ATLAS 2-89-0069

ATLAS2-89-0069

Environmental Impact Analysis Process

ENVIRONMENTAL ASSESSMENT

MEDIUM LAUNCH VEHICLE II (MLV II) PROGRAM
CAPE CANAVERAL AIR FORCE STATION, FLORIDA

February 1989

DEPARTMENT OF THE AIR FORCE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE STATION, PO BOX 92960, WORLDWAY POSTAL CENTER
LOS ANGELES, CA 90009-2960

February 3, 1989

TO: Governmental Agencies, Public Officials, Public Groups and Interested Individuals

Attached for public and governmental agency notification is the Finding of No Significant Impact (FONSI) and the Environmental Assessment (EA) for the Medium Launch Vehicle II (MLV II) program at Cape Canaveral AFS, Florida. This is in compliance with the National Environmental Policy Act of 1969 and the regulations of the President's Council on Environmental Quality.

The FONSI and EA address the environmental impacts associated with the modification and renovation of Space Launch Complex 36 and nearby industrial area to support the launch of Atlas II vehicles. The thirty (30) day notification period is not required based on the standards set in Air Force Regulation 19-2, Environmental Impact Analysis Process, para. 11 f (1-4).

Copies of the FONSI and EA may be obtained by writing to:

Department of the Air Force
Headquarters Space Division, SD/DEV,
Attn: Captain Hector E. Malave
P. O. Box 92960, Worldway Postal Center,
Los Angeles, California 90009-2960

or by calling Capt Malave at (213)643-0935.

Sincerely

WILLIAM E. LEONHARD, JR., COL, USAF
Director of Acquisition Civil Engineering

ENVIRONMENTAL ASSESSMENT
MEDIUM LAUNCH VEHICLE II (MLV II) PROGRAM
CAPE CANAVERAL AIR FORCE STATION, FLORIDA

FEBRUARY 1989

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, SPACE DIVISION
ENVIRONMENTAL PLANNING DIVISION
DIRECTORATE OF ACQUISITION CIVIL ENGINEERING

FINDING OF NO SIGNIFICANT IMPACT (FONSI)
MEDIUM LAUNCH VEHICLE II PROGRAM
CAPE CANAVERAL AFS, FLORIDA

1. PROPOSED ACTION

The proposed action is the modification of Launch Complex 36 (LC 36), pads A and B, and the Industrial Area complex at Cape Canaveral AFS (CCAFS), Florida, to support eleven launches of Atlas II space vehicles from 1991 through 1994. The launches will place ten Department of Defense "Defense System Communications Satellites" (DSCS) and one Space Test Program (STP) satellite in orbit. A maximum of ten launches per year from LC 36 are possible, including up to four military launches and six commercial launches by General Dynamics' Space Systems Division. The commercial launches will be carried out subsequent to licensing under the Commercial Space Act of 1984. The project is necessary to decrease the backlog of DSCS satellites which were removed from the U.S. Space Shuttle manifest in 1986. Alternatives to the proposed action that were considered by the USAF included no action, alternative sites, and alternative launch vehicles. Alternatives were eliminated from detailed consideration in this environmental assessment (EA) because they were incapable of meeting the mission requirements of the MLV II program.

CCAFS is located along the eastern coast of Florida near the city of Cocoa Beach in Brevard County. It occupies approximately 15,800 acres (25 sq. mi.) of the barrier island that contains Cape Canaveral; it is bounded on the east by the Atlantic Ocean and on the west by the Banana River. LC 36 is located at the easternmost apex of the triangular mass of land that comprises CCAFS.

2. SUMMARY OF ENVIRONMENTAL IMPACTS

Air Quality

The air quality impacts from the processing and launch of the Atlas II vehicle would be insignificant because of the relatively innocuous nature of the propellants [RP-1 (kerosene) and liquid oxygen] and the primary combustion products [hydrogen H_2), oxygen (O_2), water (H_2O), carbon dioxide (CO_2) and carbon monoxide (CO)]. The only combustion product of concern would be CO. However, in the lower atmosphere, rapid oxidation would convert most of the CO to carbon dioxide (CO_2) within few seconds after emission. During construction, insignificant amounts of air emissions and volatile organic compounds will be generated because of the relatively small scale of construction and modification activities. Emissions during launch processing activities will be insignificant because of the relatively small amounts of monomethylhydrazine (MMH) and hydrazine (N_2O_4) used and the strict operational safety guidelines used. Thus, no significant air quality impacts would be expected from a normal launch.

