the EIS on the flight plan.

Response: Document mailed on 8/8.

7. Robert Bach, EAFB, 805-277-6294

Comment 1: Has a question regarding maps used in DEIS - please phone.
Response 1: Phoned individual. Voice mail indicated he would be out until the following week.
Response 2: Phoned individual and spoke with him about his needs. He wanted a copy of the National Geographic maps used in the DEIS. He was provided with the National Geographic map number, phone number for ordering, and address to write for further information.

8. Royce Shipley, Cascade County Disaster Services, P.O. Box 3127, Great Falls, MT 59403

Comment 1: Would like a copy of the X-33 DEIS.
Response: Document mailed 8/8.

9. Charles Perry 15220 NE (Street unidentifiable on tape), City unidentifiable on tape, OR 97132

Comment 1: Please keep citizens of Oregon informed on the actions of the X-33 program.
Comment 2: Concerned about sonic boom.
Comment 3: Will he be "eating this vehicle for an evening meal?" ie, will the vehicle crash?
Comment 4: What kind of pollution will this vehicle omit, including noise pollution?
Comment 5: Request a hard copy of the DEIS.

10. Jim Scott, KGEE TV, Bakersfield, CA, 805-327-1761.

Comment 1: Need a Beta tape.
Response 1: Tape mailed to individual from Public Affairs, MSFC, AL

Phone Message received 8/15/97

Request for hard copy of DEIS from:

Kevin Emmerich
P.O. Box 51
Death Valley, CA 92328

RESPONSE:

1. Document was mailed to the above individual on 8/15/97.

2. The above individual was added to the mailing list to receive the Final EIS.

Request for Video

Upon request the following individuals were provided with a copy of the X-33 Video:

Letter No.	Request Received	Name & Address	Reply Sent
79	7/21/97	Del E. Richardson 1046 Poole St. Mojave, CA 93501	8/4/97
80	7/21/97	Gary Letchworth P.O. Box 2008 Lancaster, CA 93539	8/4/97
81	7/21/97	Ken Hepworth 518 Fairway Drive Palmdale, CA 93551	8/4/97
82	7/21/97	Brandon Kirick 44063 Beech #55 Lancaster, CA 93534	8/4/97
83	7/24/97	Dan Mullen NASA/DFRC P.O. Box 273 MS D-2152 Edwards, CA 93523	8/4/97

APPENDIX C

CONFORMITY ANALYSIS

At time of the Notice of Intent published in the Federal Register on October 7, 1997, three sites within Edwards Air Force Base were under consideration for launch sites. Environmental evaluation proceeded on the three sites, including conformity analyses. However, further program safety and operations impact evaluations removed the South Base site as a reasonable alternative for X-33 launches. The conformity analyses were already completed by CH2M Hill, Inc., and submitted to NASA. Therefore, South Base data is included herein, but is no longer relevant as a launch site alternative for this Proposed Action.

Conformity Analysis

X-33 Advanced Technology Demonstrator

Prepared for

National Aeronautics and Space Administration (NASA)

Marshall Space Flight Center, AL 35812

Table of Contents

Tables

1.0 Introduction

The purpose of this conformity analysis is to determine if the Federal actions associated with the final development and testing of the X-33 Advanced Technology Demonstrator at various NASA sites conform to the associated state implementation plan (SIP). This analysis discusses air conformity regulations, reviews the air quality attainment status for the locations under consideration for the X-33 program, and compares estimated emissions against conformity regulatory thresholds. This conformity analysis does not include additional analyses that would be required in a conformity determination if estimated emissions exceed regulatory thresholds.

2.0 Overview of Conformity Regulations

Section 176(c) of the Clean Air Act Amendments (CAAA) of 1990 requires that all Federal actions conform to an applicable implementation plan. The U.S. Environmental Protection Agency (EPA) promulgated 40 CFR Part 51, Subpart W, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (the "General Conformity Rule"), to implement section 176(c) of the CAAA. The rule applies only to Federal actions in air basins that do not meet National Ambient Air Quality Standards (NAAQS) and have been designated as nonattainment or maintenance areas.

The General Conformity Rule is designed to focus conformity requirements on the Federal actions that have the potential for affecting air quality. Air pollutant emissions associated with the Federal actions are estimated for both direct and indirect emissions. Direct emissions are those that are caused or initiated by the Federal actions and occur at the same time and place as the actions. Examples of direct emissions include emissions from use of emergency generators and from site work during construction. Indirect emissions include emissions that do not result directly from the Federal action itself, but that would not occur in the absence of the action. Emissions resulting from spectators use of automobiles to drive to the launch and landing sites, are indirect emissions attributable to the action.

De minimis levels of emissions were established in the General Conformity Rule to define levels of emissions that have significant effects. The tons per year (tpy) *de minimis* levels are a function of the pollutant and the nonattainment classification of the air basin; the levels are lowest in areas with worse attainment status. In addition to the *de minimis* levels, the rule also specifies emission levels that are considered to be "regionally significant." A Federal action is regionally significant if the direct and indirect emissions from the action exceed 10 percent of the total emissions inventory for a particular criteria pollutant in a nonattainment or maintenance area.

A conformity analysis estimates emissions of nonattainment or maintenance pollutants associated with the action and compares them against the applicable regulatory thresholds. If emissions are found to be below the thresholds, no further analysis is required and the Federal actions being considered are found to conform. Federal actions with estimated emissions that exceed the thresholds are subject to a conformity determination. Conformity can be demonstrated through any of several means, including:

- Area-wide and/or local air dispersion modeling to demonstrate the emissions from the action would not cause or contribute to any new violation or increase the severity of an existing violation.
- Formal inclusion and approval of the emissions from the proposed actions in the applicable SIP attainment or maintenance demonstration.
- Obtaining emission offsets from other sources that fully offset the emissions associated with the action through reductions elsewhere in the nonattainment or maintenance area.
- Documentation that emissions within the nonattainment or maintenance are do not exceed the budget specified in the SIP. If the emissions budget is exceeded, the state governor may make a written commitment to EPA including a promise to make SIP revisions that will lower emissions to within the emissions budget.
- Documentation that emissions from the action do not increase total emissions with respect to a baseline

3.0 Applicability of Conformity to X-33 Sites

3.1 Launch and Landing Sites and Attainment Status

The X-33 launch site will be located at one of three sites under consideration within Edwards Air Force Base (AFB), California:

- Haystack Butte
- Spaceport 2000
- South Base

Landing sites under consideration are as follow:

- Silurian Lake (near Baker, California)
- China Lake Naval Weapons Center (NWC), California
- Dugway Proving Ground (PG), Utah
- Malmstrom Air Force Base (AFB), Montana
- Port of Moses Lake, Washington

3.2 Air Quality Status and Conformity de minimis *Thresholds*

Only the California sites are located in nonattainment areas, and are subject to generalconformity rule which means a more detailed analysis. The attainment status and *de minimis* levels of all of the launch and landing sites are outlined in Table 3-1.

Table 3-1
Attainment Status and Conformity *De minimis* Levels for X-33 Launch and Landing Sites

Site	Pollutants and Classification				
	Ozone		PM-10		Other Pollutants
	Classification	Conformity *de minimis* Level (1) (NOx & VOCs)	Classification	Conformity *de minimis* Level (1)	Classification
Edwards AFB - Haystack Butte	severe non-attainment	25 tpy	moderate non-attainment	100 tpy	attainment
Edwards AFB - Spaceport 2000	serious non-attainment	50 tpy	attainment	n/a	attainment
Edwards AFB - South Base	serious non-attainment	50 tpy	attainment	n/a	attainment
China Lake NWC	serious non-attainment	50 tpy	moderate non-attainment	100 tpy	attainment
Silurian Lake	attainment	n/a	moderate non-attainment	100 tpy	attainment
Dugway PG	attainment	n/a	attainment	n/a	attainment
Malstrom AFB	attainment	n/a	attainment	n/a	attainment
Moses Lake	attainment	n/a	attainment	n/a	attainment

(1): 40 CFR Part 51, Subpart W, §51.853(b)
tpy: tons per year
n/a: Not applicable; location is in attainment with NAAQS for that pollutant

The Edwards AFB Haystack Butte launch site is in San Bernardino County, just east of the border between Kern County and San Bernardino County. This area is located in the Mojave Desert Air Basin (previously part of the Southeast Desert Air Basin prior to redesignation) and is under the jurisdiction of the Mojave Desert Air Quality Management District (AQMD).

The Edwards AFB Spaceport 2000 and South Base launch sites are located in Kern County, and are also within the Mojave Desert Air Basin. This section of the basin is under the jurisdiction of the Kern County AQMD.

The China Lake NWC is located in Inyo, Kern and San Bernardino counties. The area where the landing will occur at the China Lake NWC is in Kern County.

The Silurian Lake landing site is located 18 miles north of Baker, California in San Bernardino County. This area is located in the Mojave Desert Air Basin and is managed by the Mojave Desert AQMD.

3.2.1 Current Ambient Air Quality Monitoring Data

Summaries of ambient air monitoring data were obtained for monitoring stations near each of the sites under consideration for the X-33 program. Data were not available for all pollutants due to location-specific variations in the extent of the monitoring programs administered. A summary of the data obtained for the monitoring station closest to the three possible launch sites and 5 landing sites and a listing of the associated NAAQS are presented in Table 3-2. Note that the attainment classification of a particular location is a function of the monitored frequencies of exceedances of the NAAQS, the availability of location-specific monitoring data, and other factors. The summary of monitoring data in Table 3-2 is provided for informational purposes. A single exceedance of a NAAQS does not necessarily result in a location being designated as nonattainment. The results in Table 3-2 should not be used as the basis for determining the attainment status of a location. The attainment designation of each location is as described earlier in Table 3-1. The monitoring data provided by the regulatory agencies and used for Table 3-1 are provided in Appendix D.

Table 3-2
National Ambient Air Quality Standards (NAAQS) and Local Monitoring Data

Pollutant	Averaging Time	NAAQS		Maximum Observed Concentrations by Monitoring Location (Monitoring Station) (values reported as ppm except PM-10 and lead ($\mu g/m^3$))								
		Primary	Secondary	Edwards AFB, Haystack Butte	Edwards AFB, Spaceport 2000 & South Base		China Lake	Silurian Lake	Dugway PG	Malmstrom AFB	Moses Lake
				(Barstow)	(Mojave)	(Lancaster)	(Trona)	(Barstow)	(Grantsville)	(Great Falls)	(Yakima)
SO_2	24 hour	0.14 ppm	None	nm	nm	nm	0.006	nm	nm	0.024	nm
	3 hour	None	0.5 ppm	nm	nm	nm	nm	nm	0.024	0.085	nm
	annual	0.03 ppm	None	nm	nm	nm	0.011	nm	nm	0.004	nm
NO_x	annual	0.053 ppm	0.053 ppm	0.12	0.12	0.14	0.05	0.12	nm	nm	nm
CO	8 hour	9 ppm	None	1.98	nm	nm	nm	1.98	nm	7.9	12.4
	1 hour	35 ppm	None	6.1	nm	nm	nm	6.1	nm	13.9	11.9
PM-10	24 hour	150 $\mu g/m^3$	150 $\mu g/m^3$	116	43	61	51	116	55	52	126
	annual	50 $\mu g/m^3$	50 $\mu g/m^3$	28.73	nm	nm	22.32	28.73	22.7	18	nm
Lead	quarterly	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	nm	nm	nm	nm	nm	nm	nm	nm
Ozone	1 hour	0.12 ppm	0.12 ppm	0.12	0.12	0.14	0.09	0.12	nm	nm	nm

Notes:

NAAQS are as listed in 40 CFR, Part 50
1995 monitoring data used with the exception Yakima (1996)
The Mojave and Lancaster monitoring stations are approximately the same distance from the Spaceport 2000 and South Base locations
nm = not monitored

3.2.2 Effect of Proposed NAAQS Revisions on Attainment Classifications

In November, 1996, EPA announced proposed revisions to the NAAQS for ozone and particulate matter. The proposed revisions are:

- Reduce ozone hourly standard from 0.12 parts per million (ppm) to an 8-hour average standard of 0.08 ppm
- Enact a new standard for particulate matter smaller than 2.5 microns diameter (PM-2.5). The proposed PM-2.5 NAAQS are 50 micrograms per cubic meter ($\mu g/m^3$) (24-hour standard) and 15 $\mu g/m^3$ (annual standard).

The proposed standards, if enacted, will result in some areas that are currently considered to be in attainment with NAAQS to be redesignated as nonattainment. EPA's proposed schedule shows that new nonattainment designations resulting from the revised NAAQS could occur as early as June 1999.

Potential changes in attainment status of X-33 program sites resulting from the new NAAQS were evaluated. Locations that are currently in attainment were assessed to determine if a change to nonattainment classification was anticipated, possibly requiring a conformity analysis (if the redesignation occurred prior to the X-33 program actions). Regulatory agencies were contacted and asked if redesignation to nonattainment was anticipated. No regulators contacted anticipated a change in classification to X-33 locations resulting from the proposed standards.

Locations that are currently classified as nonattainment were assessed to determine if the new NAAQS may cause these areas to be reclassified to more severe nonattainment status. The attainment status of the launch and landing site alternatives in Kern County (Spaceport 2000, South Base, and China Lake NWC) is not expected to change as a result of the proposed ozone and PM-2.5 standards. Regulators noted that the majority of the particulate matter in Kern County is large particle matter generated as a result of wind erosion, and would not be small enough to be considered PM-2.5. The Silurian Lake area does not expect to have any new ozone exceedances as a result of the new ozone standards.

Regulators contacted stressed that significant regulatory implementation issues need to be addressed prior to finalization of the new standards and redesignation of areas. The extent of the final revisions to the NAAQS, if any, will depend upon EPA review of comments on the proposed revisions, procedural requirements associated with formally promulgating the new standards, and collection and analysis of additional ambient air quality data.

Based on the discussions with regulatory personnel, no changes in attainment designation for the sites under consideration for the X-33 program are anticipated. The locations and pollutants included in the conformity analysis are, therefore, based on current attainment status classifications, as presented in Table 3-1.

3.3 Regional Significance Levels

Regional significance is defined as emissions exceeding ten percent of the total emission inventory for the air basin. The regionally significant levels for the nonattainment locations are summarized in Table 3-3. Only those locations and pollutants that are not classified as attainment are presented; the significance level is not applicable to attainment areas. All of the regionally significant levels greatly exceed the *de minimis* levels presented in Table 3-1. The *de minimis* thresholds will therefore be used for the conformity analysis.

Table 3-3
Air Basin Emission Inventories and Regionally Significant Levels

Location	Air Basin Total Inventory (tpy)			Regional Significance Levels (tpy)		
	Ozone Precursors		PM-10	Ozone Precursors		PM-10
	NOx	VOC[e]		NOx	VOC	
Edwards AFB: Haystack Butte[a]	54,750	22,265	65,700	5,475	2,226	6,570
Edwards AFB: Spaceport 2000[b]	11,315	9,125	n/a	1,131	912	n/a
Edwards AFB: South Base[c]	11,315	9,125	n/a	1,131	912	n/a
China Lake NWC[c]	11,315	9,125	17,520	1,131	912	1,752
Silurian Lake[d]	n/a	n/a	175,323	n/a	n/a	17,532

a Total San Bernandino County for 1995. tpy = (tons/day) X (365 days/year)
b Total Kern County in Southeast Desert Air Basin for 1994. tpy = (tons/day) X (365 days/year).
c South Base and China Lake are in the same air basin as Spaceport 2000, therefore the emission inventory is the same.
d Total Mojave Desert Emission Inventory for 1990 (tpy)
e Reactive organic compounds (ROG)

3.4 Summary of Applicable Regulatory Thresholds

As discussed in the previous sections, conformity analysis is required only for the three California locations that currently are not in attainment with the NAAQS. A summary of the applicable regulatory thresholds for the conformity analysis is presented in Table 3-4. A conformity determination will be required for the sites if the sum of direct and indirect emissions associated with the X-33 program exceed the levels presented.

Table 3-4
Summary of Applicable Regulatory Thresholds

Site	**Pollutants and Classification**				
	Ozone		**PM-10**		**Other Pollutants**
	Classification	**Conformity *de minimis* Level** (1) (NOx & VOCs)	**Classification**	**Conformity *de minimis* Level** (1)	**Classification**
Edwards AFB - Haystack Butte	severe non-attainment	25 tpy	moderate non-attainment	100 tpy	attainment
Edwards AFB - Spaceport 2000	serious non-attainment	50 tpy	attainment	n/a	attainment
Edwards AFB - South Base	serious non-attainment	50 tpy	attainment	n/a	attainment
China Lake NWC	serious non-attainment	50 tpy	moderate non-attainment	100 tpy	attainment
Silurian Lake	attainment	n/a	moderate non-attainment	100 tpy	attainment

(1): 40 CFR Part 51, Subpart W, §51.853(b)
tpy: tons per year
n/a: Not applicable; location is in attainment with NAAQS for that pollutant

4.0 Emission Calculations

4.1 Summary

Estimated emissions associated with each of the X-33 sites under consideration and located in nonattainment areas were calculated and summarized on an annual basis. An emissions summary for each location follows, along with a description of the sources included in the emissions estimate and the assumptions used. Only those pollutants for which a location is classified as nonattainment were estimated. A summary of emissions and associated regulatory thresholds is provided in Table 4-1.

4.2 Edwards AFB

This section identifies each type of emissions source and estimates the emissions from each source. It was assumed that the sources are identical for the three possible takeoff sites at Edwards AFB; Haystack Butte, South Base, and Space Port 2000. A summary of the estimated emissions and comparison with regulatory thresholds is presented in Table 4-2. Detailed calculations of emission estimates, including sources of information and emission factors, are provided in Appendix A.

Construction Emissions

Construction of a takeoff complex at Edwards AFB will result in PM-10 emissions. The emissions were estimated using AP-42, Section 13.2.3, Heavy Construction Operations. These emissions are calculated and assumptions outlined in Table A-1. The emissions due to Phase 1 construction (site preparation and earthwork) will take place in 1997. Phases 2 and 3 (concrete, steel, and equipment setting and all remaining work) will occur in 1998.

Table 4—1

Emission Summary

Site	Year	Estimated Emissions (tons/year) Ozone Precursors: Nitrogen Oxides (NOx)	Estimated Emissions (tons/year) Ozone Precursors: Volatile Organic Compounds (VOCs)	Particulate Matter (PM-10)
Edwards AFB - Haystack Butte	1997	8.11	0.96	44.7
Ozone: severe nonattainment	1998	10.7	6.46	56.7
PM-10: moderate nonattainment	1999	18.6	5.18	20.2
	De Minimis regulatory threshold	*25*	*25*	*100*
	Conformity Determination Required ? (1)	**NO**	**NO**	**NO**
Edwards AFB - Spaceport 2000 and South Base	1997	8.11	0.96	--
Ozone: serious nonattainment	1998	10.7	6.46	--
PM-10: attainment	1999	18.6	5.18	--
	De Minimis regulatory threshold	*50*	*50*	*N/A*
	Conformity Determination Required ? (1)	**NO**	**NO**	**NO**
China Lake NWS	1997	--	--	--
Ozone: serious nonattainment	1998	--	--	--
PM-10: moderate nonattainment	1999	4.57	1.26	3.42
	De Minimis regulatory threshold	*50*	*50*	*100*
	Conformity Determination Required ? (1)	**NO**	**NO**	**NO**
Silurian Lake	1997	--	--	--
Ozone: attainment	1998	--	--	--
PM-10: moderate nonattainment	1999	--	--	12.26
	De Minimis regulatory threshold	*N/A*	*N/A*	*100*
	Conformity Determination Required ? (1)	**NO**	**NO**	**NO**

N/A: Location is attainment; conformity regulations not applicable.

(1): Based on currently available information. Emission levels and associated conclusion as to whether a conformity determination is required based on exceedance of *de minimis* thresholds may be reevaluated if the source list, number of events, and operational specifications change, resulting in emission estimates different than those presented here.

Table 4—2

Source Specific Emissions (1997, 1998, and 1999)

Edwards AFB, CA

1997 Source Specific Emissions														
Pollutant	Construction			SCA Refueling	Ground Equipment	X-33 FRFs & Launches	X-33 Towing	Batch Concrete	On-Road Vehicles	Off-Road Diesel Vehicles		Total		
Nitrogen Oxides (NOx)	-	-	-	-	-	-	-	-	0.58	7.53	-	**8.11**	*25*	*50*
Particulate Matter (PM-10)	43.2	-	-	-	-	-	-	-	0.66	0.89	-	**44.7**	*100*	*100*
Volatile Organic Compounds (VOCs)	-	-	-	-	-	-	-	-	0.21	0.75	-	**0.96**	*25*	*50*

1998 Source Specific Emissions													De Minimis Regulatory Threshold (tpy)	
Pollutant	Construction	Generators	SCA (747) LTOs	SCA Refueling	Ground Equipment	X-33 FRFs & Launches	X-33 Towing	Batch Concrete	On-Road Vehicles	Off-Road Diesel Vehicles	Propane Vaporizers & Flares	Total	Haystack Butte	Spaceport 2000 & South Base
Nitrogen Oxides (NOx)	-	1.50	1.48	-	2.32	-	0.062	-	3.87	1.43	0.016	**10.7**	*25*	*50*
Particulate Matter (PM-10)	45.9	0.077	0.95	-	0.146	0.40	0.019	1.76	7.31	0.18	4.64E-04	**56.7**	*100*	*100*
Volatile Organic Compounds (VOCs)	-	0.083	0.058	0.0085	3.58	-	0.005	-	2.55	0.17	5.79E-04	**6.46**	*25*	*50*

1999 Source Specific Emissions													De Minimis Regulatory Threshold (tpy)	
Pollutant	Construction	Generators	SCA (747) LTOs	SCA Refueling	Ground Equipment	X-33 FRFs & Launches	X-33 Towing	Batch Concrete	On-Road Vehicles	Off-Road Diesel Vehicles	Propane Vaporizers & Flares	Total	Haystack Butte	Spaceport 2000 & South Base
Nitrogen Oxides (NOx)	-	4.51	0.99	-	6.16	- -	0.93	-	4.69	-	0.78	**18.1**	*25*	*50*
Particulate Matter (PM-10)	-	0.21	0.69	-	0.43	4.50	0.29	-	8.34	-	0.022	**14.5**	*100*	*100*
Volatile Organic Compounds (VOCs)	-	0.23	0.050	0.13	0.50	- -	0.075	-	3.72	-	0.028	**4.73**	*25*	*50*

Construction Generators

Diesel generators will be used in support of the construction activities at Edwards AFB. Two generators will be used during Phase 2 of the construction and 4 generators during Phase 3. A launch site generator and operational control center (OCC) generator will be used in support of the launch activities. Emissions are calculated and assumptions outlined in Table A-2. It is assumed that each construction generator will be used 480 hours during Phase 2 and 960 hours during Phase 3. The launch site and OCC generators will operate 19 hours in 1998 and 51 hours in 1999. The run time is based on 6 hours for commissioning, 4 hours per FRF or launch and 0.5 hour per month for testing.

Shuttle Carrier Aircraft (SCA) LTOs

Emissions from the landings and takeoffs (LTOs) of the SCA (Boeing 747) that will shuttle the X-33 aircraft were calculated using emission factors from EPA-450/4-81-026d, "Procedures for Emission Inventory Preparation". One LTO of the SCA is planned in 1998 and 15 LTOs are planned in 1999. Three taxi-tests and three captive carry exercises are also planned for 1998. During a taxi test the X-33 is attached to the SCA and the SCA taxis on the launch pad for approximately one hour. The captive carry is a LTO with the X-33 attached to the SCA and an increased flying time. The emission calculations and assumptions are shown in Table A-3.

X-33 FRFs and Launches

Emissions directly associated with the X-33 launch result from erosion of the ablative coating on the flame trench. This erosion is assumed to result in PM-10 emissions. Flight readiness firings (FRFs), tests where the X-33 will be fired up but not launched, will occur in 1998 and are expected to result in emissions similar to a launch. The emission calculations and assumptions are shown in Table A-4.

SCA Refueling

The SCA will require periodic refueling, resulting in VOC emissions. The volume of fuel transferred during refueling operations was assumed equal to the total SCA fuel capacity for each LTO. The emission calculations and assumptions are shown in Table A-5.

Ground Equipment

The ground equipment associated with X-33 launch site construction was assumed to be gasoline-fueled internal combustion engine equipment. Emissions were calculated using emission factors from AP-42, Section 3.3. The emission calculations and assumptions are shown in Table A-6.

X-33 Towing

Emissions resulting from the towing of the X-33 vehicle to the launch site were determined using AP-42 emission factors for travel on paved roads. The emissions are based on one tow in 1998 and 14 tows in 1999.

Emissions from the tow vehicle exhaust are estimated using emission factors for criteria pollutants, from AP-42, Section 3.3, Gasoline and Diesel Industrial Engines. The emissions are based on one tow in 1998 and 15 tows in 1999. The emission calculations and assumptions from towing operations are shown in Table A-7.

Batch Concrete Plant

One temporary batch concrete plant will be used during construction at Edwards AFB. Emission factors from AP-42 section 11.12, concrete batching, were used to calculate the particulate emissions. Emissions factors due to total process emissions, wind erosion, and vehicle traffic from AP-42 table 11.12-1 were used to calculated the emissions from the batch cement plant outlined in Table A-8. The emissions due to the batch cement plant are assumed to take place during Phase 2 of construction (1998).

Construction, Government, Personal Vehicles - Exhaust and Paved Road Emissions

Additional personnel will travel to the launch site as a result of the construction activities, additional operations requirements, and launch events. The operations and construction personnel are assumed to travel to the launch site 5 days per week. There will also be observers traveling to the launch site during the 16 launch events. Indirect emissions from spectators traveling to the 1 launch event in 1998 and the 15 launch events in 1999 are included. Emissions from vehicle exhaust are estimated and assumptions outlined in Table A-9. PM emission from vehicle travel on paved roads and assumptions are outlined in Table A-10.

Off-Road Diesel Vehicles

Emissions from the off-road vehicles required for the construction operations at Edwards AFB are outlined in Table A-11. It is assumed that these vehicles will be operated during the construction operations in 1997 and 1998.

Propane Flares

Emissions from propane flares used to burn unconsumed hydrogen at Edwards AFB are outlined in Table A-12. The quantity of propane consumed is based on the quantity used at a similar facility at the Marshall Space Flight Center.

Nitrogen Gas Vaporizer

Emissions from the propane fired nitrogen vaporizer are outline in Table A-13. The rated heat input of the units is an engineer's estimate and the run time has also been estimated.

4.3 China Lake NWC

This section identifies each type of emissions source and estimates the emissions from each source. There are plans for 2 landings of the X-33 at China Lake NWC, both to occur in 1999. A summary of the estimated emissions and comparison with regulatory thresholds is presented in Table 4-3. Detailed calculations of emission estimates, including sources of information and emission factors, are provided in Appendix B.

Diesel Generator Emissions

Two diesel powered generators are needed to provide power to support ground crew and field tracking equipment at China Lake. The generators will only operate during the two planned landing events. Emission factors from AP-42, Section 3.3, Table 3.3-1 were used to estimate emissions from the generators. Emission estimates and assumptions from the generators are shown in Table B-1.

Ground Equipment

The ground equipment associated with X-33 landings includes different pieces of diesel and gasoline fueled equipment. Emissions were calculated using emission factors from AP-42, Section 3.3. Emission estimates and assumptions from the ground equipment are shown in Table B-2.

Aircraft Refueling

The SCA and the C-130 transport aircraft will require periodic refueling, resulting in VOC emissions. The volume of fuel transferred during refueling operations was assumed equal to the total SCA or C-130 fuel capacity for each LTO. The emission calculations and assumptions are shown in Table B-3.

Table 4—3

Source Specific Emissions (1999)
China Lake NWC, CA

1999 Source Specific Emissions										
	Emission (tpy)									
Pollutant			Aircraft Refueling	X-33 Landings	Aircraft LTOs		On-Road Vehicles		Total	
Nitrogen Oxides (NOx)	0.32	2.85	–	–	0.14	0.19	1.07	–	4.57	*50*
Particulate Matter (PM-10)	0.023	0.20	–	0.004	0.093	0.024	0.22	2.86	3.42	*100*
Volatile Organic Compounds (VOCs)	0.026	0.24	0.018	–	0.028	0.023	0.93	–	1.26	*100*

X-33 Landing

Particulate emissions from the landing of the X-33 at China Lake NWC were estimated using AP-42 Section 13.2.1, emissions from paved roads. These emissions calculations and assumptions are summarized in Table B-4.

Aircraft LTOs

Sources of aircraft emissions include a SCA Boeing 747 and a C-130 cargo plane. Emissions from the landings and takeoffs of the Boeing 747 that will shuttle the X-33 aircraft were calculated using emission factors from EPA-450/4-81-026d, "Procedures for Emission Inventory Preparation". Two LTOs of the SCA are planned 1999. These calculations are shown in Table B-4.

Emissions from the landings and takeoffs of the C-130 which will be used to transport ground equipment were calculated using emission factors from "Calculation Methods for Criteria Air Pollutant Emission Inventory", Armstrong Laboratory, July, 1994. Two LTOs of the C-130 are assumed for 1999. These calculations are also shown in Table B-4.

Off-road Vehicle Emissions

Emissions from the off-road vehicles required for the landing operations at China Lake NWC are outlined in Table B-6. It is assumed that these vehicles will be operated during the landing operations in 1999.

On-road Vehicle Emissions

Additional ground personnel will be traveling to the landing site due to the additional operations support requirements. Spectators are expected as well. A tractor trailer may be used to transport ground equipment to the landing site. The ground personnel, spectators and the tractor trailer used for transport are assumed to be traveling to the landing site for each of the two landing events in 1999. Emissions from vehicle exhaust are estimated and assumptions outlined in Table B-7. PM emission from vehicle travel on paved roads and assumptions are outlined in Table B-8.

4.4 Silurian Lake

This section identifies each type of emissions source and estimates the emissions from each source. There are 2 landings of the X-33 planned at Silurian Lake in 1999. A summary of the estimated emissions and comparison with regulatory thresholds is presented in Table 4-4. Detailed calculations of emission estimates, including sources of information and emission factors, are provided in Appendix C

Construction

A staging area sized at approximately 5,000 square feet is the only construction planned for this landing site. Particulate emission generated from clearing of the staging area are estimated in Table C-1.

Diesel Generators

Four diesel powered generators are needed to provide power to support ground crew and field tracking equipment at Silurian Lake. The generators will only operate during the two planned landing events. Emission factors from AP-42, Section 3.3, Table 3.3-1 were used to estimate emissions from the generators. Emission estimates and assumptions from the generators are shown in Table C-2.

Ground Equipment

The ground equipment associated with X-33 landings includes different pieces of diesel and gasoline fueled equipment. Emissions were calculated using emission factors from AP-42, Section 3.3. Emission estimates and assumptions from the ground equipment are shown in Table C-3.

Table 4—4

Source Specific Emissions (1998 and 1999)

Silurian Lake, CA

1998 Source Specific Emissions											
	Emissions (tpy)										
Pollutant	Construction	Diesel Generators	Ground Equipment	X-33 Landings	Aircraft LTOs	Off-Road Vehicles	On-Road Vehicles	Vehicles on Paved Roads	Helicopter LTOs	Total	De Minimis Regulatory Threshold (tpy)
Particulate Matter (PM-10)	0.066	–	–	–	–	0.10	0.016	0.11	–	0.30	*100*
1999 Source Specific Emissions											
	Emissions (tpy)										
Pollutant	Construction	Diesel Generators	Ground Equipment	X-33 Landings	Aircraft LTOs	Off-Road Vehicles	On-Road Vehicles	Vehicles on Paved Roads	Helicopter LTOs	Total	De Minimis Regulatory Threshold (tpy)
Particulate Matter (PM-10)	–	0.021	0.20	0.14	0.093	0.027	0.068	0.004	12.3	12.8	*100*

X-33 Landing

The landing site at Silurian Lake is a dry lake bed. Particulate emissions from the landing of the X-33 at Silurian Lake were estimated using AP-42 Section 13.2.2.2, emissions from unpaved roads. Emissions from the landing of the X-33 at Silurian Lake and assumptions are outlined in Table C-4.

Aircraft Emissions

Operations and sources of aircraft emissions at Silurian Lake are identical to those at China Lake NWC. Calculations of aircraft emissions at Silurian Lake and assumptions are shown in Table C-5.

Off-road Vehicle Emissions

Emissions from the off-road vehicles required for the landing operations and the construction operations at Silurian Lake are outlined in Table C-6. It is assumed that the construction vehicles will be operated in 1998 during site preparation activities. The off-road vehicles associated with the landing operations will be operated in 1999.

On-road Vehicle Emissions

Additional ground personnel will travel to the landing site due to the additional operations support requirements and construction activities. Spectators are not expected at Silurian Lake. A tractor trailer may be used to transport ground equipment to the landing site. Construction personnel will travel to the landing site for one month in 1998. The ground personnel and the tractor trailer used for transport are assumed to be traveling to the landing site for each of the two landing events in 1999. Emissions from vehicle exhaust are estimated and assumptions outlined in Table C-7. PM emission from vehicle travel on paved roads and assumptions are outlined in Table C-8.

Helicopter Emissions

Particulate emissions from helicopter landings and takeoffs were calculated using emissions factors from AP-42 Section 13.2.2, Unpaved Roads, Table 13.2.2. Calculations of helicopter emissions at Silurian Lake and assumptions are shown in Table C-9.

Appendix A

Edwards AFB Emission Calculations

Table A–1

Emission Calculations for Facility and Road Construction

Edwards AFB, CA

1.0 PM Emission Estimate Methodology

Calculation methodology from AP-42, Section 13.2.3 - Heavy Construction Operations, 1/95.

Emission Factor = E = 1.2 ton of total suspended particulate (TSP)/acre/month of activity

2.0 Assumptions

Construction emissions are based on Haystack Butte location and assumed to be similar for South Base and Spaceport 2000.

Construction is planned in three phases:

Phase 1 - Site Prep and Earthwork (3 months)	Oct. 1997 - Dec. 1997
Phase 2 - Concrete/Steel/Equipment Setting (3 months)	Jan 1998 - Mar 1998
Phase 3 - All Remaining Work (6 months)	Apr 1998 - Sept 1998

- 24 acres will be initially disturbed, this includes the access road to the site from Mars Blvd and the launch site itself north of Haystack Butte.

- Phases 2 and 3 will only disturb the the launch site itself after Phase 1 is complete, equivalent to 17 acres

- control efficiencies for measures such as water sprays are assumed to be 50% for Phase 1 and 75% for Phases 2 & 3

	Equivalent Const. Activity	Area Disturbed	Control Efficiency
Phase 1 =	3 months	24 acres	50 %
Phase 2 =	3 months	17 acres	75 %
Phase 3 =	6 months	17 acres	75 %

3.0 Calculations

Phase 1 - 1997

E = 1.2 ton/acre/month of activity * 24 acres * 3 months

= 86.4 tons

43.2 tons with 50% control efficiency

Phase 2 - 1998

E = 1.2 ton/acre/month of activity * 17 acres * 3 months

= 61.2 tons

15.3 tons with 75% control efficiency

Phase 3 - 1998

E = 1.2 ton/acre/month of activity * 17 acres * 6 months

= 122 tons

30.6 tons with 75% control efficiency

4.0 Summary

	Uncontrolled Emissions (tpy)	Control Efficiency (%)	Controlled Emissions (tpy)
Phase 1 (1997)	86.4	50	43.2
TOTAL 1997			**43.2**
Phase 2 (1998)	61.2	75	15.3
Phase 3 (1998)	122	75	30.6
TOTAL 1998			**45.9**

Table A–2

Emission Calculations for Facility and Road Construction

Edwards AFB, CA

1.0 Data Required to Calculate Emissions for Generators (<600 hp)

Note: Generators used during construction, assumed diesel generators.

Assume operation 8 hrs/day for 3 months of Phase 2 construction.

Assume operation 8 hrs/day for 6 months of Phase 3 construction.

Construction generator size on memo dated 1/29/97 from Fred Yoder (memo #090473-V037)

3 FRF and 1 launch in 1998 and 15 launches in 1999.

Location of Unit	Generator Rating (hp)	Generator Rating (kw)	Run Time [1] (hr/yr)	Annual Power Output (hp-hr/yr)	Annual Power Output (kw-hr/yr)
Generators					
1998					
Phase 2	50	37.3	480	24,000	17,901
Phase 2	50	37.3	480	24,000	17,901
OCC generator	67	50	47	3,158	2,355
1998 Total:	**167**	**125**		**51,158**	**38,157**
1999					
Phase 3	50	37.3	960	48,000	35,802
Phase 3	50	37.3	960	48,000	35,802
Phase 3	10	7.46	960	9,600	7,160
Phase 3	10	7.46	960	9,600	7,160
OCC Generator	67	50	170	11,425	8,520
1999 Total:	**187**	**140**		**126,625**	**94,445**

(1) Run Time for OCC Generator based on 2 hours for commissioning in 1998, 10 hours per launch or FRF, and 1.7 hours per month for testing. (Lockheed Martin)

Assumed 3 months operation in 1998 and 12 months in 1999.

2.0 Emission Factors for Criteria Pollutants, from AP-42, Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1

Constituent	Emission Factor (lb/hp-hr)	Emission Factor (g/kw-hr)
NOx	0.031	18.8
PM-10	0.002	1.34
VOC	2.51E-03	1.53

3.0 Calculation of Criteria Pollutant Emissions

Constituent	1998 Annual Actual (lb/yr)	1999 Annual Actual (lb/yr)
NOx	1,586	3,925
Particulate	112	278
PM-10	113	279
VOC	129	318

Emission Factor (lb/hp-hr) x Annual Power Output (hp-hr/yr) = Emissions (lb/yr)

Table A–2

Emission Calculations for Facility and Road Construction

Edwards AFB, CA

3.0 Data Required to Calculate Emissions for Generators (>600 hp)

Note:

Construction generator size from phone conversation with Fred Yoder (4/22/97)

Location of Unit	Generator Rating (hp)	Generator Rating (kw)	Run Time (1) (hr/yr)	Annual Power Output (hp-hr/yr)
Generators				
1998				
Launch site	1,341	1000	44	59,138
1998 Total:	**1341**	**1000**		**59,138**
1999				
Launch site	1,341	1000	158	212,414
1999 Total:	**1,341**	**1,000**		**212,414**

(1) Run Time for Generator based on 2 hours for commissioning in 1998, 10 hours per launch or FRF, and 0.7 hours per month for testing. (Lockheed Martin)

Assumed 3 months operation in 1998 and 12 months in 1999.

4.0 Emission Factors for Criteria Pollutants, from AP-42, Section 3.4, Large Stationary Diesel and All Stationary Dual-fuel Engines (10/96) Table 3.4-1

Constituent	Emission Factor (lb/hp-hr)
NOx	0.024
PM-10	0.0007
VOC	6.42E-04

5.0 Calculation of Criteria Pollutant Emissions

Constituent	1998 Annual Total (lb/yr)	1998 Annual Total (Tons)	1999 Annual Total (lb/yr)	1999 Annual Total (Tons)
NOx	3,005	1.50	9,023	4.51
PM-10	154	0.077	427	0.21
VOC	167	0.083	455	0.23

Emission Factor (lb/hp-hr) x Annual Power Output (hp-hr/yr) = Emissions (lb/yr)

Table A–3

Emission Calculations for X–33 Shuttle Carrier Aircraft (SCA) Landings and Take Offs

Edwards AFB, CA

Emission Factors, Fuel Flows, Time In Mode (TIM), and Engine Type obtained from "Procedures for Emission Inventory Preparation", Volume IV:Mobile Sources, Section 5, EPA-450/4-81-026d

Note : Emission Factors in reference are for JP-4 fuel; the factors in this table have been modified for JP-8 fuel according to the report referenced above by the following :

NOx - no change
VOC - increased by 10%
PM - increased by 25%

Note: 1 LTO in 1998
15 LTOs in 1999

Aircraft Type	Engine Type	Number of Engines	LTO Cycles	Mode	Fuel Flow (lb/min)	TIM (mins)	Emission Factor (lb/1000lb/engine) VOC[1]	NOx	PM[2]	Estimated Emissions VOC	NOx	PM-10[3]
1998												
Boeing B-747-200	JT9D-7R4G2	4	1	Taxi Out	29.6	19.0	1.87	3.80	6.5	4.21	8.55	14.6
				Take Off	321	0.70	0.18	41.3	10.0	0.16	37.2	9.00
				Climb Out	249	2.20	0.17	32.1	17.5	0.37	70.2	38.3
				Approach	87.2	4.00	0.22	8.80	17.5	0.31	12.3	24.4
				Taxi In	29.6	7.00	1.87	3.80	6.50	1.55	3.15	5.39
Boeing B-747-200 Taxi-tests[4]	JT9D-7R4G2	4	5	Taxi Out	29.6	30.0	1.87	3.80	6.50	33.2	67.5	115.5
				Taxi In	29.6	30.0	1.87	3.80	6.50	33.2	67.5	115.5
Boeing B-747-200 Captive Carry[5]	JT9D-7R4G2	4	5	Taxi Out	29.6	19.0	1.87	3.80	6.5	21.05	42.77	73.2
				Take Off	321	0.70	0.18	41.3	10.0	0.81	185.8	44.98
				Climb Out	249	15.0	0.17	32.1	17.5	12.68	2,394.8	1,305.6
				Approach	87.2	4.00	0.22	8.80	17.5	1.53	61.4	121.9
				Taxi In	29.6	7.00	1.87	3.80	6.50	7.75	15.76	26.95
									1998 TOTAL EMISSIONS (lb)	116.9	2,967	1,895
									(ton)	0.058	1.48	0.95
1999												
Boeing B-747-200	JT9D-7R4G2	4	15	Taxi Out	29.6	19.0	1.87	3.80	6.50	63.1	128	219
				Take Off	321.3	0.70	0.18	41.3	10.0	2.43	557	135
				Climb Out	248.7	2.20	0.17	32.1	17.5	5.58	1,054	574
				Approach	87.2	4.00	0.22	8.80	17.5	4.60	184	366
				Taxi In	29.6	7.00	1.87	3.80	6.50	23.3	47.3	80.9
									1999 TOTAL EMISSIONS	99.02	1,971	1,375
									(ton)	0.050	0.99	0.69

1 VOC=HC*1.0947, Section 5 6.1
2 PM factors are for engine TF33-P-3/5/7 P&W, Table 5-7 due to lack of available data. The TF33-P-3-3/5/7 is 747 with Pratt and Whitney engine as opposed to a Boeing engine.
3 Assumed all PM = PM-10
4 Taxi-test is when the X-33 is attached to the SCA and will taxi on launch pad for 1 hour.
5 Captive Carry is a LTO with the X-33 on the SCA, includes longer fling time, increased climbout to 15 minutes from 2.2 minutes

Table A–4

Emission Calculations from X-33 FRFs and Launches

Edwards AFB, CA

The X-33 aircraft is fueled by hydrogen and oxygen; water is the product of combustion.

Emission directly associated with the vehicle launch are limited to erosion of the ablative coating on the flame trench. The erosion is assumed to result in particulate matter emissions.

Data on quantity of loss of ablative matter are per launch: from Conference call with NASA

Emission factor:	200 lbs of ablative material per launch

Assume all material lost is PM-10.

1998 Flight Readiness Firings (FRFs) Emissions

3 FRF in 1998	600 lbs PM-10
	0.30 tons PM-10

Flight Readiness Firings (FRF) assumed to have emissions equal to launch.

1998 Launch Emissions

1 Launch in 1998	200 lbs PM-10
	0.10 tons PM-10

1999 Launch Emissions

15 Launches in 1999	9000 lbs PM-10
	4.50 tons PM-10

Table A–5
Emission Calculations forSCA Refueling
Edwards AFB, CA

1.0 Calculation of Emissions from Fuel Transfer Operations

1998

Transfer Activity	Qty of Fuel Transferred [1] (1000 gal/yr)	No. of Refuelings	Saturation Factor (s) [2]	Liquid Vapor Pressure (P) [3] (psia)	Vapor Molecular Weight(M) [3] (lb/lb-mole)	Liquid Temperature (T) (° R)	Actual Annual VOC Emission [4] (lb/yr)
JP-8							
Refueler truck fill	57.3	1.0	1.45	0.033	130	520	8.54
SCA Refueling	57.3	1.0	1.45	0.033	130	520	8.54
TOTAL 1998 VOC Emissions (lb)							17.1
TOTAL 1998 VOC EMISSIONS (tons)							0.009

Note: Assume 1 refueling of the SCA in 1998. (one refueling event for each LTO)

1999

Transfer Activity	Actual Qty of Fuel Transferred [1] (1000 gal/yr)	No. of Refuelings	Saturation Factor (s) [2]	Liquid Vapor Pressure (P) [3] (psia)	Vapor Molecular Weight(M) [3] (lb/lb-mole)	Liquid Temperature (° R)	Actual Annual VOC Emission [4] (lb/yr)
JP-8							
Refueler truck fill	859	15	1.45	0.033	130	520	128
SCA Refueling	859	15	1.45	0.033	130	520	128
TOTAL 1999 VOC EMISSIONS (lb)							256
TOTAL 1999 VOC EMISSIONS (tons)							0.13

Note: Assume 15 refuelings of SCA in 1999. (one refueling event for each LTO)

Notes:

(1) Based on total fuel capacity of 57,285,000 gallons per SCA, per Boeing specification.

(3) Source: AP-42, Section 5.2, Transportation and Marketing of Petroleum Liquids, Table 5.2-1.

(4) Source: "Calculation Methods For Criteria Air pollutant Emission Inventories", Appendix B, Armstrong Laboratories (AL), Report No. AL/OE-TR-1994-0049.

(6) Actual VOC Emissions = (Actual Quantity of Fuel transferred (1000 gal/yr))*(12.46*Saturation Factor*Vapor Press*Mol. wt/Temp.).

Source: AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, Equation (1).

Table A–6

Emission Calculations forX-33 Launch Site Construction Related Ground Equipment

Edwards AFB, CA

Assumptions:

- Equipment is internal combustion engine
- Typical fuel use of 4 gal/hr for all equipment
- Gasoline fuel value is 130,000 Btu/gal
- Diesel fuel value is 137,400 Btu/gal
- 50 hours of operation per launch event assumed for diesel equipment (1 event in 1998 and 15 events in 1999)
- Light-Alls operate 8 hours each per launch
- The 28 VDC generator will operate 1 hour per launch

1998 Ground Equipment Emissions -- Gasoline							
		Run Time per	Total	Total	Emission Factors[1] (lb/mmBTU)		
					PM-10	NOx	VOC
Equipment	No.	Equipment (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	0.10	1.63	3.03
					Emissions (lbs/yr)		
Gas Welder (Phase 2)	2	250	2,000	260	26.0	424	788
Gas Welder (Phase 3)	8	500	16,000	2080	208	3,390	6,302
Total	10		18,000		234	3,814	7,090

1998 Ground Equipment Emissions -- Diesel							
		Total			Emission Factors[1] (lb/mmBTU)		
		Run			PM-10	NOx	VOC
Equipment	No.	Time (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	0.31	4.41	0.36
28 VDC Power Supply	1	1	4	1	0.17	2	0.2
270 VDC Power Supply	1	50	200	27	8.52	121	9.9
Light-All	6	288	1,152	158	49.1	698	57.0
Total	8		1,356		58	822	67

1998 Annual Totals	PM-10	NOx	VOC
(lb/yr)	292	4,636	7,157
(tpy)	0.15	2.32	3.58

1999 Ground Equipment Emissions -- Diesel							
		Total			Emission Factors[1] (lb/mmBTU)		
		Run			PM-10	NOx	VOC
Equipment	No.	Time (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	0.31	4.41	0.36
28 VDC Power Supply	1	15	60	8	3	36	3
270 VDC Power Supply	1	750	3,000	412	128	1,818	148
Light-All	6	4320	17,280	2,374	736	10,471	855
Total	8		20,340		866	12,325	1,006

1999 Annual Totals	PM-10	NOx	VOC
(lb/yr)	866	12,325	1,006
(tpy)	0.43	6.16	0.50

[1] Emission Factors from AP-42, Section 3.3, Table 3.3-1 (10/96)

Note: This equipment not used in 1997.

Calculation of Actual Annual Emissions

Fuel Used (gal/yr) x (130,000 BTU/gal) x (1 mmBTU/1,000,000 BTU) x Emission Factor (lb/mmBTU) = Actual Emissions (lb/yr)

Table A–7

Emission Calculations forX-33Towing

Edwards AFB, CA

1.0 Calculations for Haystack Butte Launch Site (15 towings, 1 in 1998, 14 in 1999)

Methodology: AP-42 Section 13.2.1, Paved Roads

Paved roadway 36.5 miles between launch site and Dreyden Flight Research Center

E = k*(sL/2)^0.65*(W/3)^1.5 (AP-42 Section 13.2.1, Equation (1))

E=	Emissions	lb/Vehicle Mile Travelled (VMT)
k =	0.016	lb/VMT, particle size multiplier for PM-10, AP-42 Section 13.2.1.2
sL =	2.50	g/m^2, 50th percentile nonindustrial silt loading for low average daily traveled (ADT) roads AP-42, Table 13.2-1-2.
W =	37.5	tons, vehicle landing weight (32.5 tons) + tow vehicle weight (5 tons)

E = 0.82 lb/VMT

Distance travelled = 36.5 VMT

2.0 Emissions per tow=

= 29.8 lb PM-10/tow

1998 Emissions= 0.015 ton PM-10

Note: 1 towing in 1998.

1999 PM Emissions for 15 towings

= 448 lb PM-10

1999 Emissions= 0.21 ton PM-10

3.0 Data Required to Calculate Exhaust Emissions for Tow Vehicle

Note: Tow Vehicle used to move X-33, assumed diesel engine.

Assume 10 hours of operation per tow (from Fred Yoder 4/22/97 phone conversation)

Tow vehicle engine is 400 hp (from Fred Yoder 4/22/97 phone conversation)

Location of Unit	Generator Rating (hp)	Run Time (hr/yr)	Annual Power Output (hp-hr/yr)
Generators			
1998			
1 Tow	400	10	4,000
1998 Total:	**400**		**4,000**
1999 15 Tows	400	150	60,000
1999 Total:	**400**		**60,000**

Table A–7
Emission Calculations forX-33Towing
Edwards AFB, CA

4.0 Emission Factors for Criteria Pollutants, from AP-42, Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1

Constituent	Emission Factor (lb/hp-hr)
NOx	0.031
PM-10	0.002
VOC	2.51E-03

5.0 Calculation of Criteria Pollutant Emissions

Constituent	**1998 Annual Actual (lb/yr)**	**1999 Annual Actual (lb/yr)**
NOx	124	1,860
PM-10	8.80	132
VOC	10.1	151

Emission Factor (lb/hp-hr) x Annual Power Output (hp-hr/yr) = Emissions (lb/yr)

6.0 Total Criteria Pollutant Emissions (Tow Vehicle exhaust and PM-10 emissions)

Constituent	**1998 Annual Actual (lb/yr)**	**1998 Annual Actual (Tons)**	**1999 Annual Actual (lb/yr)**	**1999 Annual Actual (Tons)**
NOx	124	0.062	1,860	0.93
PM-10	38.6	0.019	580	0.29
VOC	10.1	0.005	151	0.075

Table A–8

Emission Calculations for Batch Concrete Plant

Edwards AFB, CA

1.0 Methodology

Emission Estimate based on AP-42, Section 11.12, Concrete Batching, (1/95), Table 11.12-2

2.0 Assumptions

Note: Concrete used in Phase 2 of the construction (1998).

Estimated Concrete Required

Note: all areas calculated using CADD figure supplied by Lockheed.

Estimated area to be covered with concrete.

Shelter Ramp	64,800 ft^2	
Liquid O_2 Pad	6,600 ft^2	
Gas N_2/Helium tank storage	9,800 ft^2	
Utility Bldg Skid	1,200 ft^2	
Liquid H_2 Storage	8,000 ft^2	
Utility Skid	2,000 ft^2	
Utility Skid	600 ft^2	
Sound Suppresion water	500 ft^2	
Westt side of Apron	21,500 ft^2	
East side of Apron	14,500 ft^2	
TOTAL	129,500 ft^2	Assume 0.5 ft deep.
TOTAL Volume Concrete	64,750 ft^3	
	2,398 yd^3	
Trench	135000 ft^3	
	5000 yd^3	
Support for Strong Back	90000 ft^3	
	3,333 yd^3	

TOTAL VOLUME	10,731	yd^3	**Rounded to**	11,000	yd^3

3.0 Emissions Estimate

	Emission Factor (lb/yd^3)	Material Mixed (yd^3)	Uncontrolled PM Emissions
Total Process Emissions (Truck Mix)[1]	0.20	11,000	2,200
Wind Erosion (from sand & aggregate production)	0.10	11,000	1,100
Vehicle Traffic (unpaved roads)	0.02	11,000	220
		Total =	**3,520 lbs**
		1998 TOTAL (TPY) =	**1.76 tons**

(1) Based on pneumatic conveying of cement at a truck mix facility;
does not include vehicle traffic or wind erosion from storage piles

Table A–9

Emission Calculations fo rGovernment and Personal Vehicles—Emissions from Exhaust

Edwards AFB, CA

1.0 Methodology

Vehicle type is to be defined as one of the following:

LDGV - light duty gasoline-fueled vehicle

LDGT - light duty gasoline-fueled trucks

LDDT - light duty diesel-fueled trucks

HDDT - heavy duty diesel-fueled trucks

Fuel Combustion Emission Factors from:

For the Government Vehicles: "Calculation Methods for Criteria Air Pollutant Emission Inventories", Section H, Report Number: AL/OE-TR-1994.

For the POVs : 1997 and 1998 EMFAC7EP Emission Factors for South Coast Air Quality Management District, Table A9-5-J-4

2.0 Construction Related Emissions

Vehicle Type	Number of Vehicles	Mileage [1]	Emission Factors[2] (g/mile)			Emission (lb/yr)		
			VOC	NO_x	PM	VOC	NO_x	PM
CONSTRUCTION								
Phase 1 - Site Prep and Earthwork (daily for 3 months 1997)								
Government Vehicles								
LDGV	0	0	1.12	1.22	0.022	0.0	0.0	0.00
LDGT (70 mile r.t.)	4	25,200	1.63	1.63	0.022	92.4	92.4	1.25
LDDT	0	0	0.60	1.21	0.26	0.0	0.0	0.00
HDDT (70 mile r.t.)	6	37,800	2.16	10.8	1.65	183.7	918.5	140.5
Personal Vehicles (POVs)								
POVs (70 mile r.t.)	18	113,400	0.57	0.58	0.105	145	148	26.8
					Phase 1 Total (lb)	422	1,159	168.5
1997 (Phase 1) TOTAL CONSTRUCTION EMISSION (TPY)						**0.21**	**0.58**	**0.084**
Phase 2 - Concrete/Steel/Equipment Setting (daily for 3 months 1998)								
Government Vehicles								
LDGV	0	0	1.12	1.22	0.022	0.0	0.0	0.00
LDGT (70 mile r.t.)	6	37,800	1.63	1.63	0.022	139	139	1.87
LDDT	0	0	0.60	1.21	0.26	0.0	0.0	0.00
HDDT (70 mile r.t.)	9	56,700	2.16	10.8	1.65	275.6	1,378	210.8
Personal Vehicles (POVs)								
POVs (70 mile r.t.)	25	157,500	0.57	0.58	0.105	202	206	37.2
					Phase 2 Total (lb)	616	1,722	250
					(ton)	0.31	0.86	0.125
Phase 3 - All Remaining Work (daily for 6 months 1998)								
Government Vehicles								
LDGV	0	0	1.12	1.22	0.022	0.0	0.0	0.00
LDGT (70 mile r.t.)	10	126,000	1.63	1.63	0.022	462	462	6.24
LDDT	0	0	0.60	1.21	0.26	0.0	0.0	0.00
HDDT (70 mile r.t.)	6	75,600	2.16	10.8	1.65	367.4	1,837	281.0
Personal Vehicles (POVs)								
POVs (70 mile r.t.)	35	441,000	0.57	0.58	0.105	566	576	104.2
					Phase 3 Total (lb)	1,395	2,875	391
					(ton)	0.70	1.44	0.196
1998 (Phase 2 &3) TOTAL CONSTRUCTION EMISSIONS (TPY)						**1.01**	**2.30**	**0.32**

Note: Distance travelled (70 mi RT) from spreadsheets received from Lockheed-Martin

Phases 1 and 2 are 3 months (90 days). Phase III is 6 months (180 days).

Table A–9
Emission Calculations forGovernment and Personal Vehicles—Emissions from Exhaust
Edwards AFB, CA

3.0 Operations Related Emissions

Vehicle Type	Number of Vehicles	Mileage [1]	Emission Factors[2] (g/mile) VOC	NOx	PM	Emission (lb/yr) VOC	NOx	PM
OPERATIONS (1999)								
Daily (5 days/wk for 1999 total of 260 days)								
Government Vehicles								
LDGV	0	0	1.12	1.22	0.022	0.0	0.0	0.00
LDGT (70 mile r.t.)	2	36,400	1.63	1.63	0.022	133	133	1.80
LDDT	0	0	0.60	1.21	0.26	0.0	0.0	0.00
HDDT (70 mile r.t.)	2	36,400	2.16	10.8	1.65	176.9	885	135.3
Personal Vehicles (POVs)								
POVs (70 mile r.t.) (1)	250	4,550,000	0.44	0.51	0.105	4505	5221	1074.9
					Ops Total (lb/yr)	4,815	6,239	1,212
		1999 TOTAL OPERATIONAL EMISSIONS (TPY)				2.41	3.12	0.61

(1) Anticipate 200 operations personnel will be used, conservative estimate of 250 personnel assumed.