Water Quality

Surface water impacts would not be significant. During periods of precipitation, surface runoff would accumulate sediment from disturbed areas. The runoff, however, would discharge to storm drains in paved areas and would infiltrate rapidly (>20 in/hr) to groundwater in unpaved areas.

Discharge from the holding ponds that contain spent deluge water after each launch would be directed into earthen swales. The swales lead to a culvert that connects to a 5-acre wetland area outside the exclusion fence between Launch Complexes 36 A and B. No surface water impacts are expected because gate valves will be installed at the culvert which leads to the wetland to prevent the runoff from reaching the wetland.

Uncontained deluge water would infiltrate to the unconfined aquifer from the unpaved areas around the launch complex and from deluge water discharge to the wetland adjacent to the site. The deluge water discharge has been analyzed following previous launches and has not shown concentrations of chemical constituents in excess of Florida's water quality standards, with the exception of iron. An application for an industrial waste water discharge permit has been submitted to the Florida Department of Environmental Regulation.

Noise

Noise levels during the launch of MLV-II vehicles would be expected to reach a peak of 93 dBA at a distance of 3.1 miles from the launch site. Lower noise levels will be experienced in areas outside of CCAFS. The nearest off-base land area is about 5 miles south of LC 36. The noise from launch vehicles is normally perceived in surrounding communities as a rumble in the distance. The noise, at worst, would be considered an infrequent nuisance as opposed to a health hazard. Sonic booms, which are generated during lift-off of the vehicle and reentry of spent stages, would occur over the open ocean and would not impact developed areas.

Ecology

Limited freshwater habitat exists on CCAFS and only a few freshwater fish species, which are characteristic of harsh environments, inhabit the area. No threatened or endangered fish or aquatic invertebrate species have been identified in the water bodies near the site. Because no adverse impacts to surface water quality are expected and because no construction is planned to occur in the wetland, aquatic biota at the launch site would not be affected.

Construction activities would be restricted to previously disturbed areas of LC 36 and the Industrial Area, therefore no plant and animal habitats would be destroyed, and no significant impacts on biota would occur. Atmospheric emissions during processing and launch and deluge water discharge would not contain toxic substances that would be damaging to vegetation of wildlife habitat. Noise levels during launch could result in some hearing loss among wildlife, increasing their susceptibility to predation; however, population levels would not be expected to decline significantly.

Threatened and endangered species, with the possible exception of three species of sea turtles, would not be significantly affected by the proposed project, because no loss of habitat would occur. However, illumination of the

LC 36 launch pads at night, for security reasons, could affect sea turtle hatchings. The hatchings have been observed to be attracted inland by artificial lighting near other launch complexes adjacent to the beach, whereupon they experienced increased mortality due to desiccation and predation. Consultation by the USAF with the U.S. Fish and Wildlife Service (USFWS) is underway regarding the activities at CCAFS (including LC 36) and their potential to exacerbate the sea turtle issue. Informal consultation between the USAF and USFWS has indicated that mitigation measures can be employed which will avoid a potential taking in violation of Section 9 of the Endangered Species Act. The Air Force will undertake all mitigation measures committed to in the mitigation plan to be completed prior to the operation of LC 36. USFWS agrees in principle with the USAF's proposed measures to mitigate any adverse effects on the endangered turtles from the operation at LC 36. Formal Biological Consultation will occur once a Light Management Plan is prepared by the USAF and submitted to the USFWS. This will occur before the incoming turtle hatch season.

Socioeconomics

Project employment would have a negligible impact on the local population, economy, and other community resources during both construction and operation. Because construction workers would be hired from the local labor pool, no significant impacts are expected. The in-migration of 130 new operations employees would represent 0.09% of the County's employment base, and with their families, 0.12% of the County's 1984 population. This increase would have negligible impacts to the economy and demand for public services.