4.0 Launch Related Emissions

Vehicle Type	Number of Vehicles	Mileage [1]	Emission Factors[2] (g/mile) VOC	NOx	PM	Emission (lb/yr) VOC	NOx	PM
Launch Event								
Government Vehicles								
LDGV (70 mile r.t.)	4	280	2.05	1.84	0.022	1.3	1.2	0.01
LDGT (70 mile r.t.)	2	140	2.85	2.33	0.022	1	1	0.01
LDDT	0	0	0.80	1.78	0.26	0.0	0.0	0.00
HDDT (70 mile r.t.)	3	210	2.80	19.7	1.65	1.3	9	0.8
Personal Vehicles (POVs) [3]								
1998 FRF POVs (140 mile r.t.)	500	70,000	0.57	0.58	0.105	90	91	16.5
1998 Launch POVs (140 mile r.t.)	16,667	2,333,333	0.57	0.58	0.105	2993	3045	551
1999 POVs (140 mile r.t.)	1,667	233,380	0.44	0.51	0.105	231	268	55.1
					1998 Ops Total (lb)	3,086	3,148	569
		1998 TOTAL LAUNCH EVENT			(ton)	1.54	1.57	0.28
					1999 Ops Total (lb)	235	279	55.9
				Per Launch Event	(ton)	0.12	0.14	0.028
For 15 Launch Events in 1999								
					Total (lb)	3,518	4,185	839
		1999 TOTAL LAUNCH EVENTS			(ton)	1.76	2.09	0.42

5.0 Summary of Annual Emissions

	VOC	NOx	PM
1997 TOTAL Vehicle Emissions (TPY)	0.21	0.58	0.084
1998 TOTAL Vehicle Emissions (TPY)	2.55	3.87	0.60
1999 TOTAL Vehicle Emissions (TPY)	4.17	5.21	1.03

(1) Mileage is for all the vehicles in a vehicle category.
(2) Emission factors for 1995 fleet vehicles used.
(3) Assumed 50,000 total viewers for each the 1st launch event (3 people per car; 16,667 cars per event) and 5,000 people for the other 15 launches (3 people per car; 1,667 cars). Average distance travelled 140 miles assumed twice the distance travelled by operations and construction personnel (70 mi round-trip). Assumed 500 observers per FRF (3 person per car).

Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Mileage (mile) x 0.00225 (lb/gm) = Emissions (lb)

Table A–10

Emission Calculations Government and personal Vehicles—Emission from Paved Roads Travel

Edwards AFB, CA

1.0 Methodology

PM Paved Road Emission Factors can be obtained from the following :

AP-42, Sections 13.2.1 & 2, (1/95)

E = k*(sL/2)^0.65*(W/3)^1.5

E=	Emissions	lb/Vehicle Mile Travelled (VMT)
k =	0.016	lb/VMT, particle size multiplier for PM-10, AP-42 Section 13.2.1.2
sL =	0.40	g/m^2, 50th percentile nonindustrial silt loading for high average daily traveled (ADT) roads AP-42, Table 13.2-1-2.
W =		tons, vehicle weight estimated for the different vehicles

2.0 Construction Related Emissions

Vehicle Type	Number of Vehicles	Mileage [1]	Parameters k[2] (lb/VMT)	sL[3] (g/m^2)	W (tons)	Emissions PM (lbs)
CONSTRUCTION						
Phase 1 - Site Prep and Earthwork (daily for 3 months 1997)						
Government Vehicles						
LDGV	0	0	0.016	0.4	2	0.0
LDGT (70 mile r.t.)	4	25,200	0.016	0.4	4	218
LDDT	0	0	0.016	0.4	4	0.0
HDDT (70 mile r.t.)	6	37,800	0.016	0.4	8	925
Personal Vehicles (POVs)						
POVs (70 mile r.t.)	18	113,400	0.016	0.4	2	347
					Phase 1 Total (lb)	1,143
					(ton)	0.57
Phase 2 - Concrete/Steel/Equipment Setting (daily for 3 months 1998)						
Government Vehicles						
LDGV	0	0	0.016	0.4	2	0.0
LDGT (70 mile r.t.)	6	37,800	0.016	0.4	4	327
LDDT	0	0	0.016	0.4	4	0.0
HDDT (70 mile r.t.)	9	56,700	0.016	0.4	8	1,388
Personal Vehicles (POVs)						
POVs (70 mile r.t.)	25	157,500	0.016	0.4	2	482
					Phase 2 Total (lb)	2,197
					(ton)	1.10
Phase 3 - All Remaining Work (daily for 6 months 1998, 180 total days)						
Government Vehicles						
LDGV	0	0	0.016	0.4	2	0.0
LDGT (70 mile r.t.)	6	75,600	0.016	0.4	4	654
LDDT	0	0	0.016	0.4	4	0.0
HDDT (70 mile r.t.)	6	75,600	0.016	0.4	8	1,850
Personal Vehicles (POVs)						
POVs (70 mile r.t.)	35	441,000	0.016	0.4	2	1,349
					Phase 3 Total (lb)	3,854
					(ton)	1.93
1997 Paved Road Construction Emissions TOTAL (Tons)						**0.57**
1998 Paved Road Construction Emissions TOTAL (Tons)						**3.03**

Table A–10

Emission Calculations Government and personal Vehicles—Emission from Paved Roads Travel

Edwards AFB, CA

3.0 Operations Related Emissions

Vehicle Type	Number of Vehicles	Mileage (1)		Parameters k(2) (lb/VMT)	sL(3) (g/m^2)	W (tons)	Emissions PM (lbs)
OPERATIONS							
Daily (5 days/wk for 1999; 260 total days)							
Government Vehicles							
LDGV	0	0		0.016	0.4	2	0.0
LDGT (70 mile r.t.)	2	36,400		0.016	0.4	4	315
LDDT	0	0		0.016	0.4	4	0.0
HDDT (70 mile r.t.)	2	36,400		0.016	0.4	8	891
Personal Vehicles (POVs)							
POVs (70 mile r.t.)	250	4,550,000		0.016	0.4	2	13,921
						Ops Total (lb/yr)	15,127
1999 Paved Road Operations Emissions TOTAL (Tons)							7.56

4.0 Launch Related Emissions

Vehicle Type	Number of Vehicles	Mileage (1)		Parameters k(2) (lb/VMT)	sL(3) (g/m^2)	W (tons)	Emissions PM (lbs)
Launch Event							
Government Vehicles							
LDGV (70 mile r.t.)	4	280		0.016	0.4	2	0.86
LDGT (70 mile r.t.)	2	140		0.016	0.4	4	1.21
LDDT	0	0		0.016	0.4	4	0.0
HDDT (70 mile r.t.)	4	280		0.016	0.4	8	6.9
Personal Vehicles (POVs)							
1998 FRF POVs (140 mile r.t.)	500	70,000		0.016	0.4	2	214
1998 Launch POVs (140 mile r.t.)	16,667	2,333,333		0.016	0.4	2	7,139
1999 per Launch POVs (140 mile r.t.)	1,667	233,380		0.016	0.4	2	714
						1998 Ops Total (lb)	7,353
1998 Paved Road Launch Event Emissions TOTAL (Tons)							3.68
						1999 Ops Total Per Launch (lb)	723
						(ton)	0.36
For 15 Launch Events in 1999							
						Total (lb)	10,844
1999 Paved Road Launch Event Emissions TOTAL (Tons)							5.42

5.0 Summary of Annual Emissions

1997 PAVED ROAD EMISSION TOTAL	**0.57**
1998 PAVED ROAD EMISSION TOTAL	**6.70**
1999 PAVED ROAD EMISSION TOTAL	**12.99**

(1) Mileage is for all the vehicles in a vehicle category.

(2) k, emission factor for PM-10 used, (AP-42 Section 13.2.1.3)

(3) Silt Loading (g/m^2) from Table 13.2.1-2. Value for 50th percentile in High-Average Daily Travel (ADT) Roads.

(4) Assumed 50,000 total viewers for each the 1st launch event (3 people per car; 16,667 cars per event) and 5,000 people for the othe 14 launches (3 people per car; 1,667 cars). Average distance travelled 140 miles assumed twice the distance travelled by operations and construction personnel (70 mi round-trip). Assumed 500 observers per FRF (3 people per car).

Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Mileage (mile) x 0.00225 (lb/gm) = Emissions (lb)

Table A–11

Emission Calculations Off–road Diesel Vehicles

Edwards AFB, CA

Emission Factors from : *Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).

VOC Emission Factors sum up the exhaust, crank, evaporative, and refueling emission factors

1997 Phase 1 Emissions

Type of Unit	Rated HP[2] (hp)	# of Units	Total Annual Usage (hr/yr)[3]	Total Usage (hp-hr/yr)	Emission Factor (g/hp-hr) VOC	NOx	PM-10	Emissions (lbs) VOC	NOx	PM-10
D8 Dozer[1]	356	2	240	170,880	0.86	9.60	0.66	323.3	3,609	248
Scrapers	300	5	240	360,000	0.71	8.70	1.26	562	6,890	998
Backhoe	299	1	240	71,760	1.43	10.1	1.05	226	1,595	166
Vibrating Compactor	250	1	240	60,000	1.43	10.1	1.05	189	1,333	139
Cranes	150	2	240	72,000	1.29	10.3	1.44	204	1,632	228
TOTAL EMISSIONS								1,504	15,059	1,778

[1] Rubber tire dozer emission factors

[2] Construction equipment listed on fax from NASA. Size of units estimated from:

*Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).

[3] Assume equipment used 50% time for 3 months of Phase I construction

1997 TOTAL EMISSIONS (TPY)	VOC	NOx	PM-10
	0.75	7.53	0.89

1998 Phase 2 Emissions

Type of Unit	Rated HP (hp)	# of Units	Total Annual Usage (hr/yr)[2]	Total Usage (hp-hr/yr)	Emission Factor (g/hp-hr) VOC	NOx	PM	Emissions (lbs) VOC	NOx	PM
Cranes	150	2	240	72,000	1.29	10.3	1.44	204.3	1,632	228.1
Fork Lifts	83	2	240	39,840	1.60	14.0	1.60	140.2	1,227	140.2
TOTAL EMISSIONS								345	2,859	368

[1] Equipment listed on fax from NASA. Size of units estimated from:

*Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).

[2] Assumed equipment used 25% time for 6 months of Phase 3 construction.

1998 TOTAL EMISSIONS (TPY)	VOC	NOx	PM
	0.17	1.43	0.18

2.1 Calculation of Annual Emissions

Rated HP (hp) x Number of Units x Total Annual Usage (hr/yr) = Total Usage (hp-hr/yr)

Total Usage (hp-hr/yr) x Emission Factor (gm-hp/hr) x 0.00225 (lb/gm) = Actual Emission (lb/yr)

Table A–12
Emission Calculations for Propane Flares
Edwards AFB, CA

Emission factors for propane combustion were obtained from AP-42, Sixth Edition, Table 1.5-1 Emission Factors for LPG Combustion, 10/96, p. 1.5-3. Emission factors are expressed in pounds of combustion product per 1000 gallons of propane combusted.

Description: **Combustion of Propane in Flares**
Component: **Liquid Propane**

Assumptions:

Unconsumed hydrogen is burned in flares at Edwards AFB.

Propane is used as the assist fuel to maintain combustion in the flares.

Propane and hydrogen are the only fuels consumed by the flares.

Assumed propane consumption by flares = 100,416 gallons

Based on annual propane consumption for Marshall Space Flight Center (MSFC)

Flare will be operated March-Dec 1999

Propane consumption = annual MSFC consumption *10 months /12 months

Pollutant	Emission Factor (lb/1000 gal)	1999 Emissions lb	1999 Emissions tons
Particulate (PM)	0.40	40.2	0.020
Nitrogen oxides (NO_x)	14.0	1,406	0.70
Volatile organic compounds (VOC)	0.50	50.2	0.025

Emission(lb) = Emission Factor (lb/1000 gal) * Fuel Use (gals)

Emission Rate (tons) = Emission Factor (lb/1000 gal) * Fuel Use gallons / (2000 lb/ton)

Table A–13

Emission Calculations for Nitrogen Vaporizer

Edwards AFB, CA

Emission factors for propane combustion were obtained from AP-42, Sixth Edition, Table 1.5-1 Emission Factors for LPG Combustion, 10/96, p. 1.5-3. Emission factors are expressed in pounds of combustion product per 1000 gallons of propane combusted.

Assumptions:

Rated heat input of boiler/nitrogen vaporizer is 7.069 MMBtu/hr (Lockheed Martin)

The unit operates 10 hours for every launch or flight readiness firing (FRF). (Lockheed Martin)

3 FRFs in 1998 and 15 launches in 1999

Unit Description	Rated Heat Input (1) (Btu/hr)	Run Time (2) (hrs)	Heat Content of Fuel (BTU/gal)	Fuel Use (gals)
1998				
Propane unit	7,068,788	30	91,500	2,318
1998 TOTAL				2,318
1999				
Propane unit	7,068,788	150	91,500	11,588
1999 TOTAL				11,588

Pollutant	Emission Factor (lb/1000 gal)	1998 Emissions lbs	1999 Emissions lb	1998 Emissions tons	1999 Emissions tons
Particulate (PM)	0.40	0.93	4.64	4.64E-04	2.32E-03
Nitrogen oxides (NO_x)	14.0	32.4	162	0.016	0.081
Volatile organic compounds (VOC)	0.50	1.16	5.79	5.79E-04	2.90E-03

Emission(lb) = Emission Factor (lb/1000 gal) * Fuel Use (gals)

Emission Rate (tons) = Emission Factor (lb/1000 gal) * Fuel Use gallons / (2000 lb/ton)

Appendix B

China Lake NWC Emission Calculations

Table B-1

Emission Calculations forDiesel Generators

China Lake NWC, CA

1999

1.0 Data Required to Calculate Emission for Generators

Location of Unit	Generator Rating [1] (kw)	Generator Rating (hp)	Run Time [2] (hr/yr)	Annual Power Output (hp-hr/yr)
Generators				
LMCMS Van	40	53.6	192	10,297
LMCMS Van	40	53.6	192	10,297
Total:	**80**	**107**		**20,593**
(1) Generator Rating given in fax from Lockheed Martin				
(2) Run time is 96 hours per landing event per Lockheed Martin.				

2.0 Emission Factors for Criteria Pollutants from AP-42, Section 3.3. Table 3.3-1

Constituent	Emission Factor (lb/hp-hr)
NOx	0.031
Particulate (1)	0.002
VOC	2.51E-03
(1) Assume 100% of PM-10 emissions are particulates.	

3.0 Calculation of Criteria Pollutant Emissions

Constituent	Annual Actual (lb/yr)
NOx	638
PM10	45.31
VOC	51.8

Emission Factor (lb/hp-hr) x Annual Power Output (hp-hr/yr) = Emissions (lb/yr)

Table B-2

Emission Calculations for Ground Equipment

China Lake NWC, CA

Assumptions:

- -- Equipment is internal combustion engine
- -- Typical fuel use is 4 gal/hr
- -- Equipment listed on fax from Lockheed Martin
- -- Fuel use for the 480 VAC/300 kW unit is 21 gal/hr

Ground Equipment Emissions -- Diesel Fuel							
		Total			Emission Factors[1] (lb/mmBTU)		
		Run			PM	NOx	VOC
Equipment	No.	Time (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	0.31	4.41	0.36
					Emissions (lbs/yr)		
Ground Purge System	1	100	400	55.0	17.0	242	19.8
480 VAC/300 kW	2	200	4,200	577	178.9	2,545	208
Light-All	10	1000	4,000	550	170	2,424	198
28 VDC Power Supply	1	100	400	55.0	17.0	242	19.8
270 VDC Power Supply	1	100	400	55.0	17.0	242	19.8
Total	**15**		**9,400**	**1,292**	**400**	**5,696**	**465**

Ground Equipment Emissions -- Gasoline							
		Total			Emission Factors[1] (lb/mmBTU)		
		Run			PM	NOx	VOC
Equipment	No.	Time (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	0.10	1.63	3.03
					Emissions (lbs/yr)		
Wind Machine	1	10	40	5	0.52	8.48	15.8
Total	**1**		**40**	**5**	**0.52**	**8.5**	**15.8**

Totals		PM	NOx	VOC
	lbs	401	5704	481
	tons	0.200	2.85	0.24

[1] Emission Factors from AP-42, Section 3.3, Table 3.3-2 (1/95)

Fuel Used (gal/yr) x Emission Factor (lb/gal) = Actual Emissions (lb/yr)

Table B-3
Emission Calculations for Fuel Transfer Operations
China Lake NWC, CA

1.0 Calculation of Emissions from Fuel Transfer Operations

1999

Transfer Activity	Actual Qty of Fuel Transferred (1) (1000 gal/yr)	No. of Refueling Events	Saturation Factor (2)	Liquid Vapor Pressure (3) (psia)	Vapor Molecular Weight (3) (lb/lb-mole)	Liquid Temperature (° R)	Actual Annual VOC Emission (4) (lb/yr)
JP-8							
Refueler truck fill	115	2	1.45	0.033	130	520	17.1
747 Refueling	115	2	1.45	0.033	130	520	17.1
Refueler truck fill	8.70	2	1.45	0.033	130	520	1.30
C-130 Refueling	8.70	2	1.45	0.033	130	520	1.30
TOTAL FOR 1999 (lb)							36.7
TOTAL 1999 EMISSIONS (tons)						1999 Total (TPY)	0.018

Note: Assume 2 refuelings of 747 in 1999. (one refueling event for each LTO)

Notes:

(1) Source: Based on SCA total fuel capacity of 57,285 gallons, per Boeing specifications. C-130 total fuel capacity of 8,700 gallons per ANG specifications.

(2) Source: AP-42, Section 5.2, Transportation and Marketing of Petroleum Liquids, Table 5.2-1

(3) Source: "Calculation Methods For Criteria Air pollutant Emission Inventories", Appendix B, Armstrong Laboratories (AL), Report No. AL/OE-TR-1994-0049.

(4) Actual VOC Emissions = (Actual Quantity of Fuel transferred (1000 gal/yr))*(12.46*Saturation Factor*Vapor Press*Mol. wt/Temp.).
Source: AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, Equation (1).

Table B-4

Emission Calculations for X–33 Landings

China Lake NWC, CA

Emission factor for particulate emissions from paved roads from AP-42, Section 13.2.1

$E = k*(sL/2)^{0.65}*(W/3)^{1.5}$

E=	particulate emission factor			
k =	emission factor	=0.016 lb/VMT		particle size multiplier for PM-10, AP-42 Section 13.2.1.2
sL =	road surface silt loading	=25 g/m^2	(Worst case loading)	
W =	average vehicle weight	=65,000 lbs	(32.5 tons)	

Assumptions:	Landing Distance =		8000	ft
		=	1.52	mi
	Landing speed =		180	knots
		=	207	mph

E = $0.016*(25/2)^{0.65}*(32.5/3)^{1.5}$ = 15.1 lb/VMT*1.52

E = 4.48 lbs/landing PM

PM emissions from 2 landings in 1999 =	**8.96**	**lbs**

Table B-5

Emission Calculations for Landings and Take Offs

China Lake NWC, CA

EMISSIONS ESMATE LTOs

747 Emission Factors, Fuel Flows, Time in Mode (TIM), and Engine Type obtained from "Procedures for Emission Inventory Preparation", Volume IV:Mobile Sources, Section 5, EP
C-130 Emission Factors, Fuel Flows, Time in Mode (TIM) and Engine Type obtained from "Calculation Methods for Criteria Air Pollutant Emission Inventories" Armstrong Laboratc
JP-8 fuel conversion calculated based on Armstrong factors.

Note : Emission Factors in reference are for JP-4 fuel; the factors in this table have been modified for JP-8 fuel according to the report referenced above by the following :

NOx - no change
VOC - increased by 10%
PM - increased by 25%

1999

Aircraft Type	Engine Type	Number of Engines	LTO Cycles	Mode	Fuel Flow (lb/min)	TIME (mins)	Emission Factor (lb/1000lb/engine) VOC[1]	NOx	PM[2]	Emissions (lb) VOC	NOx	PM-10[3]
Boeing B-747-200	JT9D-7R4G2	4	2	Taxi Out	29.6	19.0	1.87	3.80	6.50	8.40	17.1	29.3
				Take Off	321	0.70	0.18	41.3	10.0	0.32	74.3	18.0
				Climb Out	249	2 20	0.17	32 1	17.5	0.74	140	76.6
				Approach	87.2	4.00	0.22	8.80	17.5	0.60	24.5	48.7
				Taxi In	29.6	7 00	1.87	3.80	6.50	3.10	6.30	10.8
									747 EMISSIONS	**13.2**	**263**	**183**
Aircraft Type	**Engine Type**	**Number of Engines**	**LTO Cycles**	**Mode**	**Fuel Flow (lb/hr)**	**TIME (hr)**	**Emission Factor (lb/hr) VOC**	**NOx**	**PM**	**Emissions (lb) VOC**	**NOx**	**PM-10[3]**
C-130	T56-7	4	2	Taxi Out	720	0.15	16.6	2.81	0.74	20.3	3.44	0.91
				Take Off	1960	0.007	0.86	18.2	1.20	0.048	1.02	0.067
				Climb Out	1960	0.02	0.86	18.2	1.20	0.14	2.91	0.19
				Approach	830	0.085	11.3	3.65	1.01	7.68	2.48	0.69
				Taxi In	720	0.11	16.6	2.81	0.74	14.9	2.5	0.7
									C-130 EMISSIONS	**43.1**	**12.4**	**2.51**
									TOTAL LTO EMISSIONS	**56.2**	**275**	**186**
									TOTAL EMISSIONS (tpy)	**0.028**	**0.14**	**0.093**

[1] The 747 VOC=HC*1.0947, Section 5.6.1

[2] PM factors for 747 are for engine TF33-P-3/5/7 P&W, Table 5-7 due to lack of available data. This engine is a 747 with a Pratt and Whitney engine as opposed to a Boeing engine.

[3] Assumed all PM = PM-10

Calculation of Emissions

Number of Engines x Number of LTOs x time (hr) x emission factor (lb/hr) = Annual Actual Emission (lb/yr)

Table B-6

Emission Calculations for Off–Road Vehicles

China Lake NWC, CA

Emission Factors from : "Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).

VOC Emission Factors sum up the exhaust, crank, evaporative, and refueling emission factors

Type of Unit	Rated HP (1)	# of Units(1)	Annual Usage (2) (hr/yr/unit)	Total Usage (hp-hr/yr)	Emission Factor (g/hp-hr)			Emissions (lbs)		
					VOC	NOx	PM	VOC	NOx	PM
200 Ton Crane	150	1	24	3,600	1.29	10.3	1.44	10.2	82	11.4
400 Ton Crane	150	1	24	3,600	1.29	10.3	1.44	10.2	82	11.4
Fork Lifts	83	2	24	3,984	1.60	14.0	1.60	14.0	123	14.0
Man Lifts[3]	43	3	24	3,096	1.60	14.0	1.60	10.9	95	10.9
TOTAL EMISSIONS								**45.4**	**381**	**47.7**

[1] Equipment lised on fax from NASA. Size of units estimated from:
"Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).
[2] Total annual usage for each unit estimated to be = 8hrs./day, 1 day/event, 2 events/year and 4 hours of testing per landing event.
[3] Aerial lift emission factors

Calculation of Emissions

Rated HP x Number of Units x Annual Use (hr/yr) = Total Usage (hp-hr/yr)

Total Usage (hp-hr/yr) x Emission Factor (gm-hp/hr) x 0.00225 (lb/gm) = Emission (lb/yr)

Table B-7

Emission Calculations for On–Road Vehicles

China Lake NWC, CA

Emission Factors can be obtained from the following:
Ground Personnel and Spectator vehicle emissions - CEQA Air Quality Handbook, South Coast Air Quality Management District, April 1993
Heavy Duty Gas Vehicles - "Calculation Methods for Criteria Air Pollutant Emission Inventories",
1995 emission factors, Section H, Report Number: AL/OE-TR-1994.

Calculation of Mileage for Ground Personnel Vehicles

	VOCs	NOx	PM	Number of Vehicles Per Landing	Number of Landings	Average Round Trip Vehicle Miles Traveled	VOCs	NOx	PM
	Emission Factor (grams/vmt[1])						Vehicle Emissions (lbs/yr)		
Vehicle mix for year 1999[2]	0.44	0.51	0.105	60	2	20	2.38	2.75	0.57

[1] Emission factors for vehicles gross weight 6,000 pounds and less. Includes light automobiles, light-duty trucks, vans, station wagons and 4x4 trucks.
[2] Vehicle speed assumed to 25 mph.

Calculation of Mileage for Spectator Vehicles

	VOCs	NOx	PM	Number of Vehicles per Landing[3]	Number of Landings	Average Round Trip Vehicle Miles Traveled	VOCs	NOx	PM
	Emission Factor (grams/vmt[1])						Vehicle Emissions (lbs/yr)		
Vehicle mix for year 1999[2]	0.44	0.51	0.105	6667	2	140	1,848	2,142	441

[1] Emission factors for vehicles gross weight 6,000 pounds and less. Includes light automobiles, light-duty trucks, vans, station wagons and 4x4 trucks.
[2] Vehicle speed assumed to 25 mph.
[3] Assumes 3 people per vehicle for a total of 20,000 people per landing.

Calculation of Mileage for Heavy Duty Gas Vehicles

	VOCs	NOx	PM	Number of Vehicles Per Landing	Number of Landings	Average Round Trip Vehicle Miles Traveled	VOCs	NOx	PM
	Emission Factor (grams/vmt)						Vehicle Emissions (lbs/yr)		
Heavy Duty Gas Vehicle[3]	2.42	4.93	0.10	4	2	20	0.87	1.77	0.036

[3] includes: one tractor trailer, 2 refueler trucks

	VOCs	NOx	PM
TOTAL VEHICLE EMISSIONS (LBS/YR)	1,851	2,147	442
TOTAL VEHICLE EMISSIONS (TPY)	0.93	1.07	0.22

Calculation of Emissions

Emission Factor (gm/vmt) x On-Base Mileage x Number of vehicles x 0.00225 (lb/gm) = Emissions (lb/yr)

Chinalke.xls/Onroad Vehicles
9/3/97

Table B-8

Emission Calculations for On–Road Vehicles—emmissions from Paved roads Travel

China Lake NWC, CA

1.0 Methodology

PM Paved Road Emission Factors can be obtained from the following :

AP-42, Sections 13.2.1 & 2, (1/95)

E = k*(sL/2)^0.65*(W/3)^1.5

E=	Emissions	lb/Vehicle Mile Travelled (VMT)
k =	0.016	lb/VMT, particle size multiplier for PM-10, AP-42 Section 13.2.1.2
sL =	0.40	g/m^2, 50th percentile nonindustrial silt loading for high average daily traveled (ADT) roads AP-42, Table 13.2-1-2.
W =		tons, vehicle weight estimated for the different vehicles

2.0 Ground Personnel Vehicles

Vehicle Type	Number of Vehicles	Mileage (1)		Parameters			Emissions
				k(2)	sL(3)	W	PM
				(lb/VMT)	(g/m^2)	(tons)	(lbs)
Ground Personnel Vehicles							
Vehicle mix for year 1999^2	60	2,400		0.016	0.40	2.00	7.34
					Ground Personnel Total (lb)		7.34
1999 Paved Road Ground Personnel Emissions TOTAL (Tons)							0.0037

3.0 Spectator Vehicles

Vehicle mix for year 1999^2	6667	1,866,760		0.016	0.40	2.00	5,711
					Spectator Total (lb/yr)		5,711
1999 Paved Road Spectator Emissions TOTAL (Tons)							2.86

4.0 Heavy Duty Gas Vehicles

Heavy Duty Gas Vehicles	4	160		0.016	0.40	2.00	0.49
					Heavy Duty Vehicles Total (lb)		0.49
1999 Paved Road Heavy Duty Vehicle Emissions TOTAL (Tons)							2.45E-04

5.0 Summary of Annual Emissions

1999 PAVED ROAD EMISSION TOTAL	**2.86**

(1) Mileage is for all the vehicles in a vehicle category.

(2) k, emission factor for PM-10 used, (AP-42 Section 13.2.1.3)

(3) Silt Loading (g/m^2) from Table 13.2.1-2. Value for 50th percentile in High-Average Daily Travel (ADT) Roads.

(4) Assumed 20,000 total viewers for each of the 2 launch events(3 People per vehicle or 6,667 vehicles per event)

Distance travelled 140 miles roundtrip twice the distance travelled by operations and construction personnel.

Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Mileage (mile) x 0.00225 (lb/gm) = Emissions (lb)

Appendix C

Silurian Lake Emission Calculations

Table C-1
Emission Calculations for Construction Activities
Silurian Lake, CA

1998

1.0 PM Emission Estimate Methodology

Construction methodology from AP-42, Section 13.2.3 - Heavy Construction Operations, 1/95.

Emission Factor = E = 1.2 ton of total suspended particulate (TSP)/acre/month of activity

2.0 Assumptions

- 5,000 ft^2 (0.11 acres) will be disturbed
- site preparation will take 1 month
- control efficiency is 50%
- construction will take place at Silurian Lake in 1998.

3.0 Calculations

E = 1.2 ton/acre/month of activity * 0.11 acres * 1 month
= 0.13 tons
0.066 tons with 50% control efficiency

4.0 Summary

	Uncontrolled Emissions (tpy)	Control Efficiency	Controlled Emissions (tpy)
Site Prep.	0.13	50	0.066
Total	0.13		**0.066**

Table C-2

Emission Calculations for Diesel Generators

Silurian Lake, CA

1999

1.0 Data Required to Calculate Emission for Generators

Location of Unit	Generator Rating (1) (kw)	Generator Rating (hp)	Run Time (3) (hr/yr)	Annual Power Output (hp-hr/yr)
Generators				
Trailer #1	200	268	40	10,726
Trailer #2	200	268	40	10,726
LMCMS Van (3)	40	54	192	10,297
LMCMS Van (3)	40	54	192	10,297
Total:	**400**	**536**		**21,451**
(1) Generator rating given in fax from Lockheed Martin				
(2) Run time estimated = 8 hours per day, 2 days per event, 2 events per year + 4 hours testing per event.				
(3) Run time is 96 hours per landing event per Lockheed Martin.				

2.0 Emission Factor for PM-10, from AP-42, Section 3.3. Table 3.3-1

Constituent	Emission Factor (lb/hp-hr)
Particulate (1)	0.002
(1) Assume 100% of PM-10 emissions are particulates.	

3.0 Calculation of PM-10 Emissions

Constituent	Annual Actual (lb/yr)
PM-10	42.9

3.1 Calculation of Emissions:

Emission Factor (lb/hp-hr) x Annual Power Output (hp-hr/yr) = Emissions (lb/yr)

Table C-3
Emission Calculations for Ground Equipment
Silurian Lake, CA

1999
Assumptions:

-- Equipment is internal combustion engine.
-- Typical fuel use of 4 gal/hr
-- Fuel use for the 480 VAC/300 kW unit is 21 gal/hr

Ground Equipment Emissions -- Diesel Fuel					
Equipment	No.	Total Run Time (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	Emission Factors[1] (lb/mmBTU) PM 0.31
					Emissions (lbs/yr)
Ground Purge System	1	100	400	55.0	17.0
480 VAC/300 kW	2	200	4,200	577	179
Light-All	10	1000	4,000	550	170
28 VDC Power Supply	1	100	400	55.0	17.0
270 VDC Power Supply	1	100	400	55.0	17.0
Total	**15**		**9,400**		**400**

Ground Equipment Emissions -- Gasoline					
Equipment	No.	Total Run Time (hr/yr)	Fuel Used (gal/yr)	Heat Input (mmBTU)	Emission Factors[1] (lb/mmBTU) PM 0.10
					Emissions (lbs/yr)
Wind Machine	1	10	40	5.20	0.52
Total	**1**		**40**		**0.52**

Totals	**PM**
lbs	**401**
TONS	**0.20**

Note: Equipment needed for landings listed in fax from NASA 4/3/97
[1] Emission Factors from AP-42, Section 3.3, Table 3.3-2 (1/95)

Calculation of Emissions
Fuel Used (gal/yr) x Heating Value (BTU/gal) x (1 mmBTU/1,000,000 Btu) x Emission Factor (lb/mmBTU)
= Actual Emissions (lb/yr)

Table C-4

Emission Calculations for X-33 Landings

Silurian Lake, CA

1999

Emission factor for particulate emissions from unpaved roads from AP-42, Section 13.2.2.2

E = k(5.9)s/12*S/30*(W/3)0.7*(w/4)0.5*(365-p/365)*lb/VMT

E=	Emission Factor					
k =	Particle size multiplier =	0.36	PM-10			
s =	silt content of road surface =	12%	Table 13.2.2-1 for rural dirt roads			
S =	mean vehicle speed =	207mph	(180 knots)	=207/2	=	103.5 mph
W =	mean vehicle weight	65,000	lbs.	(32.5 tons)		
w =	mean number of wheels=	3	(F-15 landing gear)			
	days of precipitation per yr=	0	(worst case, landing will occur only if clear)			
VMT =	8000 ft =	1.52 mi				

E = 0.36*(5.9)12/12*103.5/30*(32.5/3)0.7*(3/4)0.5*(365-p/365)=57.1lb/VMT*1.51

E = 50.8 lbs PM/landing

PM emissions from 2 landings in 1999	**=**	**273**	**lbs**
	=	**0.14**	**tons**

Table C–5

Emission Calculations for Landings and Take Offs

Silurian Lake, CA

1999
EMISSIONS ESIMATE LTOs

747 Emission Factors, Fuel Flows, Time In Mode (TIM), and Engine Type obtained from "Procedures for Emission Inventory Preparation", Volume IV:Mobile Sources, Section 5, EPA-450/4-81-026d
C-130 Emission Factors, Fuel Flows, Time In Mode (TIM) and Engine Type obtained from "Calculation Methods for Criteria Air Pollutant Emission Inventories" Armstrong Laboratory, July, 1994
JP-8 fuel conversion calculated based on Armstrong factors.

Note : Emission Factors in reference are for JP-4 fuel; the factors in this table have been modified for JP-8 fuel according to the report referenced above by the following :
PM - increased by 25%

Aircraft Type	Engine Type	Number of Engines	LTO Cycles	Mode	Fuel Flow (lb/min)	TIM (mins)	Emission Factor (lb/1000lb/engine) PM[2]	Emissions (lb) PM
Boeing B-747-200	JT9D-7R4G2	4	2	Taxi Out	29.6	19.0	6.50	29.3
				Take Off	321	0.70	10.0	18.0
				Climb Out	249	2.20	17.5	76.6
				Approach	87.2	4.00	17.5	48.7
				Taxi In	29.6	7.00	6.50	10.8
							747 EMISSIONS	183
Aircraft Type	**Engine Type**	**Number of Engines**	**LTO Cycles**	**Mode**	**Fuel Flow (lb/hr)**	**TIM (hr)**	**Emission Factor (lb/hr) PM**	**Emissions (lb) PM**
C-130	T56-7	4	2	Taxi Out	720	0.15	0.59	0.72
				Take Off	1,960	0.007	0.94	0.053
				Climb Out	1,960	0.020	0.94	0.15
				Approach	830	0.085	0.81	0.55
				Taxi In	720	0.11	0.59	0.53
							C-130 EMISSIONS	2.00
							TOTAL LTO EMISSIONS	185
							TOTAL EMISSIONS (tpy)	0.093

[1] The 747 VOC=HC*1 0947, Section 5.6.1
[2] PM factors for 747 are for engine TF33-P-3/5/7 P&W, Table 5-7 due to lack of available data. This engine is a 747 with a Pratt and Whitney engine as opposed to a Boeing engine.
[3] Assumed all PM = PM-10

Calculation of Emissions
Number of Engines x Number of LTOs x time (hr) x emission factor (lb/hr) = Annual Actual Emission (lb/yr)

Table C–6

Emission Calculations for Off-Road Diesel Vehicles

Silurian Lake, CA

Emission Factors from : "Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).
VOC Emission Factors sum up the exhaust, crank, evaporative, and refueling emission factors

1998 Emissions

Type of Unit	Rated HP (hp)1	# of Units1	Total Annual Usage (hr/yr)[2]	Total Usage (hp-hr/yr)	Emission Factor (g/hp-hr) PM	Emissions (lbs) PM
D8 Dozer[3]	356	1	80	28,480	0.66	41.4
Scrapers	300	1	80	24,000	1.26	66.5
Backhoe	299	1	80	23,920	1.05	55
Vibrating Compactor	250	1	80	20,000	1.05	46
TOTAL Emissions						209
TOTAL EMISSIONS (TPY)						0.10

[1] Equipment listed on fax from NASA. Size of units estimated from:
"Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).
[2] Assume equipment used 50% time for 1 month construction
[3] Rubber tire dozer emission factors

1999
Emission Factors from : "Nonroad Engine and Vehicle Emission Study Report, EPA 21A-20001, Table 2.07 (a).
VOC Emission Factors sum up the exhaust, crank, evaporative, and refueling emission factors

Type of Unit	Rated HP (hp)	# of Units	Total Annual Usage [(1)] (hr/yr)	Total Usage (hp-hr/yr)	Emission Factor (g/hp-hr) PM	Emissions (lbs) PM
200 Ton Crane	150	1	24	3,600	1.44	11.4
400 Ton Crane	150	1	24	3,600	1.44	11.4
Fork Lifts	83	3	24	5,976	1.60	21.0
Man Lifts[2]	43	3	24	3,096	1.60	10.9
TOTAL EMISSIONS						54.7

[1] Total annual usage estimated for each unit = 8hrs./day, 1 day/event, 2 events/year and 4 hours of testing per landing event.
[2] Aerial lift emission factors

Note: This equipment needed for landings, listed in fax from NASA 4/3/97

Calculation of Annual Emissions

Rated HP (hp) x Number of Units x Total Annual Usage (hr/yr) = Total Usage (hp-hr/yr)
Total Usage (hp-hr/yr) x Emission Factor (gm-hp/hr) x 0.00225 (lb/gm) = Actual Emission (lb/yr)

Table C–7

Emission Calculations for On—Road Vehicles

Silurian Lake, CA

Emission Factors can be obtained from the following
Ground Personnel vehicle emissions - CEQA Air Quality Handbook, South Coast Air Quality Management District, April 1993
Tractor Trailer and Refueler - "Calculation Methods for Criteria Air Pollutant Emission Inventories", 1995 emission factors, Section H, Report Number: AL/OE-TR-1994.

1998

Construction Vehicles

Vehicle Type	Number of Vehicles	# of Days	Total Mileage (1)	Emission Factor (g/mi) PM	Emission (lb/yr) PM
CONSTRUCTION					
Site Prep and Earthwork (daily for 1 month 1998)					
Government Vehicles					
LDGV	0	30	0	0.022	0.00
LDGT (40 mile r.t.)	4	30	4,800	0.022	0.24
LDDT	0	30	0	0.26	0.00
HDDT (40 mile r.t.)	6	30	7,200	1.65	26.8
Personal Vehicles (POVs)					
POVs (40 mile r.t.)	18	30	21,600	0.105	5.10
				Total (lb)	32.1
				1998 Emissions TONS	**0.016**

Assume construction personnel similar to personnel required at Edwards for the site preparation.

1999 Calculation of Mileage for Ground Personnel Vehicles

	PM Emission Factor (grams/vmt[1])	Number of Vehicles	Average RT Vehicle Miles Traveled	# Landings	Total vehicle miles	PM Emissions (lbs/yr)
Vehicle mix for year 1999[2]	0.11	60	20	2	40	136

[1] Emission factors for vehicles gross weight 6,000 pounds and less. Includes light automobiles, light-duty trucks, vans, station wagons and 4x4 trucks.

[2] Vehicle speed assumed to 25 mph.

Assume these vehicles travel to base 240 days (1 year)

Calculation of Mileage for Heavy Duty Gas Vehicles

	PM Emission Factor (grams/vmt)	Number of Vehicles	Average RT Vehicle Miles Traveled	# Landings	Total Vehicle Miles	PM Vehicle Emissions (lbs/yr)
Heavy Duty Gas Vehicle[3]	0.10	4	20	2	40	0.0/2

[3] includes: one tractor trailer, 2 refueler trucks, 1 two vehicle and 1 tow truck

Assume that equipment associated with the landing travel to base 2 times for 2 landings

TOTAL VEHICLE EMISSIONS (LBS/YR)	**136**
1999 Vehicle Emissions TPY	**0.068**

Calculation of Annual Actual Emissions

Emission Factor (gm/vmt) x On-Base Mileage x Number of vehicles x 0.00225 (lb/gm) = Actual Emissions (lb/yr)

Table C–8

Emission Calculations for Helicopter LTOs

Silurian Lake, CA

1.0 Methodology

PM Paved Road Emission Factors can be obtained from the following :

AP-42, Sections 13.2.1 & 2, (1/95)

E = k*(sL/2)^0.65*(W/3)^1.5

E=	Emissions	lb/Vehicle Mile Travelled (VMT)
k =	0.016	lb/VMT, particle size multiplier for PM-10, AP-42 Section 13.2.1.2
sL =	0.40	g/m², 50th percentile nonindustrial silt loading for high average daily traveled (ADT) roads AP-42, Table 13.2-1-2.
W =		tons, vehicle weight estimated for the different vehicles

2.0 Construction Related Emissions

Vehicle Type	Number of Vehicles	Mileage (1)		Parameters k(2) (lb/VMT)	sL(3) (g/m²)	W (tons)	Emissions PM (lbs)
CONSTRUCTION							
Site Prep and Earthwork (daily for 1 month 1998)							
Government Vehicles							
LDGV	0	0		0.016	0.4	2	0.0
LDGT (40 mile r.t.)	4	4,800		0.016	0.4	4	41.5
LDDT	0	0		0.016	0.4	4	0.0
HDDT (40 mile r.t.)	6	7,200		0.016	0.4	8	176
Personal Vehicles (POVs)							
POVs (40 mile r.t.)	18	21,600		0.016	0.4	2	66.1
						Total (lb)	218
						(ton)	0.11
1998 Paved Road Construction Emissions TOTAL (Tons)							**0.11**

3.0 Ground Personnel Vehicles

Vehicle Mix for 1999	60	2,400		0.016	0.40	2	7.34
1999 Paved Road Ground Personnel Emissions TOTAL (Tons)							0.004

4.0 Heavy Duty Gas Vehicles

Heavy Duty Gas Vehicle	4	160		0.016	0.4	2	0.49
						1999 Ops Total (lb)	0.49
1999 Paved Road Heavy Duty Gas Vehicles Emissions TOTAL (Tons)							2.45E-04

5.0 Summary of Annual Emissions

1998 PAVED ROAD EMISSION TOTAL	**0.11**
1999 PAVED ROAD EMISSION TOTAL	**0.004**

(1) Mileage is for all the vehicles in a vehicle category.

(2) k, emission factor for PM-10 used, (AP-42 Section 13.2.1.3)

(3) Silt Loading (g/m²) from Table 13.2.1-2. Value for 50th percentile in High-Average Daily Travel (ADT) Roads.

Calculation of Annual Actual Emissions

Emission Factor (gm/mile) x Mileage (mile) x 0.00225 (lb/gm) = Emissions (lb)

Appendix D

Ambient Air Monitoring Data

DATE 97/04/03 EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS) PAGE 1
AMP450 AIR QUALITY SUBSYSTEM
QUICK LOOK REPORT
CARBON MONOXIDE (42101) MONTANA UNITS: 007 PPM

SITE ID	P O C	N T	CITY	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 1-HR 1ST	MAX 1-HR 2ND	OBS> 35	MAX 8-HR 1ST	MAX 8-HR 2ND	OBS> 9	METH
30-013-1025	1	2	GREAT FALLS	CASCADE CO	SKYWAY CONOCO, 700-10TH	93	003	8602	10.6	10.2	0	8.2	6.9	0	066
30-013-1025	1	2	GREAT FALLS	CASCADE CO	SKYWAY CONOCO, 700-10TH	94	003	8415	11.5	11.3	0	7.4	4.8	0	000
30-013-1025	1	2	GREAT FALLS	CASCADE CO	SKYWAY CONOCO, 700-10TH	95	003	7938	13.9	13.7	0	7.9	6.2	0	051
30-013-1025	1	2	GREAT FALLS	CASCADE CO	SKYWAY CONOCO, 700-10TH	96	003	7880	21.9	19.1	0	8.5	5.4	0	000
30-013-1025	1	2	GREAT FALLS	CASCADE CO	SKYWAY CONOCO, 700-10TH	97	003	1402	9.2	8.5	0	6.4	5.1	0	093

DATE 97/04/03 EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS) PAGE 1

CARBON MONOXIDE (42101)

METHODS:

CODE	COLLECTION METHOD	ANALYSIS METHOD
000	MULTIPLE METHODS	MULTIPLE METHODS
051	INSTRUMENTAL	NON DISPERSIVE INFRA-RED
066	INSTSRUMENTAL	NON DISPERSIVE INFRA-RED
093	INSTRUMENTAL	GAS FILTER COORELATION CO ANALYZER

DATE 97/04/03
AMP450

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
QUICK LOOK REPORT
MONTANA

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SULFUR DIOXIDE (42401)

UNITS: 007 PPM

SITE ID	POC	MT	CITY	COUNTY	ADDRESS		YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS > STD	MAX 3-HR 1ST	MAX 3-HR 2ND	OBS > STD	MAX 1-HR 1ST	MAX 1-HR 2ND	ARIT MEAN	METH
30-013-2000	1	4	GREAT FALLS	CASCADE CO	WIRE MILL RD/MT	R	94	072	1108	.021	.020	0	.071	.064	0	.133	.097	.009?	077
30-013-2000	1	4	GREAT FALLS	CASCADE CO	WIRE MILL RD/MT	R	95	072	7841	.024	.020	0	.085	.067	0	.145	.093	.004	077
30-013-2000	1	4	GREAT FALLS	CASCADE CO	WIRE MILL RD/MT	R	96	072	6483	.021	.020	0	.082	.056	0	.123	.122	.004?	077

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

METHODS:

SULFUR DIOXIDE (42401)

CODE	COLLECTION METHOD	ANALYSIS METHOD
077	INSTRUMENTAL	FLUORESCENCE DETECTION

DATE 97/04/03
AMP450

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
QUICK LOOK REPORT
MONTANA

PAGE 1

PM-10 TOTAL 0-10UM (81102)

UNITS: 001 UG/CU METER (25 C)

SITE ID	P O C	M T	CITY	COUNTY	ADDRESS	YR	REP ORG	NUM OBS	SCHEDULED NUM OBS	% OBS	NUM REQ	MAXIMUM VALUES 1ST	2ND	3RD	4TH	VALS > 150 MEAS	EST	WTD ARITH MEAN	METH
30-013-0009	1	2	GREAT FALL	CASCADE CO	FIRE STATION, 9TH ST	93	001	117	117	95	123	73	61	60	59	0	0.00	21	064
30-013-0009	1	2	GREAT FALL	CASCADE CO	FIRE STATION, 9TH ST	94	001	112	112	91	123	53	48	42	41	0	0.00	21	064
30-013-0009	1	2	GREAT FALL	CASCADE CO	FIRE STATION, 9TH ST	95	001	103	103	84	123	52	52	47	36	0	0.00	18?	064
30-013-0009	1	2	GREAT FALL	CASCADE CO	FIRE STATION, 9TH ST	96	001	86	85	90	94	69	59	44	40	0	0.00	19	064
30-013-0009	1	2	GREAT FALL	CASCADE CO	FIRE STATION, 9TH ST	97	001	2	2	13	15	62	5			0	0.00	34?	064

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

PM-10 TOTAL 0-10UM (81102)

METHODS:	CODE	COLLECTION METHOD	ANALYSIS METHOD
	064	HI-VOL-SA/GMW-321-B	GRAVIMETRIC

MOJAVE DESERT AIR QUALITY SUMMARIES

1988 AIR QUALITY SUMMARY

MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE			CARBON MONOXIDE				NITROGEN DIOXIDE		SULFUR DIOXIDE		
	days exceeding state std	days exceeding federal std	max 1 hr ppm	days exceeding state 8hr/1hr	days exceeding federal 8hr/1hr	max 8 hr ppm	max 1 hr ppm	days exceeding state std	max 1 hr ppm	days xceedin state 4hr/1hr	max 24 hr ppm	max 1 hr ppm
Barstow	78	12	0.15	0/0	0/0	2.88	10.80	0	0.10	nm	nm	nm
Hesperia	126	83	0.27	0/0	0/0	3.66	8.50	0	0.07	0	0.02	0.08
Phelan	122	62	0.19	0/0	0/0	5.81	10.30	0	0.06	0	0.04	0.04
Trona	11	0	0.12	nm	nm	nm	nm	0	0.07	0	0.01	0.02
29 Palms	37	3	0.15	nm	nm	nm	nm	nm	nm	nm	nm	nm
Victorville	80	23	0.18	nm	nm	nm	nm	nm	nm	0	0.04	0.05

	PM 10					TSP			LEAD		SULFATE	
	days exceeding state std	days exceeding federal std	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	days xceedin state std	max 24 hr ug/m3	days exceeding state std
Barstow	nm	nm	nm	nm	nm	129	68.54	63.68	0.06	0	11.0	0
Hesperia	nm	nm	nm	nm	nm	171	85.11	79.09	0.06	0	9.5	0
Lucerne	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Trona	nm	nm	nm	nm	nm	285	90.18	81.61	0.03	0	15.9	0
29 Palms	nm	nm	nm	nm	nm	118	57.95	53.27	0.20	0	6.4	0
Victorville	nm	nm	nm	nm	nm	368	101.04	93.77	0.24	0	9.2	0

nm=not monitored

1989 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE			CARBON MONOXIDE				NITROGEN DIOXIDE		SULFUR DIOXIDE		
	days exceeding state std	days exceeding federal std	max 1 hr ppm	days exceeding state 8hr/1hr	days exceeding federal 8hr/1hr	max 8 hr ppm	max 1 hr ppm	days exceeding state std	max 1 hr ppm	days xceedin state 4hr/1hr	max 24 hr ppm	max 1 hr ppm
Barstow	87	6	0.14	0/0	0/0	3.49	5.5	0	0.12	nm	nm	nm
Hesperia	127	74	0.21	0/0	0/0	3.74	3.8	0	0.12	0	0.01	0.03
Phelan	108	57	0.22	0/0	0/0	2.48	11.0	0	0.10	0	0.01	0.06
Trona	5	0	0.10	nm	nm	nm	nm	0	0.10	0	0.01	0.08
29 Palms	33	3	0.13	nm	nm	nm	nm	nm	nm	nm	nm	nm
Victorville	87	26	0.17	nm	nm	nm	nm	nm	nm	0	0.03	0.08

LOCATION	PM 10					TSP			LEAD		SULFATE	
	days exceeding state std	days exceeding federal std	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	days xceedin state std	max 24 hr ug/m3	days exceeding state std
Barstow	12	1	191	43.2	38.4	nm	nm	nm	nm	nm	nm	nm
Hesperia	39	0	124	58.1	53	nm	nm	nm	nm	nm	nm	nm
Lucerne	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Trona	23	0	112	47.6	41.1	194	102.7	92.5	0.12	0	18.0	0
29 Palms	15	1	155	46.7	39.9	nm	nm	nm	nm	nm	nm	nm
Victorville	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm

nm=not monitored& TSP data incomplete except for Trona TSP.

1990 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE			CARBON MONOXIDE				NITROGEN DIOXIDE		SULFUR DIOXIDE		
	days exceeding state std	days exceeding federal std	max 1 hr ppm	days exceeding state 8hr/1hr	days exceeding federal 8hr/1hr	max 8 hr ppm	max 1 hr ppm	days exceeding state std	max 1 hr ppm	days exceedin state 4hr/1hr	max 24 hr ppm	max 1 hr ppm
Barstow	35	1	0.13	0/0	0/0	3.80	5.5	0	0.12	nm	nm	nm
Hesperia	119	59	0.27	0/0	0/0	3.31	7.1	0	0.08	0	0.01	0.05
Phelan	105	53	0.24	0/0	0/0	3.78	9.2	0	0.07	0	0.01	0.05
Trona	1	0	0.11	nm	nm	nm	nm	0	0.20	0	0.03	0.05
29 Palms	37	1	0.14	nm	nm	nm	nm	nm	nm	nm	nm	nm
Victorville	58	9	0.18	nm	nm	nm	nm	nm	nm	0	0.05	0.08

	PM 10					TSP			LEAD		SULFATE	
	days exceeding state std	days exceeding federal std	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	days xceedin state std	max 24 hr ug/m3	days exceeding state std
Barstow	14	1	381	48.1	38.9	nm	nm	nm	nm	nm	nm	nm
Hesperia	16	1	171	48.8	42.3	nm	nm	nm	nm	nm	nm	nm
Lucerne	8	4	317	47.8	32.4	nm	nm	nm	nm	nm	nm	nm
Trona	16	1	366	47.7	37.9	686	104.5	86.7	0.15	0	29.1	3
29 Palms	6	2	297	41.2	28.4	nm	nm	nm	nm	nm	nm	nm
Victorville	23	1	181	60.6	57.0	nm	nm	nm	nm	nm	nm	nm

nm=not monitored

1991 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE days exceeding state std	OZONE days exceeding federal std	OZONE max 1 hr ppm	CARBON MONOXIDE days exceeding state 8hr/1hr	CARBON MONOXIDE days exceeding federal 8hr/1hr	CARBON MONOXIDE max 8 hr ppm	CARBON MONOXIDE max 1 hr ppm	NITROGEN DIOXIDE days exceeding state std	NITROGEN DIOXIDE max 1 hr ppm	SULFUR DIOXIDE days xceedin state 4hr/1hr	SULFUR DIOXIDE max 24 hr ppm	SULFUR DIOXIDE max 1 hr ppm
Barstow	24	3	0.13	0/0	0/0	3.41	5.3	0	0.13	nm	nm	nm
Hesperia	117	39	0.19	0/0	0/0	3.70	4.9	0	0.09	0	0.01	0.02
Phelan	112	51	0.24	0/0	0/0	2.00	2.3	0	0.05	0	0.01	0.01
Trona	6	0	0.12	nm	nm	nm	nm	3	0.35	0	0.01	0.03
29 Palms	52	3	0.14	nm	nm	nm	nm	nm	nm	nm	nm	*
Victorville	60	13	0.19	nm	nm	nm	nm	0	0.10	0	0.01	0.02

LOCATION	PM 10 days exceeding state std	PM 10 days exceeding federal std	PM 10 max 24 hr ug/m3	PM 10 annual arithmetic mean ug/m3	PM 10 annual geometric mean ug/m3	TSP max 24 hr ug/m3	TSP annual arithmetic mean ug/m3	TSP annual geometric mean ug/m3	LEAD max 24 hr ug/m3	LEAD days xceedin state std	SULFATE max 24 hr ug/m3	SULFATE days exceeding state std
Barstow	4	1	197	38.05	31.19	nm	nm	nm	nm	nm	nm	nm
Hesperia	19	1	320	53.13	45.00	nm	nm	nm	nm	nm	nm	nm
Lucerne	10	1	389	43.18	31.07	nm	nm	nm	nm	nm	nm	nm
Trona	13	0	114	43.26	37.27	294	89.55	74.98	0.03	0	32.5	2
29 Palms	8	1	297	41.72	31.97	nm	nm	nm	nm	nm	nm	nm
Victorville	18	1	439	53.72	42.17	nm	nm	nm	nm	nm	nm	nm

nm=not monitored

1992 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

	OZONE			CARBON MONOXIDE				NITROGEN DIOXIDE		SULFUR DIOXIDE		
LOCATION	days exceeding state std	days exceeding federal std	max 1 hr ppm	days exceeding state 8hr/1hr	days exceeding federal 8hr/1hr	max 8 hr ppm	max 1 hr ppm	days exceeding state std	max 1 hr ppm	days exceedin state 4hr/1hr	max 24 hr ppm	max 1 hr ppm
Barstow	34	1	0.13	0/0	0/0	3.21	6.0	0	0.01	0/0	0.01	0.03
Hesperia	131	57	0.23	0/0	0/0	3.20	5.6	0	0.08	0/0	0.01	0.01
Phelan	117	52	0.19	0/0	0/0	1.30	5.1	0	0.04	0/0	0.01	0.08
Trona	3	0	0.10	nm	nm	nm	nm	1	0.25	0/0	0.01	0.03
29 Palms	27	0	0.12	nm	nm	nm	nm	0	0.06	0/0	0.01	0.01
Victorville	76	19	0.19	nm	nm	nm	nm	0	0.10	0/0	0.01	0.03

	PM 10					TSP			LEAD		SULFATE	
	days exceeding state std	days exceeding federal std	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	days xceedin state std	max 24 hr ug/m3	days exceeding state std
Barstow	8	0	68	31.43	28.35	nm	nm	nm	nm	nm	nm	nm
Hesperia	15	0	80	39.49	35.62	nm	nm	nm	nm	nm	nm	nm
Lucerne	0	0	42	23.49	20.82	nm	nm	nm	nm	nm	nm	nm
Trona	10	0	105	36.93	32.72	202	77.3	70.3	0.04	0	18.6	0
29 Palms	0	0	48	25.82	23.02	nm	nm	nm	nm	nm	nm	nm
Victorville	5	0	62	33.37	30.14	nm	nm	nm	nm	nm	nm	nm

nm=not monitored

1993 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE days exceeding state std	OZONE days exceeding federal std	OZONE max 1 hr ppm	CARBON MONOXIDE days exceeding state 8hr/1hr	CARBON MONOXIDE days exceeding federal 8hr/1hr	CARBON MONOXIDE max 8 hr ppm	CARBON MONOXIDE max 1 hr ppm	NITROGEN DIOXIDE days exceeding state std	NITROGEN DIOXIDE max 1 hr ppm	SULFUR DIOXIDE days xceedin state 4hr/1hr	SULFUR DIOXIDE max 24 hr ppm	SULFUR DIOXIDE max 1 hr ppm
Barstow	28	1	0.13	0/0	0/0	2.49	4.9	0	0.10	0/0	0.01	0.02
Hesperia	103	36	0.17	0/0	0/0	3.30	4.4	0	0.07	0/0	0.01	0.01
Phelan	108	53	0.20	0/0	0/0	1.36	3.2	0	0.07	0/0	0.01	0.01
Trona	5	0	0.10	nm	nm	nm	nm	1	0.36	0/0	0.01	0.03
29 Palms	16	2	0.13	0/0	0/0	1.84	2.6	0	0.04	0/0	0.01	0.02
Victorville	64	11	0.16	0/0	0/0	2.58	4.3	0	0.11	0/0	0.01	0.02

	PM 10 days exceeding state std	PM 10 days exceeding federal std	PM 10 max 24 hr ug/m3	PM 10 annual arithmetic mean ug/m3	PM 10 annual geometric mean ug/m3	TSP max 24 hr ug/m3	TSP annual arithmetic mean ug/m3	TSP annual geometric mean ug/m3	LEAD max 24 hr ug/m3	LEAD days xceedin state std	SULFATE max 24 hr ug/m3	SULFATE days exceeding state std
Barstow	0	0	49	27.76	24.67	nm	nm	nm	nm	nm	nm	nm
Hesperia	9	0	64	34.19	29.20	nm	nm	nm	nm	nm	nm	nm
Lucerne	1	0	54	20.46	15.67	nm	nm	nm	nm	nm	nm	nm
Trona	2	0	56	25.72	22.24	96	47.48	43.36	0.07	0	8.4	0
29 Palms	0	0	39	20.82	17.97	nm	nm	nm	nm	nm	nm	nm
Victorville	7	0	62	35.40	31.86	nm	nm	nm	nm	nm	nm	nm

nm=not monitored

1994 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE			CARBON MONOXIDE				NITROGEN DIOXIDE		SULFUR DIOXIDE		
	days exceeding state std	days exceeding federal std	max 1 hr ppm	days exceeding state 8hr/1hr	days exceeding federal 8hr/1hr	max 8 hr ppm	max 1 hr ppm	days exceeding state std	max 1 hr ppm	days xceedin state 4hr/1hr	max 24 hr ppm	max 1 hr ppm
Barstow	26	1	0.13	0/0	0/0	2.35	4.2	0	0.10	0/0	0.009	0.016
Hesperia	119	47	0.18	0/0	0/0	2.18	3.5	0	0.08	0/0	0.006	0.025
Phelan	111	57	0.19	0/0	0/0	1.43	2.6	0	0.09	0/0	0.003	0.008
Trona	3	0	0.10	nm	nm	nm	nm	0	0.06	0/0	0.006	0.013
29 Palms	9	0	0.12	0/0	0/0	3.16	7.9	0	0.05	0/0	0.005	0.009
Victorville	63	14	0.16	0/0	0/0	2.19	4.8	0	0.12	0/0	0.012	0.014

	PM 10					TSP			LEAD		SULFATE	
	days exceeding state std	days exceeding federal std	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	annual arithmetic mean ug/m3	annual geometric mean ug/m3	max 24 hr ug/m3	days xceedin state std	max 24 hr ug/m3	days exceeding state std
Barstow	1	0	140	28	24	nm	nm	nm	nm	nm	nm	nm
Hesperia	5	0	76	35	30	nm	nm	nm	nm	nm	nm	nm
Lucerne	2	0	65	19	16	nm	nm	nm	nm	nm	nm	nm
Trona	16	0	107	29	34	254	54	48	0.02	0	50.1	1
29 Palms	2	0	79	21	18	nm	nm	nm	nm	nm	nm	nm
Victorville	16	0	108	42	37	nm	nm	nm	nm	nm	nm	nm

nm=not monitored

1995 AIR QUALITY SUMMARY
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

LOCATION	OZONE days exceeding state std	OZONE days exceeding federal std	OZONE max 1 hr ppm	CARBON MONOXIDE days exceeding state 8hr/1hr	CARBON MONOXIDE days exceeding federal 8hr/1hr	CARBON MONOXIDE max 8 hr ppm	CARBON MONOXIDE max 1 hr ppm	NITROGEN DIOXIDE days exceeding state std	NITROGEN DIOXIDE max 1 hr ppm	SULFUR DIOXIDE days xceedin state 4hr/1hr	SULFUR DIOXIDE max 24 hr ppm	SULFUR DIOXIDE max 1 hr ppm
Barstow	7	0	0.12	0/0	0/0	1.98	6.1	0	0.12	nm	nm	nm
Hesperia	46	7	0.17	0/0	0/0	1.98	3.1	0	0.09	0	0.005	0.008
Phelan	68	26	0.24	0/0	0/0	1.49	1.7	0	0.06	0	0.004	0.006
Trona	0	0	0.09	*	*	*	*	0	0.05	0	0.006	0.011
29 Palms	3	0	0.11	0/0	0/0	1.90	5.0	0	0.07	0	0.005	0.012
Victorville	41	7	0.15	0/0	0/0	2.36	3.1	0	0.11	0	0.008	0.013

LOCATION	PM 10 days exceeding state std	PM 10 days exceeding federal std	PM 10 max 24 hr ug/m3	PM 10 annual arithmetic mean ug/m3	PM 10 annual geometric mean ug/m3	TSP max 24 hr ug/m3	TSP annual arithmetic mean ug/m3	TSP annual geometric mean ug/m3	LEAD max 24 hr ug/m3	LEAD days xceedin state std	SULFATE max 24 hr ug/m3	SULFATE days exceeding state std
Barstow	0	0	116	28.73	24.29	nm	nm	nm	nm	nm	nm	nm
Hesperia	2	0	82	32.49	27.69	nm	nm	nm	nm	nm	nm	nm
Lucerne	0	0	50	18.17	14.40	nm	nm	nm	nm	nm	nm	nm
Trona	0	0	51	22.32	20.12	86	42.28	40.51	0.04	0	8.3	0
29 Palms	0	0	85	19.85	16.87	nm	nm	nm	nm	nm	nm	nm
Victorville	0	0	80	28.84	25.80	nm	nm	nm	nm	nm	nm	nm

nm=not monitored TSP data not complete (missing Aug).

02/12/97 EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS) PAGE 10
AMP355RP AIR QUALITY SUBSYSTEM
STANDARDS REPORT - PM10 TOTAL 0-10UM (81102)
DAILY VALUES
STATE 49 UTAH

SITE-ID: 49-045-0002 POC: 1
COUNTY (045): TOOELE CO
CITY (31120): GRANTSVILLE
SITE ADDRESS: 90 S PARK ST., GRANTSVILLE, UTAH
SUPPORT AGENCY (001): UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
SITE COMMENTS:
MONITOR COMMENTS:
REPORTING ORGANIZATION (001): UTAH DEPARTMENT OF ENVIRONMENTAL QUAL
MONITOR TYPE (2): SLAMS
COLLECTION AND ANALYSIS METHOD (063): HI-VOL-SA/GMW-1200 GRAVIMETRIC

AQCR (220): WASATCH FRONT
URBAN AREA (0000): NOT IN AN URBAN AREA
LAND USE (1): RESIDENTIAL
LOCATION-SETTING (2): SUBURBAN
MONITORING OBJECTIVE ( ): *** NOT FOUND ***

LATITUDE: 40:35:52 N
LONGITUDE: 112:28:00 W
UTM ZONE: 12
UTM-NORTHING: 4494932
UTM-EASTING: 00375910
ELEVATION-MSL: 01321 M
UNITS (001): UG/CU MET
PROBE HEIGHT: 4 M

		JAN 1996	FEB 1996	MAR 1996	APR 1996	MAY 1996	JUN 1996	JUL 1996	AUG 1996	SEP 1996	OCT 1996	NOV 1996	DEC 1996
	1	M	T	F	M	W	S	M	50 T	S	T	F	S
	2	T	F	S	T	T	13 S	33 T	F	M	W	S	M
	3	W	34 S	S	W	23 F	M	W	S	T	T	S	T
	4	8 T	S	17 M	T	S	T	T	S	W	F	M	W
D	5	F	M	T	F	S	W	F	M	T	S	10 T	8 T
	6	S	T	W	S	M	T	S	T	26 F	29 S	W	F
A	7	S	W	T	S	T	F	S	29 W	S	M	T	S
	8	M	T	F	M	W	32 S	30 M	T	S	T	F	S
Y	9	T	F	S	T	15 T	S	T	F	M	W	S	M
	10	17 W	S	25 S	W	F	M	W	S	T	T	S	T
	11	T	S	M	T	S	T	T	S	W	F	29 M	4 W
O	12	F	M	T	F	S	W	F	M	T	25 S	T	T
	13	S	T	W	S	M	T	S	T	F	S	W	F
F	14	S	W	T	S	T	24 F	23 S	W	S	M	T	S
	15	M	72 T	F	M	22 W	S	M	T	S	T	F	S
	16	T	F	12 S	T	T	S	T	F	M	W	S	M
M	17	W	S	S	W	F	M	W	S	T	T	7 S	10 T
	18	T	S	M	T	S	T	T	S	W	25 F	M	W
O	19	F	M	T	F	S	W	F	M	T	S	T	T
	20	S	T	W	S	M	27 T	18 S	T	F	S	W	F
N	21	S	5 W	T	5 S	12 T	F	S	W	S	M	T	S
	22	9 M	T	19 F	M	W	S	M	T	S	T	F	S
T	23	T	F	S	T	T	S	T	F	M	W	8 S	6 M
	24	W	S	S	W	F	M	W	S	T	9 T	S	T
H	25	T	S	M	T	S	T	T	33 S	W	F	M	W
	26	F	M	T	F	S	W	29 F	M	T	S	T	T
	27	S	7 T	W	S	8 M	T	S	T	F	S	W	F
	28	7 S	W	T	S	T	F	S	W	S	M	T	S
	29	M	T	F	M	W	S	M	T	S	T	6 F	4 S
	30	T		S	T	T	S	T	F	38 M	17 W	S	M
	31	W		S		F		W	43 S		T		T
NUMBER		4	4	4	1	5	4	5	4	2	5	5	5
MAXIMUM		17	72	25	5	23	32	33	50	38	29	29	10
ARITH-MEAN		10	30	18	5	16	24	27	39	32	21	12	6
SAMPLE FREQS(QTRLY MIN)				(6)			(6)			(6)			(6)
QTRLY ARITH MEAN				19.3			18.1			32.0			13.1
QTRLY EXP NUM EXCEED				0.00			0.00			0.00			0.00

TOTAL SAMPLES = 48 0 STARRED (*) ITEMS EXCEEDED THE PRIMARY STANDARD OF 150 UG/CU METER (25 C)
ARITHMETIC MEAN = 20.6 DOES NOT MEET SUMMARY CRITERIA EXPECTED NUMBER OF EXCEEDANCES 0.0
ARITHMETIC STANDARD DEVIATION = 14 PRIMARY STANDARD OF 50 UG/CU METER (25 C) WAS MET

04/08/97
AMP355RP

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
STANDARDS REPORT - SULFUR DIOXIDE (42401)
1-HOUR MAXIMUM
STATE 49 UTAH

SITE-ID: 49-045-0002 POC: 1
COUNTY (045): TOOELE CO
CITY (31120): GRANTSVILLE
SITE ADDRESS: 90 S PARK ST., GRANTSVILLE, UTAH
SUPPORT AGENCY (001): UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
SITE COMMENTS:
MONITOR COMMENTS:
REPORTING ORGANIZATION (001): UTAH DEPARTMENT OF ENVIRONMENTAL QUAL
MONITOR TYPE (2): SLAMS
COLLECTION AND ANALYSIS METHOD (060): INSTRUMENTAL PULSED FLUORESCENT

AQCR (220): WASATCH FRONT
URBAN AREA (0000): NOT IN AN URBAN AREA
LAND USE (1): RESIDENTIAL
LOCATION-SETTING (2): SUBURBAN
MONITORING OBJECTIVE ( ): *** NOT FOUND ***

LATITUDE: 40:35:52 N
LONGITUDE: 112:28:00 W
UTM ZONE: 12
UTM-NORTHING: 4494932
UTM-EASTING: 00375910
ELEVATION-MSL: 01321 M
UNITS (007): PPM
PROBE HEIGHT: 0 M

		JAN 1995		FEB 1995		MAR 1995		APR 1995		MAY 1995		JUN 1995	
	1	.003	S	.003	W	.001	W	.009	S	.000	M	.002	T
	2	.002	M	.000	T	.003	T	.000	S	.000	T	.000	F
	3	.012	T	.001	F	.000	F	.000	M	.000	W	.000	S
	4	.011	W	.000	S	.000	S	.006	T	.000	T	.000	S
D	5	.003	T	.003	S	.000	S	.000	W	.001	F	.000	M
	6	.001	F	.003	M	.000	M	.001	T	.000	S	.000	T
A	7	.000	S	.002	T	.002	T	.000	F	.000	S	.000	W
	8	.000	S	.000	W	.000	W	.000	S	.000	M	.000	T
Y	9	.000	M	.000	T	.000	T	.000	S	.000	T	.000	F
	10	.000	T	.000	F	.000	F	.000	M	.000	W	.001	S
	11	.000	W	.000	S	.000	S	.004	T	.000	T	.001	S
O	12	.000	T	.000	S	.000	S	.002	W	.000	F	.000	M
	13	.000	F	.000	M	.000	M	.000	T	.006	S	.000	T
F	14	.000	S	.000	T	.000	T	.000	F	.002	S	.000	W
	15	.000	S	.007	W	.004	W	.000	S	.000	M	.000	T
	16	.000	M	.003	T	.002	T	.004	S	.000	T	.000	F
M	17	.000	T	.024	F	.008	F	.000	M	.000	W	.000	S
	18	.000	W	.000	S	.001	S	.000	T	.000	T	.000	S
O	19	.000	T	.001	S	.000	S	.000	W	.000	F	.000	M
	20	.002	F	.001	M	.000	M	.000	T	.000	S	.000	T
N	21	.002	S	.001	T	.000	T	.000	F	.000	S	.000	W
	22	.011	S	.000	W	.000	W	.000	S	.000	M	.000	T
T	23	.006	M	.003	T	.000	T	.000	S	.000	T	.000	F
	24	.008	T	.001	F	.000	F	.000	M	.000	W	.001	S
H	25	.000	W	.002	S	.000	S	.000	T	.000	T	.000	S
	26	.000	T	.001	S	.000	S	.005	W	.000	F	.007	M
	27	.000	F	.000	M	.000	M	.000	T	.000	S	.000	T
	28	.000	S	.000	T	.010	T	.000	F	.001	S	.000	W
	29	.005	S			.001	W	.000	S	.001	M	.001	T
	30	.001	M			.005	T	.000	S	.000	T	.000	F
	31	.001	T			.003	F			.000	W		
NUMBER		737		661		737		712		707		711	
MAXIMUM		.012		.024		.010		.009		.006		.007	
ARITH-MEAN		.001		.001		.001		.001		.001		.001	

		JUL 1995		AUG 1995		SEP 1995		OCT 1995		NOV 1995		DEC 1995	
	1	.000	S	.003	T	.001	F	.000	S	.000	W	.000	F
	2	.000	S	.001	W	.002	S	.000	M	.001	T	.000	S
	3	.000	M	.001	T	.008	S	.000	T	.001	F	.001	S
	4	.000	T	.001	F	.000	M	.000	W	.001	S	.000	M
D	5	.001	W	.001	S	.001	T	.000	T	.000	S	.000	T
	6	.000	T	.000	S	.002	W	.002	F	.000	M	.000	W
A	7	.000	F	.000	M	.000	T	.001	S	.001	T	.000	T
	8	.000	S	.002	T	.000	F	.010	S	.000	W	.001	F
Y	9	.000	S	.004	W	.001	S	.001	M	.000	T	.001	S
	10	.000	M	.006	T	.001	S	.002	T	.000	F	.000	S
	11	.000	T	.000	F	.000	M	.000	W	.000	S	.000	M
O	12	.000	W	.001	S	.001	T	.000	T	.003	S	.000	T
	13	.000	T	.001	S	.002	W	.001	F	.000	M	.000	W
F	14	.000	F	.001	M	.001	T	.001	S	.001	T	.000	T
	15	.000	S	.002	T	.001	F	.001	S	.000	W	.000	F
	16	.000	S	.000	W	.005	S	.001	M	.001	T	.000	S
M	17	.000	M	.000	T	.000	S	.002	T	.000	F	.000	S
	18	.000	T	.000	F	.000	M	.000	W	.000	S	.000	M
O	19	.000	W	.001	S	.000	T	.000	T	.001	S	.001	T
	20	.000	T	.001	S	.000	W	.002	F	.001	M	.000	W
N	21	.000	F	.000	M	.001	T	.002	S	.001	T	.000	T
	22	.000	S	.001	T	.001	F	.000	S	.001	W	.000	F
T	23	.000	S	.005	W	.001	S	.003	M	.000	T	.001	S
	24	.000	M	.001	T	.002	S	.002	T	.000	F	.000	S
H	25	.000	T	.000	F	.002	M	.002	W	.000	S	.000	M
	26	.000	W	.000	S	.000	T	.001	T	.000	S	.000	T
	27	.003	T	.000	S	.002	W	.001	F	.000	M	.000	W
	28	.004	F	.005	M	.001	T	.005	S	.000	T	.000	T
	29	.001	S	.000	T	.000	F	.001	S	.000	W	.000	F
	30	.001	S	.002	W	.001	S	.001	M	.000	T	.000	S
	31	.002	M	.004	T			.001	T			.000	S
NUMBER		739		735		714		739		709		737	
MAXIMUM		.004		.006		.008		.010		.003		.001	
ARITH-MEAN		.001		.001		.001		.001		.001		.001	

TOTAL SAMPLES = 8638
% OF POSSIBLE OBSERVATIONS = 98.6
ARITHMETIC MEAN = .001
ARITHMETIC STANDARD DEVIATION = .001

MEETS SUMMARY CRITERIA
PRIMARY STANDARD OF .030 PPM WAS MET

04/08/97
AMP355RP

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
STANDARDS REPORT - SULFUR DIOXIDE (42401)
1-HOUR MAXIMUM
STATE 49 UTAH

SITE-ID: 49-045-0002 POC: 1
COUNTY (045): TOOELE CO
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SITE ADDRESS: 90 S PARK ST., GRANTSVILLE, UTAH
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SITE COMMENTS:
MONITOR COMMENTS:
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MONITOR TYPE (2): SLAMS
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AQCR (220): WASATCH FRONT
URBAN AREA (0000): NOT IN AN URBAN AREA
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LOCATION-SETTING (2): SUBURBAN
MONITORING OBJECTIVE ( ): *** NOT FOUND ***

LATITUDE: 40:35:52 N
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UTM ZONE: 12
UTM-NORTHING: 4494932
UTM-EASTING: 00375910
ELEVATION-MSL: 01321 M
UNITS (007): PPM
PROBE HEIGHT: 0 M

		JAN 1996		FEB 1996		MAR 1996		APR 1996		MAY 1996		JUN 1996		JUL 1996		AUG 1996		SEP 1996		OCT 1996		NOV 1996		DEC 1996	
	1	.000	M	.000	T	.000	F	.000	M	.000	W	.000	S	.002	M	.004	T	.001	S	.003	T	.001	F	.000	S
	2	.000	T	.000	F	.001	S	.000	T	.000	T	.001	S	.002	T	.001	F	.001	M	.002	W	.002	S	.001	M
	3	.000	W	.001	S	.001	S	.000	W	.002	F	.002	M	.001	W	.001	S	.002	T	.001	T	.001	S	.000	T
	4	.000	T	.000	S	.000	M	.000	T	.001	S	.001	T	.002	T	.000	S	.001	W	.003	F	.000	M	.001	W
D	5	.000	F	.000	M	.000	T	.000	F	.001	S	.000	W	.002	F	.000	M	.001	T	.001	S	.000	T	.000	T
	6	.001	S	.000	T	.000	W	.000	S	.001	M	.004	T	.001	S	.000	T	.002	F	.001	S	.000	W	.000	F
A	7	.000	S	.001	W	.001	T	.000	S	.001	T	.003	F	.002	S	.002	W	.002	S	.001	M	.001	T	.001	S
	8	.001	M	.000	T	.001	F	.000	M	.004	W	.002	S	.002	M	.002	T	.001	S	.004	T	.001	F	.001	S
Y	9	.001	T	.001	F	.005	S	.000	T	.000	T	.001	S	.001	T	.004	F	.002	M	.002	W	.001	S	.001	M
	10	.000	W	.000	S	.002	S	.000	W	.001	F	.002	M	.003	W	.001	S	.002	T	.001	T	.001	S	.000	T
	11	.000	T	.001	S	.000	M	.000	T	.001	S	.001	T	.001	T	.004	S	.002	W	.002	F	.001	M	.000	W
O	12	.001	F	.001	M	.000	T	.000	F	.003	S	.001	W	.002	F	.002	M	.001	T	.002	S	.002	T	.000	T
	13	.001	S	.001	T	.000	W	.000	S	.001	M	.001	T	.001	S	.002	T	.000	F	.001	S	.002	W	.001	F
F	14	.003	S	.001	W	.001	T	.000	S	.001	T	.001	F	.004	S	.001	W	.001	S	.000	M	.001	T	.000	S
	15	.001	M	.002	T	.000	F	.000	M	.001	W	.001	S	.001	M	.000	T	.000	S	.003	T	.000	F	.000	S
	16	.000	T	.001	F	.000	S	.000	T	.000	T	.000	S	.001	T	.003	F	.000	M	.000	W	.000	S	.000	M
M	17	.000	W	.000	S	.000	S	.003	W	.002	F	.000	M	.002	W	.001	S	.001	T	.001	T	.000	S	.000	T
	18	.000	T	.000	S	.000	M	.000	T	.000	S	.000	T	.000	T	.000	S	.000	W	.001	F	.000	M	.001	W
O	19	.000	F	.000	M	.001	T	.000	F	.000	S	.001	W	.001	F	.005	M	.001	T	.000	S	.000	T	.001	T
	20	.000	S	.000	T	.001	W	.000	S	.000	M	.002	T	.000	S	.001	T	.002	F	.000	S	.002	W	.001	F
N	21	.000	S	.000	W	.000	T	.000	S	.002	T	.001	F	.001	S	.001	W	.001	S	.001	M	.001	T	.001	S
	22	.000	M	.000	T	.000	F	.000	M	.000	W	.001	S	.002	M	.003	T	.000	S	.003	T	.000	F	.001	S
T	23	.000	T	.000	F	.000	S	.000	T	.000	T	.002	S	.001	T	.002	F	.001	M	.002	W	.000	S	.001	M
	24	.000	W	.000	S	.000	S	.001	W	.001	F	.001	M	.002	W	.002	S	.004	T	.001	T	.000	S	.000	T
H	25	.000	T	.000	S	.000	M	.000	T	.001	S	.004	T	.001	T	.001	S	.001	W	.000	F	.000	M	.001	W
	26	.000	F	.000	M	.001	T	.000	F	.000	S	.000	W	.003	F	.001	M	.000	T	.001	S	.000	T	.000	T
	27	.000	S	.000	T	.000	W	.000	S	.001	M	.000	T	.001	S	.000	T	.002	F	.001	S	.001	W	.000	F
	28	.000	S	.000	W	.000	T	.000	S	.000	T	.000	F	.000	S	.001	W	.002	S	.003	M	.000	T	.001	S
	29	.000	M	.000	T	.000	F	.001	M	.000	W	.003	S	.001	M	.001	T	.003	S	.001	T	.000	F	.001	S
	30	.000	T			.001	S	.000	T	.000	T	.003	S	.001	T	.002	F	.002	M	.001	W	.000	S	.001	M
	31	.000	W			.000	S			.000	F			.003	W	.002	S			.002	T			.001	T
NUMBER		735		682		737		712		731		708		738		712		711		737		712		736	
MAXIMUM		.003		.002		.005		.003		.004		.004		.004		.005		.004		.004		.002		.001	
ARITH-MEAN		.001		.001		.001		.001		.001		.001		.001		.001		.001		.001		.001		.001	

TOTAL SAMPLES = 8651
% OF POSSIBLE OBSERVATIONS = 98.5
ARITHMETIC MEAN = .001
ARITHMETIC STANDARD DEVIATION = .000

MEETS SUMMARY CRITERIA
PRIMARY STANDARD OF .030 PPM WAS MET

04/08/97
AMP355RP

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
STANDARDS REPORT - SULFUR DIOXIDE (42401)
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STATE 49 UTAH

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SITE COMMENTS:
MONITOR COMMENTS:
REPORTING ORGANIZATION (001): UTAH DEPARTMENT OF ENVIRONMENTAL QUAL
MONITOR TYPE (2): SLAMS
COLLECTION AND ANALYSIS METHOD (060): INSTRUMENTAL PULSED FLUORESCENT

AQCR (220): WASATCH FRONT
URBAN AREA (0000): NOT IN AN URBAN AREA
LAND USE (1): RESIDENTIAL
LOCATION-SETTING (2): SUBURBAN
MONITORING OBJECTIVE ( ): *** NOT FOUND ***

LATITUDE: 40:35:52 N
LONGITUDE: 112:28:00 W
UTM ZONE: 12
UTM-NORTHING: 4494932
UTM-EASTING: 00375910
ELEVATION-MSL: 01321 M
UNITS (007): PPM
PROBE HEIGHT: 0 M

		JAN 1995	FEB 1995	MAR 1995	APR 1995	MAY 1995	JUN 1995	JUL 1995	AUG 1995	SEP 1995	OCT 1995	NOV 1995	DEC 1995
	1	.003 S	.003 W	.001 W	.009 S	.000 M	.002 T	.000 S	.003 T	.001 F	.000 S	.000 W	.000 F
	2	.002 M	.000 T	.003 T	.000 S	.000 T	.000 F	.000 S	.001 W	.002 S	.000 M	.001 T	.000 S
	3	.012 T	.001 F	.000 F	.000 M	.000 W	.000 S	.000 M	.001 T	.008 S	.000 T	.001 F	.001 S
	4	.011 W	.000 S	.000 S	.006 T	.000 T	.000 S	.000 T	.001 F	.000 M	.000 W	.001 S	.000 M
D	5	.003 T	.003 S	.000 S	.000 W	.001 F	.000 M	.001 W	.001 S	.001 T	.000 T	.000 S	.000 T
	6	.001 F	.003 M	.000 M	.001 T	.000 S	.000 T	.000 T	.000 S	.002 W	.002 F	.000 M	.000 W
A	7	.000 S	.002 T	.002 T	.000 F	.000 S	.000 W	.000 F	.000 M	.000 T	.001 S	.001 T	.000 T
	8	.000 S	.000 W	.000 W	.000 S	.000 M	.000 T	.000 S	.002 T	.000 F	.010 S	.000 W	.001 F
Y	9	.000 M	.000 T	.000 T	.000 S	.000 T	.000 F	.000 S	.004 W	.001 S	.001 M	.000 T	.001 S
	10	.000 T	.000 F	.000 F	.000 M	.000 W	.001 S	.000 M	.006 T	.001 S	.002 T	.000 F	.000 S
	11	.000 W	.000 S	.000 S	.004 T	.000 T	.001 S	.000 T	.000 F	.000 M	.000 W	.000 S	.000 M
O	12	.000 T	.000 S	.000 S	.002 W	.000 F	.000 M	.000 W	.001 S	.001 T	.000 T	.003 S	.000 T
	13	.000 F	.000 M	.000 M	.000 T	.006 S	.000 T	.000 T	.001 S	.002 W	.001 F	.000 M	.000 W
F	14	.000 S	.000 T	.000 T	.000 F	.002 S	.000 W	.000 F	.001 M	.001 T	.001 S	.001 T	.000 T
	15	.000 S	.007 W	.004 W	.000 S	.000 M	.000 T	.000 S	.002 T	.001 F	.001 S	.000 W	.000 F
	16	.000 M	.003 T	.002 T	.004 S	.000 T	.000 F	.000 S	.000 W	.005 S	.001 M	.001 T	.000 S
M	17	.000 T	.024 F	.008 F	.000 M	.000 W	.000 S	.000 M	.000 T	.000 S	.002 T	.000 F	.000 S
	18	.000 W	.000 S	.001 S	.000 T	.000 T	.000 S	.000 T	.000 F	.000 M	.000 W	.000 S	.000 M
O	19	.000 T	.001 S	.000 S	.000 W	.000 F	.000 M	.000 W	.001 S	.000 T	.000 T	.001 S	.001 T
	20	.002 F	.001 M	.000 M	.000 T	.000 S	.000 T	.000 T	.001 S	.000 W	.002 F	.001 M	.000 W
N	21	.002 S	.001 T	.000 T	.000 F	.000 S	.000 W	.000 F	.000 M	.001 T	.002 S	.001 T	.000 T
	22	.011 S	.000 W	.000 W	.000 S	.000 M	.000 T	.000 S	.001 T	.000 F	.001 S	.001 W	.000 F
T	23	.006 M	.003 T	.000 T	.000 S	.000 T	.000 F	.000 S	.005 W	.001 S	.003 M	.000 T	.001 S
	24	.008 T	.001 F	.000 F	.000 M	.000 W	.001 S	.000 M	.001 T	.002 S	.002 T	.000 F	.000 S
H	25	.000 W	.002 S	.000 S	.000 T	.000 T	.000 S	.000 T	.000 F	.002 M	.002 W	.000 S	.000 M
	26	.000 T	.001 S	.000 S	.005 W	.000 F	.007 M	.000 W	.000 S	.000 T	.001 T	.000 S	.000 T
	27	.000 F	.000 M	.000 M	.000 T	.000 S	.000 T	.003 T	.000 S	.002 W	.001 F	.000 M	.000 W
	28	.000 S	.000 T	.010 T	.000 F	.001 S	.000 W	.004 F	.005 M	.001 T	.005 S	.000 T	.000 T
	29	.005 S		.001 W	.000 S	.001 M	.001 T	.001 S	.000 T	.000 F	.001 S	.000 W	.000 F
	30	.001 M		.005 T	.000 S	.000 T	.000 F	.001 S	.002 W	.001 S	.001 M	.000 T	.000 S
	31	.001 T		.003 F		.000 W		.002 M	.004 T		.001 T		.000 S
NUMBER		737	661	737	712	707	711	739	735	714	739	709	737
MAXIMUM		.012	.024	.010	.009	.006	.007	.004	.006	.008	.010	.003	.001
ARITH-MEAN		.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001

TOTAL SAMPLES = 8638
% OF POSSIBLE OBSERVATIONS = 98.6
ARITHMETIC MEAN = .001
ARITHMETIC STANDARD DEVIATION = .001

MEETS SUMMARY CRITERIA
PRIMARY STANDARD OF .030 PPM WAS MET

1996 Data

Criteria pollutants in area of Moses Lake AFB

Carbon Monoxide

	hourly	8-hour average	
Yakima	11.9	7.4	1/12
	10.5	7.3	1/11
	14.9	12.4	2/7
	13.4	6.4	11/8

PM_{10}

	24-hour average	
Yakima	119	2/15
	126	2/13
	112	2/3
	105	2/15
Ellensburg	109	12/19
	83	2/3
	93	12/17
Walla Walla	71	2/15
	70	9/13
	69	8/13
Kennewick	84	8/17
	82	9/12
	77	8/30

APPENDIX D

X-33 FLIGHT TRACK ACTIVITY
COUNTY AND GENERALIZED COMMERCIAL/
GENERAL AVIATION FLIGHT CORRIDORS

APPENDIX D

X-33 FLIGHT TRACK ACTIVITY COUNTY AND GENERALIZED COMMERCIAL/GENERAL AVIATION FLIGHT CORRIDORS

Prepared Under Contract to NASA/X-33 Program by W.K. Dickson

through CH2M Hill

April 15, 1997

INTRODUCTION

The purpose of this exercise is to determine, to the extent feasible within time and funding constraints, the level of general and commercial flight operations which may be impacted by the proposed X-33 flights departing from Edwards Air Force Base in California and terminating at: (1) Silurian Lake, California; (2) China Lake, California; (3) Michael Army Airfield, Utah; (4) Malmstrom Air Force Base, Montana; and, (5) Moses Lake, Washington.

Specifically, tabular data and appropriate graphics of commercial and general aviation flight corridors in the vicinity of X-33 flight tracks (to a maximum of five) and density of use by time of day in 1-hour increments over a 24-hour period are to be provided, and to the extent readily available, frequency of requests for priority airspace/emergency landing clearance.

The data are arranged by the Air Route Traffic Control Centers (ARTCC) beginning at Edwards and ending at the respective destinations. The ARTCC data are collected by sector within the general ARTCC boundaries. Since the activity data are not readily available for each specific airway or for general aviation activity not utilizing ARTCC services, sector data were used to provide the activity counts which provide reasonable data concerning the impacts of this activity. This means that some of the sectors may be higher that would actually be present along a 50-mile swath of the X-33 flight track. (Note that general aviation aircraft which did not use ARTCC services are not included in the counts since obtaining this data, which is not readily available would take several months to obtain and cost far more than funds available.) However, we believe that the relative activity levels presented will allow reasonable decisions to be made concerning the impacts to commercial and general aviation activity along the X-33 flight tracks.

Notes Common to All Flight Tracks and ARTCC:

- Data are separated into high altitude (above 18,000 feet) and low altitude (below 18,000 feet) for both commercial and general aviation.
- The data are presented by ARTCC sector separately for high and low altitude.
- Both generalized commercial and general aviation flight corridors are similar for those flights utilizing ARTCC services and are not separated.

- Sources and limitations for each ARTCC and sector are noted on respective tables.
- In all cases, actual activity counts were retrieved by respective ARTCC's for one week in March 1997. The data for several of the days during the week were prepared for a 24-hour period in 1-hour increments. Activity levels where hourly counts were not provided by respective ARTCC, extrapolations were made on the 24-hour totals to arrive at hourly counts. Individual notes were included on each sector activity count table where this occurred.
- For those days where counts are not presented (either stratified of total), the data were not available from the respective center and is noted on the individual sector tabulations.
- In all cases military data were subtracted from the activity counts.
- Due to the "de-projected" map supplied by NASA, all commercial and general aviation flight corridors, ARTCC and sector boundaries, and locations of features presented on the attached maps are approximate. This is because the graphical data were transferred from maps of varying projections and scales to the "de-projected" map supplied by NASA.
- The Los Angeles' ARTCC has only one sector. The remaining areas are restricted airspace and no civilian aircraft normally enter the area.
- All times noted on the individual tabulations are in "Zulu," or Coordinated Universal Time, except Seattle which is "Standard" local time. To arrive at local time subtract the following from the indicated times on the tables:

Los Angeles Center	-8 hours
Oakland	-8 hours
Seattle	-0 hours (already presented in local time)
Salt Lake City	-7 hours

<u>Requests for Emergency Landing or Priority Airspace</u>

The requests for emergency or priority airspace varies by ARTCC:

Los Angeles ARTCC:	Requests for emergency/priority airspace average two-three per month, with 70 percent of those requests being by civil aircraft and 30 percent by military aircraft according to center representative Vicki Conroy, Los Angeles ARTCC, (805) 265-8200.
Oakland ARTCC:	For the year 1996, there were eight requests by civilian aircraft for emergency/priority airspace and eight requests by military aircraft for emergency/priority airspace. This data was provided by Mr. Gary Hess, Oakland ARTCC, (510) 745-3334.

Seattle ARTCC: There are no requests for emergency/priority airspace on file for the Seattle ARTCC. After 15 days all requests are deleted unless an actual emergency occurs. Center representative, Eon Parsons, Seattle ARTCC (206) 351-3596, indicated that they could not provide an estimate of such requests.

Salt Lake City ARTCC: Requests for emergency/priority airspace average two-three per day with civilian aircraft requesting approximately 30 percent of the time (usually for medical emergencies) and military approximately 70 percent. Mr. Paul Brophy, Salt Lake City ARTCC, (801) 320- 2537.

SILURIAN LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS:SECTOR 16 (LOS ANGELES)

Low and High Altitudes

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SOURCES: Ms. Vicky Conroy TMU Analyst 805-265-8200 Los Angeles ARTCC

Notes: No sectors impacted, totals=0.

CHINA LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 16 (LOS ANGELES)

Low and High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SOURCES: Ms. Vicky Conroy TMU Analyst 805-265-8200 Los Angeles ARTCC

Notes: No sectors impacted, totals=0.

MICHALES AAF- X33 FLIGHT TRACK AND ACTIVITY COUNTS:SECTOR 16 (LOS ANGELES)

Low and High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THU	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	1	3	3	5	3	3	4	25	24	24	23	24	21	30	26	27	27	28	27	24	34
0100	1	3	3	4	3	3	3	28	21	21	19	21	15	25	29	24	24	23	24	18	28
0200	0	1	1	2	1	2	1	21	14	14	9	14	11	17	21	15	15	11	15	13	18
0300	0	3	3	6	3	6	4	25	21	21	27	21	15	25	25	24	24	33	24	21	29
0400	0	1	1	2	1	2	1	18	14	14	10	14	14	17	18	15	15	12	15	16	18
0500	0	2	2	4	2	6	3	5	14	14	50	14	20	17	5	16	16	54	16	26	20
0600	0	3	3	6	3	6	4	0	17	17	60	17	19	21	0	20	20	66	20	25	25
0700	0	2	2	3	2	2	2	0	10	10	49	10	13	13	0	12	12	52	12	15	15
0800	0	1	1	1	1	2	1	0	7	7	8	7	11	8	0	8	8	9	8	13	9
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
1400	0	1	1	2	1	1	1	1	7	7	12	7	8	8	1	8	8	14	8	9	9
1500	3	4	4	5	4	4	4	13	21	21	25	21	22	26	16	25	25	30	25	26	30
1600	3	4	4	5	4	3	4	17	17	17	21	17	15	21	20	21	21	26	21	18	25
1700	7	5	5	6	5	3	6	26	24	24	29	24	19	30	33	29	29	35	29	22	36
1800	3	4	4	6	4	4	5	24	24	24	26	24	23	30	27	28	28	32	28	27	35
1900	1	3	3	4	3	3	3	22	21	21	28	21	20	25	23	24	24	32	24	23	28
2000	2	4	4	5	4	4	4	23	24	24	23	24	26	30	25	28	28	28	28	30	34
2100	2	3	3	5	3	3	4	23	21	21	24	21	16	25	25	24	24	29	24	19	29
2200	1	2	2	3	2	3	3	24	21	21	16	21	18	25	25	23	23	19	23	21	28
2300	1	3	3	5	3	4	4	24	52	52	24	52	21	64	25	55	55	29	55	25	68
TOTAL:	25	52	52	79	52	64	61	321	374	374	483	374	327	457	346	426	426	562	426	391	518

SOURCES: Ms. Vicky Conroy TMU Analyst 805-265-8200 Los Angeles ARTCC

Notes:
1) Sector 16 is combined High and Low Altitudes
2) For Sunday, Tuesday, Thursday, information derived from stratification tables.
Dates for Friday, Saturday, Monday, Wednesday, hourly counts were extrapolated from daily totals supplied by ARTCC.
3) Times are Zulu (Coordinated Universal Time).

MICHAEL'S AAF - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 28 (SALT LAKE)

Low and High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		0		1		4			23		11		10		0	23	0	12	0	14	0
0100		0		1		0			25		29		18		0	25	0	30	0	18	0
0200		0		2		2			22		11		12		0	22	0	13	0	14	0
0300		0		3		2			20		20		11		0	0	0	23	0	13	0
0400		0		0		0			17		15		12		0	17	0	15	0	12	0
0500		0		2		1			22		7		21		0	22	0	9	0	22	0
0600		0				1			8				7		0	8	0	0	0	8	0
0700		0		0		0			1		15		9		0	1	0	15	0	9	0
0800		0		0		0			9		10		10		0	9	0	10	0	10	0
0900		0		1		2			3		3		4		0	3	0	4	0	6	0
1000		0		0		0			0		7		5		0	0	0	7	0	5	0
1100		0		0		0			0		2		1		0	0	0	2	0	1	0
1200		1		0		1			0		1		1		0	1	0	1	0	2	0
1300		2		2		0			8		10		4		0	10	0	12	0	4	0
1400		2		3		1			7		10		16		0	9	0	13	0	17	0
1500		1		4		3			25		25		30		0	26	0	29	0	33	0
1600		0		6		4			36		24		20		0	36	0	30	0	24	0
1700		1		4		4			41		35		22		0	42	0	39	0	26	0
1800		2		2		2			39		29		27		0	41	0	31	0	29	0
1900		0		4		3			26		22		19		0	26	0	26	0	22	0
2000		0		3		4			21		30		13		0	21	0	33	0	17	0
2100		0		3		4			22		16		12		0	22	0	19	0	16	0
2200		1		2		2			52		29		32		0	53	0	31	0	34	0
2300		0		4		3			24		11		14		0	24	0	15	0	17	0
TOTAL:		10		47		43			451		372		330		0	461	0	419	0	373	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 28.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MICHAEL'S AAF - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 47 (SALT LAKE)

Low Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		0		1		4			23		11		10		0	23	0	12	0	14	0
0100		0		1		0			25		29		18		0	25	0	30	0	18	0
0200		0		2		2			22		11		12		0	22	0	13	0	14	0
0300		0		3		2			20		20		11		0	0	0	23	0	13	0
0400		0		0		0			17		15		12		0	17	0	15	0	12	0
0500		0		2		1			22		7		21		0	22	0	9	0	22	0
0600		0				1			8				7		0	8	0	0	0	8	0
0700		0		0		0			1		15		9		0	1	0	15	0	9	0
0800		0		0		0			9		10		10		0	9	0	10	0	10	0
0900		0		1		2			3		3		4		0	3	0	4	0	6	0
1000		0		0		0			0		7		5		0	0	0	7	0	5	0
1100		0		0		0			0		2		1		0	0	0	2	0	1	0
1200		1		0		1			0		1		1		0	1	0	1	0	2	0
1300		2		2		0			8		10		4		0	10	0	12	0	4	0
1400		2		3		1			7		10		16		0	9	0	13	0	17	0
1500		1		4		3			25		25		30		0	26	0	29	0	33	0
1600		0		6		4			36		24		20		0	36	0	30	0	24	0
1700		1		4		4			41		35		22		0	42	0	39	0	26	0
1800		2		2		2			39		29		27		0	41	0	31	0	29	0
1900		0		4		3			26		22		19		0	26	0	26	0	22	0
2000		0		3		4			21		30		13		0	21	0	33	0	17	0
2100		0		3		4			22		16		12		0	22	0	19	0	16	0
2200		1		2		2			52		29		32		0	53	0	31	0	34	0
2300		0		4		3			24		11		14		0	24	0	15	0	17	0
TOTAL:		10		47		43			451		372		330		0	461	0	419	0	373	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 47 is low altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MICHAELS AAF - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 45 (SALT LAKE)

High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		0		4		2			39		23		15		0	39	0	27	0	17	0
0100		0		4		2			26		16		17		0	26	0	20	0	19	0
0200		0		7		1			32		24		14		0	32	0	31	0	15	0
0300		0		2		2			28		20		27		0	0	0	22	0	29	0
0400		0		4		1			34		25		17		0	34	0	29	0	18	0
0500		0		1		0			19		20		16		0	19	0	21	0	16	0
0600		0							14						0	14	0	0	0	0	0
0700		0							14						0	14	0	0	0	0	0
0800		0							8						0	8	0	0	0	0	0
0900		0							7						0	7	0	0	0	0	0
1000		0							0						0	0	0	0	0	0	0
1100		0							0						0	0	0	0	0	0	0
1200		0							7						0	7	0	0	0	0	0
1300		0		2					9		2				0	9	0	4	0	0	0
1400		0		4		2			12		10		4		0	12	0	14	0	6	0
1500		0		6		1			21		22		27		0	21	0	28	0	28	0
1600		0		6		4			22		31		25		0	22	0	37	0	29	0
1700		0		2		4			21		38		39		0	21	0	40	0	43	0
1800		0		7		6			21		27		30		0	21	0	34	0	36	0
1900		0		4		9			16		20		27		0	16	0	24	0	36	0
2000		0		3		6			18		22		24		0	18	0	25	0	30	0
2100		0		4		2			29		28		30		0	29	0	32	0	32	0
2200		0		9		2			35		85		29		0	35	0	94	0	31	0
2300		2		9		2			37		32		20		0	39	0	41	0	22	0
TOTAL:		2		78		46			469		445		361		0	471	0	523	0	407	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 45 is high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MALMSTROM - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 28 (SALT LAKE) Low and High Altitude																					
	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		0		1		4			23		11		10		0	23	0	12	0	14	0
0100		0		1		0			26		29		18		0	26	0	30	0	18	0
0200		0		2		2			22		11		12		0	22	0	13	0	14	0
0300		0		3		2			20		20		11		0	0	0	23	0	13	0
0400		0		0		0			17		15		12		0	17	0	15	0	12	0
0500		0		2		1			22		7		21		0	22	0	9	0	22	0
0600		0				1			8				7		0	8	0	0	0	8	0
0700		0		0		0			1		15		9		0	1	0	15	0	9	0
0800		0		0		0			9		10		10		0	9	0	10	0	10	0
0900		0		1		2			3		3		4		0	3	0	4	0	6	0
1000		0		0		0			0		7		5		0	0	0	7	0	5	0
1100		0		0		0			0		2		1		0	0	0	2	0	1	0
1200		1		0		1			0		1		1		0	1	0	1	0	2	0
1300		2		2		0			8		10		4		0	10	0	12	0	4	0
1400		2		3		1			7		10		16		0	9	0	13	0	17	0
1500		1		4		3			25		25		30		0	26	0	29	0	33	0
1600		0		6		4			36		24		20		0	36	0	30	0	24	0
1700		1		4		4			41		35		22		0	42	0	39	0	26	0
1800		2		2		2			39		29		27		0	41	0	31	0	29	0
1900		0		4		3			26		22		19		0	26	0	26	0	22	0
2000		0		3		4			21		30		13		0	21	0	33	0	17	0
2100		0		3		4			22		16		12		0	22	0	19	0	16	0
2200		1		2		2			52		29		32		0	53	0	31	0	34	0
2300		0		4		3			24		11		14		0	24	0	15	0	17	0
TOTAL:		10		47		43			451		372		330		0	461	0	419	0	373	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 28.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MALMSTROM - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 40 (SALT LAKE)

Low and High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		0		1		4			23		11		10		0	23	0	12	0	14	0
0100		0		1		0			25		27		18		0	25	0	28	0	18	0
0200		0		2		2			22		11		12		0	22	0	13	0	14	0
0300		0		3		2			20		20		11		0	0	0	23	0	13	0
0400		0		0		0			17		15		12		0	17	0	15	0	12	0
0500		0		2		1			22		7		21		0	22	0	9	0	22	0
0600		0				1			8				7		0	8	0	0	0	8	0
0700		0		0		0			1		15		9		0	1	0	15	0	9	0
0800		0		0		0			9		10		10		0	9	0	10	0	10	0
0900		0		1		2			3		3		4		0	3	0	4	0	6	0
1000		0		0		0			0		7		5		0	0	0	7	0	5	0
1100		0		0		0			0		2		1		0	0	0	2	0	1	0
1200		1		0		1			0		1		1		0	1	0	1	0	2	0
1300		2		2		0			8		10		4		0	10	0	12	0	4	0
1400		2		3		1			7		14		16		0	9	0	17	0	17	0
1500		1		4		3			25		25		30		0	26	0	29	0	33	0
1600		0		6		4			36		24		20		0	36	0	30	0	24	0
1700		1		4		4			41		35		22		0	42	0	39	0	26	0
1800		2		2		2			39		29		27		0	41	0	31	0	29	0
1900		0		4		3			26		22		19		0	26	0	26	0	22	0
2000		0		3		4			21		20		13		0	21	0	23	0	17	0
2100		0		3		4			22		16		12		0	22	0	19	0	16	0
2200		1		2		2			52		37		32		0	53	0	39	0	34	0
2300		0		4		3			24		17		14		0	24	0	21	0	17	0
TOTAL:		10		47		43			451		378		330		0	461	0	425	0	373	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 40.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MALMSTROM - X33 FLIGHT TRACK AND ACTIVITY COUNTS:SECTOR 18 (SALT LAKE)
Low and High Altitude

TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes: No data provided by ARTCC.

MALMSTROM - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 41 (SALT LAKE)

High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		2		7		5			25		18				0	27	0	25	0	5	0
0100		2		5		3			20		25				0	22	0	30	0	3	0
0200		1		2		5			20		19				0	21	0	21	0	5	0
0300		0		5		2			27		26				0	27	0	31	0	2	0
0400		0		7		1			28		15				0	28	0	22	0	1	0
0500		0		1		1			18		18				0	18	0	17	0	1	0
0600		0		0		1			8		2				0	8	0	2	0	1	0
0700		0		0		0			2		0				0	2	0	0	0	0	0
0800		0		0		0			3		5				0	3	0	5	0	0	0
0900		0		2		0			2		1				0	2	0	3	0	0	0
1000				0		1					2				0	0	0	2	0	1	0
1100				1		0					2				0	0	0	3	0	0	0
1200		1		1		0			2		3				0	3	0	4	0	0	0
1300		0		2		2			4		30				0	4	0	32	0	2	0
1400		6		4		4			16		24				0	22	0	28	0	4	0
1500		3		6		5			30		21				0	33	0	27	0	5	0
1600		3		2		7			23		15				0	26	0	17	0	7	0
1700		3		9		0			23		26				0	26	0	35	0	0	0
1800		5		4		1			14		29				0	19	0	33	0	1	0
1900		2		4		3			20		15				0	22	0	19	0	3	0
2000		2		0		3			19		15				0	21	0	15	0	3	0
2100		3		3		3			37		24				0	40	0	27	0	3	0
2200		2		7		3			28		22				0	30	0	29	0	3	0
2300		3		9		5			28		15				0	31	0	24	0	5	0
TOTAL:		38		81		55			397		370				0	435	0	451	0	55	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 41 is high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MALMSTROM - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 6 (SALT LAKE)

Low and High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		0		5		3			18		10		7			18	0	15	0	10	0
0100		1		6		1			21		18		11			22	0	24	0	12	0
0200		0		4		0			9		16		3			9	0	20	0	3	0
0300		0		4					11		16					0	0	20	0	0	0
0400		0		3					16		10					16	0	13	0	0	0
0500		1							13							14	0	0	0	0	0
0600		2							3							5	0	0	0	0	0
0700		1							3							4	0	0	0	0	0
0800		0							1							1	0	0	0	0	0
0900		0							1							1	0	0	0	0	0
1000		0							0							0	0	0	0	0	0
1100		0							1							1	0	0	0	0	0
1200		0							3							3	0	0	0	0	0
1300		1							6							6	0	0	0	0	0
1400		9		5					13		15					22	0	20	0	0	0
1500		6		3					14		11					20	0	14	0	0	0
1600		1		4		8			15		7		11			16	0	11	0	19	0
1700		0		4		6			16		13		14			16	0	17	0	20	0
1800		4		2		1			13		15		1			17	0	17	0	2	0
1900		5		1		4			14		12		16			19	0	13	0	20	0
2000		4		3		3			15		9		5			19	0	12	0	8	0
2100		3		6		4			16		14		10			19	0	20	0	14	0
2200		6		8		5			17		11		14			23	0	19	0	19	0
2300		3		4		2			11		10		4			14	0	14	0	6	0
TOTAL:	0	47	0	62	0	37	0	0	249	0	0	0	96	0	0	296	0	62	0	133	0

SOURCES: *Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537*

Notes:
1) Sector 16 is low and high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MALMSTROM - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 20 (SALT LAKE)

High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		2							12						0	14	0	0	0	0	0
0100		0							12						0	12	0	0	0	0	0
0200		0							6						0	6	0	0	0	0	0
0300		0							9						0	0	0	0	0	0	0
0400		0							17						0	17	0	0	0	0	0
0500		0							6						0	6	0	0	0	0	0
0600		0				1			2		6				0	2	0	6	0	1	0
0700		0		0		1			3		9		4		0	3	0	9	0	5	0
0800		0		1		1			4		6		3		0	4	0	7	0	4	0
0900		0		0		0			2		3		6		0	2	0	3	0	6	0
1000		0		0		0			1		3		3		0	1	0	3	0	3	0
1100		0		0		0			1		3		2		0	1	0	3	0	2	0
1200		0		1		1			4		4		1		0	4	0	5	0	2	0
1300		1		5		0			3		10		4		0	4	0	15	0	4	0
1400		6		0					5		2				0	11	0	2	0	0	0
1500		5				0			15				8		0	20	0	0	0	8	0
1600		1				0			15				11		0	16	0	0	0	11	0
1700		3				3			10				18		0	13	0	0	0	21	0
1800		1				1			14				10		0	15	0	0	0	11	0
1900		0							10						0	10	0	0	0	0	0
2000		3							13						0	16	0	0	0	0	0
2100		3							17						0	20	0	0	0	0	0
2200		7							15						0	22	0	0	0	0	0
2300		2							14						0	16	0	0	0	0	0
TOTAL:		34		7		8			210		46		70		0	244	0	53	0	78	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 20 is high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 9 (SEATTLE)

Low Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	2	2	0	0	0	0
0600	2	5	7	6	5	0	0	3	8	12	6	6	0	0	5	13	19	12	11	0	0
0700	6	5	7	8	7	0	0	10	9	13	14	13	0	0	16	14	20	22	20	0	0
0800	5	8	7	3	4	0	0	8	15	14	6	8	0	0	13	23	21	9	12	0	0
0900	4	4	4	7	4	0	0	8	8	6	11	7	0	0	12	12	10	18	11	0	0
1000	8	5	6	7	10	0	0	14	10	11	12	16	0	0	22	15	17	19	26	0	0
1100	7	5	5	4	5	0	0	11	9	10	8	9	0	0	18	14	15	12	14	0	0
1200	4	4	4	4	6	0	0	7	6	7	9	11	0	0	11	10	11	13	17	0	0
1300	7	7	6	6	5	0	0	12	11	10	10	8	0	0	19	18	16	16	13	0	0
1400	8	6	6	6	6	0	0	13	7	10	11	10	0	0	21	13	16	17	16	0	0
1500	5	7	3	8	5	0	0	8	21	8	13	10	0	0	13	28	11	21	15	0	0
1600	7	5	6	4	9	0	0	11	17	10	17	15	0	0	18	22	16	21	24	0	0
1700	5	6	9	4	8	0	0	9	24	15	6	13	0	0	14	30	24	10	21	0	0
1800	5	8	4	7	3	0	0	8	24	7	11	6	0	0	13	32	11	18	9	0	0
1900	5	4	4	4	0	0	0	9	21	6	8	0	0	0	14	25	10	12	0	0	0
2000	0	2	3	0	0	0	0	0	24	4	0	0	0	0	0	26	7	0	0	0	0
2100	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	21	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0	52	0	0	0	0	0
TOTAL:	78	83	82	78	77	0	0	131	308	144	142	132	0	0	209	391	226	220	209	0	0

SOURCES: Mr. Eon Parsons TMU Analyst ARTCC 206-351-3596

Notes:
1) Sector 9 is low altitude.
2) All data gerated from RDP Entry Historical Data Tables.
3) Times are Standard Pacific Time

MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 18 (SEATTLE)

Low Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	2	4	2	0	2	3	2	7	11	7	0	6	11	6	9	15	9	0	8	14	8
0100	0	1	0	0	0	1	2	0	3	0	0	0	4	5	0	4	0	0	0	5	7
0200	0	1	0	0	0	0	0	0	4	0	0	0	1	1	0	5	0	0	0	1	1
0300	0	0	1	0	0	1	0	0	1	4	0	0	4	1	0	1	5	0	0	5	1
0400	1	1	2	0	1	1	0	2	5	7	0	5	2	1	3	6	9	0	6	3	1
0500	3	4	2	1	4	3	1	8	11	6	4	12	9	4	11	15	8	5	16	12	5
0600	4	3	5	4	4	3	3	14	11	19	13	13	10	8	18	14	24	17	17	13	11
0700	3	4	5	5	5	6	5	10	12	16	16	17	20	14	13	16	21	21	22	26	19
0800	2	3	4	5	4	5	3	8	10	12	16	12	17	11	10	13	16	21	16	22	14
0900	5	5	3	4	4	6	7	15	14	13	11	12	20	21	20	19	16	15	16	26	28
1000	3	4	3	5	4	4	5	8	11	12	14	11	20	22	11	15	15	19	15	24	27
1100	4	4	3	3	4	4	5	13	12	11	9	11	11	22	17	16	14	12	15	15	27
1200	3	4	3	3	3	6	5	9	12	9	8	10	17	15	12	16	12	11	13	23	20
1300	3	4	3	4	3	6	7	11	14	10	14	8	19	2	14	18	13	18	11	25	9
1400	3	4	3	2	3	4	6	40	13	9	8	11	14	17	43	17	12	10	14	18	23
1500	3	5	3	3	4	5	7	9	16	11	9	11	16	22	12	21	14	12	15	21	29
1600	3	3	4	4	4	5	6	11	10	12	12	12	14	20	14	13	16	16	16	19	26
1700	5	4	4	5	4	5	6	16	13	14	16	13	15	19	21	17	18	21	17	20	25
1800	4	5	4	4	6	3	6	11	16	13	12	20	8	17	15	21	17	16	26	11	23
1900	3	4	3	4	5	3	4	10	12	10	12	14	8	13	13	16	13	16	19	11	17
2000	6	5	4	7	7	3	4	17	14	12	21	20	9	12	23	19	16	28	27	12	16
2100	4	3	3	3	6	1	4	12	10	10	8	18	2	11	16	13	13	11	24	3	15
2200	4	3	3	5	4	3	4	13	9	10	15	14	8	13	17	12	13	20	18	11	17
2300	3	2	3	3	2	2	4	10	8	11	10	8	6	13	13	10	14	13	10	8	17
TOTAL:	71	80	70	74	83	83	96	254	252	238	228	258	265	290	325	332	308	302	341	348	386

SOURCES: Ms. Vicky Conroy TMU Analyst 805-265-8200 Los Angeles ARTCC

Notes:
1) Sector 16 is combined High and Low Altitudes
2) For Sunday, Tuesday, Thursday, information derived from stratification tables.
Dates for Friday, Saturday, Monday, Wednesday, hourly counts were extrapolated from daily totals supplied by ARTCC.
3) Times are Zulu (Coordinated Universal Time).

MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 30 + 31 (SALT LAKE)

Low Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		2		17		5			17		17		11		0	19	0	34	0	16	0
0100		0		8					13		18				0	13	0	24	0	0	0
0200		0		6					18		15				0	18	0	21	0	0	0
0300		0		6					14		13				0	14	0	19	0	0	0
0400		1		0					12		6				0	13	0	6	0	0	0
0500		0							10						0	10	0	0	0	0	0
0600		0							2						0	2	0	0	0	0	0
0700		0							0						0	0	0	0	0	0	0
0800		0							0						0	0	0	0	0	0	0
0900		0							0						0	0	0	0	0	0	0
1000		0							0						0	0	0	0	0	0	0
1100		0							0						0	0	0	0	0	0	0
1200		3							1						0	4	0	0	0	0	0
1300		1							9						0	10	0	0	0	0	0
1400		7		5		2			21		20		6		0	28	0	25	0	8	0
1500		5		4		8			11		10		11		0	16	0	14	0	19	0
1600		2		8		10			18		16		20		0	20	0	24	0	30	0
1700		2		9		7			10		6		7		0	12	0	15	0	14	0
1800		6		13		4			16		12		12		0	22	0	25	0	16	0
1900		5		12		4			22		17		14		0	27	0	29	0	18	0
2000		6		7		6			11		11		12		0	17	0	18	0	18	0
2100		15		5		7			14		16		13		0	29	0	21	0	20	0
2200		12		13		3			12		15		17		0	24	0	28	0	20	0
2300		9		13		9			14		8		10		0	23	0	21	0	19	0
TOTAL:		76		126		65			245		198		133		0	321	0	324	0	198	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 31 is low altitude.
2) All data gererated from RDP Entry Historical Data Tables and combine Sector 30 and 31.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 39 (SEATTLE)

Low Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SOURCES: Mr. Eon Parsons TMU Analyst ARTCC 206-351-3596

Notes: No data available. this sector is usually closed and not available to civil aircraft.

MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 7 (SEATTLE)
High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	1	1	1	0	1	1	2	6	5	5	5	5	6	2	7	6	6	5	6	7
0600	1	2	2	2	2	2	2	11	19	19	20	20	15	17	12	21	21	22	22	17	19
0700	2	2	3	2	3	3	2	21	22	25	21	23	25	17	23	24	28	23	26	28	19
0800	2	2	1	2	2	2	1	15	19	14	14	17	15	10	17	21	15	16	19	17	11
0900	1	2	2	2	2	1	3	11	18	18	14	17	8	25	12	20	20	16	19	9	28
1000	2	1	2	2	3	2	1	18	14	14	17	24	15	11	20	15	16	19	27	17	12
1100	1	1	2	1	1	1	2	14	11	21	13	14	10	16	15	12	23	14	15	11	18
1200	2	2	2	2	2	2	2	20	14	18	17	20	17	19	22	16	20	19	22	19	21
1300	2	2	3	3	2	2	1	16	20	23	21	19	17	12	18	22	26	24	21	19	13
1400	1	2	1	2	2	1	1	11	18	12	20	19	13	11	12	20	13	22	21	14	12
1500	1	1	1	1	1	1	2	9	10	10	12	6	8	15	10	11	11	13	7	9	17
1600	1	1	2	2	1	1	1	11	174	16	15	9	14	7	12	175	18	17	10	15	8
1700	1	1	1	1	2	1	1	10	13	12	5	14	8	14	11	14	13	6	16	9	15
1800	2	1	2	1	1	1	1	14	13	14	14	15	9	11	16	14	16	15	16	10	12
1900	2	2	2	1	1	1	1	16	16	16	14	12	8	11	18	18	18	15	13	9	12
2000	1	1	2	1	1	1	1	13	11	20	22	10	7	9	14	12	22	23	11	8	10
2100	2	2	1	1	1	1	1	23	16	9	8	12	9	9	25	18	10	9	13	10	10
2200	1	1	1	1	1	1	0	6	7	10	9	10	10	1	7	8	11	10	11	11	1
2300	0	0	0	0	0	1	0	0	0	0	0	1	7	0	0	0	0	0	1	8	0
TOTAL:	25	27	31	28	28	26	24	241	421	276	261	267	220	221	266	448	307	289	295	246	245

SOURCES: Mr. Eon Parsons TMU Analyst ARTCC 206-351-3596

Notes:
1) Sector 7 is high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Standard Pacific Time

· MOSES LAKE- X33 FLIGHT TRACK AND ACTIVITY COUNTS:SECTOR 16 (Seattle) High Altitude																					
	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	1	0	0	0	0	0	1	5	4	2	1	1	0	1	6	4	2	1	1
0600	2	2	2	2	2	2	1	16	16	21	18	18	15	12	18	18	23	20	20	17	13
0700	3	3	3	3	3	3	2	28	27	28	30	28	23	23	31	30	31	33	31	26	25
0800	3	3	3	3	3	3	3	31	31	32	28	30	26	24	34	34	35	31	33	29	27
0900	1	2	2	2	2	2	2	14	14	24	14	16	16	18	15	16	26	16	18	18	20
1000	2	3	3	3	3	3	2	23	23	24	28	29	24	22	25	26	27	31	32	27	24
1100	3	2	3	3	2	3	3	26	20	27	23	23	26	27	29	22	30	26	25	29	30
1200	3	3	3	3	3	3	2	28	29	28	25	26	24	19	31	32	31	28	29	27	21
1300	2	2	3	2	3	3	3	19	29	25	19	29	27	24	21	31	28	21	32	30	27
1400	2	2	2	2	2	2	1	18	16	22	15	23	17	10	20	18	24	17	25	19	11
1500	3	2	3	3	3	2	3	26	16	23	25	26	23	29	29	18	26	28	29	25	32
1600	2	2	2	2	2	2	1	14	23	18	22	23	16	13	16	25	20	24	25	18	14
1700	2	3	3	2	2	2	3	20	23	23	22	23	18	23	22	26	26	24	25	20	26
1800	2	2	2	3	2	1	2	19	22	15	23	14	12	17	21	24	17	26	16	13	19
1900	2	3	3	2	3	2	2	23	15	24	21	23	18	19	25	18	27	23	26	20	21
2000	2	2	2	2	2	2	2	16	21	19	19	19	13	17	18	23	21	21	21	15	19
2100	2	2	2	2	2	1	2	15	13	16	18	15	11	16	17	15	18	20	17	12	18
2200	0	0	0	0	0	0	1	1	0	5	4	3	2	8	1	0	5	4	3	2	9
2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL:	36	38	42	39	39	36	35	337	339	379	358	370	312	322	373	377	421	397	409	348	357

SOURCES: Ms. Vicky Conroy TMU Analyst 805-265-8200 Los Angeles ARTCC

Notes:
1) Sector 16 is combined High and Low Altitudes
2) For Sunday, Tuesday, Thursday, information derived from stratification tables.
Dates for Friday, Saturday, Monday, Wednesday, hourly counts were extrapolated from daily totals supplied by ARTCC.
3) Times are Zulu (Coordinated Universal Time).

MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 41 (SALT LAKE)

High Altitude

	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000		2		7		5			25		18				0	27	0	25	0	5	0
0100		2		5		3			20		25				0	22	0	30	0	3	0
0200		1		2		5			20		19				0	21	0	21	0	5	0
0300		0		5		2			27		26				0	27	0	31	0	2	0
0400		0		7		1			28		15				0	28	0	22	0	1	0
0500		0		1		1			18		16				0	18	0	17	0	1	0
0600		0		0		1			8		2				0	8	0	2	0	1	0
0700		0		0		0			2		0				0	2	0	0	0	0	0
0800		0		0		0			3		5				0	3	0	5	0	0	0
0900		0		2		0			2		1				0	2	0	3	0	0	0
1000				0		1					2				0	0	0	2	0	1	0
1100				1		0					2				0	0	0	3	0	0	0
1200		1		1		0			2		3				0	3	0	4	0	0	0
1300		0		2		2			4		30				0	4	0	32	0	2	0
1400		6		4		4			16		24				0	22	0	28	0	4	0
1500		3		6		5			30		21				0	33	0	27	0	5	0
1600		3		2		7			23		15				0	26	0	17	0	7	0
1700		3		9		0			23		26				0	26	0	35	0	0	0
1800		5		4		1			14		29				0	19	0	33	0	1	0
1900		2		4		3			20		15				0	22	0	19	0	3	0
2000		2		0		3			19		15				0	21	0	15	0	3	0
2100		3		3		3			37		24				0	40	0	27	0	3	0
2200		2		7		3			28		22				0	30	0	29	0	3	0
2300		3		9		5			28		15				0	31	0	24	0	5	0
TOTAL:		38		81		55			397		370				0	435	0	451	0	55	0

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 41 is high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.

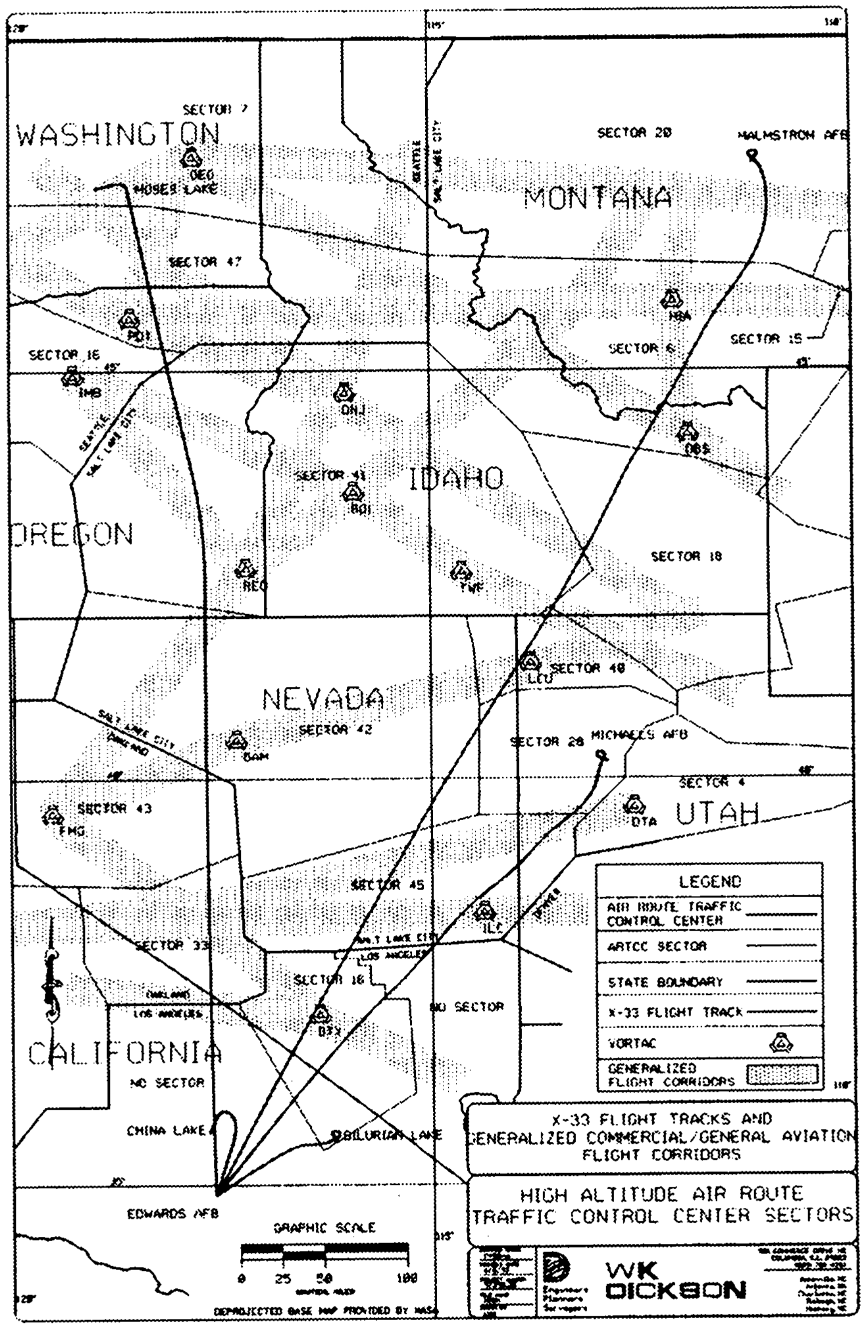
MOSES LAKE - X33 FLIGHT TRACK AND ACTIVITY COUNTS: SECTOR 47 (SEATTLE)

High Altitude

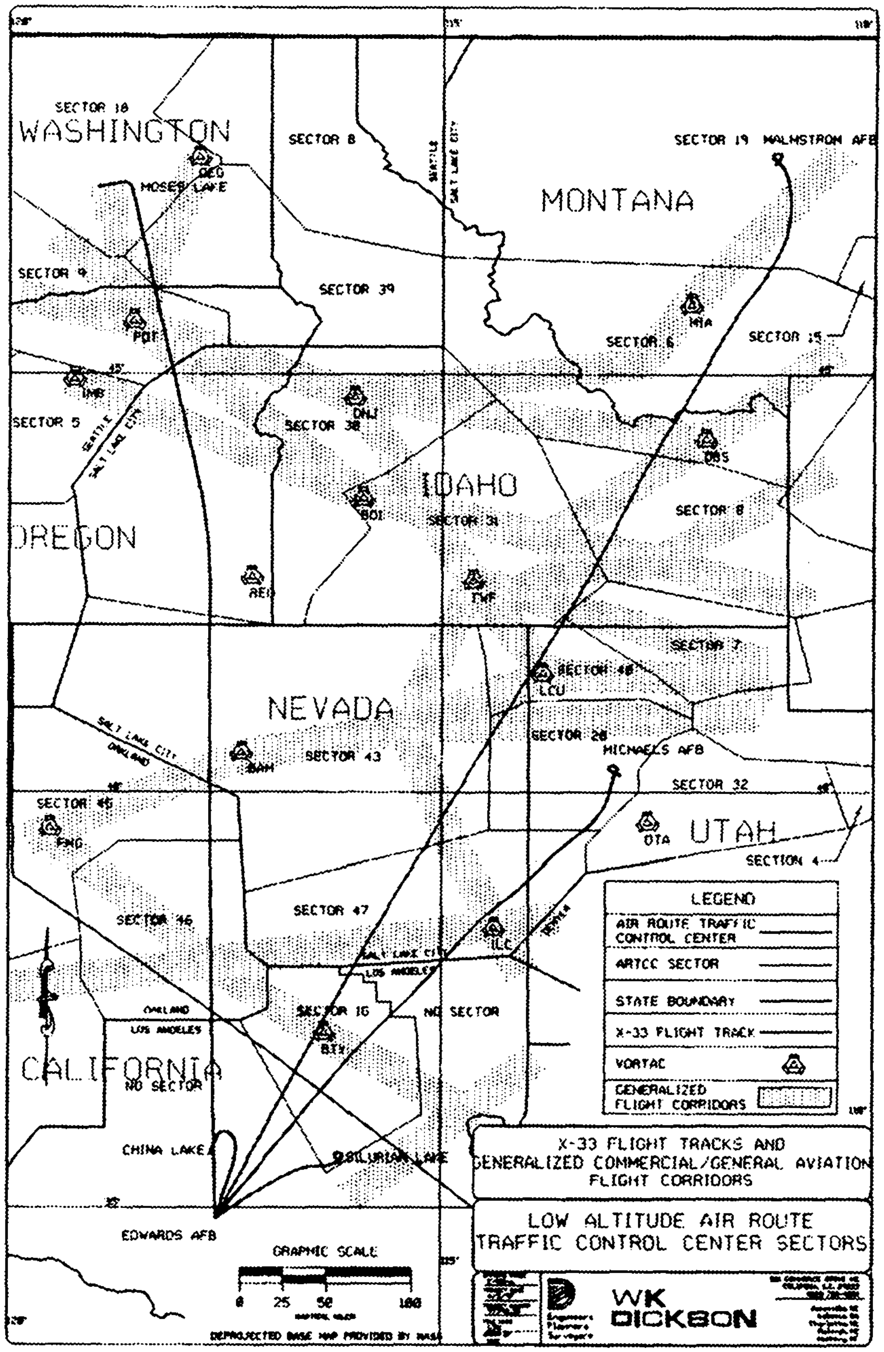
	GA							AIR CARRIER							TOTALS						
TIME	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600	1	1	1	1	0	0	0	7	9	11	0	0	0	0	8	10	12	1	0	0	0
0700	2	3	3	3	2	1	1	13	19	25	7	18	11	10	15	22	28	10	20	12	11
0800	0	2	2	2	1	1	2	15	15	13	20	11	11	14	15	17	15	22	12	12	16
0900	2	2	2	1	2	2	1	14	15	18	12	12	11	10	16	17	20	13	14	13	11
1000	2	3	3	3	4	3	4	19	19	20	10	27	20	27	21	22	23	13	31	23	31
1100	2	2	2	2	3	2	1	15	18	16	27	22	12	12	17	20	18	29	25	14	13
1200	2	3	2	2	2	2	1	18	18	13	16	20	16	12	20	21	15	18	22	18	13
1300	2	2	3	1	3	3	2	14	16	23	17	22	19	15	16	18	26	18	25	22	17
1400	1	2	1	2	1	1	1	9	14	10	12	10	8	9	10	16	11	14	11	9	10
1500	2	2	2	2	2	2	2	17	14	19	14	20	19	13	19	16	21	16	22	21	15
1600	1	3	2	2	2	2	2	13	25	16	15	13	14	15	14	28	18	17	15	16	17
1700	1	1	2	2	1	2	2	11	12	13	16	10	12	15	12	13	15	18	11	14	17
1800	2	2	3	2	2	1	1	16	17	21	13	16	9	12	18	19	24	15	18	10	13
1900	2	3	3	2	2	1	2	14	19	20	17	14	10	12	16	22	23	19	16	11	14
2000	1	2	2	2	2	2	1	10	15	14	18	13	15	9	11	17	16	20	15	17	10
2100	0	1	1	1	0	1	2	0	7	11	12	4	9	12	0	8	12	13	4	10	14
2200	0	0	0	1	0	0	1	0	0	0	11	0	1	5	0	0	0	12	0	1	6
2300	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	5	0	0	0
TOTAL:	23	34	34	31	29	26	26	205	252	263	0	232	197	202	228	286	297	31	261	223	228

SOURCES: Mr. Paul Brophy, ARTCC Salt Lake City 801-320-2537

Notes:
1) Sector 47 is high altitude.
2) All data gererated from RDP Entry Historical Data Tables.
3) Times are Zulu (Coordinated Universal Time).
4) Data was not available for days/entries where no data is shown.



WASHINGTON
SECTOR 7
MOSES LAKE
SECTOR 47
SECTOR 16
OREGON
SECTOR 20
MALMSTROM AFB
MONTANA
SECTOR 15
SECTOR 6
IDAHO
SECTOR 18
NEVADA
SECTOR 42
SECTOR 40
SECTOR 28
MICHAELS AFB
SECTOR 4
UTAH
SECTOR 43
SECTOR 45
SECTOR 33
SECTOR 16
NO SECTOR
CALIFORNIA
NO SECTOR
CHINA LAKE
SILURIAN LAKE
EDWARDS AFB
GRAPHIC SCALE
0 25 50 100
DEPROJECTED BASE MAP PROVIDED BY NASA
LEGEND
AIR ROUTE TRAFFIC CONTROL CENTER
ARTCC SECTOR
STATE BOUNDARY
X-33 FLIGHT TRACK
VORTAC
GENERALIZED FLIGHT CORRIDORS
X-33 FLIGHT TRACKS AND GENERALIZED COMMERCIAL/GENERAL AVIATION FLIGHT CORRIDORS
HIGH ALTITUDE AIR ROUTE TRAFFIC CONTROL CENTER SECTORS
WK DICKSON


WASHINGTON
MONTANA
OREGON
IDAHO
NEVADA
UTAH
CALIFORNIA
SECTOR 18
SECTOR 8
SECTOR 19 MALMSTROM AFB
MOSES LAKE
SECTOR 9
SECTOR 39
SECTOR 6
SECTOR 15
SECTOR 5
SECTOR 38
SECTOR 31
SECTOR 7
SECTOR 48
SECTOR 28
MICHAELS AFB
SECTOR 43
SECTOR 32
SECTOR 45
SECTION 4
SECTOR 46
SECTOR 47
SECTOR 16
NO SECTOR
CHINA LAKE
SILURIAN LAKE
EDWARDS AFB
LEGEND
AIR ROUTE TRAFFIC CONTROL CENTER
ARTCC SECTOR
STATE BOUNDARY
X-33 FLIGHT TRACK
VORTAC
GENERALIZED FLIGHT CORRIDORS
X-33 FLIGHT TRACKS AND GENERALIZED COMMERCIAL/GENERAL AVIATION FLIGHT CORRIDORS
LOW ALTITUDE AIR ROUTE TRAFFIC CONTROL CENTER SECTORS
GRAPHIC SCALE
0 25 50 100
UNPROJECTED BASE MAP PROVIDED BY NASA
WK DICKSON

X-33 FLIGHT TRACK ACTIVITY COUNTY AND GENERALIZED COMMERCIAL/GENERAL AVIATION FLIGHT CORRIDORS

Report provided by W. K. Dickson

through CH2M Hill under contract to

NASA/X-33 Program April 1997.

INTRODUCTION 3.7

The purpose of this exercise is to determine, to the extent feasible within time and funding constraints, the level of general and commercial flight operations which may be impacted by the proposed X-33 flights departing from Edward's AFB in California and terminating at: 1, Silurian Lake, California; 2, China Lake, California; 3, Michael's AFB, Utah; 4, Malmstrom AAF, Montana; and, 5, Moses Lake, Washington.

Specifically, tabular data and appropriate graphics of commercial and general aviation flight corridors in the vicinity of X-33 flight tracks (to a maximum of 5) and density of use by time of day in one hour increments over a 24 hour period are to be provided, and to the extent readily available, frequency of requests for priority airspace/emergency landing clearance.

The data are arranged by Air Route Traffic Control Centers (ARTCC) beginning at Edward's AFB and ending at the respective destinations. The ARTCC data are collected by sector within the general ARTCC boundaries. Since the activity data are not readily available for each specific airway or for general aviation activity not utilizing ARTCC services, sector data were used to provide the activity counts which provide reasonable data concerning the impacts of this activity. This means that some of the sectors may be higher that would actually be present along a 50 mile swath of the X-33 flight track. (Note that general aviation aircraft which did not use ARTCC services are not included in the counts since obtaining this data, which is not readily available would take several months to obtain and cost far more than funds available.) However, we believe that the relative activity levels presented will allow reasonable decisions to be made concerning the impacts to commercial and general aviation activity along the X-33 flight tracks.

Notes Common to All Flight Tracks and ARTCC

- Data are separated into high altitude (above 18,000 feet) and low altitude (below 18,000 feet for both commercial and general aviation.
- The data are presented by ARTCC sector separately for high and low altitude.
- Both generalized commercial and general aviation flight corridors are similar for those flights utilizing ARTCC services and are not separated.
- Sources and limitations for each ARTCC and sector are noted on respective tables.

- In all cases, actual activity counts were retrieved by respective ARTCC's for one week in March 1997. The data for several of the days during the week was prepared for a 24 hour period in one hour increments. Activity levels where hourly counts were not provided by respective ARTCC, extrapolations were made on the 24 hour totals to arrive at hourly counts. Individual notes are included on each sector activity count table where this occurred.

- For those days where counts are not presented (either stratified of total), the data were not available from the respective center and is noted on the individual sector tabulations.

- In all cases military data were subtracted from the activity counts.

- Due to the "de-projected" map supplied by NASA, all commercial and general aviation flight corridors, ARTCC and sector boundaries, and locations of features presented on the attached maps are approximate. This is because the graphical data were transferred from maps of varying projections and scales to the "de-projected" map supplied by NASA.

- The Los Angeles ARTCC has only one sector. The remaining areas are restricted airspace and no civilian aircraft normally enter the area.

- All times noted on the individual tabulations are in "Zulu", or Coordinated Universal Time, except Seattle which is "Standard" local time. To arrive at local time subtract the following from the indicated times on the tables:

Los Angeles Center	-8 hours
Oakland	-8 hours
Seattle	-0 hours (already presented in local time)
Salt Lake City	-7 hours

<u>Requests for Emergency Landing or Priority Airspace</u>
The requests for emergency or priority airspace varies by ARTCC:

Los Angeles ARTCC: Requests for emergency/priority airspace average 2-3 per month, with 70% of those requests being by civil aircraft and 30% by military aircraft according to center representative Vicki Conroy, Los Angeles ARTCC, (805) 265-8200.

Oakland ARTCC: For the year 1996, there were 8 requests by civilian aircraft for emergency/priority airspace and 8 requests by military aircraft for emergency/priority airspace. This data was provided by Mr. Gary Hess, Oakland ARTCC, (510) 745-3334.

Seattle ARTCC:	There are no requests for emergency/priority airspace on file for the Seattle ARTCC. After 15 days all requests are deleted unless an actual emergency occurs. Center representative, Eon Parsons, Seattle ARTCC (206)351-3596 indicated that they could not provide an estimate of such requests.
Salt Lake City ARTCC:	Requests for emergency/priority airspace average 2-3 per day with civilian aircraft requesting approximately 30% of the time (usually for medical emergencies) and military approximately 70%. Mr. Paul Brophy, Salt Lake City ARTCC, (801) 320- 2537.

AIRSPACE 3.7.1

Airspace is defined dimensionally by limitations describing its height, depth, width, and period of use (time). Changes in airspace usage such as activity intensity (few flights versus numerous flights), altitudes (low level versus high level) and speeds (subsonic versus supersonic) can affect other resource areas (noise and/or health and safety) or limit airspace availability to other users.

The FAA is charged with the overall management of airspace and as established certain criteria and limits for use of various sectors of the airspace.

Restricted airspace subjects some or all aircraft to air traffic control, as well as confining certain flight activities, entry and cautions of other aircraft operating within specific boundaries. Specific permission is required from the controlling agency to penetrate active restricted areas.

Military Operating Areas (MOA's) are established outside positive control area (below 18,000 feet) to separate and segregate certain nonhazardous military activities from instrument flight rules (IFR) traffic. MOA's are identified by marking on appropriate aeronautical charts, and are open to aircraft operating visual flight rules (VFR). They are used to conduct training activities such as air combat maneuvers, air intercepts, aerobatics, low-altitude tactics and other military specific activities.

All X-33 flight paths will originate for Edwards Air Force Base. Restricted airspace for Edwards is in the R-2515 complex and has an unlimited restricted altitude.

There are 13 restricted airspace sectors and 12 Military Operations Areas (MOA) which will be affected by the five proposed flight tracts. The restrictions are identified and described in the tabulation below:

RESTRICTION ID NUMBER	TIME USED	CONTROLLING AGENCY	ALTITUDE RESTRICTION
R-2515	Continuous	FSS/Hi-Desert Tracon	Unlimited
R-2524	Continuous	FSS/Hi-Desert Tracon	Unlimited
R-2508	Continuous	FSS/Hi-Desert Tracon	20,000' -Unlimited
R-2505	Continuous	FSS/Hi-Desert Tracon	Unlimited
R-4808 N	Continuous	No A/G	Unlimited
R-4806 W	Continuous	ZLA Cntr/FSS	Unlimited
R-4807 A	Mon 1,400z to Fri 0300z	ZLA Cntr/FSS	Unlimited
R-4809	Continuous	No A/G	Unlimited
R-4816 S	Continuous	ZOA Cntr/FSS	500' AGL to but not including FL 180 (18,000 feet)
R-4816 N	Continuous	ZOA Cntr/FSS	1,500' AGL to but not including FL 180 (18,000 feet)
R-6405	Continuous	ZLC Cntr/FSS	100' AGL to but not including FL 580 (58,000 feet)
R-6402 A	Continuous	ZLC Cntr/FSS	to FL 580 (58,000 feet)
R-4602 B	Continuous	ZLC Cntr/FSS	to FL 580 (58,000 feet)

* AGL (Above Ground Level)

MILITARY OPERATIONS AREA NAME	TIME USED	CONTROLLING AGENCY	ALTITUDE OF USE
Panamint	Mon-Fri	FSS/Hi-Desert Tracon	200' AGL to FL 180 (18,000 feet)
Shoshone	Mon-Fri	ZLA Cntr/FSS	200' AGL to FL 180 (18,000 feet)
Isabella	Mon-Fri	FSS/Hi-Desert Tracon	200' AGL to but not including FL 180 (18,000 feet), excluding 3,000' and below over Domeland Wilderness Areas
Desert	Mon-Sat	ZLA Cntr/FSS or NELLIS Control on 124.45	100' AGL to but not including FL 180 (18,000 feet)
Lucin A	Mon-Sat	ZLC Cntr	100' AGL to 9,000'
Owens	Mon-Fri	FSS/Hi-Desert Tracon	200' AGL to but not including FL 180 (18,000 feet), excludes airspace below 3,000' over Wilderness Areas, National Parks and Monuments
Saline	Mon-Fri	FSS/Hi-Desert Tracon	200' AGL to but not including FL 180 (18,000 feet), excludes airspace below 3,000' over Wilderness Areas, National Parks and Monuments
Gabbs South	Continuous	ZOA Cntr/FSS	100' AGL to but not including FL 180 (18,000 feet)

Gabbs Central	Continuous	ZOA Cntr/FSS	100' AGL to but not including FL 180 (18,000 feet)
Gabbs North	Continuous	ZOA Cntr/FSS	100' AGL to but not including FL 180 (18,000 feet)
Paradise	0500-2100	ZLC Cntr	14,500' AGL to but not including FL 180 (18,000 feet)
Saddle B	Intermittent by NOTAM	ZLC Cntr	8,000' AGL to but not including FL 180 (18,000 feet)
Sevier A	Mon-Sat	ZLC Cntr/FSS	100' AGL to 14,500'
Sevier B	Mon-Sat	ZLC Cntr/FSS	100' AGL to 9,500'

SILURIAN LAKE 3.7.2

The Silurian Lake flight track is approximately 80 miles long, within the R-2580 6 complex. The flight path is located both in military restricted and MOA airspaceSilurian Lake is located in the Los Angeles Air Route Traffic Control Center (ARTCC) Sector 16.

CHINA LAKE 3.7.3

The China Lake flight path is approximately 50 miles long within the R-2508 complex. The flight track is within both military restricted and MOA airspace.China Lake is located in the Los Angeles (ARTCC) Sector 16.

MICHAEL ARMY AIR FIELD 3.7.4

The Michaels Army Airfield Fight Track, originates at Edwards Force Base and flies northeast for approximately 360 miles.

This path flies through the Los Angeles and Salt Lake City Air Route Traffic Control Center (ARTCC) crosses approximately three generalized flight corridors, and terminates at Michaels Air Force Base. Flight sectors involved are Los Angeles ARTCC Sector 16, and Salt Lake City ARTCC Sectors 47, 45, and 28.

MALMSTROM AIR FORCE BASE 3.7.5

The Malmstrom Air Force Base Fight Track originates at Edwards Air Force Base and flies northeast for approximately 750 miles. This path flies through the Los Angeles and Salt Lake City ARTCC, crosses approximately ten generalized flight corridors, and terminates at Malmstrom Air Force Base. Flight sectors involved are Los Angeles ARTCC Sector 16, and Salt Lake City ARTCC Sectors 47, 45, 43, 42, 28, 40, 7, 18, 30, 31, 41, 8, 6, 19, and 20.

MOSES LAKE 3.7.6

The Moses Lake flight track, leaving Edwards Air Force Base, flies directly north for approximately 650 miles. The path flies through the Los Angeles, Oakland, Salt Lake City and Seattle air route traffic control centers, crosses approximately 13 generalized flight corridors, and terminates at Moses Lake. Flight sectors involved are Los Angeles ARTCC Sector 16, Oakland

ARTCC Sectors 46, 33, 43 and 45, Salt Lake City ARTCC Sectors 42, 43, 30, 31, and 41, and Seattle ARTCC 9, 16, 39, 47, 18, and 7.

4.7.1 SILURIAN LAKE

Silurian Lake flight path is approximately 80 miles long. The entire flight path is within three restricted airspace areas and three military operations areas. The restricted areas impacted are R-2515, R2524 and R-2502. The two military operations areas are Panamint and Shoshone.

4.7.2 CHINA LAKE

China Lake flight path is approximately 50 miles long. The entire flight path is within four restricted airspace areas and three Military Operations Areas. The restricted airspace areas impacted are R-2515, R-2524, R-2508, R-2505, R-25415, R02524 and R-2505. All three MOA's are Panamint, Owens, and Isabella

4.7.3 MICHAEL ARMY AIRFIELD

The Michaels Army Airfield flight path is approximately 360 miles long. Seven restricted airspace areas and six Military Operations Areas are affected by this path. The restricted areas are R-2515, R-2524, R-4808 N, R-4806 W, R-6405, R-6402 A and R-6402 B.

The five MOA's affected are Panamint, Shoshone, Desert, Sevier A and Sevier B.

There are four high and low flight sectors influenced by the Michaels Air Force Base Flight Track, with the busiest day being Thursday, affecting approximately 1,887 flights during a 24-hour period, while Monday being the least busy, totaling 346 flights during a 24-hour period. Even though three sectors have no reported data for certain days, the least traveled times by commercial and general aviation aircraft range from 1:00 am to 6:00 am, local time.

4.7.4 MALSTROM AIR FORCE BASE

Malmstrom Air Force Base flight path is approximately 750 miles long transversing four restricted airspace area and four Military Operations Areas. The restricted areas impacted are R-2515, R-2524, R-4807 and R-4809. The four Military Operations Areas are Panamint, Shoshine, Desert and Lucin A.

There are 16 high and low altitude flight sectors influenced by the Malmstrom Air Force Base X-33 Flight Track, with the busiest day being Tuesday, affecting approximately 4,328 flights during a 24-hour period, while Monday being the least busy, totaling 346 flights during a 24-hour period.

Fifteen sectors have no reported data for Monday, Wednesday, Friday and Sunday, while two sectors have no reported data at all. The least traveled times by commercial and general aviation aircraft range from 1:00 am to 6:00 am.

4.7.5. MOSES LAKE

Grant County Airport flight path is approximately 650 miles long. Five restricted airspace areas and nine Military Operations Areas are affected by this X-33 flight path. The restricted areas are R-2515, R-2505, R-2508, R-4816 S and R-4816 N. The nine Military Operations Areas are Isabella, Owens, Saline, Gabbs South, Gabbs Central, Gabbs North, Panamint, Paradise and Saddle B.

There are 16 high and low altitude flight sectors influenced by the Moses Lake Flight Track, with the busiest day being Tuesday, affecting approximately 5,000 flights during a 24 period, while Sunday being the least busy, totaling approximately 2,941 flights during a 24 hour period. Even the least traveled times by commercial and general aviation aircraft range from 1:00 am to 6:00 am.

In order to further understand potential impact of X-33 flight tests, propose nominal trajectories to each landing site were plotted as altitude versus downrange distance in figures D-1 through D-4. The flight trajectories to each landing site all provide for the X-33 to fly past the runway to the "maximum distance" indicated on each figure, as it begins terminal area energy maneuvers to decelerate and position itself for final approach and landing. The maximum distance downrange of each landing site is provided in Table D-1.

Table D-1. Maximum downrange distance from each landing site that the X-33 reaches prior to final deceleration and approach.

Landing Site	Maximum Downrange Distance, km (mi)
Silurian Lake	4.8 (3)
China Lake	29 (18)
Dugway	3.2 (2)
Malmstrom	13 (8)
Moses Lake	3.2 (2)

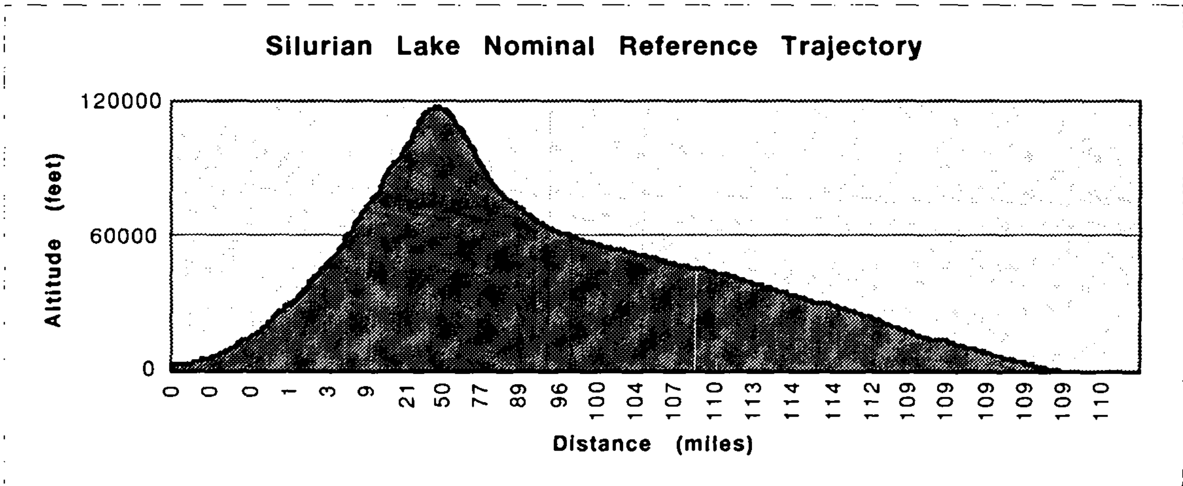


Figure D-1.

China Lake Nominal Reference Trajectory

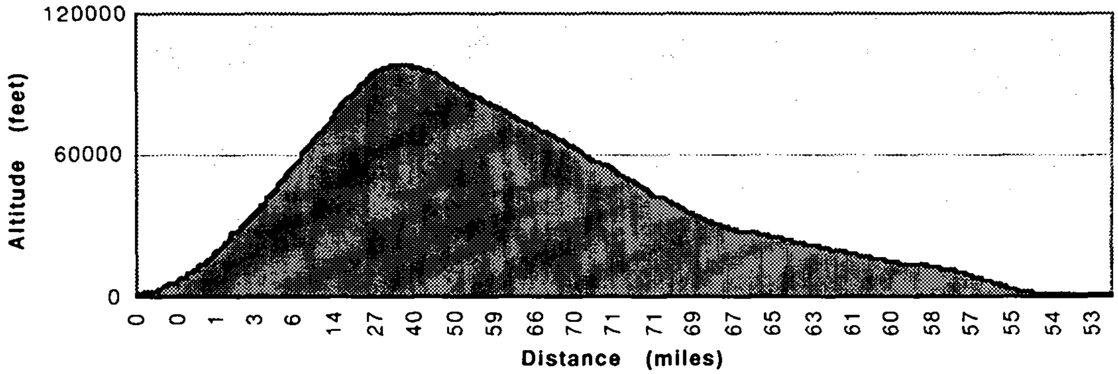


Figure D-2.

Michael AFB Nominal Reference Trajectory

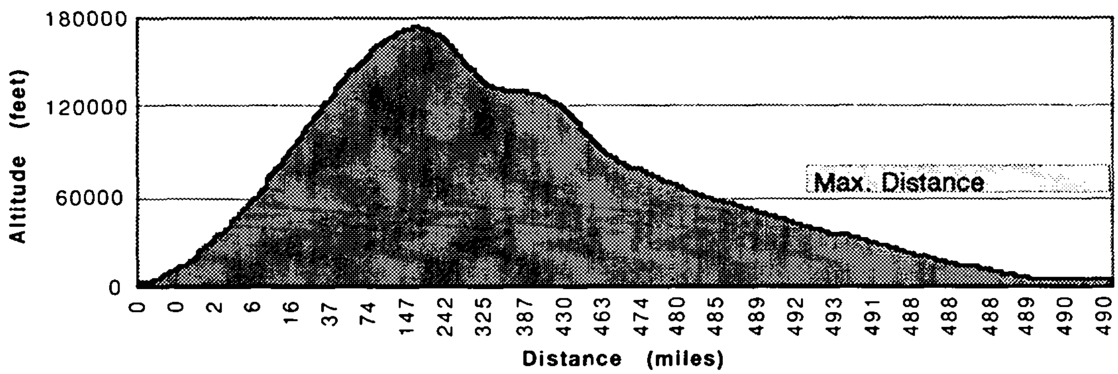
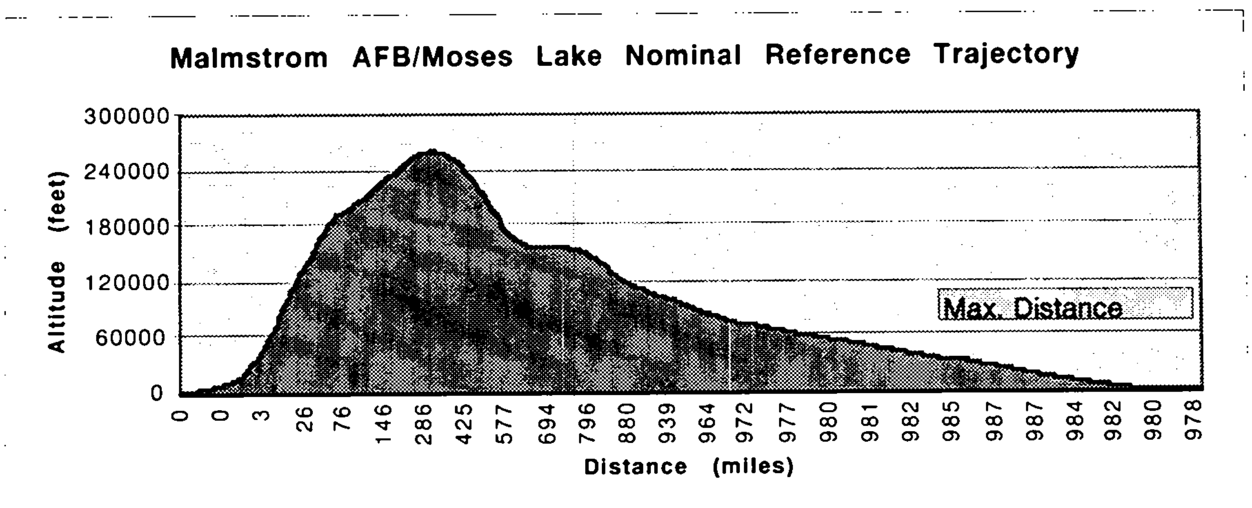


Figure D-3.



Note: Nominal reference trajectories for both long-range landing sites would be projected to be similar in profile.

Figure D-4.

The trajectories (altitude versus downrange distance) are plotted using a linear x axis scale in order to discover where the X-33 exceeds 18,300 m (60,000 ft). These graphs are provided in Figures D-5 through D-10 for each of the landing sites. Downrange ascent and descent trajectory intersections with 18,3000 m (60,000 ft) of altitude are provided in Table D-2.

Table D-2. Ascent and descent trajectory intersections with 18,300 m (60,000 ft) altitude.

Landing Site	Intersection Downrange Distance with 18,300 m (60,000 ft) altitude, km (mi)	
	Ascent	Descent
Silurian Lake	8.8 (5.5)	20.8 (13.0)
China Lake	11.7 (7.3)	37.1 (23.2)
Dugway	9.1 (5.7)	17.4 (10.9)
Malmstrom	7.8 (4.9)	15.2 (9.5)
Moses Lake	10.1 (6.3)	15.2 (9.5)

The X-33 is expected to enter airspace less than 18,300 m (60,000 ft) approximately 16–21 km (10–13 mi) or less downrange of the landing area or runway.

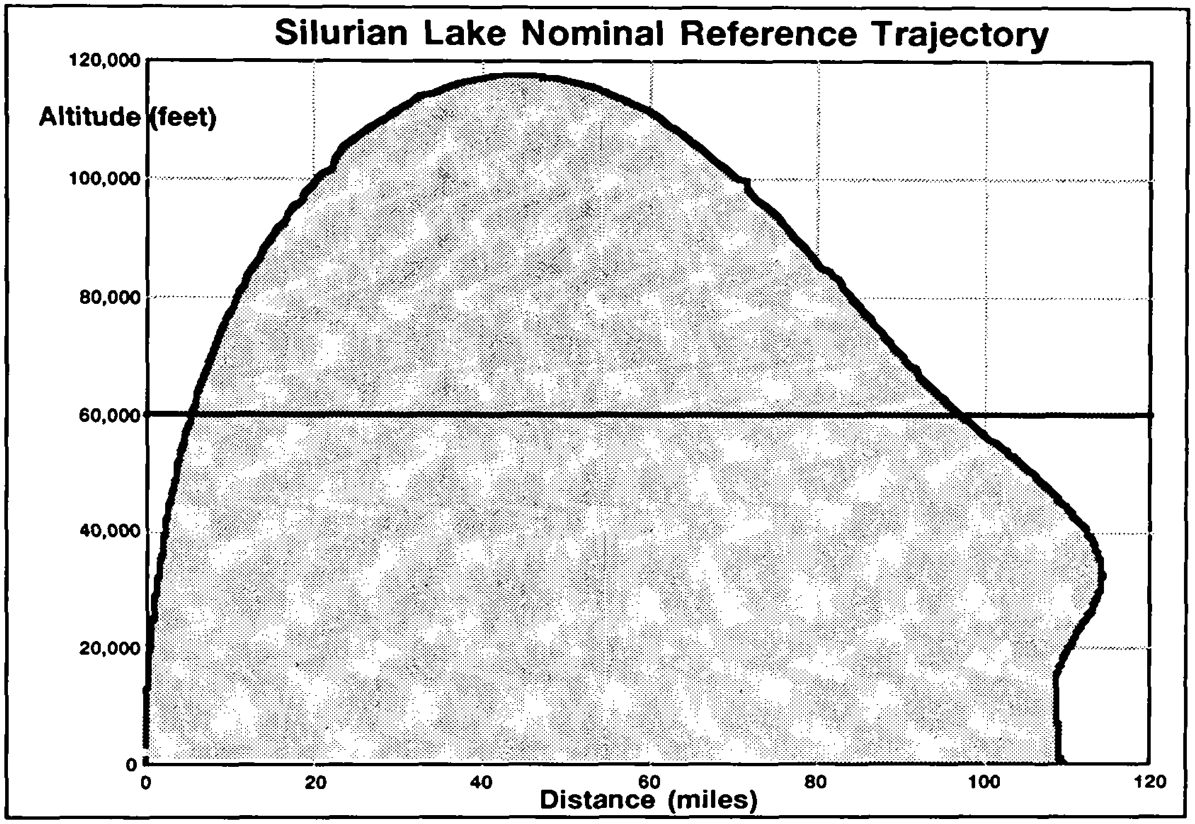


Figure D-5.

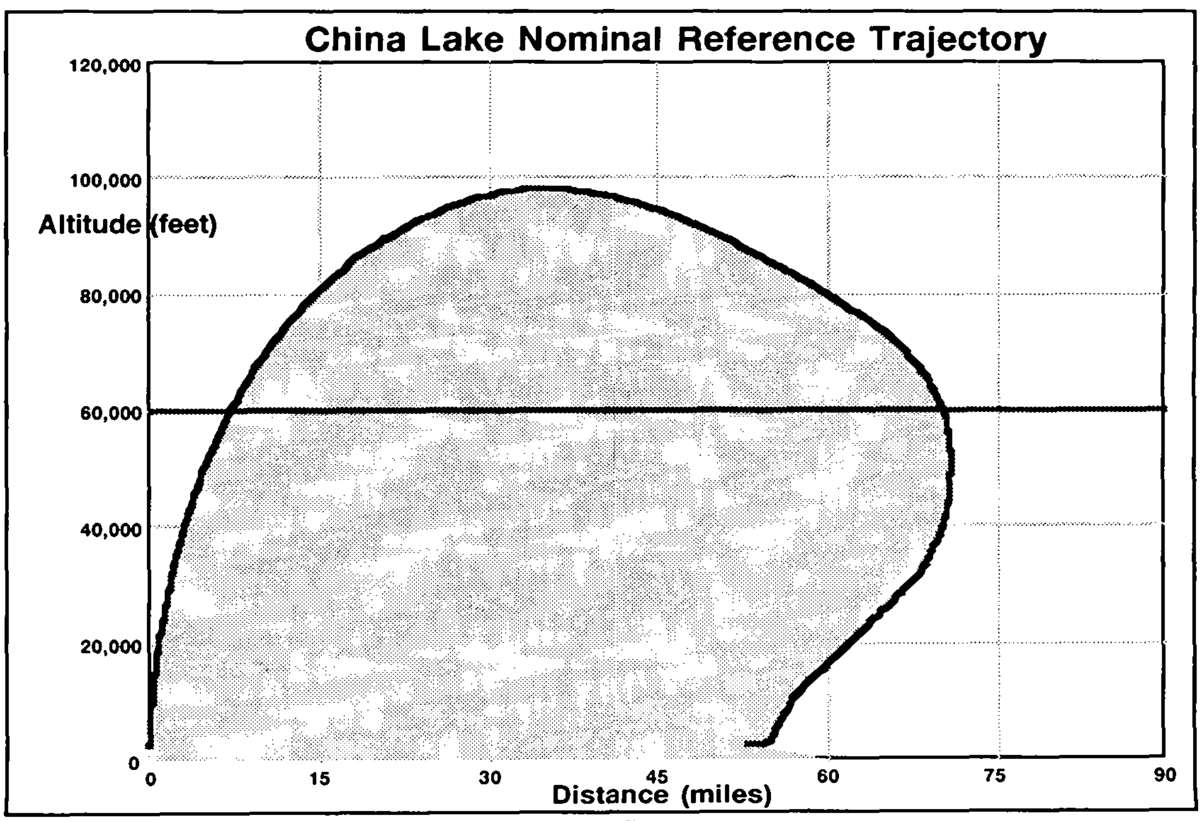


Figure D-6.

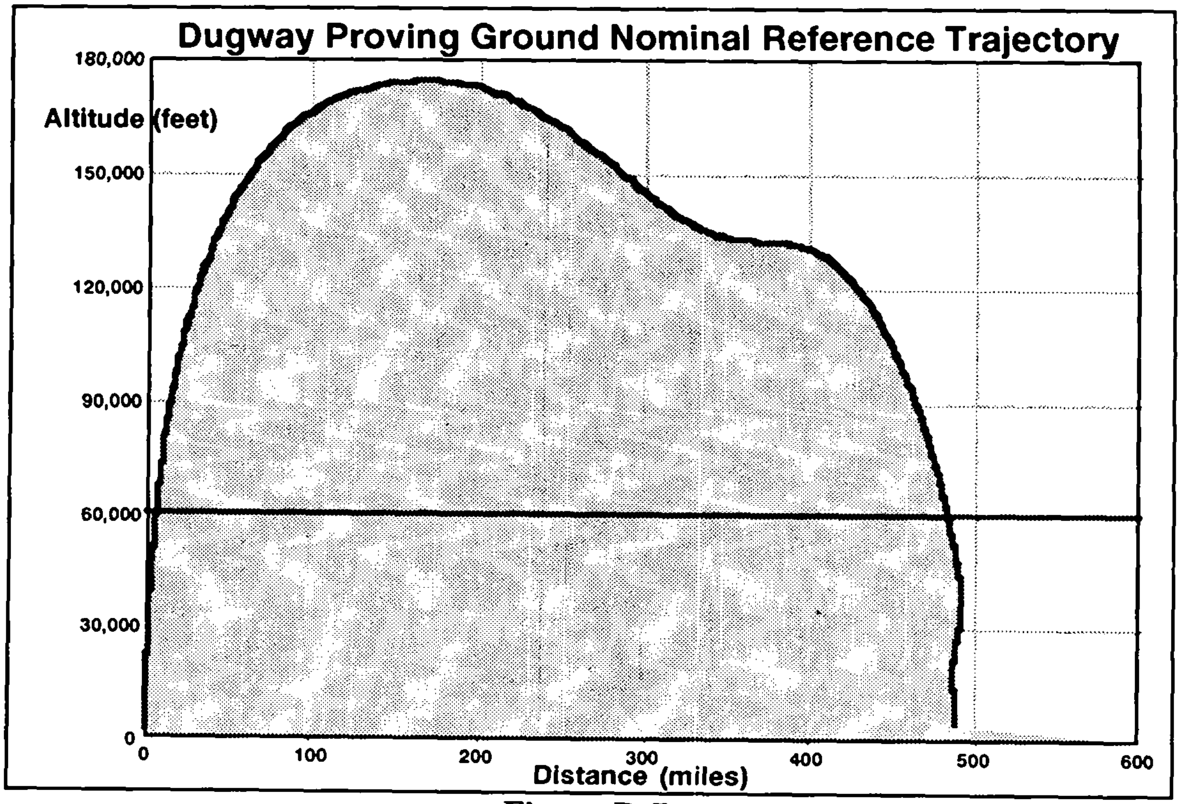


Figure D-7.

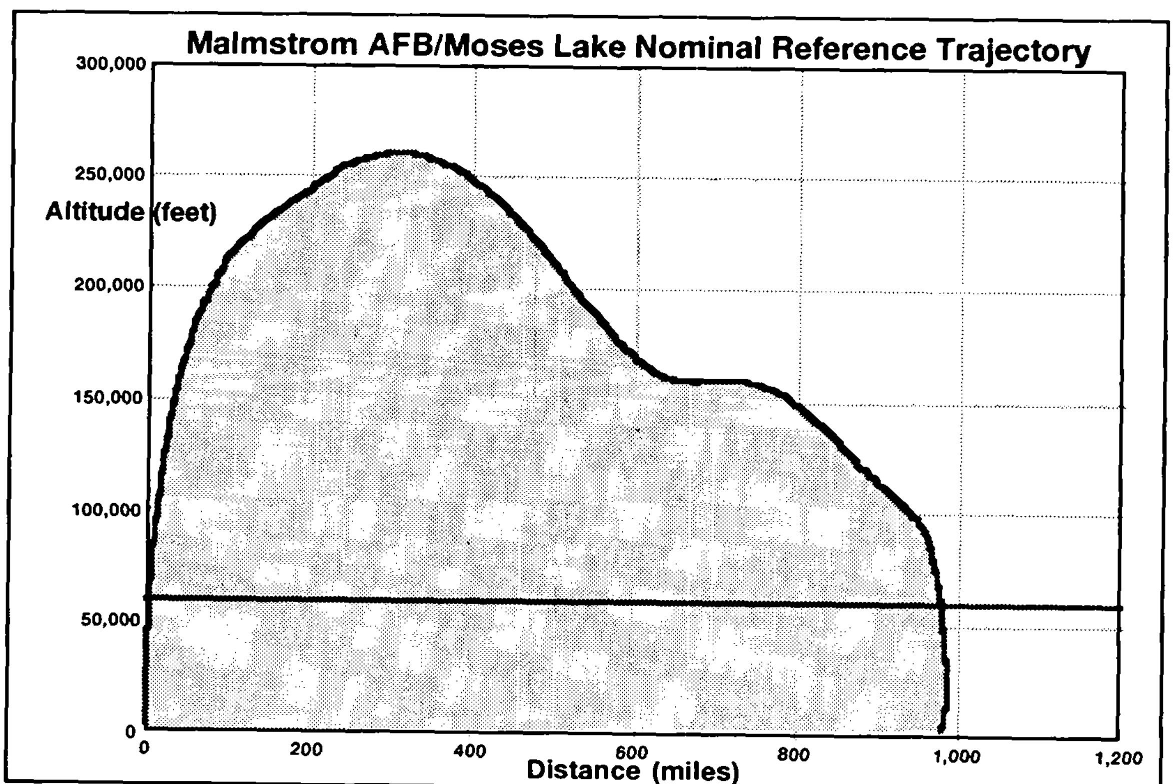


Figure D-8.

In a memo from Mr. Dan Couglin (attachment D-I), NASA/MSFC, a preliminary study's results of defining the X-33 groundtrack swath for Silurian Lake, Michael (Dugway Proving Ground), and Malmstrom test flights were provided. The groundtrack swath (maximum projected deviation from nominal flight) for test flights to China Lake and Moses Lake were assumed to be similar to Silurian Lake and Malmstrom, respectively, and therefore, were not analyzed separately. Results are attached.

February 13, 1997

To: AE01/Dr. R. McCaleb

From: ED13/D. Coughlin

Subject: X-33 Trajectory Groundtrack Swath Study

In support of the X-33 Environmental Impact Statement, a preliminary study has been performed to define the X-33 groundtrack swath for the planned Malmstrom, Michael, and Silurian flights. This study includes the groundtrack analysis for the ascent and entry phases of flight only. Simulations of the Terminal Area Energy Management (TAEM) and landing phases of flight are performed at Lockheed-Martin/Houston. The results included here should be considered a first estimate only

The intent of this study is to provide an estimate of the width of the groundtrack swath given the uncertainties and dispersions in the atmosphere and vehicle systems. A complete 6 degree-of-freedom (DOF) Monte Carlo dispersion analysis is required to define the groundtrack swath. This analysis is not scheduled until later this year.

The table below provides the downrange distance to the three landing sites from Edwards AFB and the Main Engine Cutoff (MECO) point.

Trajectory	Distance from EAFB to landing site (nmi)	MECO distance to landing site (nmi)
Silurian	90	72
Michael	430	350
Malmstrom	840	710

Ascent:

Prior to the X-33 Preliminary Design Review in November, 1996, 6 DOF simulations were performed to test the stability of the vehicle during the first 140 seconds of ascent flight (Malmstrom trajectory). These simulations included the effects of 50 'day-of-launch' wind pairs. A nominal trajectory was designed for the first of each wind pair, then simulated assuming the second of the wind pair - thus emulating 'day-of-launch' wind biasing (Figure 1.). All 50 trajectories converge to a common azimuth and the width of the groundtrack swath is approximately 1.8 nmi at MECO.