Cultural Resources

Excavation in undisturbed areas would not occur during modifications to support the MLV II program; therefore, no impact on the archaeological site of Canaveral Town is anticipated. Visual evidence of the historic integrity of LC 36 as part of the space program could be affected by some of the proposed improvements; however, in accordance with the Section 106 of the National

Historic Preservation Act, a Memorandum of Agreement (MOA) has been signed by the USAF, the Florida State Historic Preservation and the Advisory Council on Historic Preservation. The MOA includes mitigation measures which would result in the project having no adverse impacts on the historic values of LC 36.

Accidents

Safety aspects of pre-launch, launch, and post-launch phases of the proposed MLV II program are discussed in the MLV II Accident Risk Assessment Report (ARAR). The potential air quality impacts of accidents associated with the Atlas MLV II program would not be significant given the relatively innocuous nature of the vehicle propellants, the small amounts of toxic propellants (i.e., MMH and N_2O_4) in the payloads, and the hypergolic nature of MMH and N_2O_4 which would result in immediate combustion in the case of a launch failure or accident. Impacts to the water quality of the adjacent wetland and the unconfined aquifer could occur if a propellant or hydrazine spill (prior to launch) drained and deposited in the wetland. Impacts to ecological resources would depend on the amount of fuel spilled and the type of habitat affected. The impacts of an in-flight failure of the launch vehicle would be confined to the vicinity of the deposition of the debris.

Significant impacts to public health and safety could occur only in the event of the simultaneous failure of both the vehicle guidance system and the vehicle destruction system, which could result in the crash and explosion of a vehicle in an inhabited area. The likelihood of such an accident is extremely remote as the simultaneous failure of both the vehicle guidance and destruction systems has never occurred.

3. FINDINGS

The 30-day public notification period for this document is waived as this action does not meet the notification requirements set forth in Air Force Regulation 19-2, Environmental Impact Analysis Process, para. 11 f (1-4):

-This action is not considered to be unusual, new or precedent setting because the USAF has been launching Atlas from LC 36 for over 20 years.

-All environmental controversies have been mitigated, and no scientific controversy is associated with this action.

-A similar action to the one proposed in this document will not normally require an Environmental Impact Statement.

-This action will not have a direct or indirect impact on wetlands due to the preventive measures included in the operational requirements.

Based upon the above, a Finding of No Significant Impact is made. Copies of the Environmental Assessment on the proposed action, dated February 1989, can be obtained from:

Headquarters Space Division, SD/DEV
Attn: Captain Hector E. Malave
P. O. Box 92960, Worldway Postal Center,
Los Angeles, CA 90009-2960

CONTENTS

CONTENTS (continued)

CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

AFTOX	Air Force Toxic Chemical Dispersion Model
Al_2O_3	aluminum oxide
AOC	Advanced Operations Center
ARAR	Accident Risk Assessment Report
CCAFS	Cape Canaveral Air Force Station
CO	carbon monoxide
dBA	decibels, A-weighted (human receptor)
DOD	Department of Defense
DOT	Department of Transportation
DSCS	Defense Systems Communications Satellite
EA	environmental assessment
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESMC	Eastern Space and Missile Center
FDER	Florida Department of Environmental Regulation
GN_2	gaseous nitrogen
gpd	gallons per day
HCl	hydrochloric acid
IDLH	immediately dangerous to life and health
INF	Intermediate Nuclear Forces
KSC	Kennedy Space Center
LC 36	Launch Complex 36
LH_2	liquid hydrogen
LN_2	liquid nitrogen
LO_2	liquid oxygen
MCL	maximum contaminant level
mg/L	milligrams per liter
MLV II	Medium Launch Vehicle II
MMH	monomethylhydrazine
MSL	mean sea level
MST	mobile service tower
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NIOSH	National Institute of Occupational Safety and Health
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
N_2H_4	hydrazine
N_2O_4	nitrogen tetroxide
O_3	ozone
PHC	potential hazard corridor
PM	particulate matter
ppt	parts per thousand
PVC	polyvinylchloride
RP-1	rocket propellant-1 (kerosene)
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SPCC	Spills Prevention Control and Countermeasures