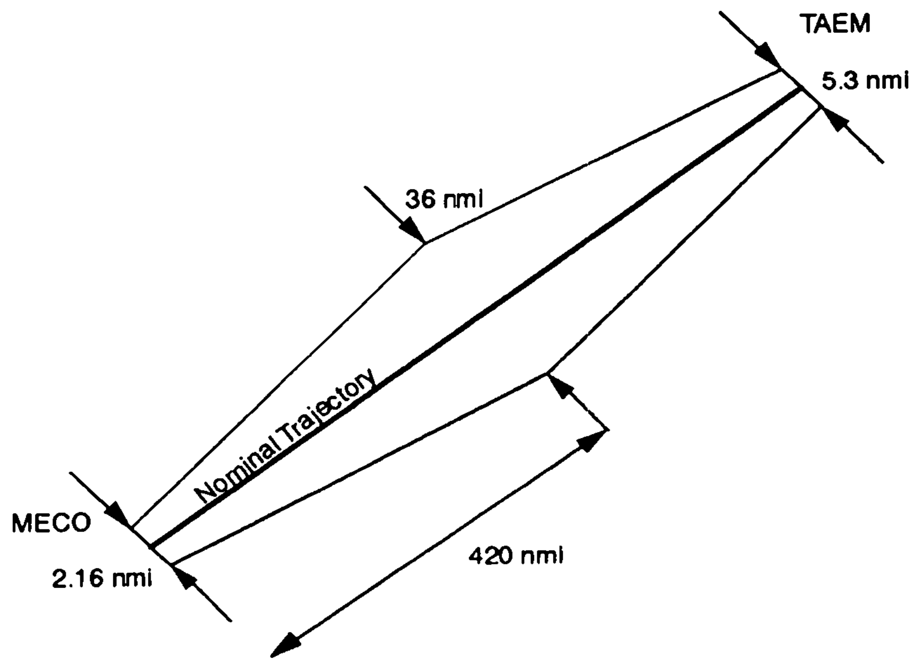
The effect of various winds is expected to cause the largest variation in groundtrack during ascent. However, the groundtrack swath resulting from use of day-of-launch wind biasing is optimistic. This method of trajectory shaping is yet to be approved. The alternate method is to design a nominal ascent trajectory based on an average wind, test the winds on launch day, and fly the vehicle to the nominal trajectory for the winds that satisfy the test. Ascent groundtrack swaths for this method are wider. Until the trajectory shaping decision is made, a safety factor of 20% shall be added to the results obtained through day-of-launch wind biasing. The following results apply for each of the reference trajectories:

Downrange from EAFB (nmi)	Width of GroundTrack Swath (nmi)
0.67	0.72
1.34	1.20
2.00	1.44
2.68	2.16
MECO	2.16

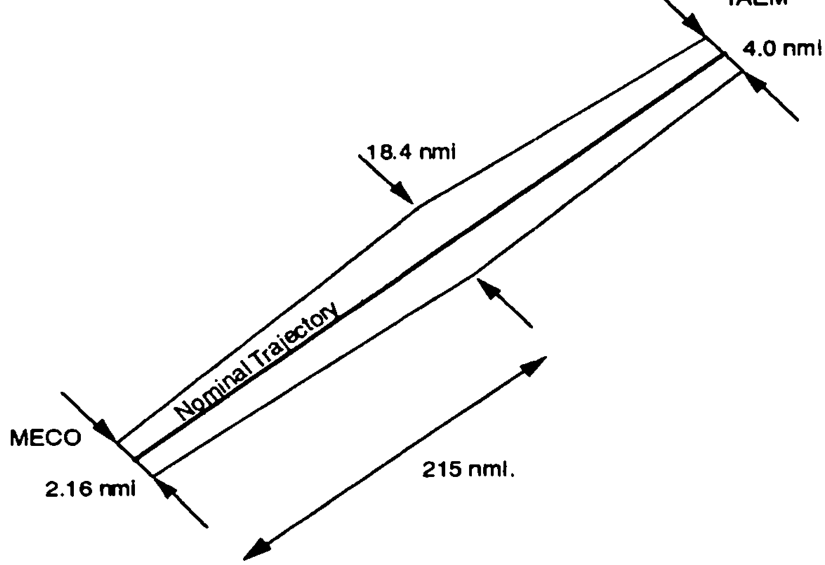
Entry:

The greatest effect on entry groundtrack dispersions result from changes in MECO targeting relative to the nominal trajectory. Naturally, the widest groundtrack swath during entry will occur on the longest (Malmstrom) flight. A comparison of the designed and guided (simulation with guidance algorithm) Malmstrom trajectories results in a groundtrack swath with a maximum width of 36 nmi (Figure 2) at approximately 420 nmi. from the landing site. During flight, the on-board entry guidance algorithm steers the vehicle to reduce the error between the reference trajectory and the actual trajectory. The groundtrack swath is reduced in width until the TAEM point (approximately 20 nmi from the landing site, altitude ~ 80 kft., speed ~ 2500 ft/s). Previous analysis show the maximum TAEM target dispersion is 5.3 nmi.

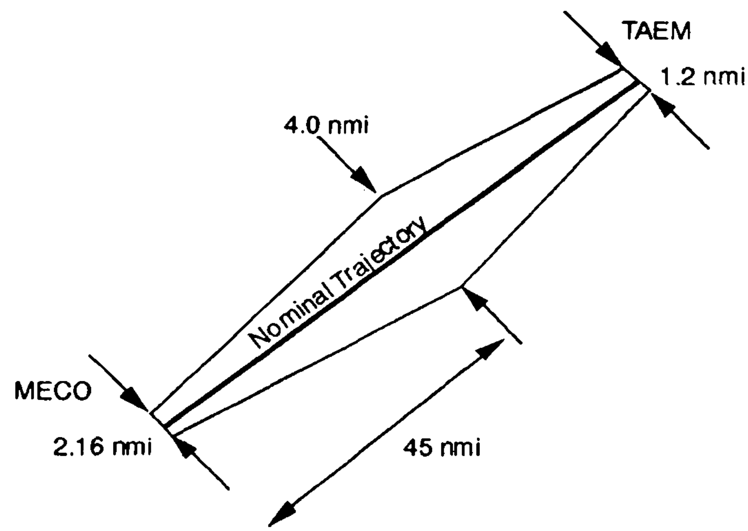
The model for the groundtrack swath for the baseline entry trajectories are as follows:



Malmstrom Trajectory Entry GroundTrack Swath



Michael Trajectory Entry GroundTrack Swath



Silurian Trajectory Entry GroundTrack Swath

Any questions may be directed to the undersigned at (205)544-2159 or by e-mail at dan.coughlin@msfc.nasa.gov

Dan Coughlin
Flight Mechanics, Guidance, Navigation and Control Systems Branch

In order to assure aviation safety, the size of the temporary restricted airspace zones for Silurian Lake, Malmstrom and Moses Lake were evaluated. The factors used to size the zone with an adequate margin of safety were:

(1) begin flight track point where the vehicle would descend below 18,300 m (60,000 ft)

(2) zone to fully include area required for energy and speed reduction maneuvers

(3) fully encompass the runway or lake bed

(4) extend the zone 3 miles past the end of the runway or lake bed to provide for safety and the runway and preclude aircraft from entire vicinity of the runway or lake bed at time of landing

(5) expand zone 150% for safety margin.

The final analysis of approach and energy management maneuvers for Moses Lake and Malmstrom are expected to be similar. Therefore, one projection is representative of both of these landing sites. Results of these analyses to determine estimated requirements for FAA Special Use Permits are provided in Figures D-9 and D-10.

Figure D-12 shows the areas of concentrated general aviation in the R-2508 Complex (USAF 1995). All flight plans would be coordinated with the appropriate Air Route Traffic Control Center.

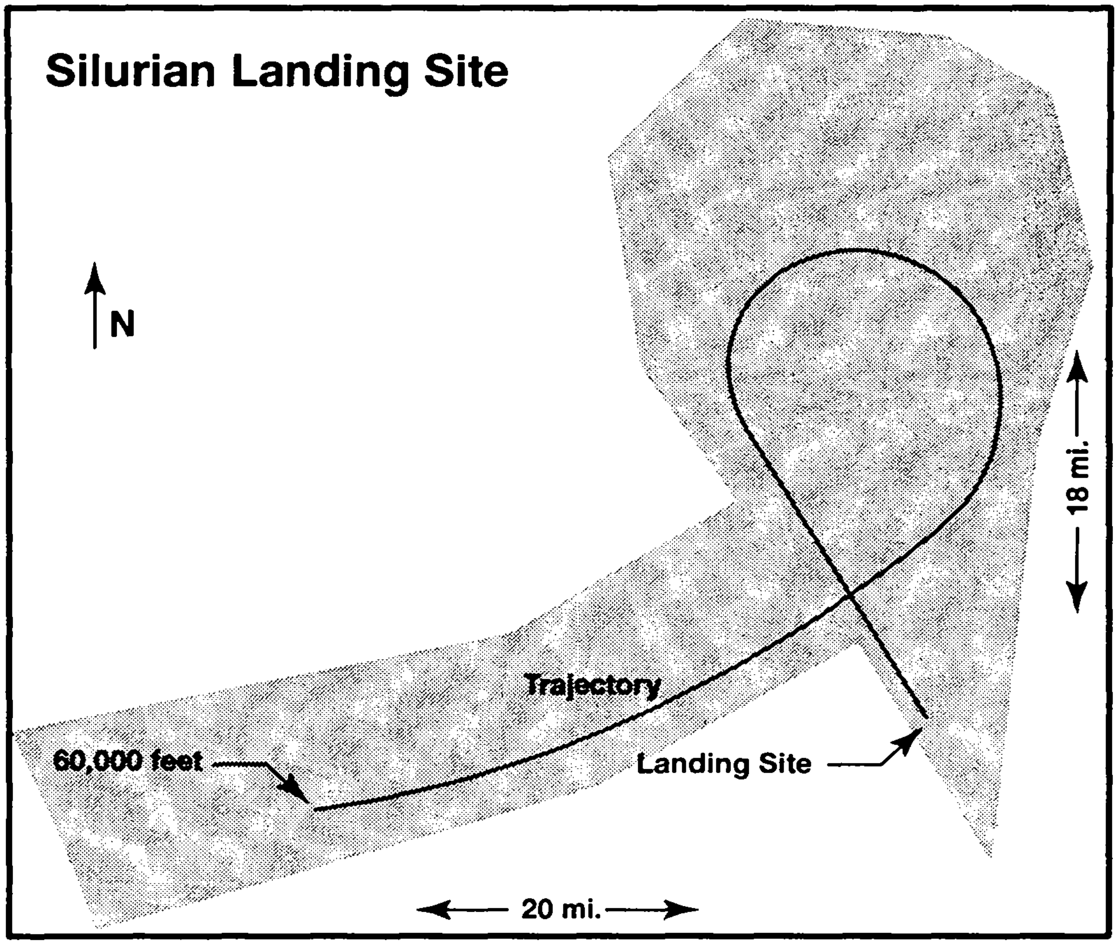


Figure D-9. Potential aviation clear zone to be addressed in an application to the FAA for a Special Use Permit for Silurian Lake landings.

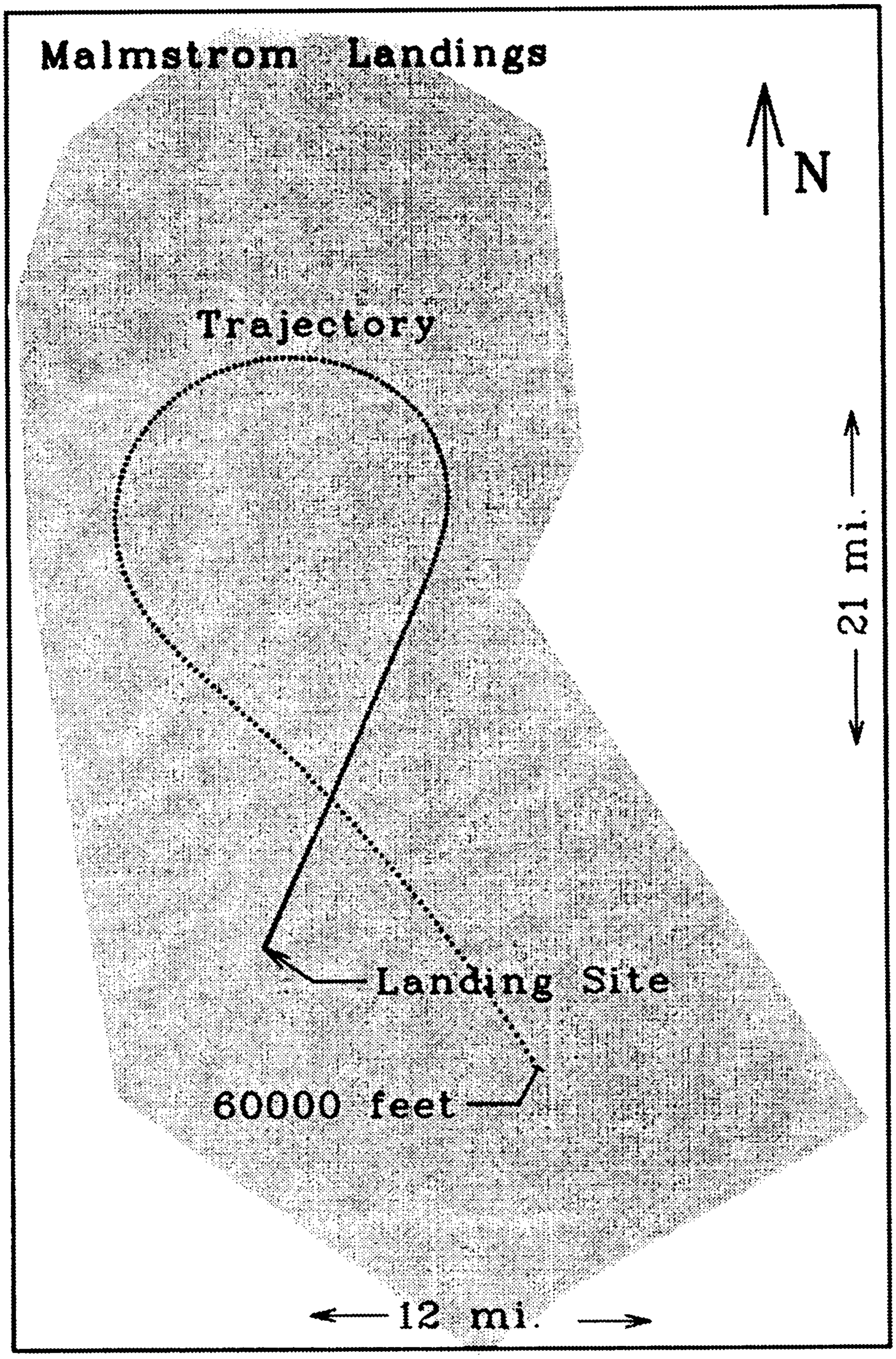


Figure D-10. Potential aviation clear zone to be addressed in an application to the FAA for a Special Use Permit for Malmstrom/Moses Lake landings.

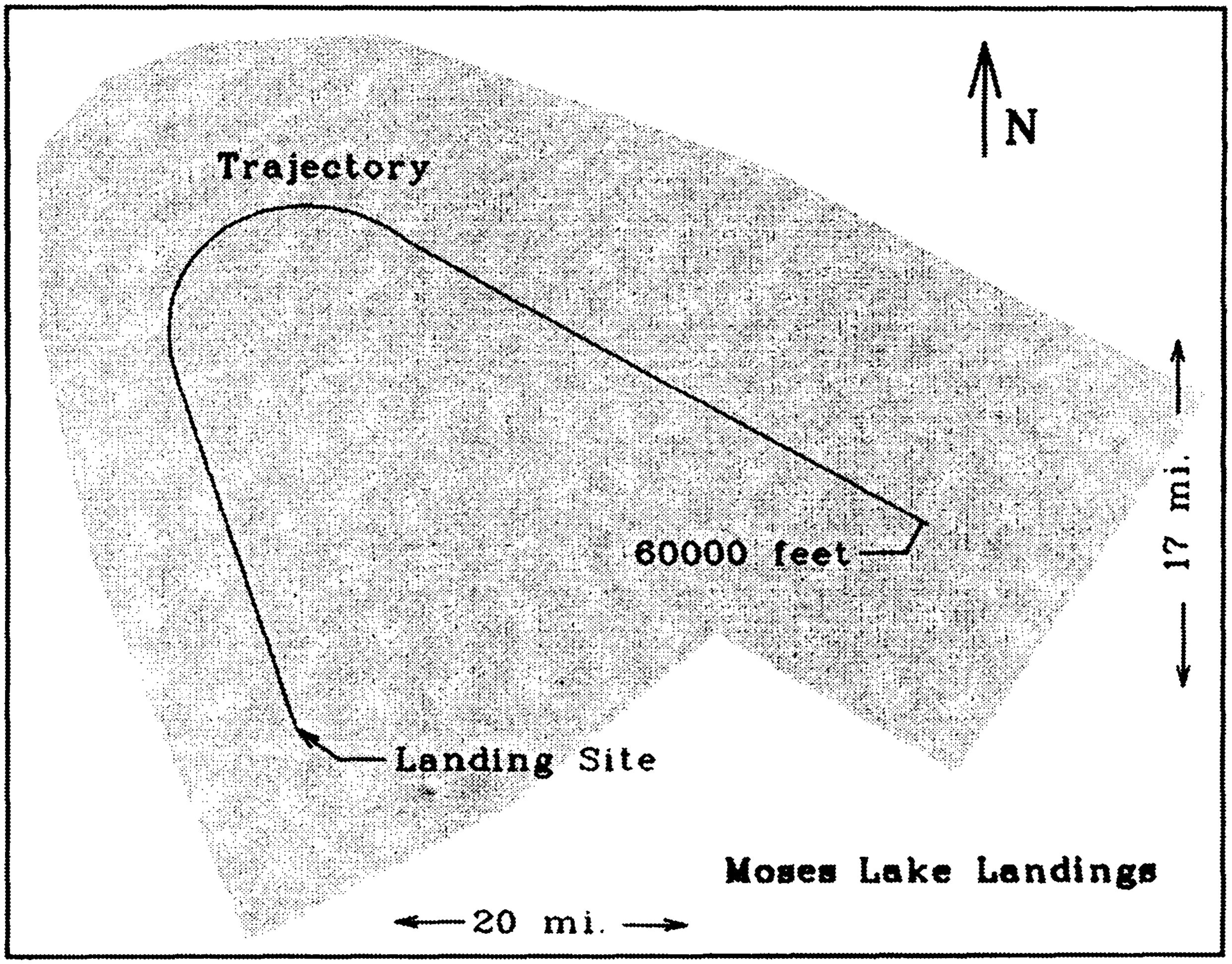


Figure D-11. Potential aviation clear zone to be addressed in an application to the FAA for a Special Use Permit for Moses Lake Landings. Areas of concentrated general aviation in R-2508 Complex (USAF 1995)

R-2508 COMPLEX

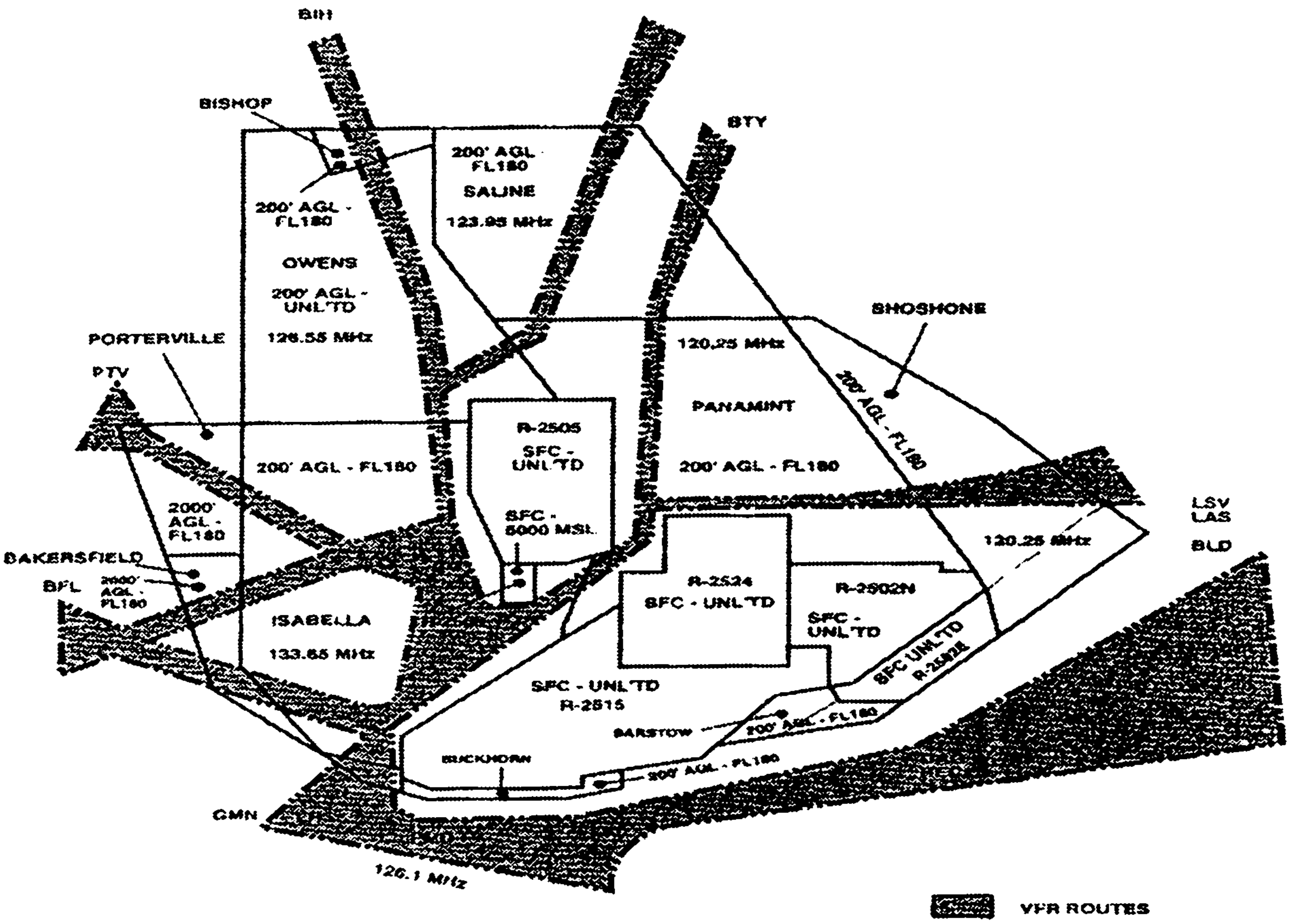


Figure D-12. Areas of concentrated general aviation in R-2508 Complex (USAF 1995).

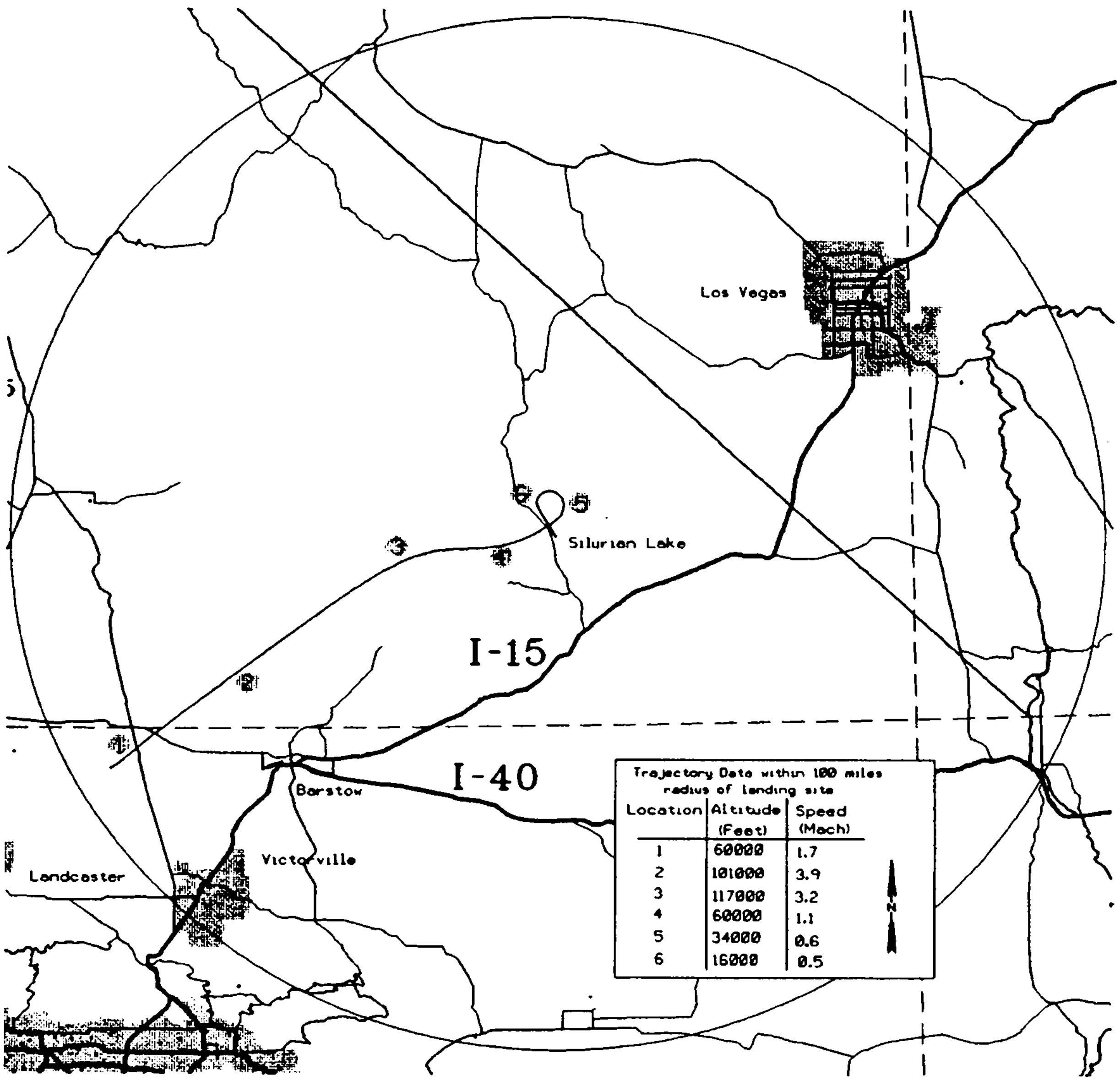
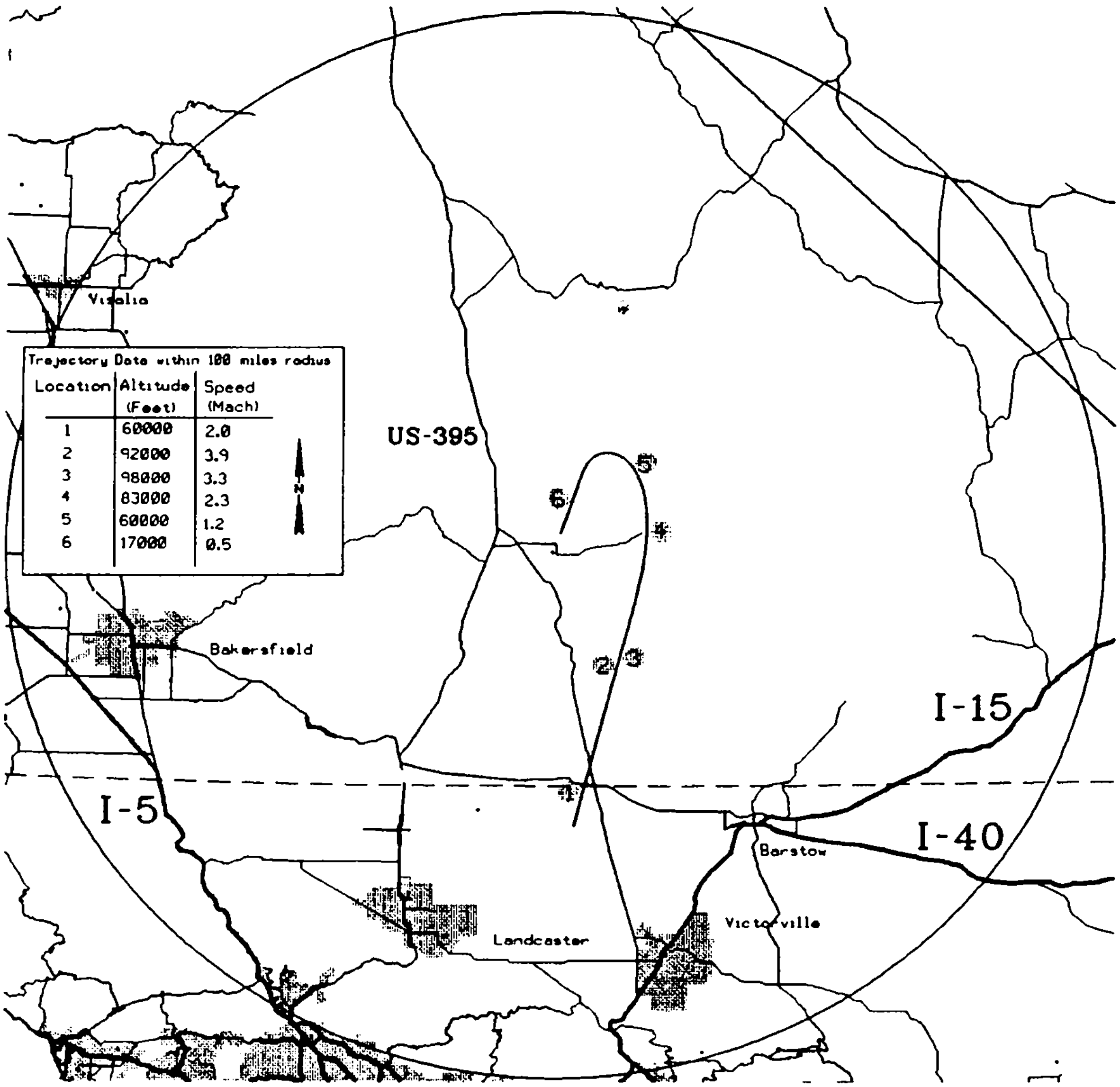
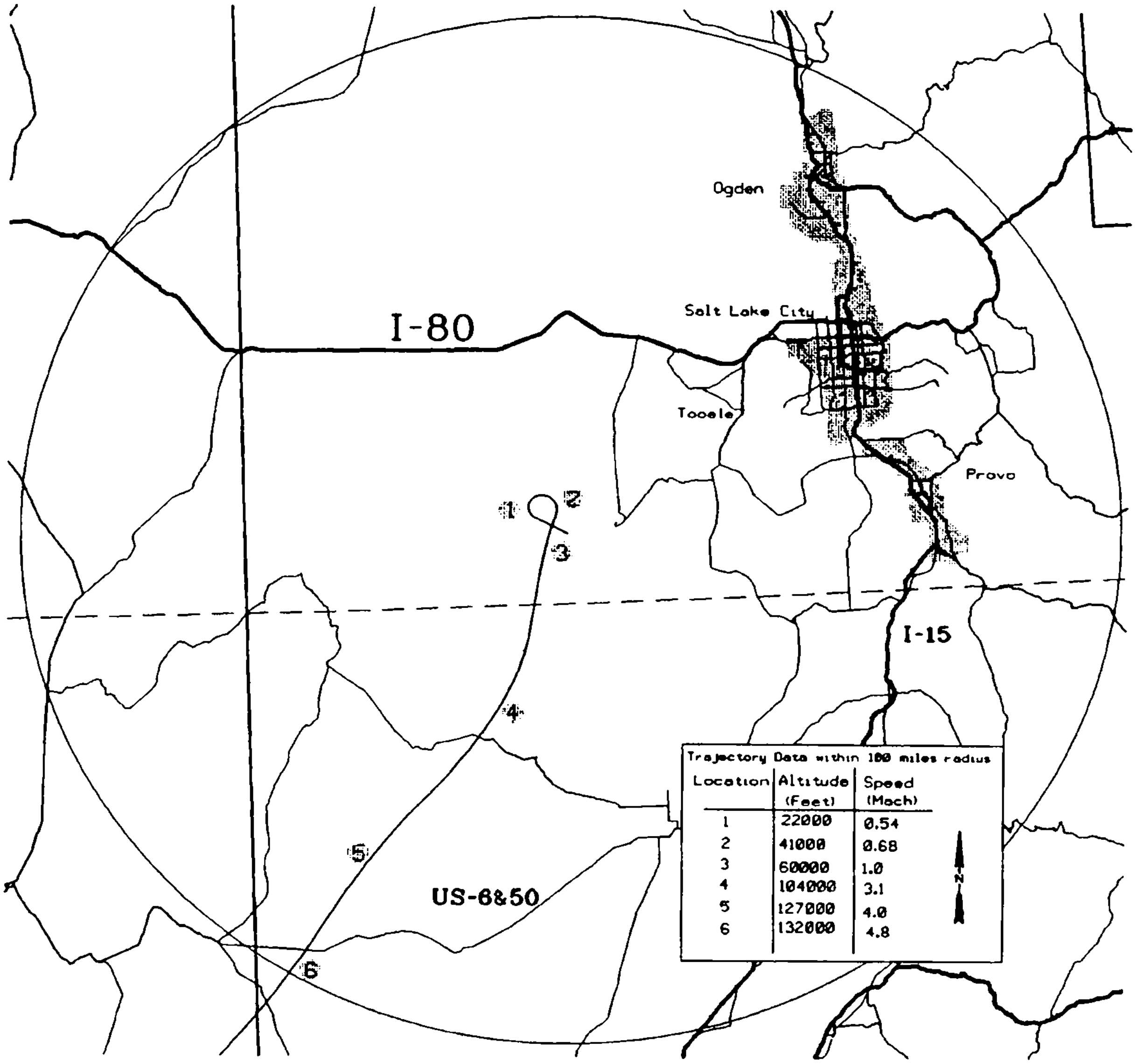


Figure D-13. Expanded map for ground track from EAFB to Silurian Lake, CA including altitude and speed.



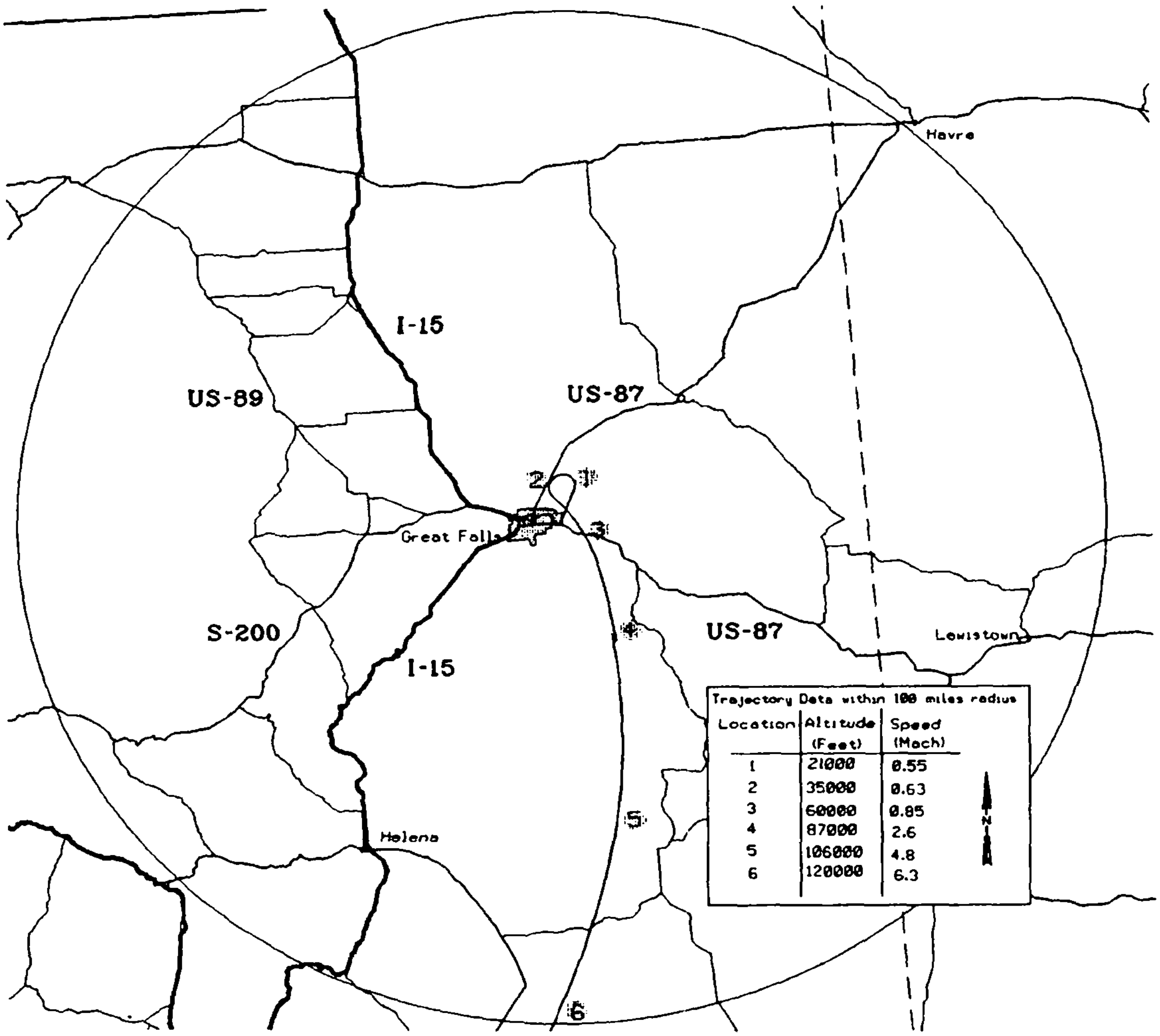
Location	Altitude (Feet)	Speed (Mach)
1	60000	2.0
2	92000	3.9
3	98000	3.3
4	83000	2.3
5	60000	1.2
6	17000	0.5

Figure D-14. Expanded map for ground track from EAFB to China Lake, CA including altitude and speed



Location	Altitude (Feet)	Speed (Mach)
1	22000	0.54
2	41000	0.68
3	60000	1.0
4	104000	3.1
5	127000	4.0
6	132000	4.8

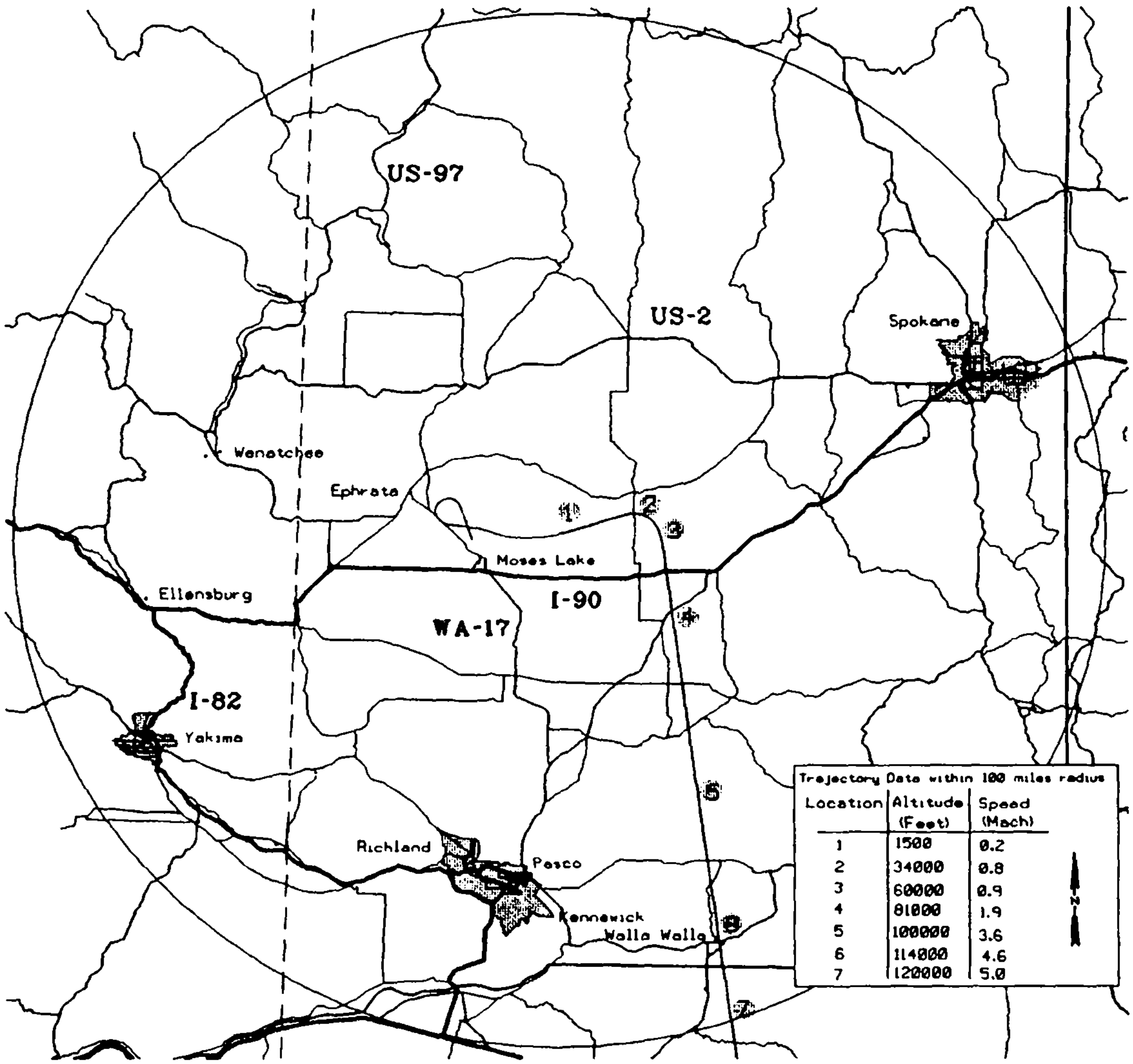
Figure D-15. Expanded map for ground track from EAFB to Dugway Proving Ground, UT, including altitude and speed.



Trajectory Data within 100 miles radius

Location	Altitude (Feet)	Speed (Mach)
1	21000	0.55
2	35000	0.63
3	60000	0.85
4	87000	2.6
5	106000	4.8
6	120000	6.3

Figure D-16. Expanded map for ground track from EAFB to Malmstrom Air Force Base, MT, including altitude and speed..



Trajectory Data within 100 miles radius

Location	Altitude (Feet)	Speed (Mach)
1	1500	0.2
2	34000	0.8
3	60000	0.9
4	81000	1.9
5	100000	3.6
6	114000	4.6
7	120000	5.0

Figure D-17. Expanded map for ground track from EAFB to Moses Lake, WA including altitude and speed.

APPENDIX E

BIOLOGICAL ASSESSMENT FOR PROPOSED TAKEOFF AND LANDING SITES FOR THE X-33 ADVANCED TECHNOLOGY DEMONSTRATOR PROGRAM

National Aeronautics and
Space Administration
John F. Kennedy Space Center
Kennedy Space Center, FL 32899

Reply to Attn of: JJ-D

April 25, 1997

Mr. Doug Laye
U.S. Fish and Wildlife Service
222 East Main, Suite 202
Barstow, CA 92311

Dear Mr. Laye:

Enclosed is the subject Biological Assessment (BA) prepared as part of the environmental review process for the implementation of NASA's X-33 Advanced Technology Demonstrator Program. We have prepared this BA as required under Section 7 of the Endangered Species Act and 50 CFR Part 402 and are submitting it to begin the formal Section 7 Consultation process.

As you know, the program crosses several states and includes two Fish and Wildlife Service Regions (Regions 1 and 6). Therefore we have requested that a single point of contact be assigned to coordinate the Service review. As you have been identified for this role (see attached letter), we are sending this document to you for coordination among the required Service offices.

Please direct all comments and any questions you may have to myself or to Dr. Rebecca McCaleb of Marshall Space Flight Center at one of the addresses below:

KSC Environmental Program Office
Attn: Mario Busacca
Mail Code: JJ-D
Kennedy Space Center, FL 32899
Telephone Number: (407) 867-2213

MSFC Environmental Engineering and
Management Office
Attn: Rebecca C. McCaleb, Ph.D.
Mail Code: AE01
Marshall Space Flight Center, AL 35812
Telephone Number: (205) 544-4367

Your assistance in the X-33 Program Section 7 Consultation effort is greatly appreciated.

Sincerely,

Mario Busacca

Mario Busacca
Lead, Natural Resources Program

Enclosures

National Aeronautics and
Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

NASA

Reply to Attn of: AE01 (34-97)

FEB 19 1997

Mr. Doug Laye
U. S. Fish and Wildlife Service
222 East Main, Suite 202
Barstow, California 92311

Dear Mr. Laye:

The National Aeronautics and Space Administration (NASA) is developing a Single-Stage-to-Orbit Reusable Launch Vehicle (SSTO RLV)/X-33 Advanced Technology Demonstrator (ATD) for testing. The X-33 program will demonstrate in flight the new technologies for a RLV, using a half-scale suborbital spaceplane. Most of our in flight testing will occur in the U. S. Fish and Wildlife Service (USFWS) Pacific Region (Region 1) with some testing in the USFWS Mountain-Prairie Region (Region 6). Enclosed for your review are a copy of our Notice-Of-Intent to prepare an Environmental Impact Statement, and a video that summarize the X-33 program.

NASA is preparing a summary of listed species that may be affected and critical habitat that may be jeopardized or adversely modified during the program. Any information that you can provide for species or habitat that should be included in our list is appreciated.

Since our testing activities will occur in two regions, but mostly Region 1, a single point-of-contact for the Service was requested to facilitate our Section 7 Consultation efforts. Your Ventura Field Office has identified you as the single point-of-contact. The other Service offices will provide their input through your office.

Your assistance in the X-33 Program Section 7 Consultation effort are appreciated.

You may call me at (205) 544-4367 or Wayne Wilson at (205) 544-6089.

Sincerely,

Rebecca C. McCaleb

Rebecca C. McCaleb, Ph. D.
Director, Environmental Engineering
and Management Office

Enclosures

National Aeronautics and
Space Administration

John F. Kennedy Space Center
Kennedy Space Center, FL 32899

Reply to Attn of: JJ-D

27 May 1997

Mr. Doug Laye
U.S. Fish and Wildlife Service
222 East Main St.
Suite 202
Barstow, CA 92311

Dear Mr. Laye,

On 28 April - 1 May 1997, a working review process was held for the draft Environmental Impact Statement for the Advanced Technology Demontrator Vehicle X-33. It was decided at that meeting that the proposed South Base launch site at Edwards Air Force Base was no longer a viable option. All refcrences to that site have been deleted from the revised draft EIS. Please do not consider the South Base site during your review of the Biological Assessment for the X-33 project that was submitted to you on 28 April 1997. Enclosed is a copy of the revised BA reflecting that change. Thank you for your attention to this matter, and please do not hesitate to contact me or Rebecca Smith if you have any questions or comments.

Sincerely,

Mario Busacca
Lead, Natural Resources Program

BIOLOGICAL ASSESSMENT FOR PROPOSED TAKEOFF AND LANDING SITES FOR THE X-33 ADVANCED TECHNOLOGY DEMONSTRATOR PROGRAM

Introduction

As required under Section 7 of the Endangered Species Act, any federal agency whose actions may affect federally protected plant or wildlife species is required to assess the effects on those species and enter into a formal consultation with the U.S. Fish and Wildlife Service. These consultations are documented in the form of Biological Assessments (BA's). This BA has been prepared to address possible effects of the X-33 Advanced Technology Demonstrator Program on listed species potentially occurring at two proposed launch sites and five proposed landing sites.

Project Description

The Advanced Technology Demonstrator Vehicle X-33 is a one-half scale test model of a spaceplane that is intended to be the next generation of reusable launch vehicles (Fig. E-1). A key feature of the X-33 that distinguishes it from vehicles currently in operation is its single-stage-to-orbit launch system. The entire spaceplane, including the lifting body airframe, two internal fuel tanks, and two engines, will launch vertically and land horizontally as a single unit. There are 15 test flights planned within a one-year timeframe (March 1999 - December 1999) for three levels of increasing distance and speed. The X-33 will be fueled with liquid hydrogen (LH_2) and liquid oxygen (LOX), and water will be the primary product of combustion. Landings will be unpowered, as with a glider. This project is intended to demonstrate the technology necessary to reliably carry payloads into space for one-tenth of current costs.

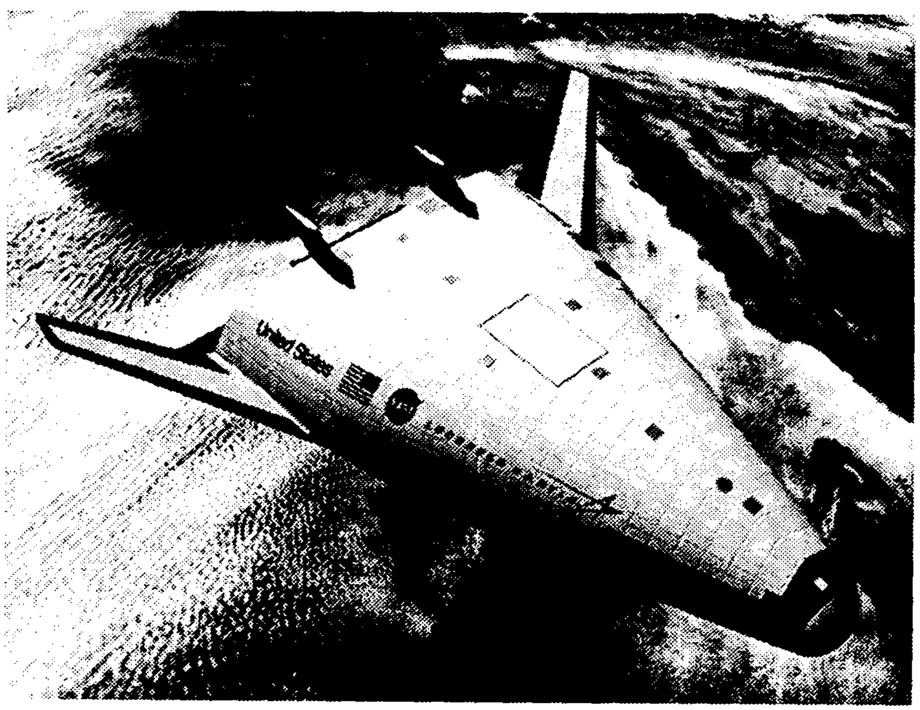


Figure E-1. X-33 Spaceplane Concept.

Launch Facilities Description

The X-33 is proposed to liftoff from one of two launch sites on Edwards Air Force Base (EAFB), California, either Haystack Butte or Space Port 2000 (Fig. E-2). Facilities at or leading to the launch site include structures and buildings to support launch, an access road, and utilities lines. After each test flight, the X-33 will be flown "piggy back" on a Boeing 747 from the landing site back to EAFB, landing at runway 04-22 (Fig. E-3). The spaceplane will be towed from there to the launch site and prepared for the next launch.

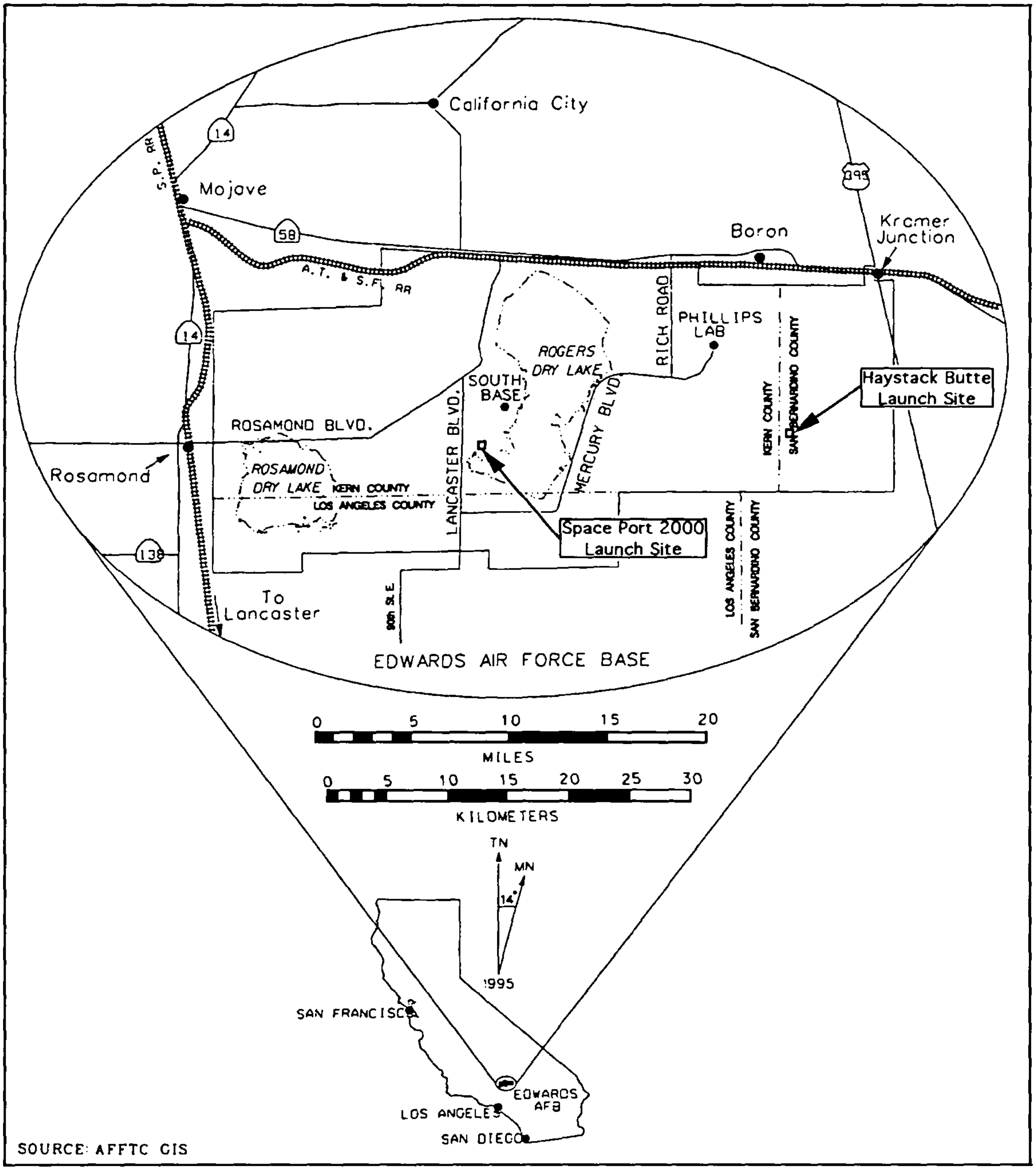


Figure E-2. Three Alternate Launch Sites at Edwards.

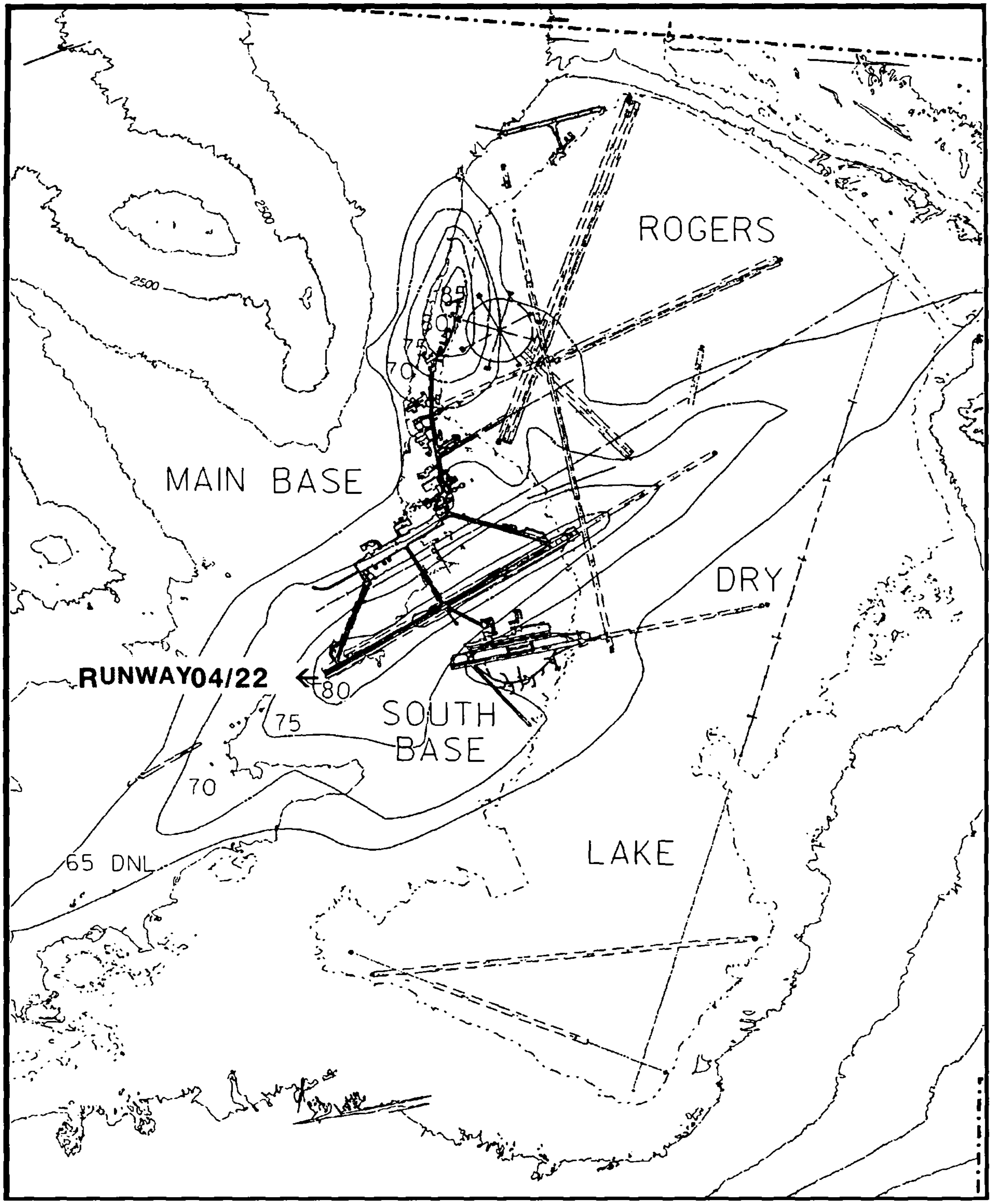


Figure E-3. Runway 04/22 at Edwards.

There are currently no facilities at the Haystack Butte site suitable for supporting the X-33 program launches, and the facilities will have to be prepared. A maximum of 19 ha (47 ac) of land will be needed. The launch site itself will encompass 9.3 ha (23 ac). Of this area, approximately 5 ha (12 ac) will be graded to remove vegetation and leveled for placement of the support facilities. Facilities include a launch pad, rolling shelter, deluge water storage tank and bucket, utility building, hydrogen flare stack, oxygen dump pit, two earthen berms, and unloading/storage areas for helium and liquid nitrogen, hydrogen and oxygen (Fig. E-4). A chain link security fence will be installed along the site perimeter.

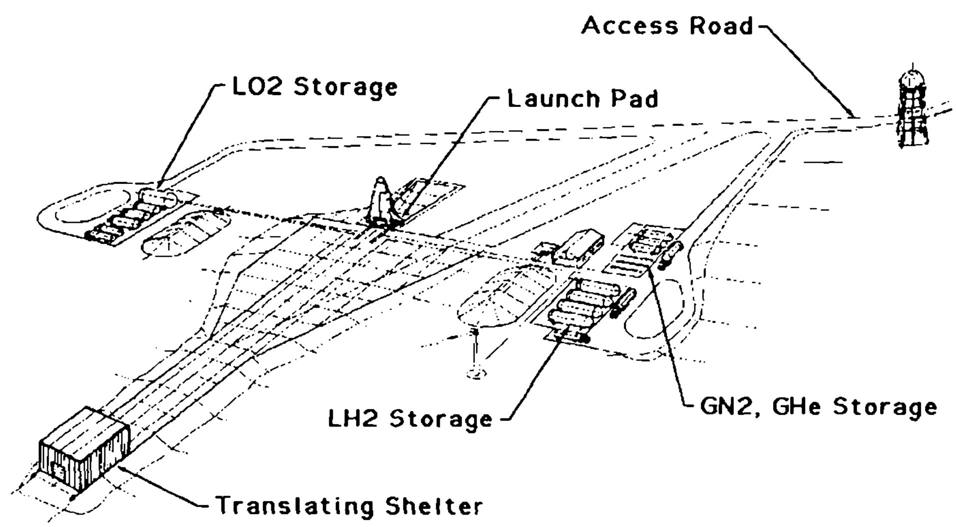


Figure E-4. Launch Site Structure.

A 400-m (1,300 ft) radius explosive safety perimeter will be established around the site, but will not involve any ground disturbance. An additional 1.2 ha (3 ac) may be cleared to install a batch plant to take advantage of the fill material from the Haystack Butte borrow pits.

An access route, water lines, electricity, gaseous nitrogen (GN_2), communication utilities, and a towway route would be needed. A 73 m wide (240 ft) by 1,219 m long (4,000 ft) corridor would be developed for the access road and communication utilities. Site preparation activities will remain within the corridor. Overhead power poles leading to underground cables onsite will bring electricity to the facilities. A 20 cm (8 in) diameter PVC water pipeline will be constructed aboveground on concrete supporting blocks to feed water into an onsite 946,350 L (250,000 gal) storage tank needed for cooling, sound suppression, and fire protection during launches. Deluge water may be sprayed at the base of the X-33 vehicle in the event of a mission abort, other emergency condition, or to wash down the launch pad. Approximately 90% of the deluge water would be evaporated during launches, leaving 10% to be recycled back into the water tank. The X-33 propellants, LH_2 and LOX, will be stored onsite. The GN_2 line, used to purge the fuel lines, would be located on supporting blocks adjacent to the water line. A fiber optic cable would be installed between the launch site and the launch control building in a 3 m (10 ft) wide, 1 m (3 ft) deep corridor. The 1,707 m (5,600 ft) long route would tie into an existing fiber optic cable north of the site to its termination at Building 9800, which would be used as the control room. Two routes have been proposed for a towway from runway 04-22 to the Haystack Butte site (Fig. E-5).

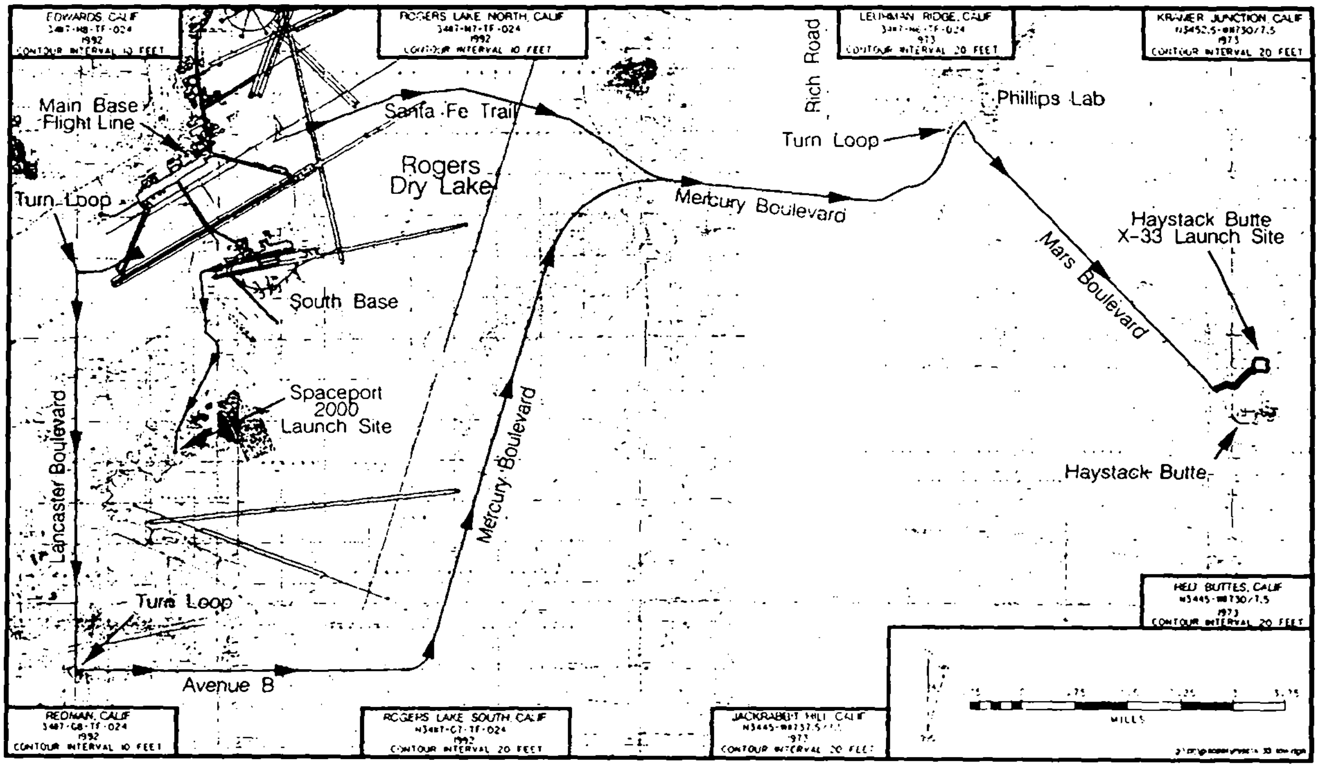


Figure E-5. X-33 Tow Routes to Haystack Butte.

The site designated for the Space Port 2000 proposed alternative is located southwest of Rogers Dry Lake (Fig. E-2). The launch support facilities (as described above for the Haystack Butte site) would be 4 km (2.5 mi) from the B-2 bomber buildings. Utilities would be extended 1.9 km (1.2†mi) to the site from Building 730. The access road and a towway from runway 04-22 would follow existing roadways. The maximum amount of land needed to support launching from the Space Port 2000 site is 9.3 ha (23 ac).

Landing Facilities Descriptions

The X-33 test protocol calls for flights at three levels of increasing distance and speed, necessitating short-range, mid-range, and long-range landing site alternatives (Fig. E-6). The two proposed short-range sites are Silurian Lake and China Lake Naval Air Warfare Center, both located approximately (100 mi) from EAFB (Figs. E-7 and E-8). The proposed mid-range site is Michael Army Air Field within Dugway Proving Ground (DPG) in Utah (Fig. E-9).

The two proposed long-range sites are Malmstrom Air Force Base (AFB), Montana (Fig. E-10), and Grant County Airport near Moses Lake, Washington (Fig. E-11). Basic operations that would occur at the sites include: landing support aircraft carrying equipment;

landing and servicing the Boeing 747 that would ferry the X-33 back to the launch site at EAFB; landing, servicing, and inspecting the X-33; attending to any residual propellants that may be in the X-33's fuel tanks; lifting the X-33 with a crane and mating it to the Boeing 747; and disassembling and deactivating the temporary base of operations at the site. Accommodations for a support crew of approximately 50 people would be needed at the landing site for between 4 and 10 days per test flight. Four of the five potential landing sites have all or most of the infrastructure and resources necessary to support X-33 landings, and no site preparation in undeveloped habitat would be necessary.

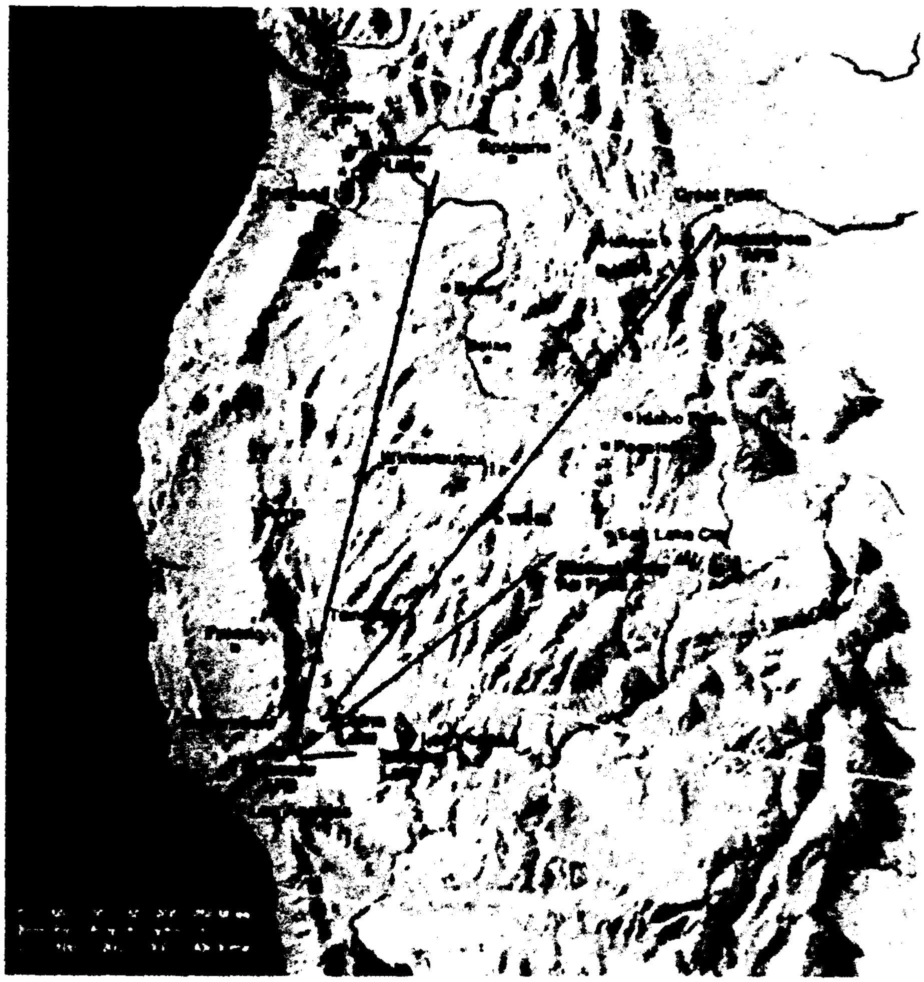


Figure E-6. X-33 Landing Site Alternatives.

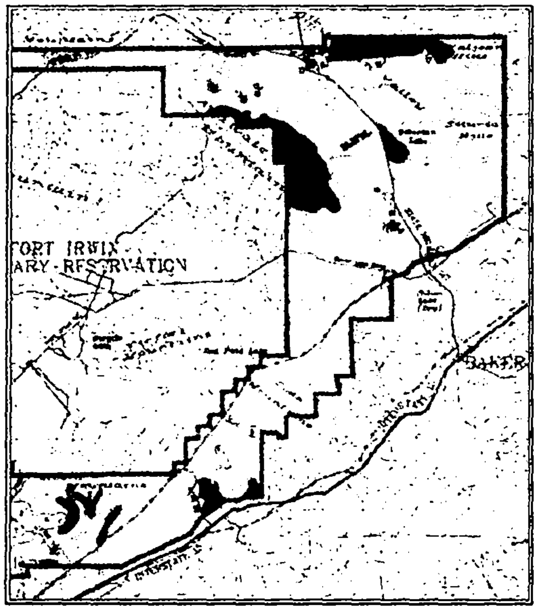


Figure E-7. Silurian Lake, California.

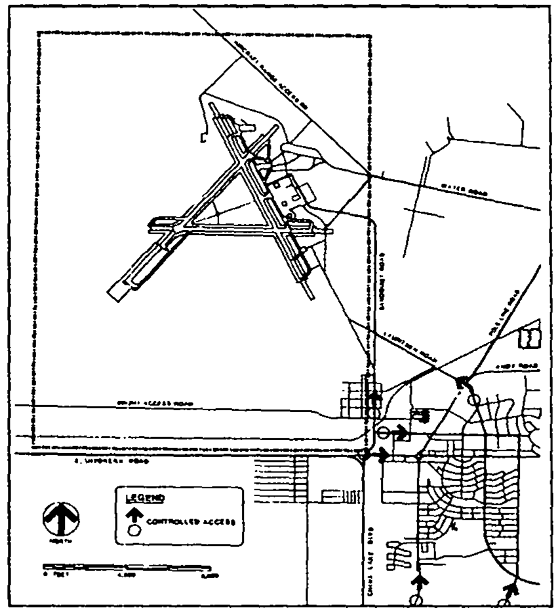


Figure E-8. Armitage Airfield, China Lake Naval Air Weapons Station, California.

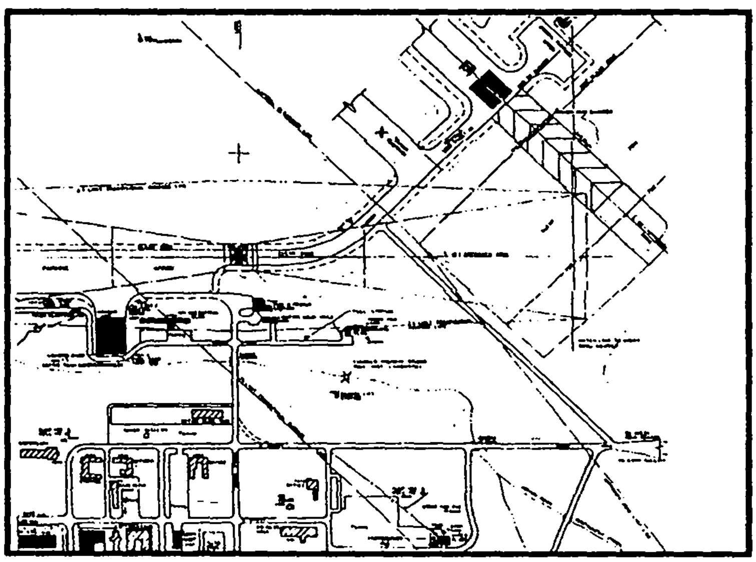


Figure E-9. Michael Army Airfield Within Dugway Proving Ground, Utah.

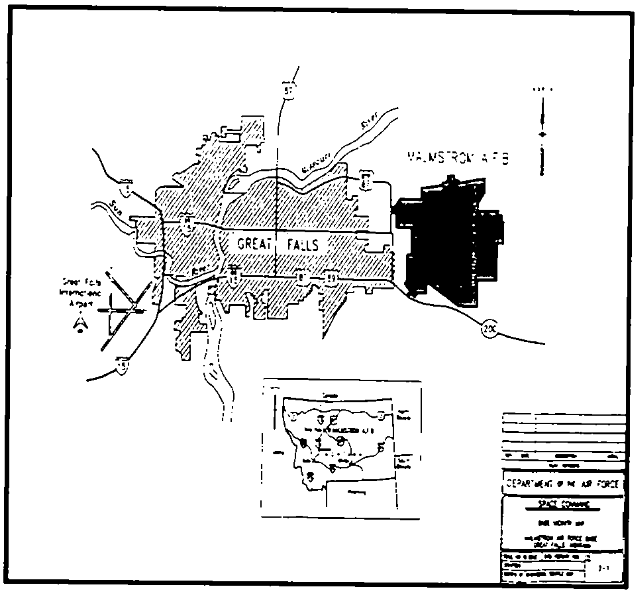


Figure E-10. Malmstrom Air Force Base, Montana.

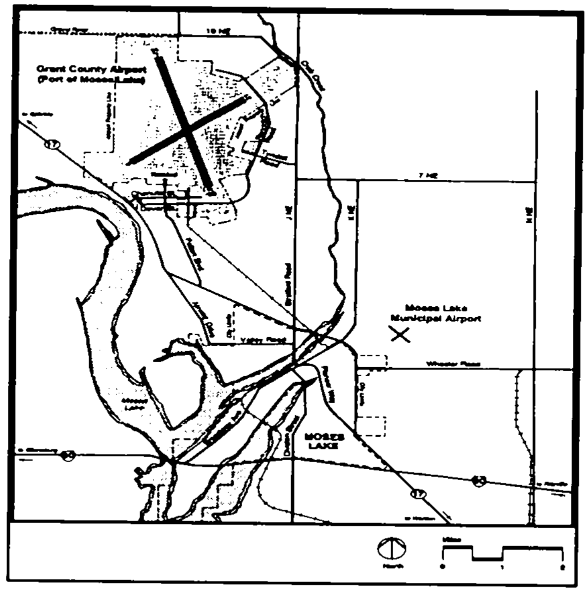


Figure E-11. Grant County Airport, Moses Lake, Washington.

Silurian Lake has no existing infrastructure, and a number of activities will have to be completed before the dry lake bed can be used for X-33 landings. Grading the lake bed is not anticipated unless the condition of its surface becomes unsuitable for landing because of rain or use by off-road vehicles. Several structures and areas would be placed on or near the lake bed, including a safing area with safing and fire protection equipment; a 46.4 m^2 (500 ft^2) staging area where the X-33 would be prepared for return to EAFB on the Boeing 747; a temporary vehicle shelter; a diesel refueling location with spill protection provisions; a lightning tower and weather station; communications and control equipment; and restrooms and potable water sources for support personnel. Some compaction of the sand would be done, particularly in the staging area. Landing stripes would be painted on the lake bed surface to facilitate landing the Boeing 747.

Launch Sites Habitat Descriptions

EAFB is 122,810 ha (301,000 ac) located in the Antelope Valley of the western Mojave desert (Fig. E-6). The Mojave is the most arid of the North American deserts and is characterized by hot summers and cold winters. Five different natural communities have been identified: halophytic phase saltbush scrub, arid phase saltbush scrub, creosote bush scrub, joshua tree woodland, and lake bed.

The Haystack Butte site is located 1,113 m (3,650 ft) north of Haystack Butte (Fig. E-2). The habitats in this area, Joshua tree woodland and creosote bush scrub, are undisturbed except for fragmentation by dirt roads. The access road and utility corridors would also occur in these habitats, but tow routes from runway 04-22 to the takeoff site would pass through all five plant communities found on EAFB.

The site proposed for the Space Port 2000 alternative occurs in halophytic phase saltbush scrub (Fig. E-2). There has been minimal disturbance to the natural habitat in this area.

Landing Sites Habitat Descriptions

Silurian Lake is an undeveloped dry lake bed that lies within the western portion of the Mojave desert north of Baker, California (Fig. E-7). The Mojave is characterized by hot summers and cold winters. It is the most arid of the North American deserts, with average annual precipitation less than 14 cm (5.5 in), most of which falls between October and February. Silurian Dry Lake is at a lower elevation than the surrounding landscape. Runoff water temporarily collects on the lake bed after heavy rains, bringing with it a deposition of fine silts, clays, salts, and minerals. The lake bed is flat, with extremely saline or alkaline soil, and little vegetation. The area surrounding the dry lake bed can be classified as Mojave creosote bush scrub, characterized by 0.5 to 3 m (1.5 to 10 ft) tall creosote bushes (*Larrea tridentata*) with considerable bare ground between them. Winter annuals comprise the majority of the ground cover, but several species of exotics can dominate cover and biomass during some years (Germano et al. 1994). Mojave creosote bush scrub is usually found on well-drained soils from 600 to 1,200 m (1,968 to 3,937 ft) elevation.

China Lake Naval Air Weapons Station is 246,091 ha (608,105 ac) also located in the western portion of the Mojave desert (Fig. E-8). Average annual precipitation at China Lake is 15 cm (4-6 in), with most falling between November and March. Vegetation at China Lake is diverse, and 12 different plant communities have been identified. The area surrounding the landing site facilities is classified as Mojave creosote bush scrub, characterized by creosote bushes and burro-bush (*Ambrosia dumosa*).

Michael Army Air Field is within the 324,846 ha (802,712 ac) Dugway Proving Ground (DPG) located near the western border of central Utah (Fig. E-9). Natural features include mountain ranges, desert shrub habitat, and a portion of the Great Salt Lake Desert. DPG lies in a mid-latitude steppe region which can generally be described as arid year-round. Summer is particularly dry and hot, but the variable terrain can cause some areas to receive much greater than average amounts of rain. Daily temperature fluctuations are extreme because of the dry air, dry ground, sparse vegetation, and light winds. Spring and fall are cool, and winter is moderately cold (Pinkham et al. 1982). A total of 333 plant species or varieties are documented as occurring on DPG and eight distinct vegetation communities are recognized (Vest 1962).

Malmstrom AFB is located in Cascade County in north-central Montana (Fig. E-10). It encompasses 1,278 ha (3,159 ac) on base, as well as an additional 182 ha (449 ac) of restrictive easements on adjacent lands. The land surrounding Malmstrom is privately owned and used primarily for agriculture. The Missouri River flows in an easterly direction 1.4 km (0.9 mi) north of the base. The climate is characteristic of a semi-arid continental region, with moderately warm summers and milder winters than would be expected for a location at its latitude. Average annual precipitation is 39 cm (15.2 in), most of which falls as snow from late autumn through early spring. Most natural vegetation on Malmstrom has been removed by development and invasion of exotic grasses. Some areas have been recolonized by native plant species, and the reintroduction of climax perennial vegetation is encouraged (Malmstrom undated).

The Grant County Airport is located in the Columbia River basin area near Moses Lake in central Washington (Fig. E-11). The airport property consists of 1,889 ha (4,667 ac) which are primarily used for air operations and agriculture. Summers are generally mild, with high temperatures of 32°C (89°F). Winter temperatures can fluctuate between -6.7°C (20°F) to 32°C

(89°F). The climate is semi-arid, with a mean of 18 cm (7 in) of rain and 46 cm (18 in) of snow annually. Grant County Airport advertises an average of 350 Visual Flight Rules days per year. The topography is relatively flat with an elevation of 361 m (1,185 ft), except for a bluff near Moses Lake, west of the airport (Black and Veatch 1993). The undeveloped areas of the airport are shrub-steppe vegetation which is characterized by various grasses and sagebrush (*Artemesia tridentata*). Ground cover ranges between 0 - 30%. Grazing was allowed on airport property in the past, but is not currently occurring (Black and Veatch 1993). There is one 0.4 to 0.8 ha (1 to 2 ac) wetland located on the northeast portion of the airport which is designated as a seasonally flooded, palustrine emergent wetland on National Wetland Inventory maps.

Potentially Affected Species

A list of federally protected species potentially affected by X-33 Program development or operations is shown in Table E-1, as well as the sites with which each species is associated. Each species and the potential impacts are discussed below, organized by site.

Table E-1. Federally Protected Wildlife Species Potentially Affected by the X-33 Advanced Technology Demonstrator Program.

Species	Scientific Name	EAFB	Silurian Lake	China Lake	Dugway
Mohave tui chub	*Gila bicolor mohavensis*			X	
desert tortoise	*Gopherus agassizii*	X	X	X	
peregrine falcon	*Falco peregrinus*				X
Inyo California towhee	*Pipilo crissalis eremophilus*			X	

Edwards Air Force Base: The creosote bush scrub at the Haystack Butte site has been designated as Critical Habitat for the desert tortoise (*Gopherus agassizii*). This federally threatened species was listed in 1990 based on increased mortality rates caused by habitat loss, human disturbance, and the spread of Upper Respiratory Tract Disease (U.S. Fish and Wildlife Service 1990). Relative density estimates for the general Haystack Butte area range from 3 to 12 tortoises/km^2 (7 to 32/mi^2) (L.G.S. Turner & Assc. 1996) (Fig. E-12). The relative density estimate for the immediate launch site area is 5 tortoises/km^2 (13/mi^2) (Laabs et al. 1996). Approximately 70% of the proposed Haystack Butte launch site is within Desert Tortoise Management Zone 1. This designation corresponds to areas with low tortoise densities and high human disturbance, and implies minimal desert tortoise protection efforts (United States Fish and Wildlife Service 1994). The remaining 30% of the site is not in a tortoise habitat management zone.

The halophytic saltbush scrub at the Space Port 2000 site has extremely low densities of tortoises. Estimates range between no tortoises to 2 tortoises/km^2 (0 to 6/mi^2) (L.G.S. Turner & Assc. 1996) (Fig. E-12). This area is not designated as Critical Habitat and is not within a desert tortoise habitat management zone.

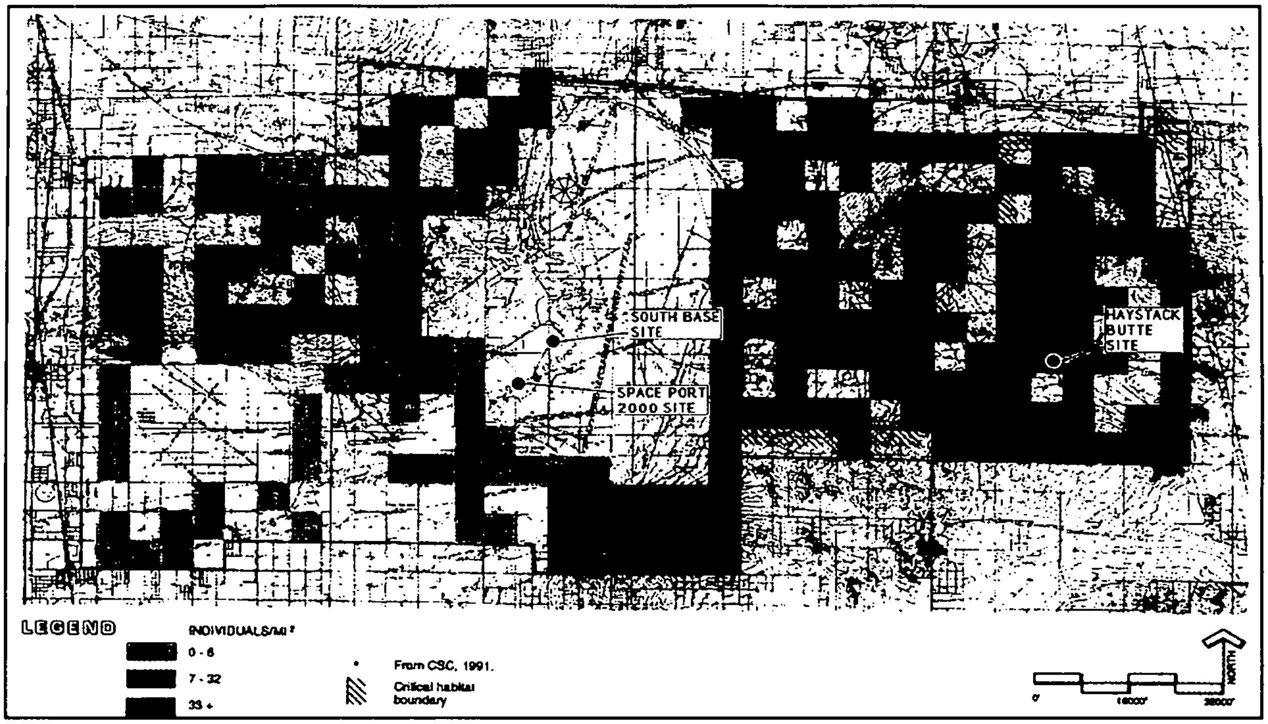


Figure E-12. Desert Tortoise Densities for Areas Surveyed on Edwards.

Malmstrom AFB: No federally protected plant or wildlife species have been documented from Malmstrom.

Grant County Airport: No federally protected plant or wildlife species will be affected by X-33 landings at the Grant County Airport.

Silurian Lake: Because the Silurian lake bed is usually dry and devoid of vegetation, wildlife usage is very rare (Bureau of Land Management, 1996). The creosote bush scrub surrounding the landing site is potentially suitable to support the desert tortoise. Surveys at Silurian Lake for the desert tortoise were conducted in 1979-1980 and 1992. Density estimates for both surveys were very low, ranging from 0 - 8 tortoises/km^2 (0 - 20/mi^2) (Bureau of Land Management, 1996). No tortoises, tortoise burrows, or other evidence of tortoises have been documented from the lake bed or immediately adjacent region (Egan, pers. comm.), and the area is not designated as Critical Habitat (Bureau of Land Management, 1996). The BLM recognizes that the lake bed lies within the known range of the desert tortoise, but because the local tortoise population is either very low or nonexistent, there is no emphasis on tortoise conservation in the land management plans for that area (Egan, pers. comm.).

China Lake: A total of ten federally protected plant and wildlife species could potentially occur on China Lake (Woodman et al. 1996). Of these, one fish, one reptile, and one bird are considered to have the potential to be affected by the X-33 project. No effects to plants are expected from the X-33 project at China Lake because there will be no ground disturbance from construction. The other six species, all birds, are not considered to be of concern to this project because (1) they occur very infrequently or have never been documented on base, and (2) they are non-nesting migrants or there is no suitable nesting habitat on base (Laye, pers. comm.; Williams, pers. comm.).

The Mohave tui chub (*Gila bicolor mohavensis*) is small minnow-like fish in the family Cyprinidae that is federally protected as endangered. This fish is native to the Mojave River in southern California, but was in danger of becoming extinct because of hybridization with the non-native arroyo chub (*Gila orcutti*). In 1971, the Lark Seep wetlands on China Lake were chosen as a recipient site, and 400 Mohave tui chubs were introduced in a last-ditch effort to save the subspecies (United States Navy 1989). Lark Seep is an artificial wetlands created by years of leakage from the evaporation ponds at the sewage treatment plants. Unlike other Mohave tui chub introduction projects, the one at China Lake was very successful and the population at Lark Seep grew to over 10,000 by 1990 (United States Navy 1989). The population has spread into several drainages and the G-1 Seep.

Suitable habitat for the desert tortoise occurs throughout much of the south range of the China Lake complex (Fig. E-6), which has been designated as a Tortoise Habitat Management Area by the United States Fish and Wildlife Service (USFWS) (United States Navy 1989; Williams, pers. comm.). Density estimates range between 0 and 19 tortoises/km^2 (0 - 50/mi^2) (Kiva 1991). On the north range, where the landing strip is located, there is little suitable habitat and the highest densities are estimated to be 8 tortoises/km^2 (20/mi^2) (Kiva 1991).

The Inyo California towhee (*Pipilo crissalis eremophilus*) is a small sparrow-like bird which was federally listed as threatened in 1987. Major threats include habitat destruction by grazing, mining, and recreational uses, as well as water diversion and groundwater pumping which destroys the vegetation the birds use for nesting (BioSystems Analysis, Inc. 1994). The total population size is estimated to be 250 - 300 birds, although a range-wide population survey has not been done since 1979 (BioSystems Analysis, Inc. 1994; LaBerteaux, pers. comm.). Its distribution is entirely restricted to the Argus mountain range in southwest Inyo County, California (Fig. E-6). Riparian scrub and the adjacent hillsides have been designated as Critical Habitat for the towhee. This includes approximately 1,700 ha (4,200 ac) on China Lake, where there is an estimated population of 100 - 150 birds (LaBerteaux 1994; LaBerteaux, pers. comm.). The towhee nesting season extends from late March through early July, and peaks during mid- to late April. The time from egg-laying to fledging is about 20 days. If the first nesting attempt is unsuccessful, the towhees will typically immediately make a second nesting attempt (BioSystems Analysis, Inc. 1994; LaBerteaux 1994).

Michael Army Air Field at Dugway Proving Ground: The federally endangered peregrine falcon (*Falco peregrinus*) has been documented nesting in the mountain cliffs located on Bureau of Land Management (BLM) property adjacent to DPG (Fig. E-9). Elevations between 1,372 m (4,500 ft) and 2,438 m (8,000 ft) are preferred. Cliffs used for nesting often have a sheer face of >50 m (164 ft) in height. There is usually an overhang, small cave, or pothole with a level ledge large enough to hold a brood of three or four young. Peregrines make no nest, but scratch out a shallow cup or scrape in the loose gravel or soil of the nesting ledge. Depending on latitude and elevation, egg-laying can begin in early April and the young may not fledge until July. The peregrine was listed with the establishment of the Endangered Species Act in 1973. Population declines were associated with the use of DDT pesticides. Since the banning of DDT and the success of captive breeding and reintroduction projects, peregrine populations have rebounded throughout their range.

Potential Impacts

Potential impacts to federally protected species or their habitats are anticipated in three categories: launch site preparation, landing site preparation (applicable only to Silurian Lake), and sonic booms. In the event of a launch or landing test failure, additional impacts could result from many sources, including vehicle impact, fire, dispersion of metal fragments, release of deluge water, emergency response, and cleanup operations. Given the redundant safety systems being used in the X-33 project, the likelihood of such a disaster is small. However, in this worst case scenario, the impact on any particular species would be impossible to predict.

Launch site preparation: These activities would occur only at EAFB and could potentially affect desert tortoises. If Haystack Butte is chosen as the launch site, a maximum of 19 ha (46 ac) of desert tortoise critical habitat would be disturbed by the structures and buildings necessary to support launch, the access road, utilities lines, and towway. Given the desert tortoise density estimate of 5 tortoises/km^2 (13/mi^2) in the immediate vicinity of the Haystack Butte site, this amount of habitat would be expected to support 2 - 3 tortoises. However, the access road, utilities lines, and towways would traverse through several kilometers of habitat of varying suitability for desert tortoises where the density ranges between 0 and 12 tortoises/km^2 (0 and 32/mi^2). Because tortoises are not sedentary, it is likely that over the course of the X-33 project, several tortoises from the general area would be encountered. While the exact number is impossible to calculate, 20 of the one-square-mile sections of habitat (Fig. E-12) may be crossed, potentially containing an averaged total of 320 tortoises. It is reasonable to assume that 5% of these animals may be encountered. Therefore, between 15 and 20 tortoises might be affected.

If the Space Port 2000 alternative is chosen, a maximum of 9.3 ha (23 ac) would be developed. This amount of habitat would not be expected to support more than one desert tortoise. However, as in the case with the Haystack Butte alternative, additional tortoises could be expected to be encountered over the duration of the X-33 project.

Landing site preparation: These activities would occur only at Silurian Lake and could potentially affect desert tortoises. The lake bed itself does not support vegetation or wildlife. Impacts would be restricted to areas adjacent to the lake bed that are potential desert tortoise habitat. Heavy equipment needed to prepare the site would have to travel there and be parked when not in use. Temporary facilities would have to be put in place to support operations and approximately 50 people needed to accomplish X-33 landings. Potential effects include permanent habitat loss due to placement of landing support facilities, and disturbance to habitat and/or tortoises during lake bed preparation activities. The Silurian Lake area is not designated as Critical Habitat and no tortoises, tortoise burrows, or other evidence of tortoises have been documented from the lake bed or immediately adjacent area. The impact of landing site preparation to desert tortoises at Silurian Lake is expected to be minimal.

Sonic booms: Sonic booms between (0.01 and 0.06 KPa) are expected to occur when the X-33 is approximately 96.5 km (60 mi) from the landing strip. Sudden noises in this range can potentially crack plaster and glass and are equivalent to the noise produced by a pile driver at a construction site (NASA 1996). Sonic booms could potentially affect (1) desert tortoises at Silurian Lake, (2) Mohave tui chubs, desert tortoises, and Inyo California towhees at China Lake, and (3) peregrine falcons at DPG (Table E-1).

Sonic boom impacts on the desert tortoise are expected to be minimal. Recent studies found that 14 tortoises exposed to a series of simulated sonic booms ranging from (0.015 to 0.30 KPa) showed no startle responses or significant changes in heart rate (Bowles et al. 1997a). The only response observed was a brief orienting of the animal toward the direction of the boom, after which normal activity quickly returned. In addition, no temporary hearing loss was noted until five tortoises were exposed to the cumulative energy equivalent to a 25.0 psf sonic boom (Bowles et al. 1997b). Four of those animals recovered full hearing capabilities within one hour, and the fifth recovered within 48 hours. It must be noted that these tortoises had been exposed to Upper Respiratory Tract Disease (Berry, pers. comm.), and one showed clinical symptoms of the disease, but all of the tortoises exhibited normal hearing capabilities and reflexes prior to testing (Bowles et al. 1997a).

No effects on the Mohave tui chub population are expected because of the sound attenuation afforded by being under water. For noise within the range of human hearing (125 - 4,000 Hz), the acoustic absorption coefficients of water are between 0.008 and 0.025 (Sutherland 1968). This is much lower than for common building materials such as wood, plaster, or brick, and infers that most of the sound waves traveling from air to the water would be reflected.

The Inyo California towhee habitat at China Lake is anticipated to experience sonic booms between 0.5 and 1.5 psf. If X-33 landings occur during the nesting season, there could potentially be an impact to individual birds or nesting pairs. Damage to eggs or young could be inflicted if the adult bird is startled off the nest by the noise, or if the adults abandon the nest due to the noise disturbance. The local population of towhees is currently exposed to sonic booms approximately once per month (Williams, pers. comm.). Several of the nesting territories are located adjacent to a busy road where they are routinely exposed to noise disturbance. No data are available to predict the response of the towhees to the sonic booms, but it is unlikely that they would abandon their nests (LaBerteaux, pers. comm.). Landings at China Lake would be scheduled to occur early in the X-33 Program, which would coincide with the beginning of the towhee nesting season. If losses did occur, there would be adequate time remaining in the nesting season for the affected pairs to renest, which they typically do under other circumstances of nesting failure (LaBerteaux, pers. comm.). Therefore, the impact of sonic booms to the Inyo California towhee population is expected to be minimal.

Peregrine falcons nesting on the Bureau of Land Management (BLM) lands adjacent to DPG may be exposed to sonic booms less than 1 psf. Short-term startle effects are not expected, as raptors appear to have little susceptibility to nest losses caused by sudden noise (Bowles 1997). In a study on cliff-nesting raptors exposed to the noise from underground nuclear explosions, damage to or desertion of nests of red-tailed hawks (*Buteo jamaicensis*) and golden eagles (*Aquila chrysaetos*) was caused by displacement of the ground and not the startled adults flying off the nest (Stahlecker and Alldredge 1976). In a different study, of six pairs of nesting peregrine falcons (12 birds total) exposed to sonic booms, half showed no response to the noise and half showed a mild alarm response. None of the adults that were incubating or brooding exhibited behavior that would endanger eggs or young in the nest (Ellis et al. 1991). Nestling and fledgling responses were either insignificant or mild, and no young were injured or killed. Long-term effects from X-33 sonic booms are also expected to be absent. Since 1990, bald eagles nesting on the Kennedy Space Center have been exposed to 15 sets of twin sonic booms produced by the Space Shuttle landings. The number of nests during those years steadily increased from four in 1990 to 10 in 1997 and the number of fledged young per year ranged from five to 13 (Whaley, pers. comm.). At DPG, no damage to nests, eggs, or young from rocks falling as a result of sound waves is expected because of the peregrine's habit of placing the nest under shelter. In addition, the likelihood of a noise-induced rockslide at the low sound pressure expected over the mountain ranges is very small. Given the extremely low density of nesting peregrine falcons in the vicinity, and the short duration of the X-33 project at the site, it is not likely that X-33 activities will adversely affect peregrine falcon populations.

Measures to Reduce or Eliminate Impacts

The only significant impacts expected from the X-33 project to federally listed species or critical habitat are for desert tortoises at the Haystack Butte launch site. Site preparation activities would disturb or destroy 19 ha (47 ac) of habitat, 13.3 ha (33 ac) of which are designated Critical Habitat. The following steps would be taken to minimize the effects of the habitat loss:

(1) Personnel regularly present at the site during preparation activities would be given the standard EAFB desert tortoise education program.

(2) The EAFB biologist would designate a biological monitor and would determine which construction activities must be monitored Any interaction between workers and tortoises would be reported to the biological monitor, including mortalities.

(3) No more than 48 hrs prior to groundbreaking in any new area (i.e., launch facilities, access road, utilities lines, towway), a biological monitor would survey the area for burrows. Any active or inactive burrows would be excavated by the biological monitor using hand tools. Tortoises removed from the burrows would be placed in the closest suitable habitat that would not be disturbed. An artificial burrow would be provided for any relocated tortoises. This protocol would also be followed if tortoises are found in site preparation areas outside of their burrows.

(4) Preparation sites would be clearly delineated and activities would remain within designated areas, including vehicle and equipment parking and staging areas. The construction sites could be delineated with chain-link fencing, including tortoise exclusionary fencing, and the need for biological monitoring would be reduced.

(5) Vehicles would travel only on established roads whenever possible. If off-road travel is necessary, vehicle operators would be alert for desert tortoises and other wildlife, and vehicle speeds would not exceed 24 km/hr (15 mi/hr).

(6) Habitat loss and disturbance would be minimized. Previously disturbed or denuded areas would be used for development wherever feasible. To promote revegetation and soil stabilization in disturbed areas, the EAFB Revegetation Plan would be implemented upon project completion (Mitchell et al. 1994). The least destructive equipment available would be used to accomplish tasks (e.g., ATV's to install fencing, cable plow to install fiber optic cable). On-site contractors would be required to follow good environmental practices, such as minimizing water use and waste, containing trash in predator-proof receptacles, and minimizing dust.

(7) Aboveground pipes and lines would be placed at least 50 cm (20 in) above the surface to allow passage underneath by tortoises.

(8) Excavations would be dug with a 3:1 slope at either end. Open excavations would be inspected for trapped wildlife daily, and prior to filling. Any wildlife found would be reported to the biological monitor who would be in charge of removal. Any open pipe or conduit would be capped or stored in such a way as to discourage use by wildlife.

(9) In the event of a test failure, a desert tortoise and Critical Habitat damage assessment would be performed and documented by the EAFB biologist.

(10) At the end of the X-33 project, any direct and indirect impacts to desert tortoises would be determined by the EAFB biologist and documented in a report to the USFWS for NASA. This determination would be based on records of mortalities and relocations compiled by the biological monitor during the project, and the final amount of Critical Habitat disturbed and/or destroyed.

Summary

The X-33 Advanced Technology Demonstrator Program is expected to have no or minimal effects on federally protected species. The most significant impact will be the loss of desert tortoise Critical Habitat from launch facilities preparation at Haystack Butte. The area is designated as Desert Tortoise Management Zone 1 by the USFWS due to the low tortoise density and high incidence of human disturbance already occurring. The loss of a maximum of 19 ha (47 ac) of habitat that supports so few tortoises is not likely to greatly influence desert tortoise populations or increase the species' extinction risk.

The preparation of the dry lake bed and surrounding area for X-33 landings at Silurian Lake is not expected to have any impact on desert tortoise populations. No tortoises, tortoise burrows, or other evidence of tortoises has ever been documented from the lake bed or immediately adjacent habitat. Facilities brought to the site would be kept to the absolute minimum necessary to support landings and very little permanent habitat disturbance or destruction is anticipated.

The sonic booms that would be produced by X-33 are considered to be mildly annoying, but not dangerous for humans. The impacts to wildlife are difficult to predict because there are few studies addressing these effects. Good data exist for desert tortoises showing that sonic booms much greater than those expected from X-33 were necessary to induce even temporary hearing loss. The noise attenuation capacity of water is expected to protect the Mojave tui chub population at China Lake. Nesting birds may be startled off their nests, potentially doing harm to young or nestlings, or giving predators an opportunity to raid the nest while the adults are gone. Peregrine falcons are not easily startled from their nests, and when they do leave, return within a few minutes. Peregrines defend such a large nesting territory from other peregrines that very few birds are likely to be exposed to the booms. It is also improbable that the Inyo California towhees would damage or desert their nests because of the sonic booms. However, if some mortality or nest abandonment occurs, there would be adequate time remaining in the season for the birds to renest, as they routinely do after nesting failures.

In conclusion, based on available data and the opinions of species experts, only a small number of individual desert tortoises may be adversely affected by the X-33 project. This probability would be minimized if the measures to reduce or eliminate impacts discussed above are implemented.

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APPENDIX F

VEGETATION AND WILDLIFE SPECIES POTENTIALLY OCCURRING AT PROPOSED LAUNCH AND LANDING SITES

APPENDIX F
VEGETATION AND WILDLIFE SPECIES POTENTIALLY OCCURRING AT PROPOSED LAUNCH AND LANDING SITES

Table F-1. Species of Concern that Occur or Potentially Occur on Edwards.

Scientific Name	Common Name	Federal Status	State Status
Plants			
Calochortus striatus	Alkali mariposa lily	C2	None
Cymopterus deserticola	Desert cymopterus	C1	None
Eriophyllum mohavense	Barstow woolly sunflower	C2	None
Puccinellia parishii	Parish's alkali grass	C2	None
Reptiles			
Gopherus agassizii	Desert tortoise	FT	ST
Sauromalus obesus	Chuckwalla	C2	None
Uma scoparia	Mojave fringe-toed lizard	None	SSC
Birds			
Accipiter cooperii	Cooper's hawk	None	SSC
Aquila chrysaetos	Golden eagle	None	SSC
Buteo regalis	Ferruginous hawk	C2	SSC
Circus cyaneus	Northern harrier	None	SSC
Haliaeetus leucocephalus	Bald eagle	FT	SE
Falco columbarius	Merlin	None	SSC
Falco mexicanus	Prairie falcon	None	SSC
Falco peregrinus anatum	Peregrine falcon	FE	SE
Charadrius montanus	Mountain plover	C2	SSC
Childonias niger	Black tern	C2	SSC
Larus californicus	California gull	None	SSC
Asio flammeus	Short-eared owl	None	SSC
Asio otus	Long-eared owl	None	SSC
Athene cunicularia	Burrowing owl	None	SSC
Chaetura vauxi	Vaux's swift	None	SSC
Toxostoma lecontei	Le Conte's thrasher	C2	SSC
Lanius ludovicianus	Loggerhead shrike	C2	SSC
Agelaius tricolor	Tricolored blackbird	C2	SSC
Mammals			
Spermophilus mojavensis	Mohave ground squirrel	C2	ST*
Taxidea taxus	American badger	None	CSC
Plecotus townsendii townsendii	Townsend's big-eared bat	C2	CSC
Nyctinomops macrotis	Big free-tailed bat	None	CSC
Nyctinomops femorosaccus	Pocketed free-tailed bat	None	CSC
Euderma maculatum	Spotted bat	C2	CSC
Antrozous pallidus	Pallid bat	None	CSC
Vulpes macrotis arsipis	Desert kit fox	BLMS	None

Federal Status

FE	Federally endangered
FT	Federally threatened
C1	Federal candidate for listing
C2	Federal candidate for listing, but sufficient data unavailable
BLMS	Designated as sensitive by Bureau of Land Management

State Status

SE	State endangered
ST	State threatened
SSC	Species of Special Concern

*In litigation.

Sources: NASA 1996, USACOE 1994-A, Tom Mull.

Table F-2. Sensitive Plant Species Potentially Occurring in the Silurian Valley Area.

Family/Scientific Name/Common Name	Status	Life Form/Flowering Period/Habitat Preferences/ Known Range/Elevation Range/Identification Information	Survey Results/Source
APIACEAE *Cymopterus deserticola* Desert cymopterus	FED: FSOC* ST: none CNPS: 1B	Perennial herb; flowering: March-May; microhabitat: fine to coarse, well-drained sandy soils of flats in dune areas; habitat: Joshua Tree woodland and Mojave Desert scrub; known range: east of Victorville to Muroc and Kramer; elevation: ± 1,500 m (2,300-2,900 ft.). Flowers required for species identification.	Species was not observed (probably due to lack of rainfall)[1]
APIACEAE *Cymopterus gilmanii* Gilman's cymopterus	FED: CEQA ST: CEQA CNPS: 2	Perennial herb; flowering: April-May; microhabitat: rocky or gravelly slopes, desert canyons, rock ledges or cliffs, often on gypsum or limestone; habitat: Mojave Desert scrub; known range: Inyo Co. from Last Chance Mtns. to Death Valley and into Nevada; elevation: 1,000-2,000 m (3,300-6,500 ft.). Flowers required for species identification.	Species was not observed[2]
ASCLEPIDACEAE *Cynanchum utahense* Utah vine milkweed	FED: CEQA? ST: CEQA? CNPS: 4	Perennial herb; flowering; April-June; microhabitat: dry, sandy, or gravelly areas; habitat: Mojave Desert scrub and Sonoran Desert scrub; known range: Deserts to Utah and Arizona; elevation: < 1,000 m. Identifiable in vegetative state.	One population observed at lava outcrop designated "the whale"[3,4]
ASTERACEAE *Encelopsis nudicaulis* Naked-stemmed daisy	FED: CEQA? ST: CEQA? CNPS: 4	Perennial herb; flowering: May; microhabitat: clayey soil, sand, or gravel, on stony slopes and ridges and in canyons, on volcanic or carbonates; habitat: Great Basin scrub, Mojave Desert scrub; known range: Death Valley area, Inyo Co. to Utah and Idaho; elevation: 950-2,000 m (< 6,000 ft.). Leaves required for species identification.	Species was not observed[2]
ASTERACEAE *Eriophyllum mohavense* Barstow woolly sunflower	FED: FSOC* ST: none CNPS: 1B	Woolly, dwarfed, annual herb; flowering: April-May; microhabitat: open sandy or silty areas with spiny saltbush or creosote bush scrub; habitat: chenopod scrub, Mojave Desert scrub, and playas; known range: Barstow area, Mojave Desert, San Bernardino Co.; elevation: 500/800 m (2,000/3,000 ft.). Flowers required for species identification.	Species was located by USFWS on the east side of Copper City Road, west of Lane Mtn. southwest of the NTC[1]
ASTERACEAE *Tetradymia argyraea* Striped horsebrush	FED: CEQA? ST: CEQA? CNPS: 4	Deciduous shrub; flowering: August-September; microhabitat: dry, rocky slopes; habitat: pinyon-juniper woodland; known range: Kingston and Clark Mtns., east Mojave Desert into Arizona; elevation: 1,400/2,100 m (< 7,000 ft.). Fruits required for species identification.	Species located east of the NTC scattered in the Avawatz Mtns., but exact location was not noted because plant did not have sensitive status at the time of the survey[1]
BORAGINACEAE *Cryptantha holoptera* Winged cryptantha	FED: CEQA? ST: CEQA? CNPS: 4	Annual herb; flowering: March-April; microhabitat: sandy to rocky soils; habitat: Sonoran Desert scrub and Mojave Desert scrub; known range: Colorado and east Mojave Desert (scattered), into Arizona; elevation: 100-1,200 m (< 2,000 ft.). Nutlets required for species identification.	Species was not observed[4]
BORAGINACEAE *Cryptantha tumulosa* New York Mtns. cryptantha	FED: FSOC ST: none CNPS: 4 Nevada: watch list	Perennial herb; flowering: April-June; microhabitat: dry places, gravel or clay, granitic or limestone soils; habitat: Mojave Desert scrub and pinyon-juniper woodland; known range: Providence Mtns., Mid Hills, New York Mtns., Ivanpah Mtns., Inyo and San Bernardino Cos., to Spring Mtns. in south Nevada; elevation: 1,400-2,100 m (< 6,000 ft.). Nutlets required for species identification.	Species located on limestone ridges near springs in Avawatz Mtns, east of the NTC[5]

Table F-2 (Continued). Sensitive Plant Species Potentially Occurring in the Silurian Valley Area.

Family/Scientific Name/Common Name	Status	Life Form/Flowering Period/Habitat Preferences/ Known Range/Elevation Range/Identification Information	Survey Results/Source
BRASSICACEAE *Draba californica* California draba	FED: CEQA? ST: CEQA? CNPS: 4	Small perennial herb; flowering: July-August; microhabitat: open, rocky areas, moist sandy soils; habitat: pinyon-juniper woodland, meadows and alpine boulder and rock fields; known range: New York Mtns., Panamint Mtns. in east Mojave Desert, White Mtns., Mono Co., to Texas; elevation: >3,000 m (5,000-6,000 ft.). May be identifiable in vegetative state but flowers preferable.	Species located east of the NTC in hills and fans in Mojave creosote bush scrub and in Mojave mixed woody scrub, but exact location was not noted because plant did not have sensitive status at the time of the survey[3]
CACTACEAE *Sclerocactus polyancistrus* Mojave fish-hook cactus	FED: FSOC ST: none CNPS: 1B	Stem succulent shrub; flowering: April-June; microhabitat: gravelly mesas, slopes, and canyons, on limestone; habitat: Joshua Tree woodland and Mojave Desert scrub; known range: Red Rock Canyon, Inyo Co. east to Nevada; elevation: 750-2,100 m (2,500-6,500 ft.). Flower required for genus identification.	Species located southwest of the NTC[1]
CRASSULACEAE *Dudleya saxosa* ssp. *saxosa* Panamint dudleya	FED: FSOC ST: none CNPS: 4	Perennial herb; flowering: April-September; microhabitat: dry, north-facing granitic or limestone slopes; habitat: Mojave Desert scrub and Joshua Tree woodland; known range: west Panamint Mtns., Inyo Co.; elevation: 1,100-2,200 m (3,000-7,000 ft.). Flowers required for species identification.	Species was not observed[1]
FABACEAE *Astragalus jaegerianus* Lane Mtn. milkvetch	FED: PE ST: none CNPS: 1B	Perennial herb; flowering: April-June; microhabitat: low, dry, stony hillsides and desert mesas, in granitic sand or gravel, commonly with Joshua trees, and usually under shrubs; habitat: Joshua Tree woodland and Mojave Desert scrub; known range: central Mojave Desert near Barstow; elevation: 900-1,200 m (3,000-3,800 ft.). Flowers required for species identification.	Species located southwest of the NTC[1]
FABACEAE *Astragalus lentiginosus* var. *borreganus* Borrego milkvetch	FED: CEQA? ST: CEQA? CNPS: 4	Annual herb; flowering: February-May; microhabitat: dunes and sandy valleys; habitat: Sonoran Desert scrub and Mojave Desert scrub; known range: east Colorado and Mojave Deserts to Arizona and northwest Mexico; elevation: 30-250 m (< 1,000 ft.). Flowers required for species identification.	Species was not observed[1]
FABACEAE *Astragalus nutans* Providence Mtns. milkvetch	FED: CEQA? ST: CEQA? CNPS: 4	Annual herb; flowering: March-June; microhabitat: sandy to rocky washes, canyon bottoms, and foothill slopes; habitat: Sonoran Desert scrub, Mojave Desert scrub, Joshua Tree woodland, and pinyon and juniper woodland; known range: east Mojave and north Colorado Deserts; elevation: 450-1,950 m (1,500-6,500 ft.). Flowers required for species identification.	Species was not observed[1]
FABACEAE *Lupinus magificus* var. *glarecola* Coso Mtns. lupine	FED: CEQA? ST: CEQA? CNPS: 4	Perennial herb; flowering: April-June; microhabitat: desert slopes and gravelly banks, in granitic soils, a fire-following species; habitat: Great Basin scrub; known range: Coso Mtns., Inyo Co.; elevation: 1,500-2,500 m (< 7,500 ft.). Flowers required for species identification.	Four populations located on steep slopes in Avawatz Mtns.[3] Two populations observed in upper elevations of the Avawatz Mtns[3, 4]

Table F-2 (Continued). Sensitive Plant Species Potentially Occurring in the Silurian Valley Area.

Family/Scientific Name/Common Name	Status	Life Form/Flowering Period/Habitat Preferences/ Known Range/Elevation Range/Identification Information	Survey Results/Source
FABACEAE *Psorothamnus arborescens* var. *arborescens* (=*Dalea fremontii* var. *saundersii*) Mojave indigobush	FED: FSOC ST: none CNPS: 4	Deciduous shrub; flowering: April-May; microhabitat: sandy alluvial fans and washes, hillsides and stony flats on granitic bedrock; habitat: riparian scrub, Mojave Desert scrub; known range: north and west Victorville area to White Mtns., Kern and San Bernardino Co.; elevation: 400-800 m (1,300-2,600 ft.). Fruit required for species identification.	Species located southwest of NTC[1]
HYDROPHYLLACEAE *Phacelia mustelina* Death Valley round-leaved phacelia	FED: FSOC ST: none CNPS: 1B Nevada: watch list	Short-lived annual herb; flowering: May-July; microhabitat: in crevices on the face of limestone cliffs, on volcanic outcrops, and in gravel talus; habitat: Mojave Desert scrub and pinyon-juniper woodland; known range: Mtns. in Death Valley to west Nevada; elevation: 1,000-2,100 m (3,000-6,000 ft.). Flowers required for species identification.	Though suitable habitat exists, species was not observed south of the NTC[1]
HYDROPHYLLACEAE *Phacelia parishii* Parish's phacelia	FED: FSOC ST: none CNPS: 2	Branched annual herb; flowering: April-July; microhabitat: clay or alkaline soils, flats, slopes, and dry lake margins; habitat: Mojave Desert scrub, Joshua Tree woodland, and playas; known range: Mojave Desert from east Victorville, sw San Bernardino Co., and into Nevada; elevation: 800-1,200 m (2,000-6,000 ft.). Flowers required for species identification.	Species located south of the NTC[1]
LILIACEAE (=AMARYLLIDACEAE-Munz) *Androstephium breviflorum* Small-flowered androstephium	FED: FSOC ST: none CNPS: 1B	Perennial herb; flowering: March-April; microhabitat: open areas and bajadas, dry loose sandy to rocky soil; habitat: Mojave Desert scrub; known range: deserts east of Inyo Co. and San Bernardino Co. to out of state; elevation: 550-2,295 m (1,800-7,550 ft.). Flower required for genus identification. Note: vegetation dies out by late spring.	Species was not observed (probably due to lack of rainfall)[1, 2] Species was located in low hills of the south Silurian Valley, west of Highway 127[3] Populations observed in Valjean Hills, north extent of the Soda Mountains, and east side of Red Pass Mountain[3, 4]
LILIACEAE *Calochortus striatus* Alkali mariposa lily	FED: FSOC ST: none CNPS: 1B Nevada: watch list	Perennial herb from bulb; flowering: April-June; microhabitat: alkaline meadows, springy areas, and ephemeral washes; habitat: chenopod scrub, alkaline meadows, creosote bush scrub, and chaparral; known range: Mojave Desert at base of San Bernardino Mtns. and San Gabriel Mtns. Kern Co. to Las Vegas, Nev.; elevation: 800-1,400 m (2,500-4,500 ft.). Flowers required for species identification.	Species located southwest of the NTC near the Paradise range[1, 2]
LOASACEAE *Petalonyx thurberi* ssp. *gilmanii* Death Valley sandpaper-plant	FED: FSOC ST: none CNPS: 1B	Evergreen shrub; flowering: May-September; microhabitat: sandy washes, canyons, dunes, and slopes; habitat: Desert dunes and Mojave Desert scrub; known range: restricted to Inyo Co.; elevation: < 1,200 m (1,500-5,000 ft.). Identifiable in vegetative state by leaves and life form.	Species was not observed (study area is out of the species' known range)[2]
PAPAVERACEAE *Arctomecon merriamii* White bear poppy	FED: FSOC ST: none CNPS: 1B Nevada: watch list	Perennial herb; flowering: April-May; microhabitat: loose rocky slopes and flats, in gypsum, limestone and dolomite; habitat: chenopod scrub and Mojave Desert scrub; known range: Death Valley region to Clark Co., Nevada; elevation: 900-1,400 m (3000-4,600 ft.). Identifiable in vegetative state by leaves and life form.	One population observed on the eastern boundary of the project site in the Silurian Hills in Owl Canyon[3, 4]

Table F-2 (Continued). Sensitive Plant Species Potentially Occurring in the Silurian Valley Area.

Family/Scientific Name/Common Name	Status	Life Form/Flowering Period/Habitat Preferences/ Known Range/Elevation Range/Identification Information	Survey Results/Source
POACEAE *Achnatherum aridum* (=*Stipa arida*) Mormon needle grass	FED: CEQA ST: CEQA CNPS: 2	Tufted perennial herb; flowering: May-July; microhabitat: dry, limestone slopes, ridges, and rocky outcrops; habitat: Mojave Desert scrub, Great Basin scrub, Joshua Tree woodland and pinyon-juniper woodland; known range: Funeral Mtns. and Clark Mtn., east Mojave Desert to Colorado, Arizona, and Texas; elevation: 1,200-1,550 m (4,000-5,700 ft.). Flowers required for species identification.	Species was not observed[2]
POACEAE *Bouteloua trifida* Red grama grass	FED: CEQA ST: CEQA CNPS: 2	Tufted perennial herb; flowering: May-September; microhabitat: dry, rocky, often calcareous slopes and crevices; habitat: Mojave Desert scrub and pinyon-juniper woodland; known range: Providence Mtns. and Death Valley region to Texas, Utah, and c. Mexico; elevation: 700-2,000 m (> 2300 ft.). Flowers required for species identification.	Species was not observed[2]
POACEAE *Piptatherum micranthum* (=*Oryzopsis micrantha*) Small-flowered rice-grass	FED: CEQA ST: CEQA CNPS: 2	Densely tufted perennial herb; flowering: June-September; microhabitat: dry limestone crevices, gravel benches, rocky slopes, and creek banks; habitat: pinyon-juniper woodland; known range: Clark, Kingston, and White Mtns., east Mojave Desert to Canada and Rocky Mtns.; elevation: 700-2,950 m (6,000-8,800 ft.). Flowers required for species identification.	Species was not observed[2]
POLEMONIACEAE *Linanthus arenicola* Sand linanthus	FED: FSOC ST: none CNPS: 2	Small annual herb; flowering: March-April; microhabitat: loose sandy to fine gravelly soils, at least some gypsum, on dunes, saline flats, or wash edges, often in Larrea-Atriplex association; habitat: Mojave Desert scrub, desert dunes, and Joshua Tree woodland; known range: Mojave Desert (Barstow, Kelso, Daggett, Searles Lake, Needles, Trona, etc.) and Nipton, Nevada; elevation: 800-1,400 m (2,500-4,000 ft.). Flowers required for species identification.	Species was not observed(probably due to lack of rainfall)[1, 2] Nine populations were located in the "stringer" washes on the bajadas east of NTC[3] Twenty-seven populations observed[3, 4]
POLYGONACEAE *Chorizanthe spinosa* Mojave spineflower	FED: FSOC ST: none CNPS: 4	Low annual herb; flowering: April-July; microhabitat: sandy to gravelly areas; habitat: Mojave Desert scrub and chenopod scrub; known range: west Mojave Desert, east to Rabbit Springs; elevation: 6-1,300 m (> 3,500 ft.). Flowers required for species identification.	Species was not observed (study area is probably too far from the known range of the species)[1]
SCROPHULARIACEAE *Castilleja plagiotoma* Mojave indian paintbrush	FED: CEQA? ST: CEQA? CNPS: 4	Hemiparasitic perennial herb; flowering: April-June; microhabitat: dry flats and ridges; habitat: Great Basin alluvial scrub and pinyon-juniper woodland; known range: base of San Gabriel and San Bernardino Mtns to Piute Mtns, and San Luis Obispo; elevation: 300-2,500 m (< 7,500 ft.). Flowers required for species identification.	Species was not observed (study area is probably too far from the known range of the species)[1]
SCROPHULARIACEAE *Cordylanthus tecopnesis* Tecopa bird's-beak	FED: FSOC ST: none CNPS: 1B Nevada: Threatened	Branched, hemiparasitic annual herb; flowering: July-October; microhabitat: alkaline marsh and meadows with high groundwater, with moist to wet soils; habitat: Mojave Desert scrub, meadows, marshes and swamps; known range: Tecopa Hot Springs, Sarasota Springs, etc. in Inyo Co. and Nye Co., Nevada; elevation: 100-900 m (< 2,500 ft.). Flowers required for species identification.	Species was not observed (the study area is out of the known range of the species)[1, 2]

Table F-2 (Continued). Sensitive Plant Species Potentially Occurring in the Silurian Valley Area.

Family/Scientific Name/Common Name	Status	Life Form/Flowering Period/Habitat Preferences/ Known Range/Elevation Range/Identification Information	Survey Results/Source
SCROPHULARIACEAE *Mimulus mohavensis* Mojave monkeyflower	FED: FSOC ST: none CNPS: 1B	Small annual herb; flowering: April-June; microhabitat: dry, sandy or rocky washes along the Mojave River, often seen nestled between or against rocks; habitat: Mojave Desert scrub and Joshua Tree woodland; known range: Mojave Desert in Barstow-Victorville-Ord Mtn. region, San Bernardino Co.; elevation: 600-1,000 m (< 3,000 ft.). Flowers required for species identification and spotting in field.	Species was not observed (probably due to lack of rainfall)[1]
SCROPHULARIACEAE *Penstemon albomarginatus* White-margined beardtongue	FED: FSOC ST: none CNPS: 1B Nevada: Threatened	Perennial herb; flowering: March-May; microhabitat: deep, stabilized desert sand, in washes, along roadsides, and on stabilized dunes; habitat: desert dunes and Mojave Desert scrub; known range: near Lavic, south Mojave Desert to south Nevada and west Arizona; elevation: 700-900 m (1,800 ft.). Flowers required for species identification.	Species was not observed[2]
SCROPHULARIACEAE *Penstemon calcareus* Limestone beardtongue	FED: FSOC ST: none CNPS: 2	Perennial herb, flowering: April-May; microhabitat: dry crevices in limestone, dry canyon sides, and rocky slopes; habitat: Mojave Desert scrub, Joshua Tree woodland, and pinyon-juniper woodland; known range: Providence, Last Chance, and Grapevine Mtns; elevation: 1,200-1,600 m (< 6,000 ft.). Flowers required for species identification.	Species was not observed[1, 2]
SCROPHULARIACEAE *Penstemon stephensii* Stephen's beardtongue	FED: FSOC ST: none CNPS: 1B	Perennial herb; flowering: April-June; microhabitat: dry granitic, dolomitic or limestone rocky slopes, cliffs, crevices, and washes; habitat: Mojave Desert scrub and pinyon-juniper woodland; known range: Kingston and Providence Mtns, San Bernardino Co. and Inyo Co.; elevation: 1,200-1,500 m (< 7,200 ft.). Flowers required for species identification.	Species was not observed[1, 2]
SIMAROUBACEAE *Castela emoryi* Crucifixion thorn	FED: CEQA ST: CEQA CNPS: 2 BLM: Protected	Spiny deciduous shrub or small tree; flowering: June-July; microhabitat: dry, gravelly washes, slopes, and plains; habitat: Sonoran Desert scrub and Mojave Desert scrub; known range: Mojave Desert (Daggett, Ludlow, Amboy, Goffs) and Colorado Desert (Hayfields, Coyote Wells) to Arizona and northwest Mexico; elevation: ± 650 m (2,132 ft.). Identifiable in vegetative state.	Species located southwest of the NTC, near Dunn Road[1]

Table F-2 (Continued). Sensitive Plant Species Potentially Occurring in the Silurian Valley Area.

Family/Scientific Name/Common Name	Status	Life Form/Flowering Period/Habitat Preferences/ Known Range/Elevation Range/Identification Information	Survey Results/Source

STATUS CODES

Federal (FED)

- FE = Federally listed, endangered
- FT = Federally listed, threatened
- PE = Federally proposed, endangered
- PT = Federally-proposed, threatened
- FSOC = Federal Species of Concern - Former Federal Candidate Species
- * = Concern for these species remains high and their status will be reevaluated based on available information about protection by the West Mojave Coordinated Management Plan.

State (ST)

- CE = State-listed, endangered
- CT = State-listed, threatened
- CR = State-listed, rare
- none = To date, species has not been afforded any official status

Additional Federal/State Codes

- CEQA? = Plant has no federal or state legal standing but is recommended by CNPS for evaluation for CEQA consideration.
- CEQA = Plant has no federal or state legal standing but CEQA consideration is mandatory.

CNPS

- 1A = Plants Presumed Extinct in California - All plants meet definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Secs. 2062 and 2067 (California Endagered Species Act) and are eligible for state listing. CEQA consideration is mandatory.
- 1B = Plants Rare, Threatened, or Endangered in California and Elsewhere - Plants meet definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Secs. 2062 and 2067 (California Endagered Species Act) and are eligible for state listing. CEQA consideration is mandatory.
- 2 = Plants Rare, Threatened, or Endangered in California but More Common Elsewhere - Plants are not eligible for federal consideration under the provisions of the Endangered Species Act. Plants meet definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Secs. 2062 and 2067 (California Endagered Species Act) and are eligible for state listing. CEQA consideration is mandatory.
- 3 = Plant for which More Information is Needed; a Review List - Plants are taxonomically problematic. Some species meet definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Secs. 2062 and 2067 (California Endagered Species Act) and are eligible for state listing. CEQA consideration is being recommended by CNPS.
- 4 = Plants of Limited Distribution; a Watch List - CEQA consideration is being recommended by CNPS.

Databases Searched

California Natural Diversity Data Base (CNDDB), USGS 7.5-minute quadrangles searched (1994); California Native Plant Society's Electronic Inventory (CNPSEI), USGS 7.5-minute quadrangles searched (1994); Quads searched in both databases: Avawatz Pass, Dumont Dunes, East of Owl Lake, North of Baker, Old Ibex Pass, Owl Lake, Red Pass Lake NE, Saddle Peak Hills, Sheep Creek Spring, Silurian Hills, Silurian Lake, Silurian Valley, Valjean Hills, and West of Baker; Scientific nomenclature as per Hickman, 1993; Range ihformation as per Munz, 1973, Hickman, 1993, and CNPSEI 1994; Flowering period, microhabitat, habitat, and elevations as per CNPSEI 1994; CNDDB 1994; Hickman 1993; and Munz 1974.

Sources

[1] MBA 1989
[2] Chambers Group Inc. 1992
[3] Bagley 1994
[4] Chambers Group 1995

Table F-3. Vegetation Species Known or Thought to Occur in the China Lake Area.

Species	Scientific Name	Family
Fiddleneck	*Amsinckia sp.*	Borage
Forget-me-not	*Cryptantha sp.*	Borage
Buckwheat	*Eriogonum sp.*	Buckwheat
Bevertail cactus	*Opuntia basilaris*	Cactus
Teddybear cholla	*Opuntia bigelovii*	Cactus
Creosotebush	*Larrea tridentata*	Caltrop
Bladderpod	*Isomeris arborea*	Caper
Mojave parsley	*Lomatium mohavense*	Carrot
Mormon tea	*Ephedra nevadensis*	Ephedra
Evening primrose	*Camissonia sp.*	Evening Primrose
Paintbrush	*Castilleja sp.*	Figwort
Sand Verbena	*Abronia villosa*	Four O'Clock
Filaree	*Erodium cicutarium*	Geranium
Shadscale	*Atriplex confertifolia*	Goosefoot
Allscale	*Atriplex polycarpa*	Goosefoot
Fourwing saltbush	*Atriplex canescens*	Goosefoot
Spiny hopsage	*Grayia spinosa*	Goosefoot
Russian Thistle	*Salsola iberica*	Goosefoot
Winter fat	*Krascheninnikovia lanata*	Goosefoot
Iodine bush	*Allenrolfea occidentalis*	Goosefoot
Indian ricegrass	*Oryzopsis hymenoides*	Grass
Brome	*Bromus sp.*	Grass
Brodiaea	*Dichelostemma pulchella*	Lilly
Apricot Mallow	*Sphaeralcea ambigua*	Mallow
Desert Milkweed	*Asclepias erosa*	Milkweed
Bladder sage	*Salazaria mexicana*	Mint
Thistle sage	*Salvia carduacea*	Mint
Chia	*Salvia columbariae*	Mint
Dodder	*Cuscuta denticulata*	Morning Glory
Desert Alyssum	*Lepidium fremontii*	Mustard
Prince's plume	*Stanleya pinnata*	Mustard
Box thorn	*Lycium andersonii*	Nightshade
Locoweed	*Astragalus lentiginosus*	Pea
Desert Senna	*Cassia armeta*	Pea
Indigo Bush	*Psorothamnus arborescens var minutifolius*	Pea
Lupine	*Lupinus sp.*	Pea
Gilia	*Gilia sp.*	Phlox
Desert Prickly Poppy	*Argemone munita*	Poppy
Goldenhead	*Acamptopappus sphaerocephalus*	Sunflower
Ragweed	*Ambrosia acanthicarpa*	Sunflower
Burrobush	*Ambrosia dumosa*	Sunflower
Brittlebush	*Encelia virginensis ssp. Actoni*	Sunflower
Pincushion Flower	*Chaenactis sp.*	Sunflower
Rabbitbrush	*Chrysothamnus paniculatus*	Sunflower
Cheesebush	*Hymenoclea salsola*	Sunflower
Mojave Aster	*Machaeranthera tortifolia*	Sunflower
Desert Dandelion	*Malacothrix glabrata*	Sunflower
Sand-wash groundsel	*Senecio douglasii var. monoensis*	Sunflower
Eriophyllum	*Eriophyllum sp.*	Sunflower
Coreopsis	*Coreopsis sp.*	Sunflower

Table F-3 (Continued). Vegetation Species Known or Thought to Occur in the China Lake Area.

Species	Scientific Name	Family
Big Sagebrush	*Artemesia tridentata*	Sunflower
Low Sagebrush	*Artemesia nova*	Sunflower
Golden bush	*Haplopappus sp.*	Sunflower
Desert Chicory	*Rafinesquia californica*	Sunflower
Tidy-tips	*Layia glandulosa*	Sunflower
Phacelia	*Phacelia sp.*	Waterleaf
Desert Five-spot	*Eremalche rotundifolia*	Mallow
Desert Calico	*Loeseliastrum matthewsii*	Phlox

Table F-4. Wildlife Species Known or Thought to Occur in the China Lake Area.

Species	Scientific Name
Mammals:	
Antelope ground squirrel	*Ammospermophilus leucurus*
Audubon cottail	*Sylvilagus audubonii*
Badger	*Taxidea taxus*
Brush mouse	*Peromyscus boylii*
Cactus mouse	*Peromyscus eremicus*
Canyon mouse	*Peromyscus crinitus*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maiculatus*
Desert pocket mouse	*Perognathus penicillatus*
Desert woodrat	*Neotoma lepida*
Jackrabbits	*Lepus californicus*
Little pocket mouse	*Perognathus longimembris*
Long-tailed pocket mouse	*Perognathus formosus*
Merriam kangaroo rat	*Dipodomys merriami*
Mohave ground squirrel	*Spermophilus mohavensis*
Pinyon mouse	*Peromyscus truei*
Southern grasshopper mouse	*Onychomys torridus*
Western harvest mouse	*Reithrodontomys megalotis*
Reptiles:	
Chuckwallas	*Sauromalus obesus*
Common kingsnakes	*Lampropeltis getulus*
Desert horned lizards	*Phrynosoma platyrhinos*
Desert iguanas	*Dipsosaurus dorsalos*
Desert night lizards	*Xantusia vigilis*
Desert spiny lizards	*Sceloporus magister*
Desert Tortoise	*Gopherus agassizii*
Gopher snakes	*Pituophis melanoleucus*
Leopard lizards	*Gambelia wislizenii*
Mojave rattlesnakes	*Crotalus scutulatus*
Night snakes	*Hypsiglena torquata*
Red racers	*Masticophis flagellum piceus*
Rosy boas	*Lichanua roseofusca*
Side-blotched lizards	*Uta stansburiana*
Sidewinders	*Crotalus cerastes*
Striped racers	*Masticophis lateralis*
Western patch-nosed snakes	*Salvadora hexalepis*
Western rattlesnakes	*Crotalus viridis*
Western whiptails	*Cnemidophorus tigris*
Zebra-tailed lizards	*Callisaurus draconoides*
Birds:	
Red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
California quail	*Callipepla califonrica*
Mourning dove	*Zenaida aurita*
Greater roadrunner	*Geococcyx califonrianus*
Burrowing owl	*Athene cunicularia*
Say's phoebe	*Sayornis saya*
Horned lark	*Eremophila alpestris*
Common raven	*Corvus corax*

Table F-4 (Continued). Wildlife Species Known or Thought to Occur in the China Lake Area.

Species	Scientific Name
Cactus wren	*Campylorhynchus brunneicapillum*
Canyon wren	*Catherpes mexicanus*
Rock wren	*Salpinctes obsoletus*
Northern Mockingbird	*Minus polyglottos*
House finch	*Carpodacus mexicanus*
Black-throated sparrow	*Amphispiza bilineata*
Sage sparrow	*Amphispiza belli*
Brewer's sparrow	*Spizella breweri*
Lesser nighttthawk	*Chordeiles acutinpennis*
Ash-throated flycatcher	*Myiarchus cinerascens*
Gray flycatcher	*Empidonox wrightii*
Blue-gray gnatcatcher	*Polioptila caerulea*
Black-chinned sparrow	*Spizella atrogularis*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperi*
Ferruginous hawk	*Buteo regalis*
American robin	*Turdis migratorius*
Hermit thrush	*Cathatus guttatus*
White-crowned sparrow	*Zonotrichia leucophrys*
Golden-crowned sparrow	*Zonotrichia atricapilla*
Song sparrow	*Melospiza melodia*
Swainson's Hawk	*Buteo swainsoni*
Short-eared Owl	*Asio flammeus*
Long-eared Owl	*Asio otus*
Northern Harrier	*Cirus cyaneus*
Peregrine Falcon	*Buteo regalis*

F-5. Federally Protected Species at or Near China Lake.

Species	Scientific Name	Status[1]
Mohave tui chub	*Gila bicolor mojavensis*	FE
Brown pelican	*Pelicanus occidentalis californicus*	FE
American peregrine falcon	*Falco peregrinus anatum*	FE
Southwestern willow flycatcher	*Empidonax trailii extimus*	FE
Least Bell's vireo	*Vireo bellii pusillus*	FE
Desert tortoise	*Gopherus agassizii*	FT,CH
Bald eagle	*Haliaeetus leucocephalus*	FT
Inyo California towhee	*Pipilo crissalis eremophilus*	FT

[1] ***Key***:
FE = federally endangered
FT = federally threatened
CH = critical habitat

F-6. Plant Species Potentially Occurring in the Malmstrom Area.

Species	Scientific Name
Canopy and Shade Trees:	
Native Green Ash	*Fraxinus pennsylvanica*
Marshall Seedless Green Ash	*Fraxinus pennsylvanica 'Marshall Seedless'*
Redmond Linden	*Tilia americana 'Redmond'*
Little-Leaf Linden	*Tilia cordata*
Norway Maple	*Acer platanoides*
Common Hackberry	*Celtis occidentalis*
Large Ornamental Trees:	
Ponderosa Pine	*Pinus ponderosa var. scopulorum*
Scotch Pine	*Pinus sylvestris*
Rocky Mountain Juniper	*Juniperus scopulorum*
Colorado Blue Spruce	*Picea glauca var. densata*
Siberian Larch	*Larix siberica*
Quaking Aspen	*Populus tremuloides*
Ornamental Trees/Large Shrubs:	
Amur Maple	*Acer ginnala*
Flowering Dogwood	*Cornus florida*
Floweirng Crabapple	*Malus sp. (non-fruit bearing var.), 'Royalty'*
Mayday Tree	*Prunus padus var. commutatus*
Stagorn Sumac	*Rhus typhina*
Common Lilac	*Syringa vulgaris*
Amur Chokecherry	*Prunus maackii*
Deciduous Shrubs	
Japanese Barberry	*Berberis tunbergii*
Red Twig Dogwood	*Cornus sericea*
Potentilla	*Potentilla fruticosa*
Fragrat Sumac	*Rhus aromatica*
Chinese Lilac	*Syringa x chinensis 'Rotho'*
Cutleaf Lilac	*Syringa laciniata x S. vulgaris hybrids*
Meyer Lilac	*Syringa meyeri*
Early Lilac	*Syringa oblata var. dilatata 'Korean'*
Preston Lilac	*Syringa x prestoniae*
Coniferous Shrubs:	
Dwarf Mugho Pine	*Pinus mugo 'Compacta'*
Pfitzer Juniper	*Juniperus chinensis 'Pfitzerana'*
Savin Juniper	*Juniperus sabina*
Creeping Juniper	*Juniper horizontalis 'Plumosa'*
Creeping Juniper	*Juniperus horizontalis 'Douglasii'*
Creeping Juniper	*Juniperus horizontalis 'Wiltonii'*
Vines:	
Virginia Creeper	*Parthenocissus quinquefolia*
Jackman Clematis	*Clematis jackmanii*
Grasses:	
Fairway Crested Wheatgrass	*Agropyron cristatum*
Western Wheatgrass	*Agropyron smithii*
Brome Grass	*Bromis inermis var. Manchar*
Orchard Grass	*Dactylis glomerata var. Chinook*
Sainfoin	*Onobrychis viciaefoila var. Eski*
Kentucky Bluegrass	*Poa pratensis*

Dryland Grass, (Treasure State Seed Co.).
Listed in the *Architectural Compatibility Guide* for MAFB and the installation's *Tree Planting Plan.*

Table F-7. Species of Concern Found Within a 20-Mile Radius of Malmstrom.

Common Name	Scientific Name	Federal Status	Status Status	Year of Last Observation
White-Faced Ibis	*Plegadis chihi*	C2	S2B, SZN	1988
Bald Eagle	*Haliaeetus leucocephalus*	LELTNL1	S3B, S3N	1997
Black-Necked Stilt	*Himantopus mexicanus*	None	S3B,SZN	1988
Franklin's Gull	*Larus pipixcan*	None	S3S4B, SZN	1994
Common Tern	*Sterna hirundo*	NLC2	S3B, SZN	1988
Burrowing Owl	*Speotyto cunicularia*	C2	S3B, SZN	1988
Dwarf Woolly-Heads	*Psilocarpus brevissimus*	None	S1	1891
California Waterwort	*Elatine californica*	None	SU	1891
Chaffweed	*Centunculus minimus*	None	S1	1891
Roundleaf Waer-Hyssop	*Bacopa rotundifolia*	None	S1	1891
Many-Headed Sedge	*Carex sychnocephala*	None	S1	1891
Torry's Sedge	*Carex torreyi*	None	S2	1889
Guadalupe Water-Nymph	*Najas guadalupensis*	None	S1	1891

Federal Status:

LELTNL1	Endangered in Montana; Listed Threatened, Not Listed, or Introduced elsewhere in its range.
C2	Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling.
NLC2	Species has no Fish and Wildlife Service designation in Montana; elsewhere in its range it may be a Category 2.

State Status:

S1	Critically imperiled because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factors of its biology making it especially vulnerable to extinction.
S2B	Breeding occurrences for the species are ranked S2 (imperiled because of rarity or because of other factors making it demonstrably very vulnerable to extinction throughout its range).
S3B	Breeding occurrences for the species are ranked S3 (either very rare and local throughout its range, or found locally (even abundant at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors) in the state.
S3N	Non-breeding occurrences are also ranked S3 in the state.
S3S4B	Breeding occurrences for the species are ranked S3 (either very rare and local throughout its range, or found locally (even abundant at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors) or S4 9 apparently secure, though it might be quite rare in parts of its range, especially at the periphery in the state.
SZN	Non-breeding occurrences are not ranked in the state.
SU	Possibly in peril, but status uncertain; more information needed.

Source: Monana Natural Heritage Program (1995)

APPENDIX G

FLIGHT SAFETY ANALYSES

APPENDIX G

FLIGHT SAFETY ANALYSES

Range Safety, the organization responsible for flight safety, is chartered to protect life and property during vehicle launch, flight, and landing operations for all flights originating within their controlled airspace. In order to satisfy Range Safety's requirements to launch from Edwards Air Force Base and optimally land at one of three landing sites, the Program must provide:

Planning

- best estimate of trajectory
- establish nominal trajectory
- population density studies
- map generation
- launch and landing hazard analysis
- debris fragmentation patterns
- how to handle flight anomalies (deviations, accidents, etc.)
- establish nominal flight envelope
- determine vehicle discretes required for display
- best data source selection
- Range Safety Office and Range Operations Center (best data source) training

Launch

- activate ground support equipment
    - certify configuration
    - stub-system and end to end test
- weather data input
- launch risk analysis
- acoustic overpressure analysis if necessary

Post-Launch

- vehicle anomaly investigation if necessary
- support system anomaly investigation if necessary
- evaluate performance of:
    - support system anomaly investigation if necessary
    - evaluate performance of
        - instrumentation systems
        - communications systems
        - computer systems

A comprehensive flight safety analysis for the powered flight mode of the X-33 has been accomplished to assist in locating reasonable launch complex sites and corridors and to provide risk modeling results in support of flight termination system trade studies (comparative studies of different systems or methods to determine the one that most efficiently and reliability meets required objectives). The Air Force Flight Test Center within Edwards Air Force Base along with Dryden Flight Research Center, and Edwards' Flight Sciences and Facilities Offices provided information and data verification for the risk analyses performed by ACTA, Inc., a group recognized by the Eastern Range (Kennedy Space Center and Patrick Air Force Base) and Western Range (Vandenberg Air Force Base, Edwards Air Force Base, and White Sands Missile Range) as range safety experts for current space launch vehicles.

Parameters used in the modeling by ACTA, Inc., were:

- potential trajectories from Space Port 2000 and Haystack Butte to potential landing sites
- mean (average) annual winds at Edwards
- vehicle position and velocity (speed) updated every 10 seconds of powered flight
- trajectories "moved" earth-relative in order to evaluate debris risks from other candidate launch sites on Edwards
- assumption: dispersed trajectories expected to have small effect on debris casualty expectations
- Edwards Air Force Base atmosphere, mean wind and wind statistics versus altitude used as representative of all areas overflown
- utilized Range Commanders Council Range Reference Atmosphere
- wind statistics used to compute impact uncertainty due to wind uncertainty
- general (public) population input: population numbers, facility shelter types and coverage areas throughout the base and local communities
- database for downrange cities, towns, and rural population to cover all areas potentially at risk
- historical reliability: historical failure probability 1/250, derived from 220 seconds of powered flight from comparable expendable launch vehicles (Atlas, Delta, and Titan II) and Space Shuttle LH2 and LOX main engines used for launch through MECO
- engineering reliability factors based on component data, degree of redundancy, and comparable components used to establish a failure probability of 1/6823 for MECO to landing
- failure scenario includes both uncontained engine failure and loss of thrust/control failure modes
- both failure modes assumed to result in vehicle breakup and explosion

In order to perform hazard modeling and risk projections, and "X-33 debris library" (Table G-1) was estimated. The evaluation identified X-33 intact debris pieces likely to result from worst case vehicle breakup (1 ton trinitrotoluene (TNT) equivalent) in-flight explosion. For each identified piece of debris the following parameters were determined:

- unit weight
- quantity
- dimensions
- approximate shape for ballistic coefficients
- material composition

Table G-1.

X-33 Debris Library - Sample of Intact Pieces

Mass WBS	Component	Qty	Unit Wt (lb)	Total Wt	Reference	Unit Shape	Dimensions (in) L	W	H	Material
12221	Canted tail	2	1218	2436	GL-01	Trapezoidal	345	63-213	286	Titanium (Ti)
12222	Vertical tail	2	446	892	GL-02	Trapezoidal	110	66-96	88	Ti
12223	Body flap	2	732	1464	GL-03	Rectangular	103	76.5		Ti
1241-1	Left LH2 tank fwd dome/conic	2	192.5	385	GL-04	1/2 hemisphere	107	54	54	Graphite epoxy (GrEp)
1241-2	Left LH2 tank barrel sections	16	127.5	2040	GL-04	1/4 cylinder	57.5	75	75	GrEp
1241-3	Left LH2 tank aft dome/conic	1	1696	1696	GL-04	dual hemisphere	216	150	54	GrEp
1241-4	Right LH2 tank fwd dome/conic	2	192.5	385	GL-04	1/2 hemisphere	107	54	54	GrEp
1241-5	Right LH2 tank barrel sections	16	127.5	2040	GL-04	1/4 cylinder	57.5	75	75	GrEP
1241-6	Right LH2 tank aft dome/conic	1	1696	1696	GL-04	dual hemisphere	216	150	54	GrEp
1242-1	LO2 tank fwd cone	4	223.5	894	GL-05	1/4 conic	136	19.5	62.5	Aluminum (Al 2219)
1242-2	LO2 tank barrel sections	8	179	1432	GL-05	1/4 cylinder	66.3	62.5	62.5	Al 2219
1242-3	LO2 tank aft dome	2	523.5	1047	GL-05	1/2 hemisphere	125	108	38	60% Al 2219, 40% GrEp
121A	Umbilical and door	2	66	132	GL-08	rectangular	48	36	12	Al 2219
123-1	Main landing gear door	2	58	116	GL-06	rectangular	106	100	4	Al 2219
123-2	Nose langing gear door	1	44	44	GL-06	rectangular	106	46	4	Al 2219
149	Payload bay with door	1	342	342	GL-07	trapezoidal box	120	72	48-60	GrEp
123-3	ORCC nosecap assembly TPS	9	24.1	216.9	GL-09	trapezoid	31.4	24	18.4	Carbon carbon (ORCC)
123-4	MA-754 TPS panels	81	7	567	Pg 41 Baseline Doc.	square	18	18	4.2	Nickel alloy (inconel)
123-5	Inco-617 TPS panels	949	4.5	4270.5	GL-10, pg 41 Baseline Doc.	square	18	18	2.5	Inconel
123-6	RSI/Epoxy TPS panels	12	178	2136	GL-11	rectangular	144	126	0.5	RSI/Epoxy
123-7	ORCC leading edge TPS	12	30.5	366	GL-12	rect. leading edge	48	6	6	ORCC
142-1	Main landing gear	2	844	1688	Pg 147 Baseline Doc.	Cyl. w/ wheel	92	36	10	Stainless steel
142-2	Nose landing gear	1	511	511	Pg 145 Baseline Doc.	Cyl. w/ wheel	93	22	15	Stainless steel
1512-1	Main engine LO2 turbopump	2	419	838	GL-13	cylindrical	43	20	20	30/70 Al 2219, St Steel
1512-2	Main engine LH2 turbopump	2	704	1408	GL-13	cylindrical	40	20	20	30/70 Al 2219, Inconel
1513	Thrust cells	4	950	3800	GL-13	rectangular	88	30	15	Stainless steel
1514	Nozzle thrust ramp	4	675	2700	GL-13	curved rectang.	88	58	4	50/50 Copper, GrEp
1516-1	Diff. throttle valve	8	37	296	GL-13	spherical	6	6	6	Stainless steel
1516-2	Main propellant valve	4	75	300	GL-13	spherical	6	6	6	Stainless steel
1517	Main eng. elect. control (DIU)	8	40	320	GL-13	rectangular	12	12	8	60/40 Al 6061, composite
1518-1	Engine base closure	2	120	240	GL-13	rectangular	88	46	6	Stainless steel
1518-2	Engine outboard seal	2	120	240	GL-13	trapezoidal	100	50	46	50/50 Al 2219, Inconel
1518-3	Engine-engine seal	1	50	50	GL-13	trapezoidal	100	50	46	Copper
1482-1	Fwd RCS thruster module	5	20	100	GL-14	rectangular	24	7	8	Stainless steel

Vehicle engineers consulted with subcontractors and vendors for estimation of subsystem breakup: propellant tanks; main propulsion system; avionics; landing gear; thermal protection system; ruddervators; rudders; thrust and intertank structure; turboalternators; main engines and engine ramps, etc. From the breakup analysis, 1269 components or intact debris pieces were identified. These pieces accounted for 18,900 kg (41,700 lb) of 26,600 kg (58,700 lb) of X-33 dry mass. Basic vehicle composition expected to be: 30% composites (graphite/expoxy); 21% inconel/MA-754/ 19% aluminum; 16% steel; 10% titanium; and 4% ORCC. A sample of the debris library is provided in Table G-1.

In order to project debris impacts, the following assumptions and modeling was used:

- IMPACT Program (software developed by Aerospace Corporation under contract to the Department of Defense)
- model used to generate explosion debris model and assign initial fragment velocities, ballistic coefficients and masses
- assumed 6.0×10^6 joules of energy released per pound of LH2 and LOX
- assumed 1% of remaining propellant consumed in explosion
- grouped debris fragments with similar ballistic coefficients, weights and induces velocities

Table G-2 provides a sample of the debris data with respective ballistic characteristics necessary to model potential ground impact.

Based on the above data, assumptions, and modeling, powered flight debris ellipses for launch were generated. The debris ellipses for launches from Haystack Butte to Silurian Lake, Dugway Proving Ground, Malmstrom Air Force Base and Moses Lake are shown in Figure G-1. The debris patterns for a trajectory to China Lake would be approximately the same as the one for Silurian Lake except that the trajectory is more northerly. Also, debris patterns for launches from Space Port 2000 would be similar to those shown in Figure G-1.

Risk and probability of occurrence was calculated for each trajectory and is provided in Tables G-3 and G-4. Land use beneath each trajectory is provided in Table G-5 (A-E).

Figure G-1.

Powered Flight Debris Ellipses Launch from Haystack to Landing Sites

- Launch From Remote Site and Flight Corridors Over Sparsely Populated Areas Help Minimize Population Overflight Risks

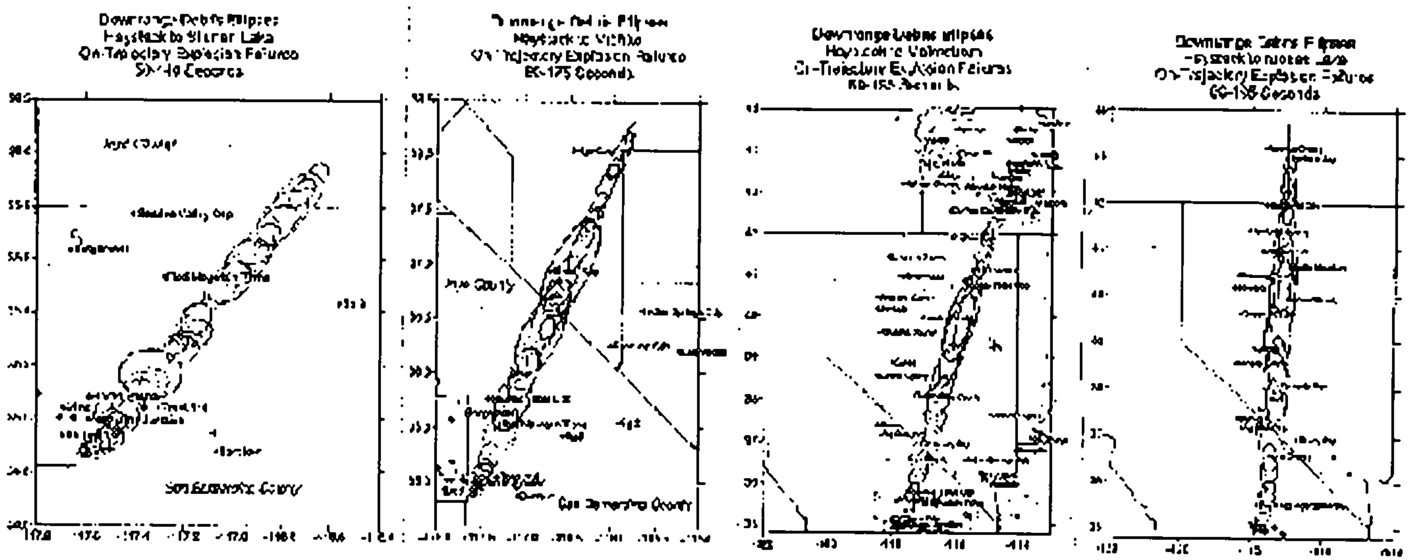

Fig. G-1a Fig. G-1b Fig. G-1c Fig. G-1d

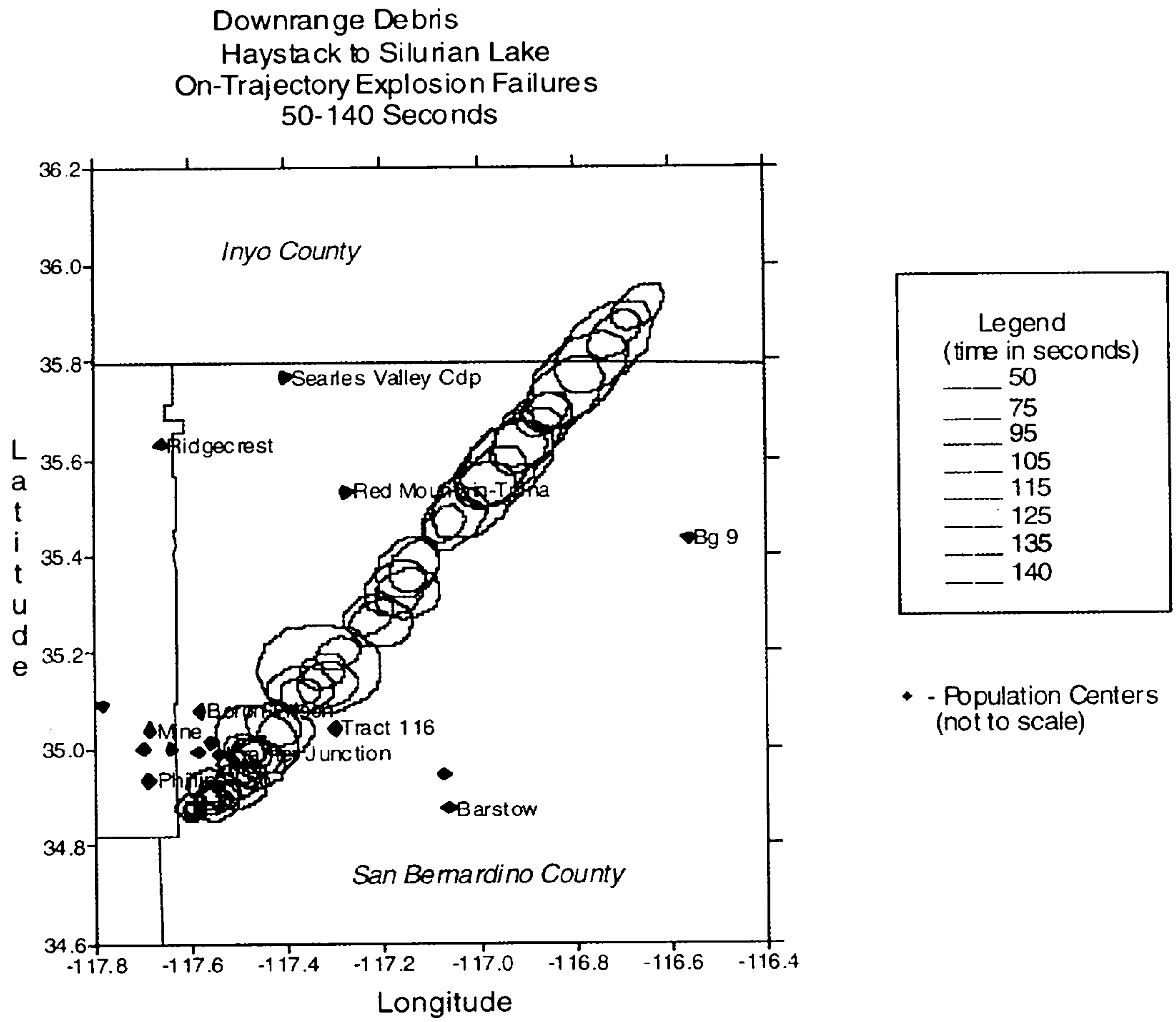

Figure G-1a. Downrange Debris, Haystack to Silurian Lake, On-Trajectory Explosion Failures, 50-140 Seconds

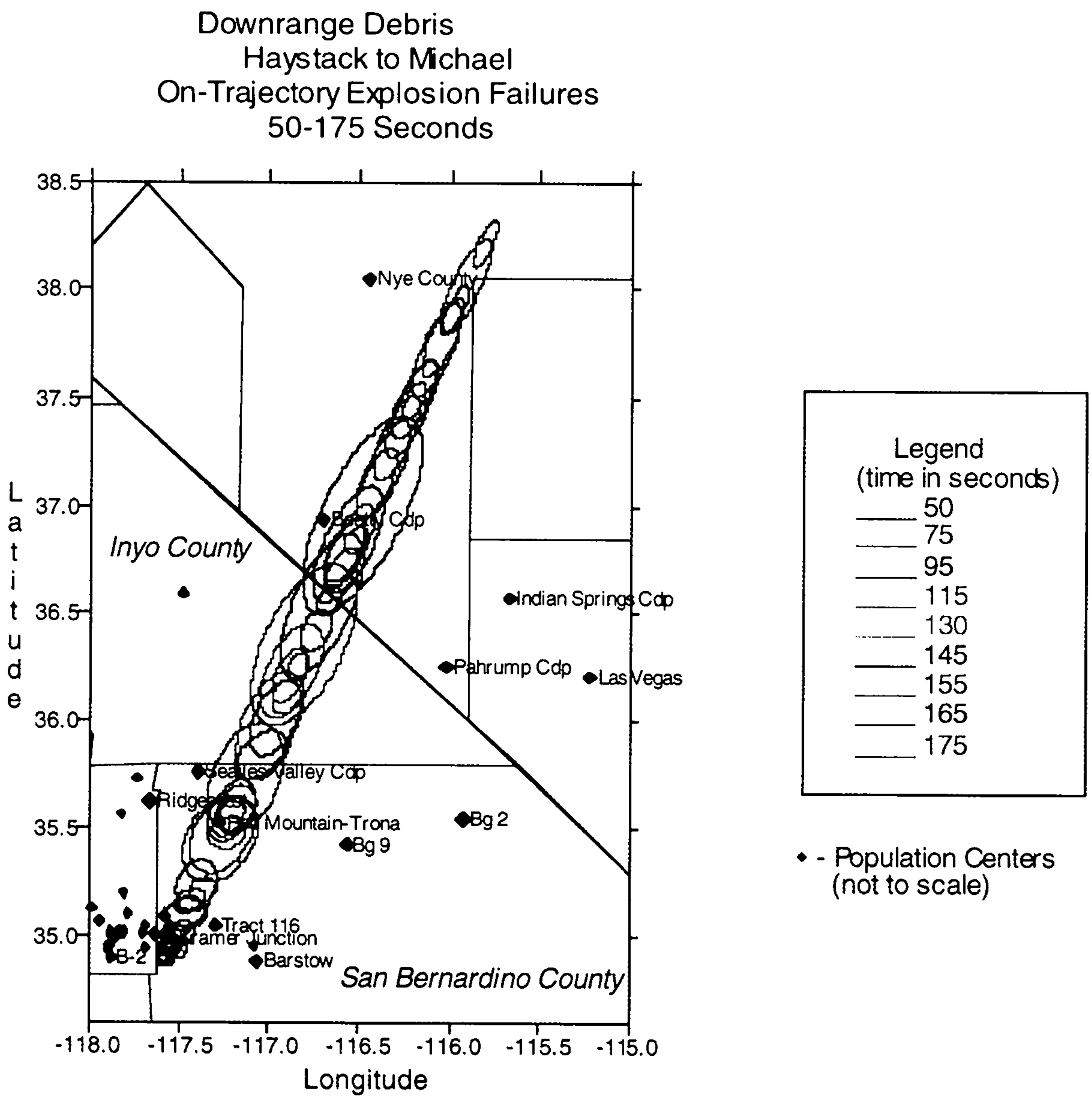

Figure G-1b. Downrange Debris, Haystack to Michael, On-Trajectory Explosion Failures, 50-175 Seconds

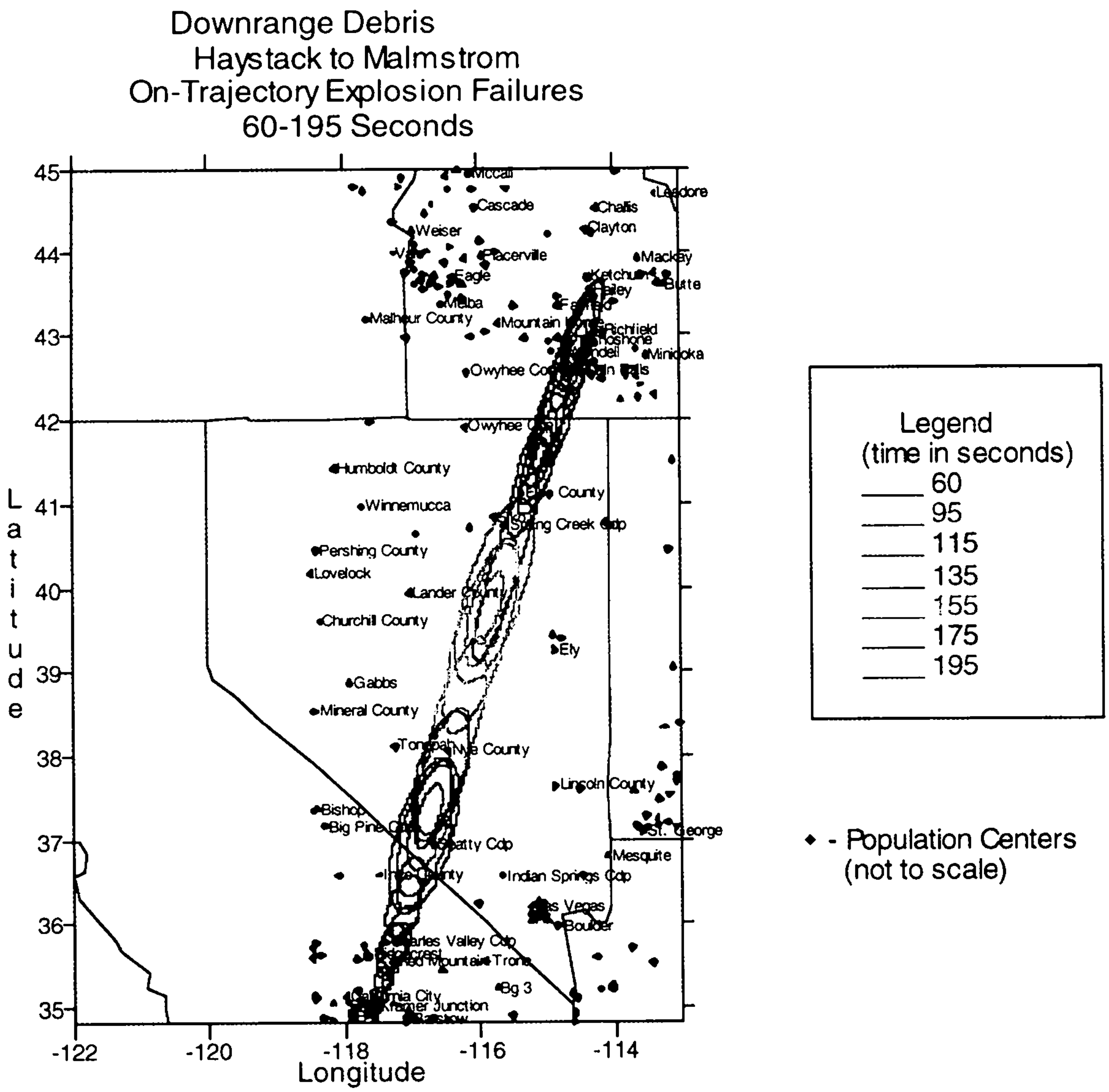

Figure G-1c. Downrange Debris, Haystack to Malmstrom, On-Trajctory Explosion Failures, 60-195 Seconds

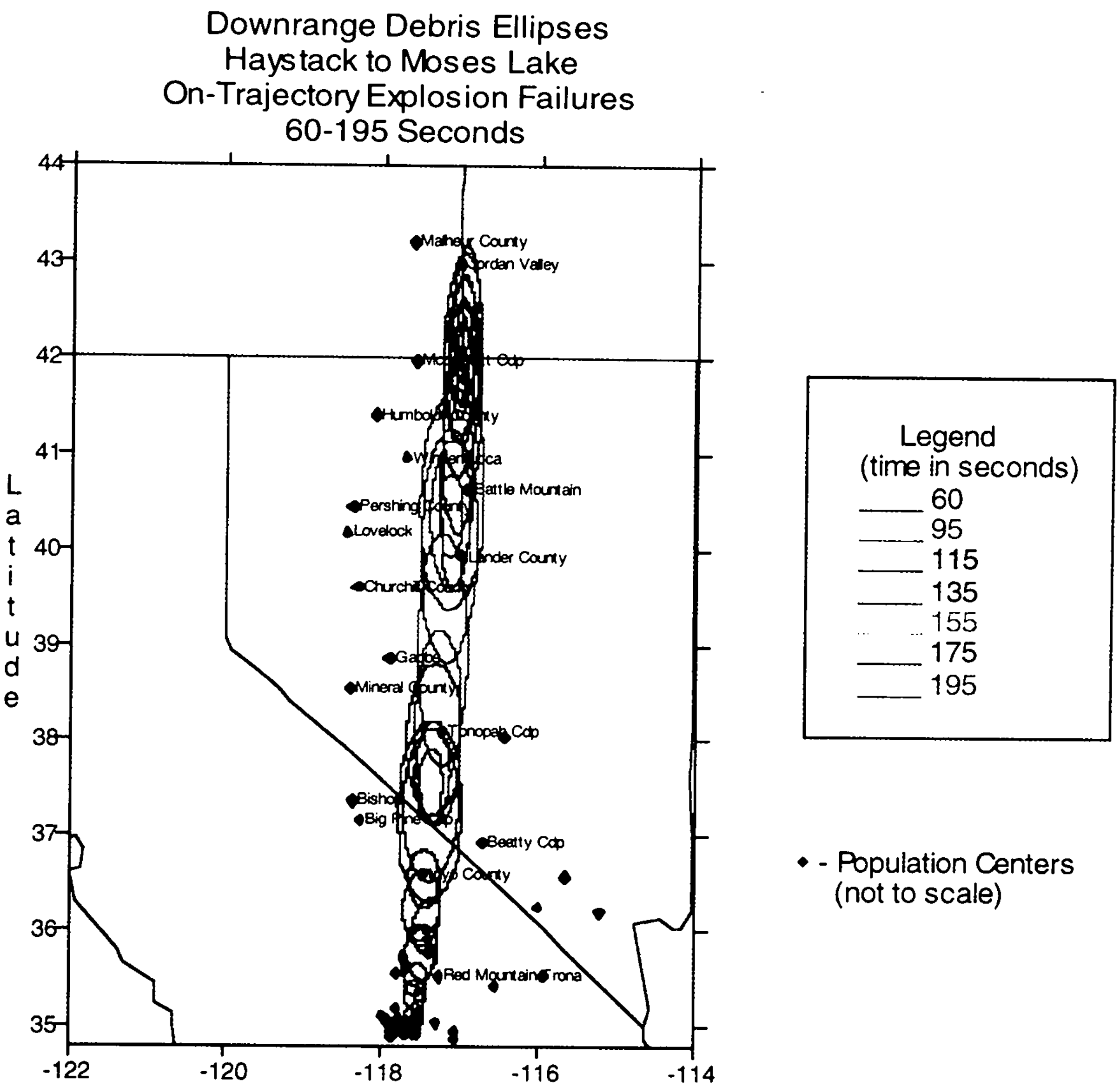

Figure G-1d. Downrange Debris Ellipses, Haystack to Moses Lake, On-Trajectory Explosion Failures, 60-195 Seconds

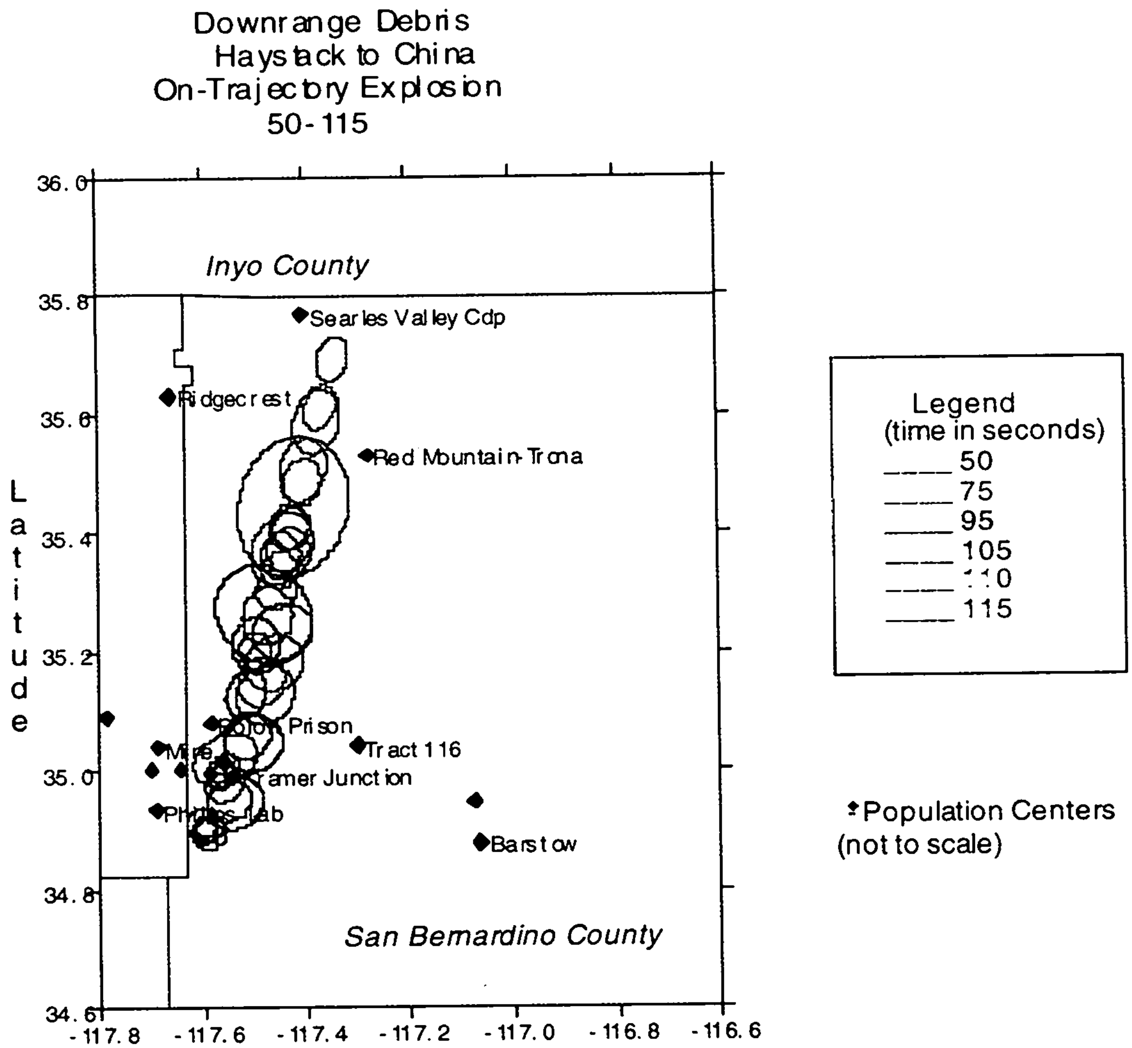

Figure G-1e. Downrange Debris, Haystack to China Lake, On-Trajectory Explosion, 50-115

Table G-2.

Debris Fragment List Based on IMPACT Program - Sample Time Interval

Fragment Time Interval : 75.01 - 105 seconds

Count	Ballistic Coefficient (lbs/ft^2)			+3s Velocity Perturbation (ft/s)	Weight (lbs)	Area (ft^2)
	min	mean	max			
1	21.96	24.40	26.84	217.47	4409.25	192.38
5	20.35	22.61	24.87	205.71	1606.52	256.93
1	23.67	26.30	28.93	422.24	1102.31	644.91
7	139.47	154.96	170.46	422.24	808.90	31.03
9	99.14	110.16	121.17	422.24	844.69	28.33
5	85.15	94.61	104.07	422.24	490.01	65.08
12	42.82	47.58	52.34	531.78	323.47	29.31
7	165.46	183.84	202.23	632.39	261.93	5.97
61	9.88	10.98	12.08	632.39	155.02	49.77
7	68.05	75.61	83.17	752.05	78.29	2.38
15	20.55	22.84	25.12	752.05	111.92	18.29
11	78.96	87.73	96.51	752.05	69.45	9.23
25	40.80	45.33	49.86	945.65	47.65	14.06
29	75.92	84.35	92.79	945.65	39.38	0.82
17	46.52	51.69	56.85	1124.57	30.24	5.01
27	17.83	19.81	21.79	1124.57	26.48	3.09
36	29.41	32.68	35.95	1337.35	15.73	1.02
1032	4.54	5.04	5.55	1681.62	4.70	2.25
34	22.95	25.50	28.05	1999.80	3.31	0.14
1972	3.60	4.00	4.40	2378.18	1.10	0.45

Table G-3. Collective (Total) per Flight Risk(R) and Probability(P) of Occurrence for Proposed Launch Sites and Trajectories in Near Vicinity of the Launch Pad. Data for Haystack Butte. Updated as of August 16, 1997

Landing Site		Haystack Butte	Space Port 2000
Silurian Lake	R	0.00019×10^{-6}	18×10^{-6}
	P	1 in 530 million	1 in 56,000
China Lake	R	1.6×10^{-6}	not available
	P	1 in 6.3 million	
Dugway	R	0.022×10^{-6}	10×10^{-6}
	P	1 in 4.6 million	1 in 100,000
Malmstrom	R	0.35×10^{-6}	2.1×10^{-6}
	P	1 in 2.9 million	1 in 520,000
Moses Lake	R	5.9×10^{-6}	2.3×10^{-6}
	P	1 in 170,000	1 in 430,000

Table G-4. Collective (Total) per Flight Risk(R) and Probability(P) of Occurrence for Proposed Launch Sites and Trajectories Downrange Based on Debris Patterns f rom Launch through Main Engine Cut Off (MECO). MECO Occurs Approximately Concurrent with Achieving Maximum Altitude (see Figure 2-9). Data for Haystack Butte Updated as of August 16, 1997.

Landing Site		Haystack Butte	Space Port 2000
Silurian Lake	R	5.4×10^{-6}	21×10^{-6}
	P	1 in 190,000	1 in 48,000
China Lake	R	4.6×10^{-6}	not available
	P	1 in 220,000	--
Dugway	R	4.7×10^{-6}	12×10^{-6}
	P	1 in 220,000	1 in 83,000
Malmstrom	R	4.5×10^{-6}	7.1×10^{-6}
	P	1 in 210,000	1 in 140,000
Moses Lake	R	10×10^{-6}	8.3×10^{-6}
	P	1 in 100,000	1 in 120,000

Table G-5 Collective (Total) per Flight Risk (R) and Probability (P) of Occurrence for Proposed Site for Portion of Trajectories from MECO to Landing

Landing Site		Haystack Butte	Space Port 2000
Silurian Lake	R	0.11×10^{-6}	not available (N/A)
	P	1 in 9,090,909	
China Lake	R	0.19×10^{-6}	N/A
	P	1 in 5,263,158	
Dugway	R	0.27×10^{-6}	N/A
	P	1 in 3,703,703	
Malmstrom	R	0.71×10^{-6}	N/A
	P	1 in 1,408,451	
Moses Lake	R	2.9×10^{-6}	N/A
	P	1 in 344,827	

Table G-6. Collective (Total) for Flight Risk (R) and Probability (P) of Occurrence for Entire Trajectory, i.e., Launch to Landing

Landing Site		Haystack Butte	Space Port 2000
Silurian Lake	R	5.5×10^{-6}	not available (N/A)
	P	1 in 181,818	
China Lake	R	6.4×10^{-6}	N/A
	P	1 in 156,250	
Dugway	R	5.0×10^{-6}	N/A
	P	1 in 200,000	
Malmstrom	R	5.5×10^{-6}	N/A
	P	1 in 181,818	
Moses Lake	R	19×10^{-6}	N/A
	P	1 in 52,632	

Table G-7. Land Ownership of Land Beneath Nominal Trajectories.

G-7 A. Silurian Lake Trajectory

Ownership	Miles	Percentage
BLM	45	39
DOD	50	43
PVT	19	16
STATE	1	1
TOTAL	115	

G-7 B. China Lake Trajectory

Ownership*	Miles	Percentage
BLM	41	42
DOD	35	36
PVT	19	20
STATE	2	2
TOTAL	98	

G-7 C. Michael AFB Trajectory

Ownership	Miles	Percentage
BLM	277	59
DOD	105	22
DOE	23	5
FS	7	1
NPS	29	6
PVT	19	4
STATE	13	3
UNK	0.1	
TOTAL	473	

G-7 D. Malmstrom Trajectory

Ownership	Miles	Percentage
BLM	372	38
DOD	74	8
DOE	58	6
FS	104	11
FWS	9	1
NPS	52	5
PVT	108	11
STATE	12	1
UNK	180	18
Total	970	

G-7 E. Moses Lake Trajectory

Ownership	Miles	Percentage
BLM	506	58
DOD	50	6
FS	74	8
PVT	238	27
STATE	8	1
UNK	1	
TOTAL	877	

*Ownership Codes:
BLM - Bureau of Land Management
DOD - Dept. of Defense
DOE - Dept. of Energy
FS - Forest Service
FWS - Fish & Wildlife Service
NPS - National Park Service
PVT - Private
STATE - State
UNK - Unknown and assumed to be private

Table G-8. X-33 Probability of Failure

Estimate based on historical experience and predictions for boost phase of other launch vehicles

	Failure Probability	220 sec Equivalent
Atlas (core vehicle; LOX/RP-2 Experience through 1991; 260 seconds	1/22 (1)	1/26
Delta (core vehicle; LOX/RP-2); Experience through 1991. 260 seconds	1/50 (1)	1/59
TITAN II (core vehicle; N204/Aerozine 50); Experience through 1991/147 seconds:	1/31(1)	1/21
Shuttle (SSME; LOX/LH-2); Fault tree Prediction: 522 seconds:	1/348(2)	1/826
Representative "Average" 220 seconds: * For catastrophic failures * Apparent reliability improvements in above vehicles since 1991.		1/250

Note: White Sands Missile Range Proposed Failure Probability for a "generic" X-33 ranged from 1/250 to 1/1000

Footnotes:

(1) Space Effective Capability: Part 1–Launch Vehicle Projected Success Rate Analysis. Prepared for AFSC Launch Services Office by Booz•Allen & Hamilton, February 1992.

(2) Probabilistic Assessment of the Space Shuttle. Prepared for NASA Office of Space Flight by Science Applications International, February 1995.

APPENDIX H

APPENDIX H

EXPANDED SONIC BOOM CONTOURS

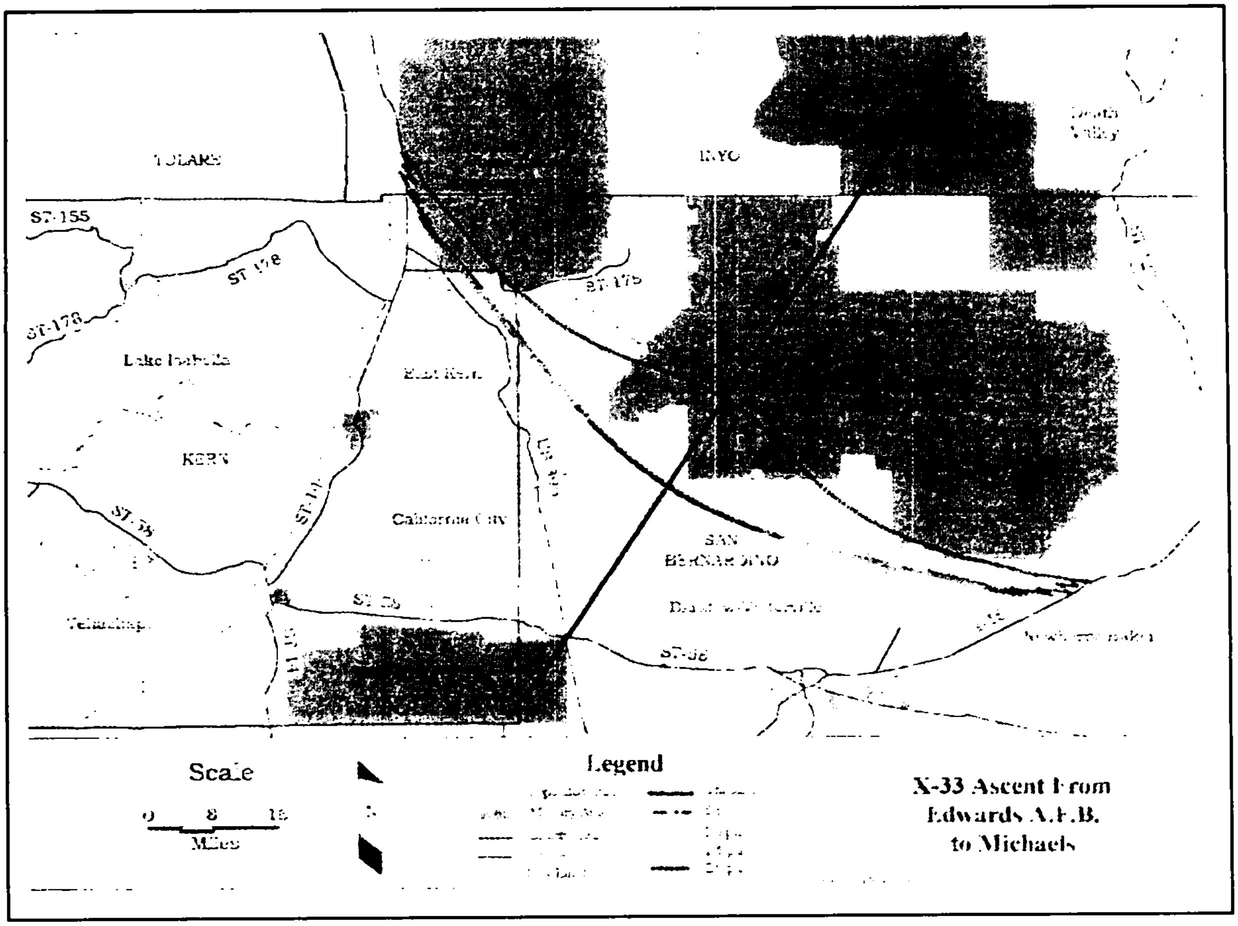

Figure H-1. Sonic Boom Contours for Ascent from Edwards A.F.B. to Dugway.

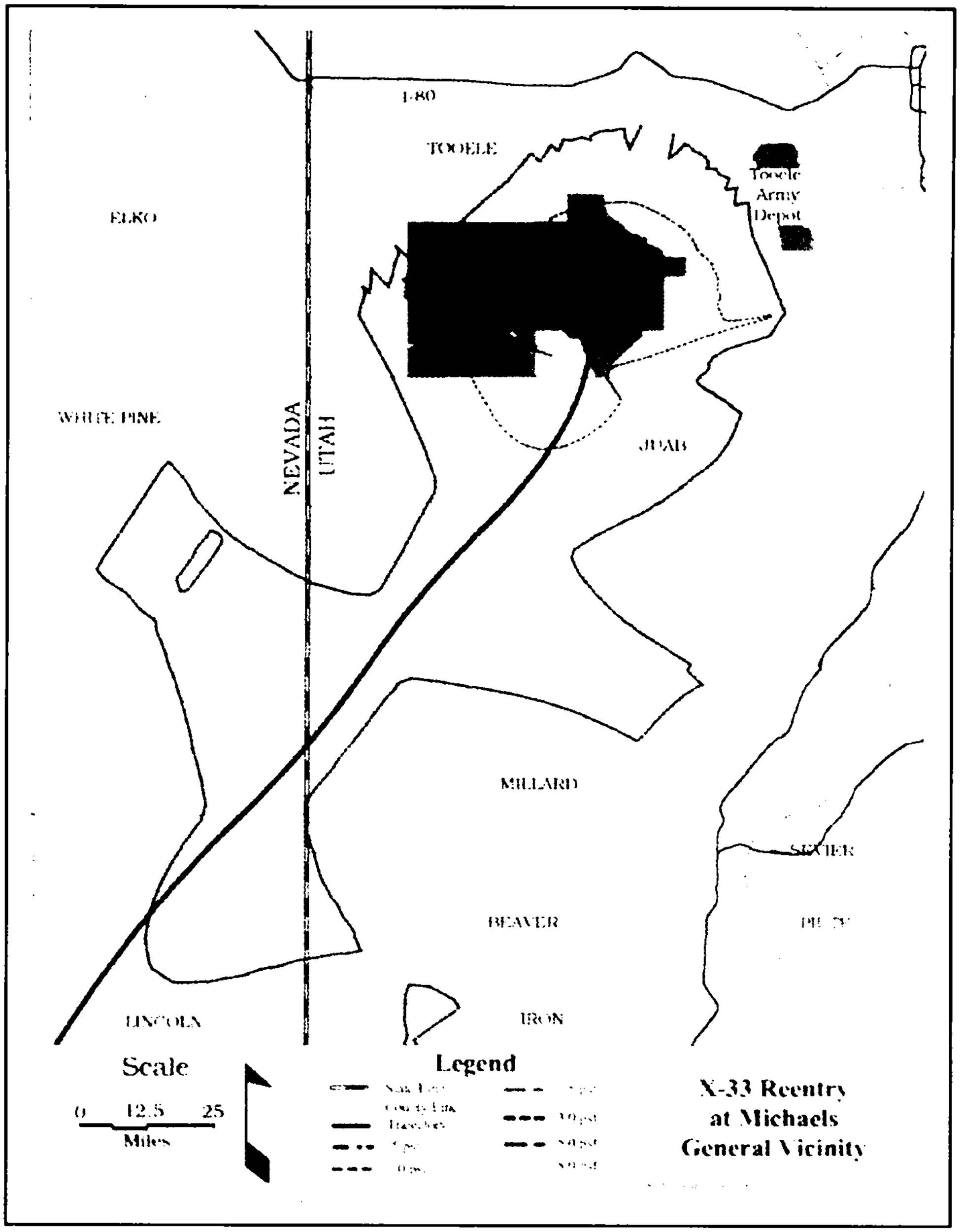

Figure H-2. Sonic Boom Contours for Reentry at Dugway General Vicinity.

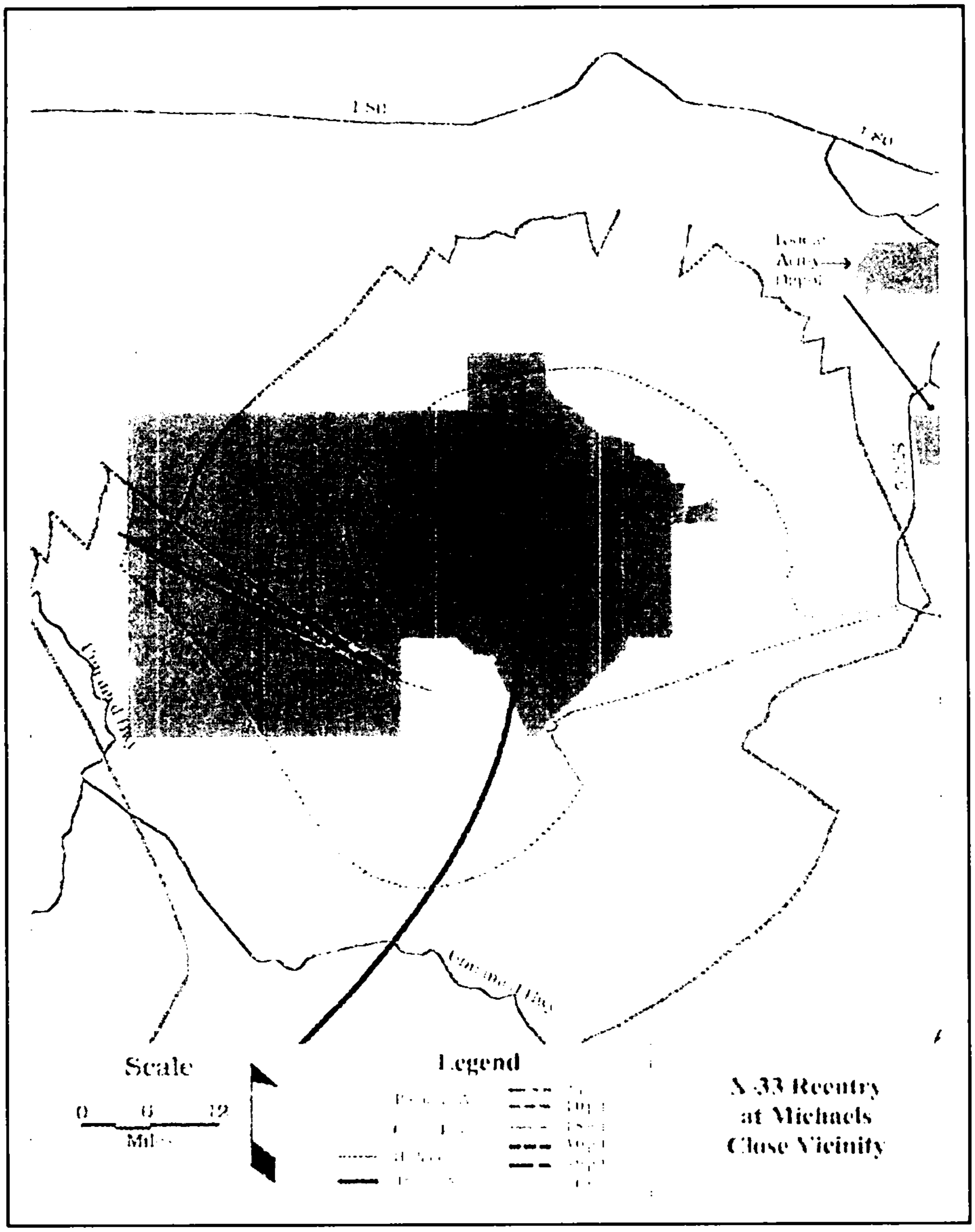

Figure H-3. Sonic Boom Contours for Reentry at Dugway Close Vicinity.

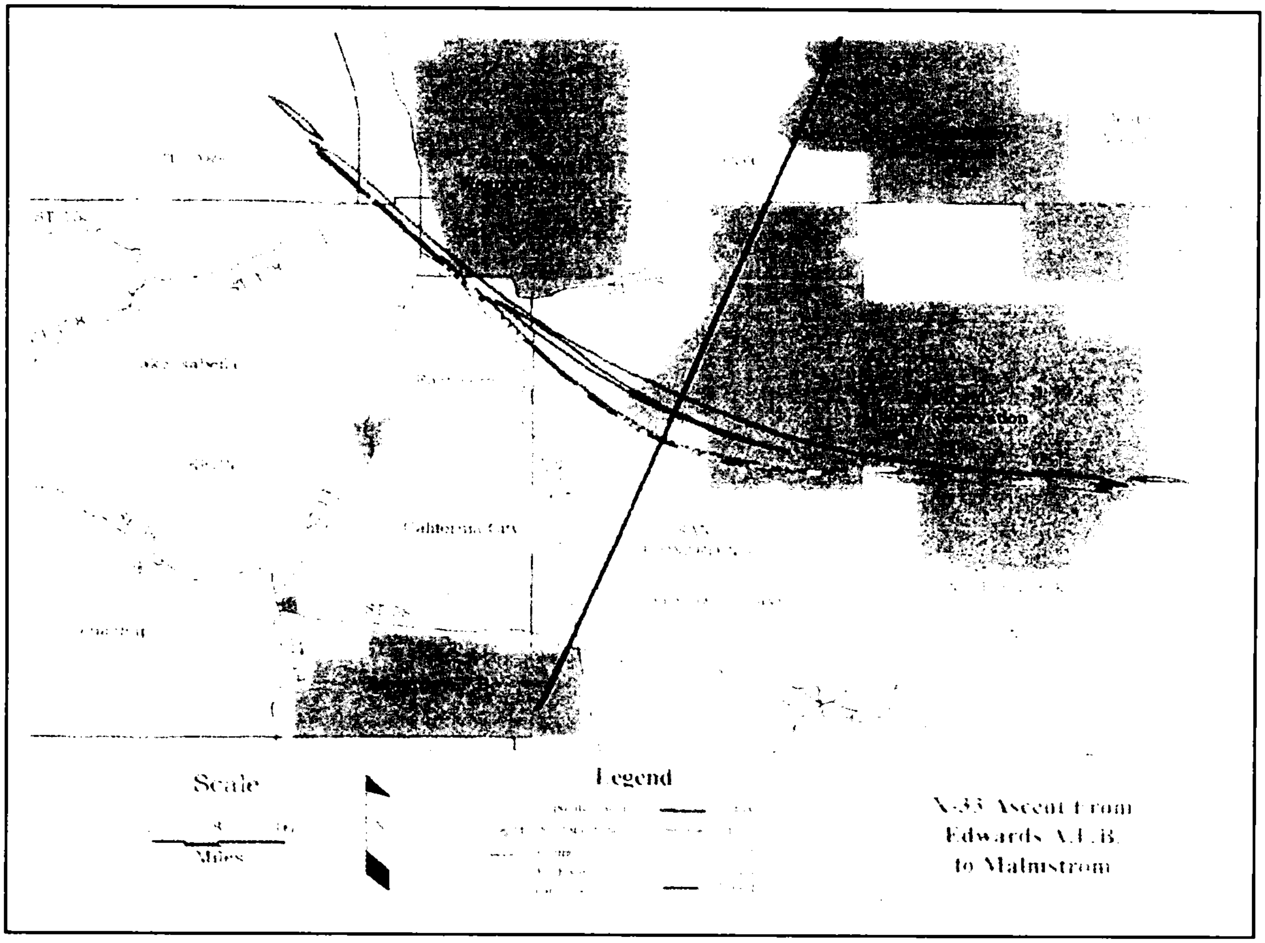

Figure H-4. Sonic Boom Contours for Ascent from Edwards A.F.B. to Malmstrom.

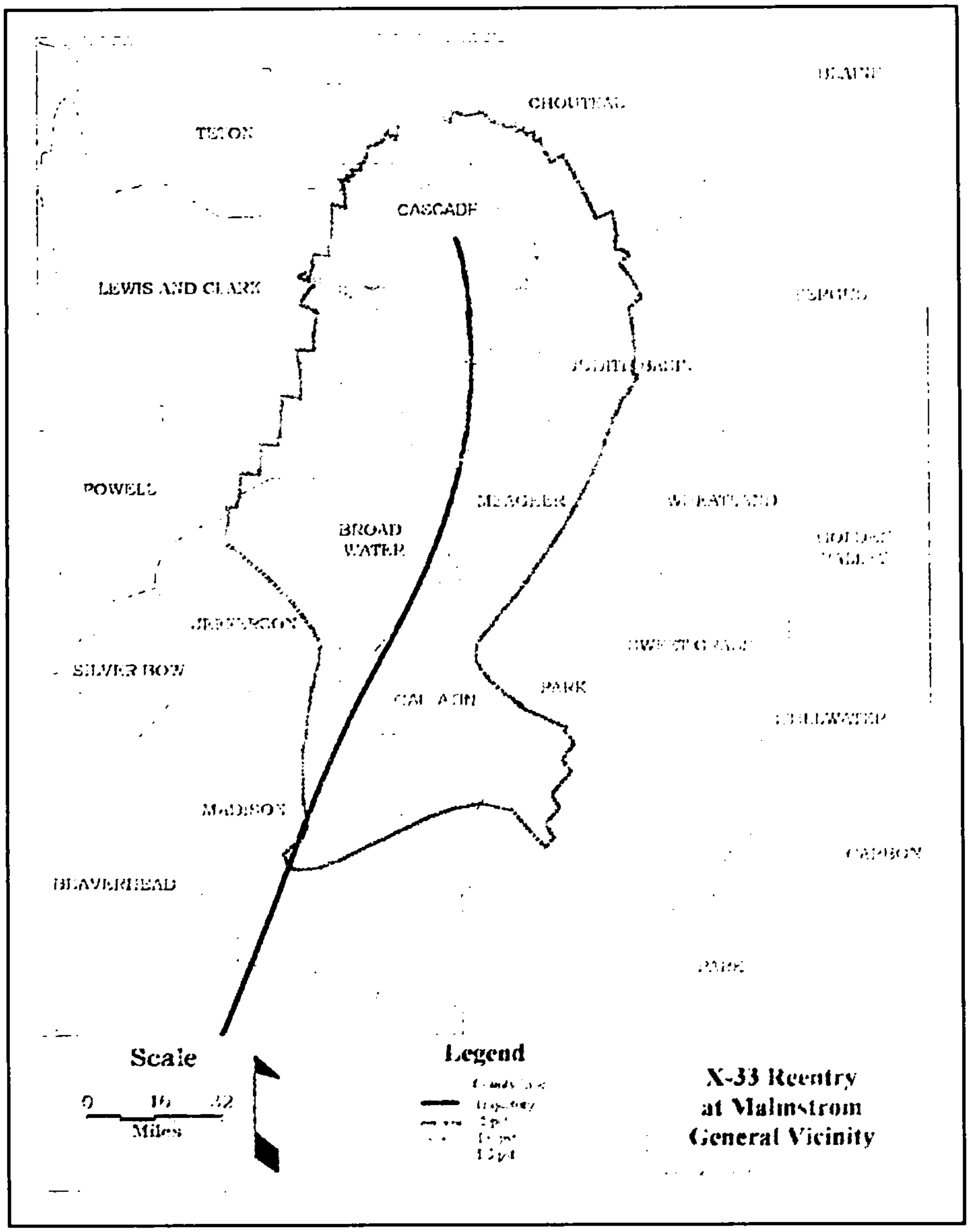

Figure H-5. Sonic Boom Contours for Reentry at Malmstrom General Vicinity.

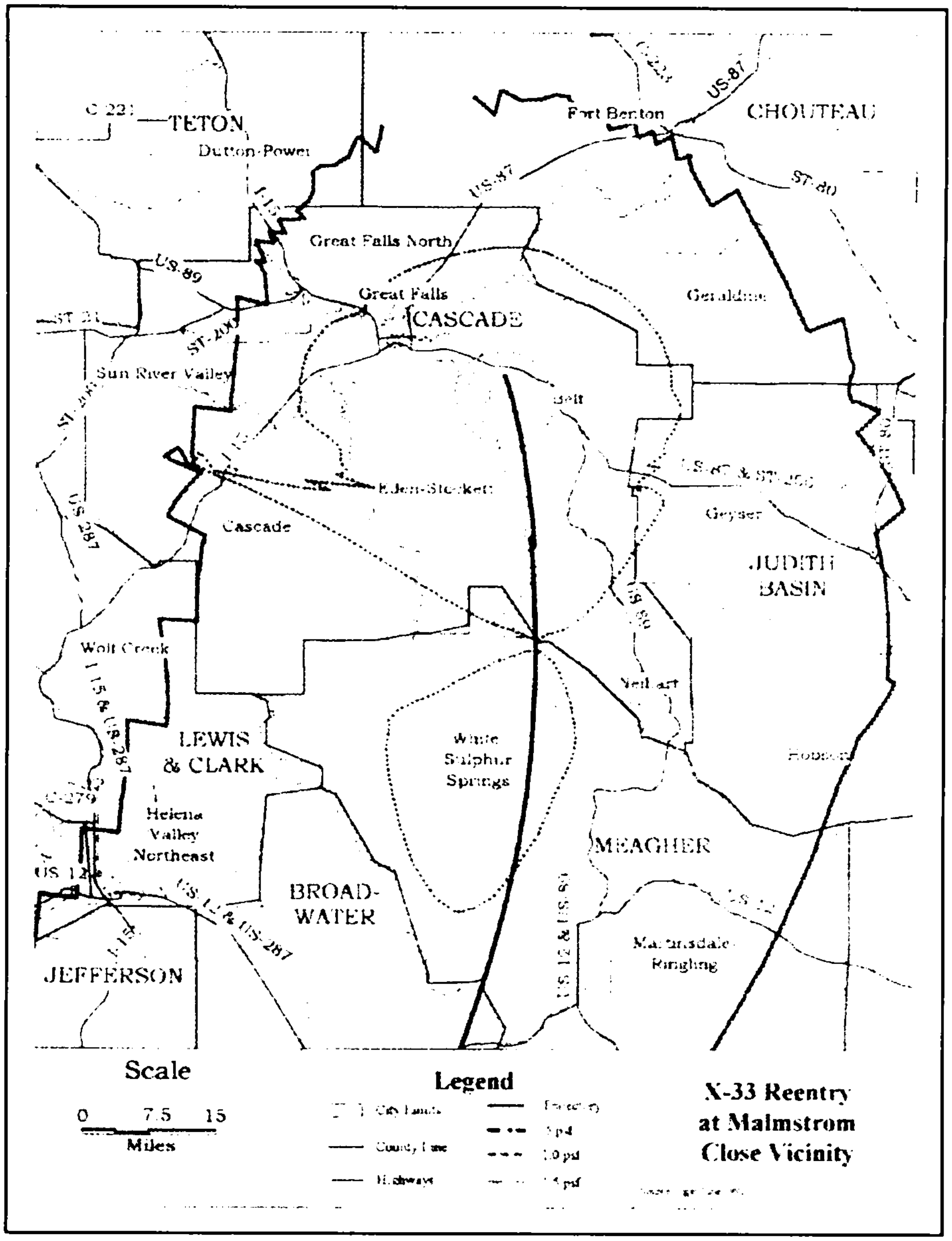

Figure H-6. Sonic Boom Contours for Reentry at Malmstrom General Vicinity.

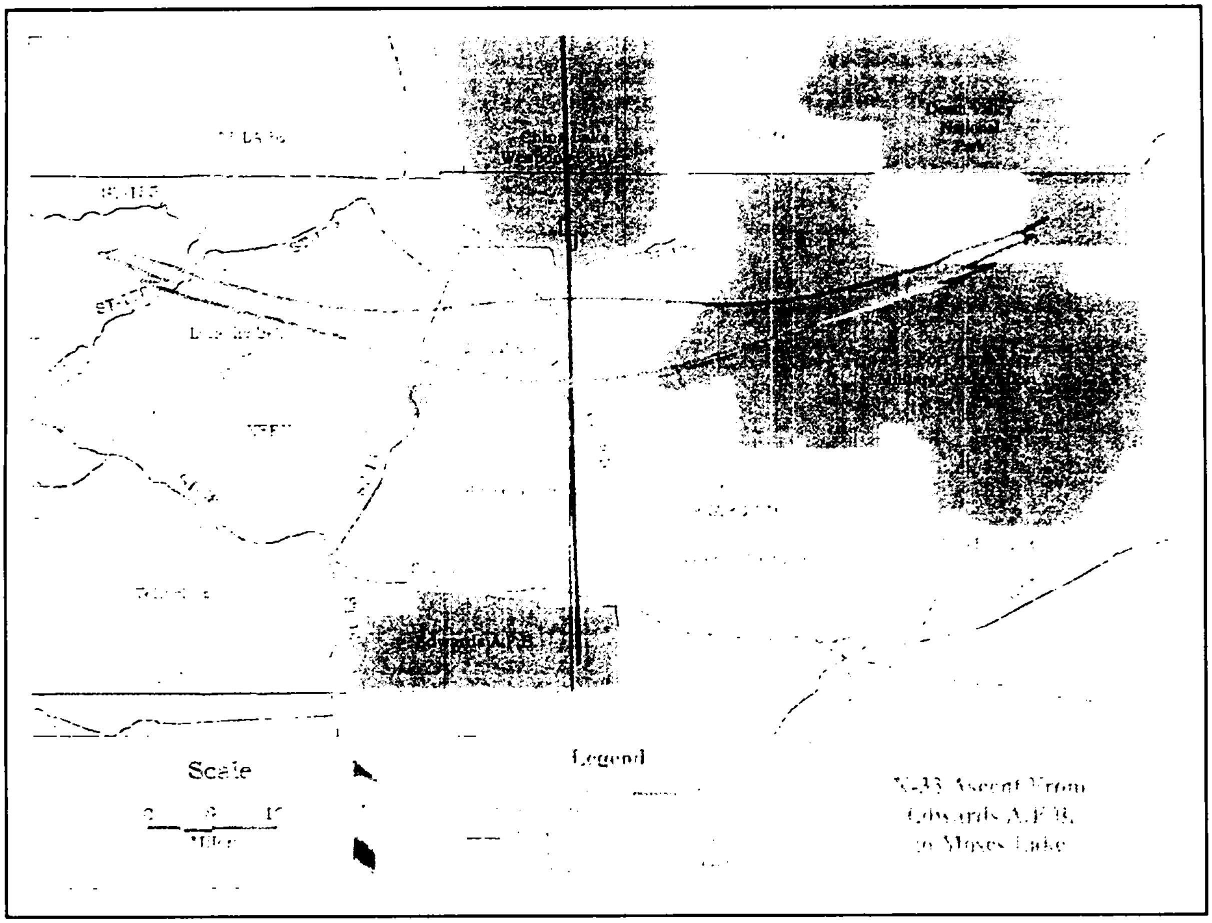

Figure H-7. Sonic Boom Contours for Ascent from Edwards A.F.B. to Moses Lake.

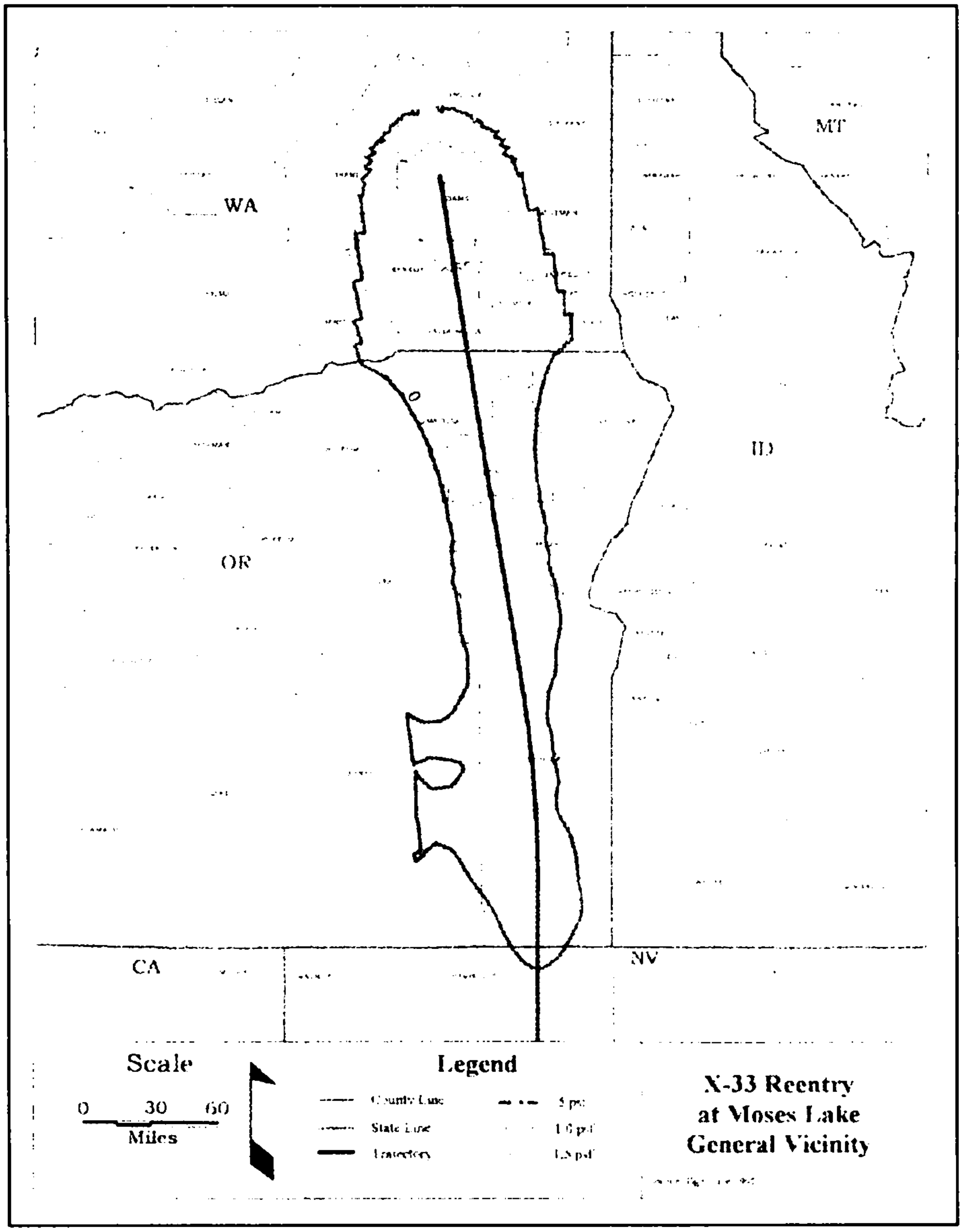

Figure H-8. Sonic Boom Contours for Reentry at Moses Lake General Vicinity.

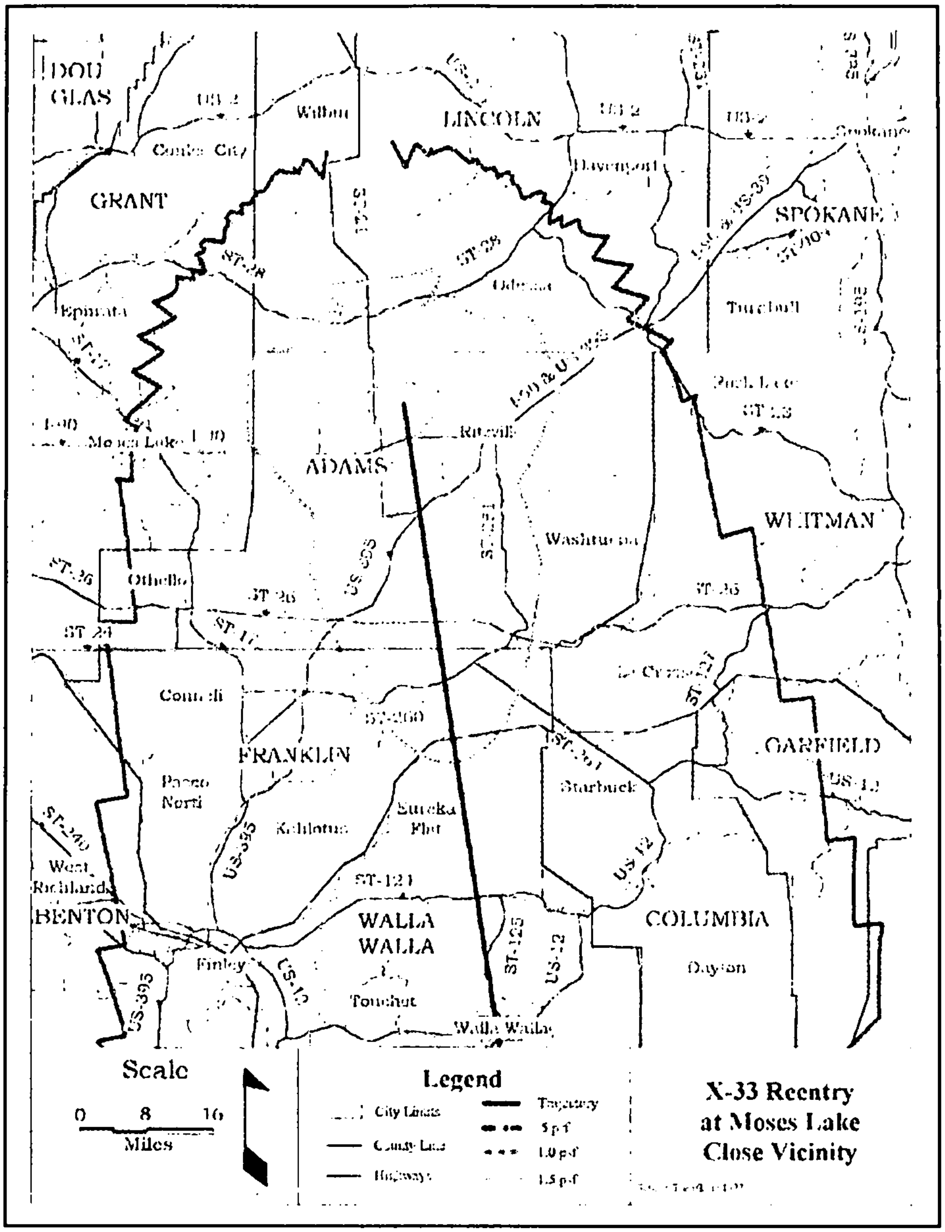

Figure H-9. Sonic Boom Contours for Reentry at Moses Lake Close Vicinity.

APPENDIX H

LAUNCH NOISE AS RELATED TO ALTITUDE AND POSITION OF THE VEHICLE

During liftoff, a reciever would hear the engine noise up to 10 km (6 mi) from the launch site. The noise level should increase as the vehicle gains altitude and then decrease as the vehicle rapidly increases the downrange distance and altitude. The amplitude and duration of the engine noise isdependent on the location of the reciever. For the specific cases of being 3.0 km (1.9 mi), 15 km (9.3 mi), and 30 km (19 mi) downrange, the following table gives the maximum A weighted noise levels, sound exposure level (SEL or LAE), and engine noise duration above 50dBA.

Table H-1 Sound Exposure Data.

Distance downrange in km (mi)	Maximum Sound Level dBA	Sound Exposure Level (SEL) dBA	Duration in seconds
3.05 (1.9)	92.5	105.9	170
15.2 (9.5)	66.2	84.6	140
30.5 (18.9)	55.6	73.7	100

At 3 km (1.9 mi) downrange, the engine peak noise level would be 92.5 dBA at approximately 32 seconds after liftoff and decrease to about one-half that level at 52 seconds. At 15 km (9.3 mi) downrange and 90 seconds after liftoff, the peak engine noise would be 66.2 dBA, and stay within 6 dBA of the peak. At 30 km (19 mi) downrange, the engine noise would peak at 55.6 dBA, and the level would remain within 6 dBA of the peak for 95 seconds. The sound level time histories of the above cases are shown below.

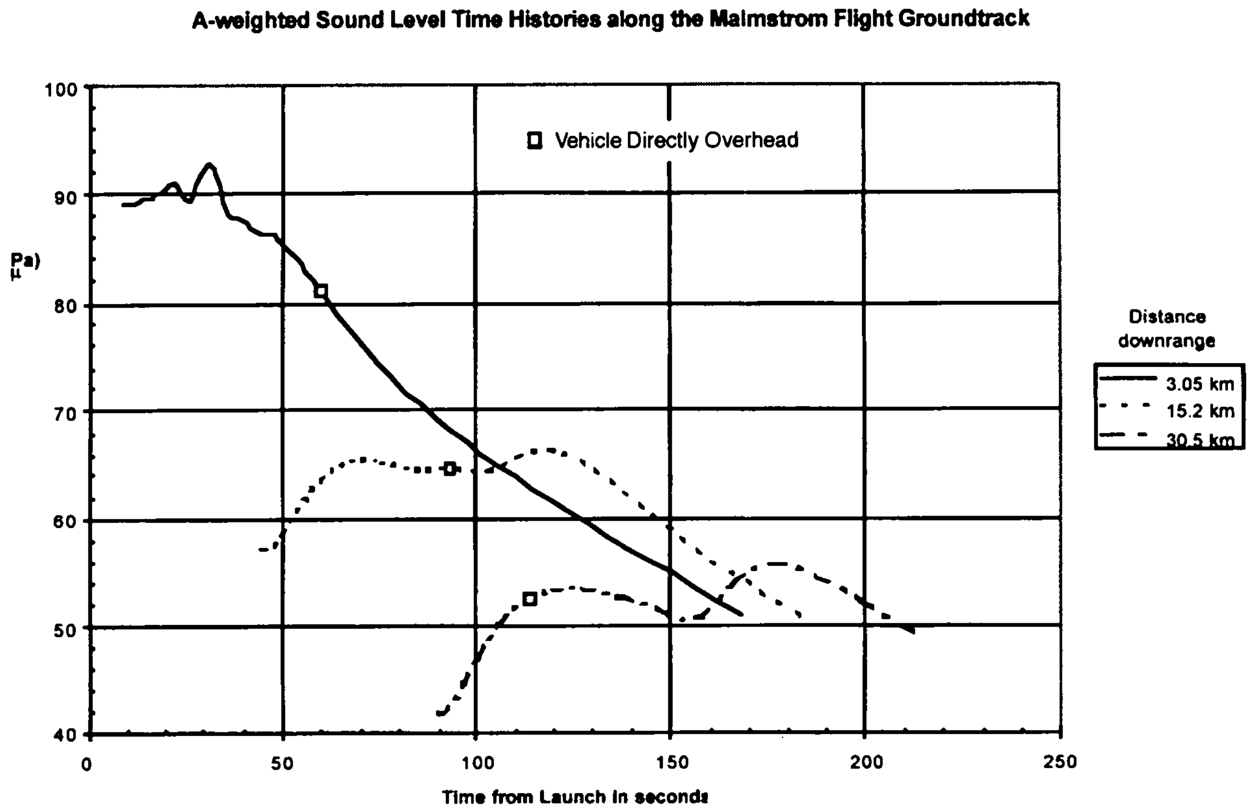

Figure H-10. **A-weighted Sound Level Time Histories along the Malmstrom Flight Groundtrack.**

Total sound duration times are provided in Table G-1. Sound exposure level is a noise metric which is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as did the actual time-varying noise event, (ASA 1988).

APPENDIX I

SILURIAN LAKE SITE LAYOUT

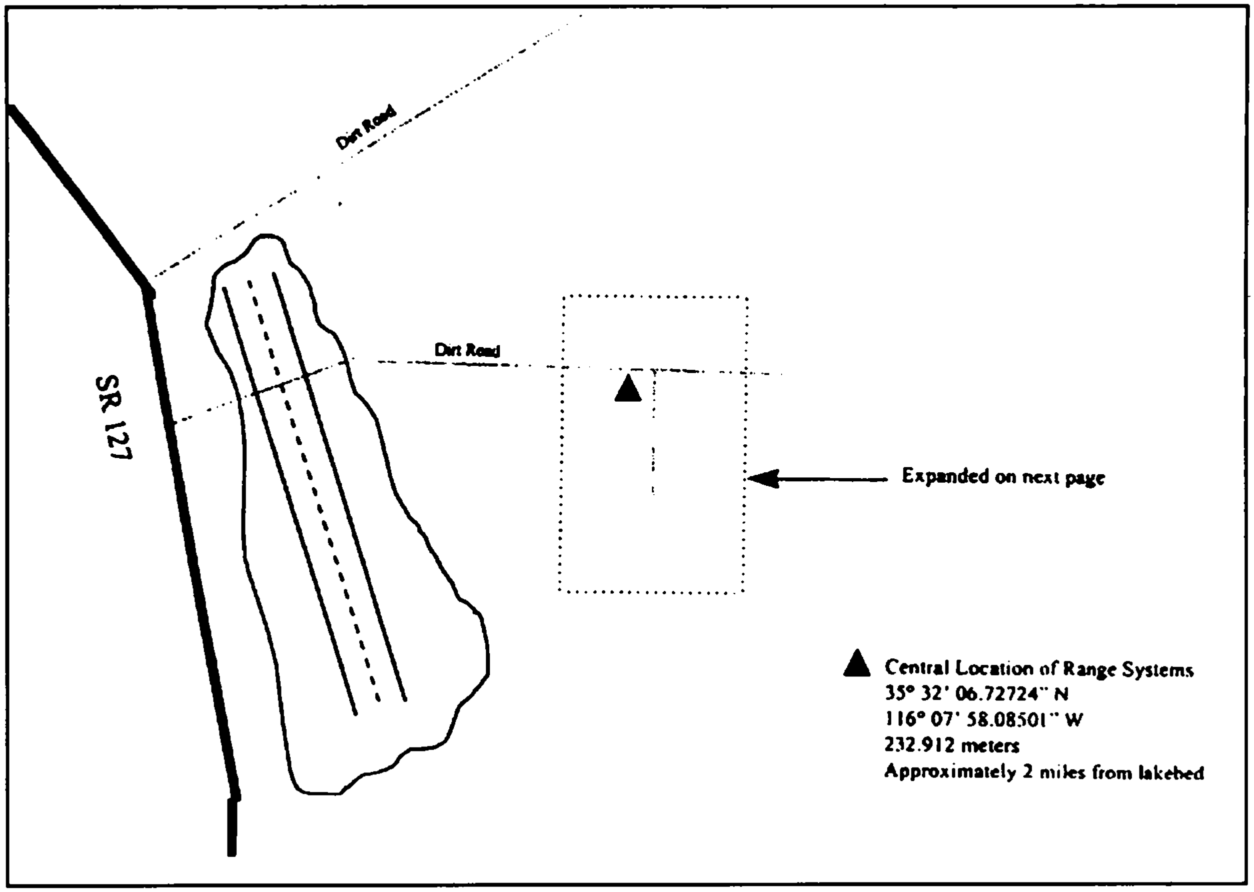

Figure I-1. Sketch of Silurian Lakebed.

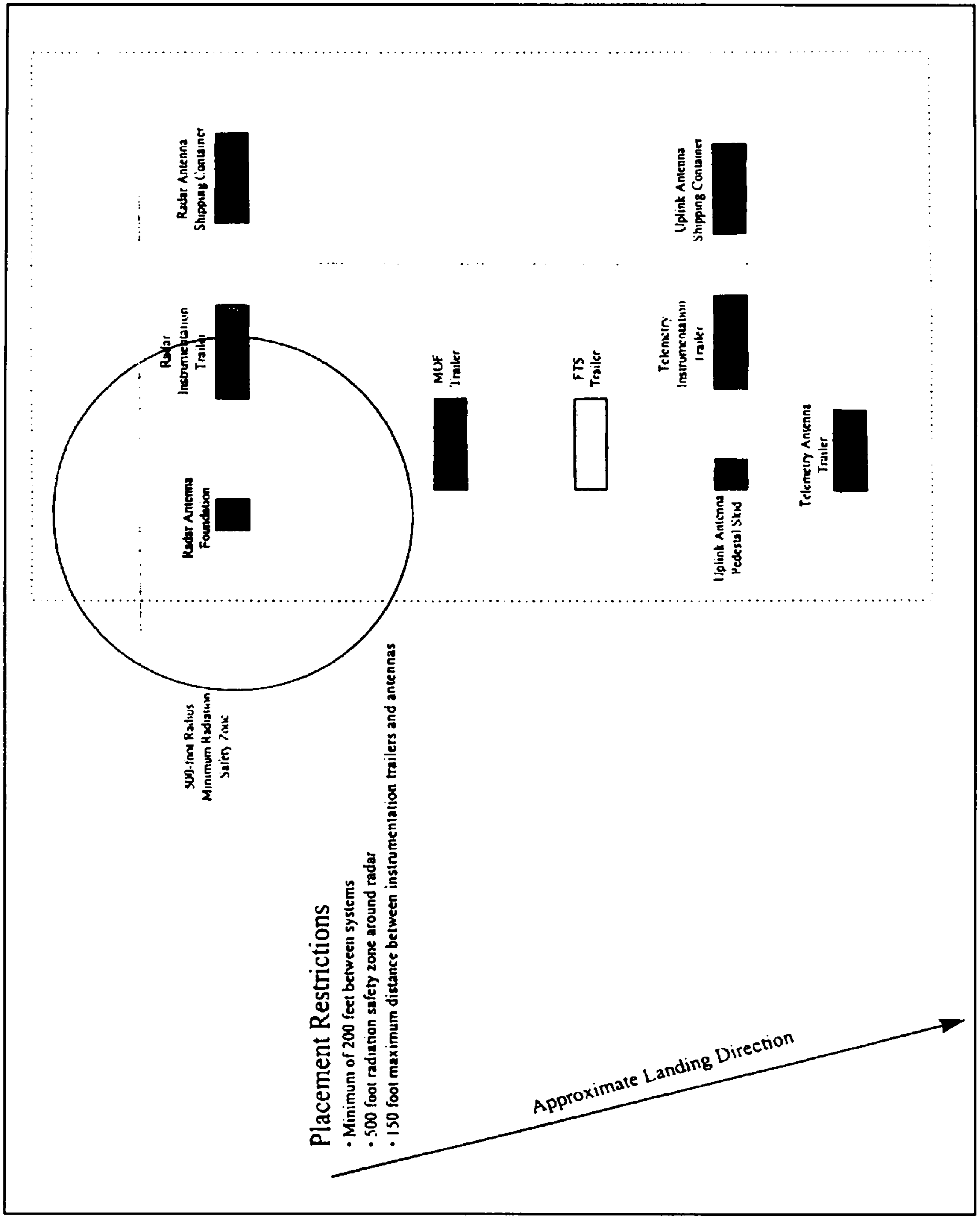

Figure I-2. Sketch of Range Area.

System	Trailer Size (L x W)	Cleared/Level Space (L x W)	Pad Size
Telemetry Antenna Trailer	20' x 8'	32' x 20'	N/A
Uplink Antenna Skid	15' x 15'	21' x 21'	N/A
Telemetry Instrumentation Trailer	42' x 9'	54' x 21'	N/A
Uplink Antenna Shipping Container	20' x 8'	32' x 20'	N/A
FTS Trailer	33' x 10'	45' x 22'	N/A
MOF Trailer	52' x 9'	64' x 21'	N/A
Radar Foundation	N/A	N/A	12' x 12' x 2'
Radar Antenna Shipping Container	48' x 9'	60' x 21'	N/A
Radar Instrumentation Trailer	50' x 9'	62' x 21'	N/A

All cleared areas need to be level and the surface needs to be either hard packed clay or gravel of some type.
Allowances should be made for road surfaces and cranes. The heaviest trailer will be 75,000 pounds.
The only concrete foundation required will be for the radar. DFRC will provide a foundation design by 10/1/97.
Additional items such as microwave systems and generators will require cleared and level space as well.
Area and placement requirements for this equipment are not known at this time.
The prime microwave link from Silurian to the communications point-of-presence in Baker will require space at the south end of the lakebed for the redundant microwave systems. In addition, the link between the range systems to this microwave at the south end of the lakebed, will either be another microwave system or a fiber cable. Allowances should be made for both. The microwave solution will require line-of-sight and the fiber solution will include a cable that runs around the end of the lakebed and will possibly need to be buried depending on environmental and traffic situations.

Table I-1. Description of Equipment Preparation Areas Depicted in Figure I-2.

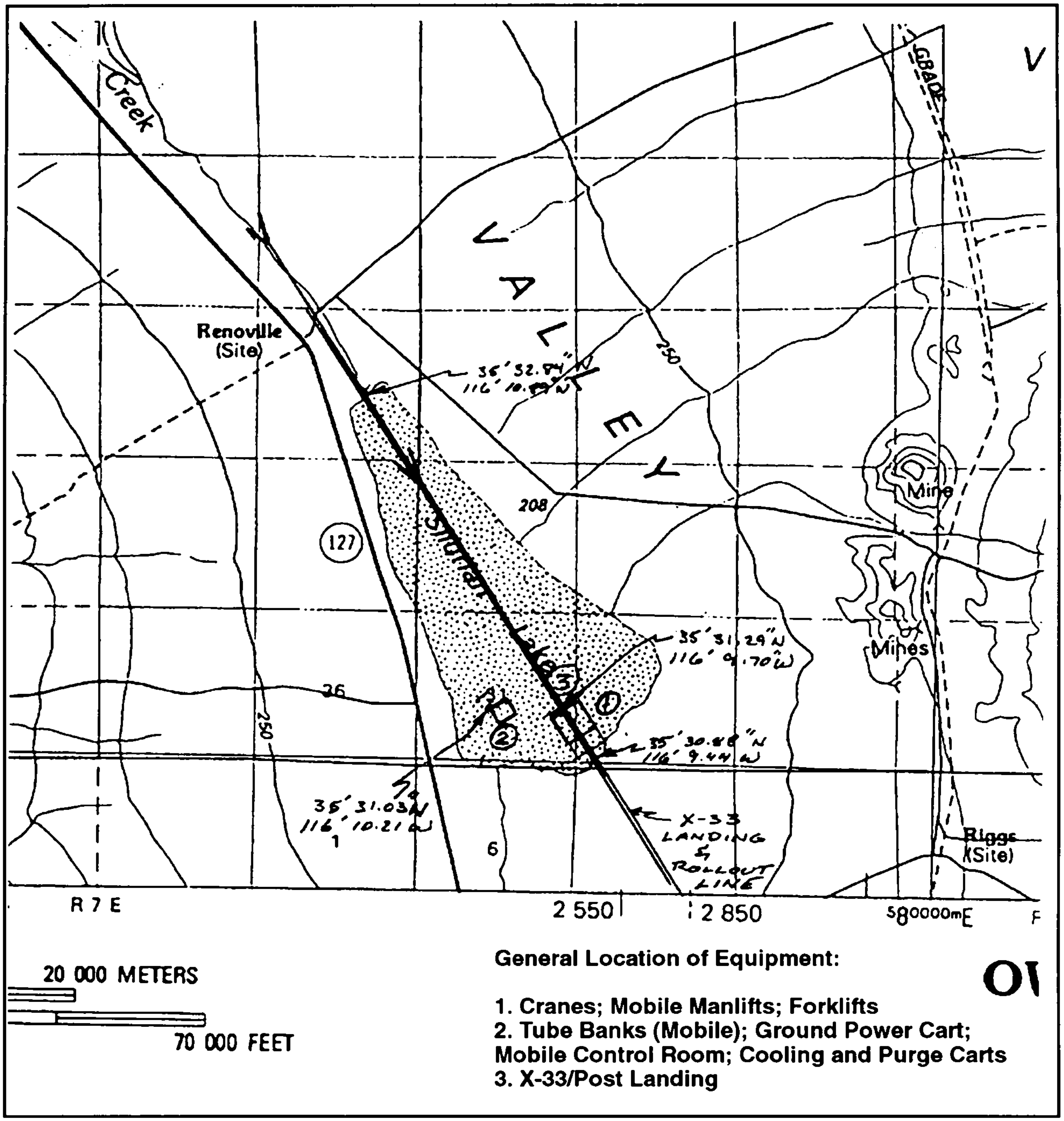

Figure I-3. General Location of Equipment Set-up on Silurian Lake.