ACRONYMS AND ABBREVIATIONS (continued)

SPEGL	short-term public emergency guidance level
STP	Space Test Program
SV	space vehicle (satellite)
TCD	terminal countdown demonstration
TCE	trichloroethylene
TSP	total suspended particulates
USAF	U.S. Air Force
USFWS	U.S. Fish and Wildlife Service
UT	umbilical tower

1. THE PROPOSED ACTION AND ALTERNATIVES

1.1 THE PROPOSED ACTION

1.1.1 Purpose of and Need for the Action

In support of the U.S. Department of Defense (DOD) space program, the U.S. Air Force (USAF) proposes to renovate and modify Space Launch Complex 36 (LC 36) and the nearby Industrial Area at Cape Canaveral Air Force Station (CCAFS), Florida, to accommodate the proposed Medium Launch Vehicle II (MLV II) program. LC 36 consists of two pads (A and B); the USAF proposes to modify Pad A for the MLV II program. The MLV II program is necessary to ensure continued national defense communications capability through space based satellites, critical to the time-sensitive needs of the DOD global information network. The loss of the Space Shuttle Challenger in 1986, and the subsequent curtailment of Space Shuttle launches resulted in a severe backlog of civilian and DOD satellites awaiting launch. The Defense Satellite Communications System III (DSCS) satellites, once scheduled for launch by the Shuttle, were removed from its manifest and left to alternate vehicles for launch into orbit.

The purpose of the MLV II program is to launch expendable Atlas II vehicles to place ten DSCS satellites and one Space Test Program satellite (STP or P87-B) into orbit over a 4-year period beginning in 1991. An independent but related action planned during the same time frame as the MLV II program (and possibly beyond) is the proposed launch of commercial vehicles and satellites from LC 36, Pad B. In accordance with the Commercial Space Launch Act of 1984 (Public Law 98-575), commercial firms may seek licenses from the U.S. Department of Transportation (DOT) to launch satellites from government facilities on a noninterference basis. General Dynamics, Space Systems Division, plans to conduct a maximum of six commercial launches of the Atlas I vehicle per year from LC 36, Pad B. Portions of the remodeling and expansion projects at LC 36, and the Industrial Area would support both military launches from Pad A and commercial launches from Pad B. Therefore, the proposed commercial activity at LC 36 is discussed in this environmental assessment (EA) to the extent necessary to comprehensively address worst-case environmental impacts at LC 36 and the Industrial Area. This EA is not, however, intended to serve as environmental documentation of future commercial launches at LC 36. Such documentation of any future commercial launches will be conducted as part of DOT licensing procedures.

The MLV II program is a continuation of the USAF MLV program that began with the MLV I, a Delta II expendable space vehicle to be launched from Complex 17 at CCAFS. The MLV I will place Navstar navigation satellites into orbit. An EA prepared by the USAF for the MLV I program (USAF 1988) found no significant environmental impacts.

1.1.2 Project Location

CCAFS is located along the eastern coast of Florida near the city of Cocoa Beach in Brevard County (Fig. 1). The base is ~15 miles north of Patrick Air Force Base (AFB) and adjacent to the National Aeronautics and Space Administration's (NASA's) Kennedy Space Center (KSC). CCAFS occupies ~15,800 acres (25 miles^2) of the barrier island that contains Cape Canaveral; it is bounded on the east by the Atlantic Ocean and on the west by the Banana River.

Launch Complex 36 (LC 36) is located at the easternmost apex of the triangular mass of land that comprises CCAFS (Fig. 2) and to the northeast of Launch Complex 17. The complex consists of two pads (A and B), which are laid out as indicated in Fig. 3. LC 36, Pad A, is the preferred site for the launch of the USAF satellites; however, Pad B, which is proposed to be used for commercial launches, could serve as a reasonable alternative for military launches if Pad A is not functional.

1.1.3 Project Description

The proposed MLV II program at LC 36 would require two major tasks: (1) modification of LC 36 and facilities to the northwest at the Industrial Area (see Fig. 2) to support military and commercial launches and

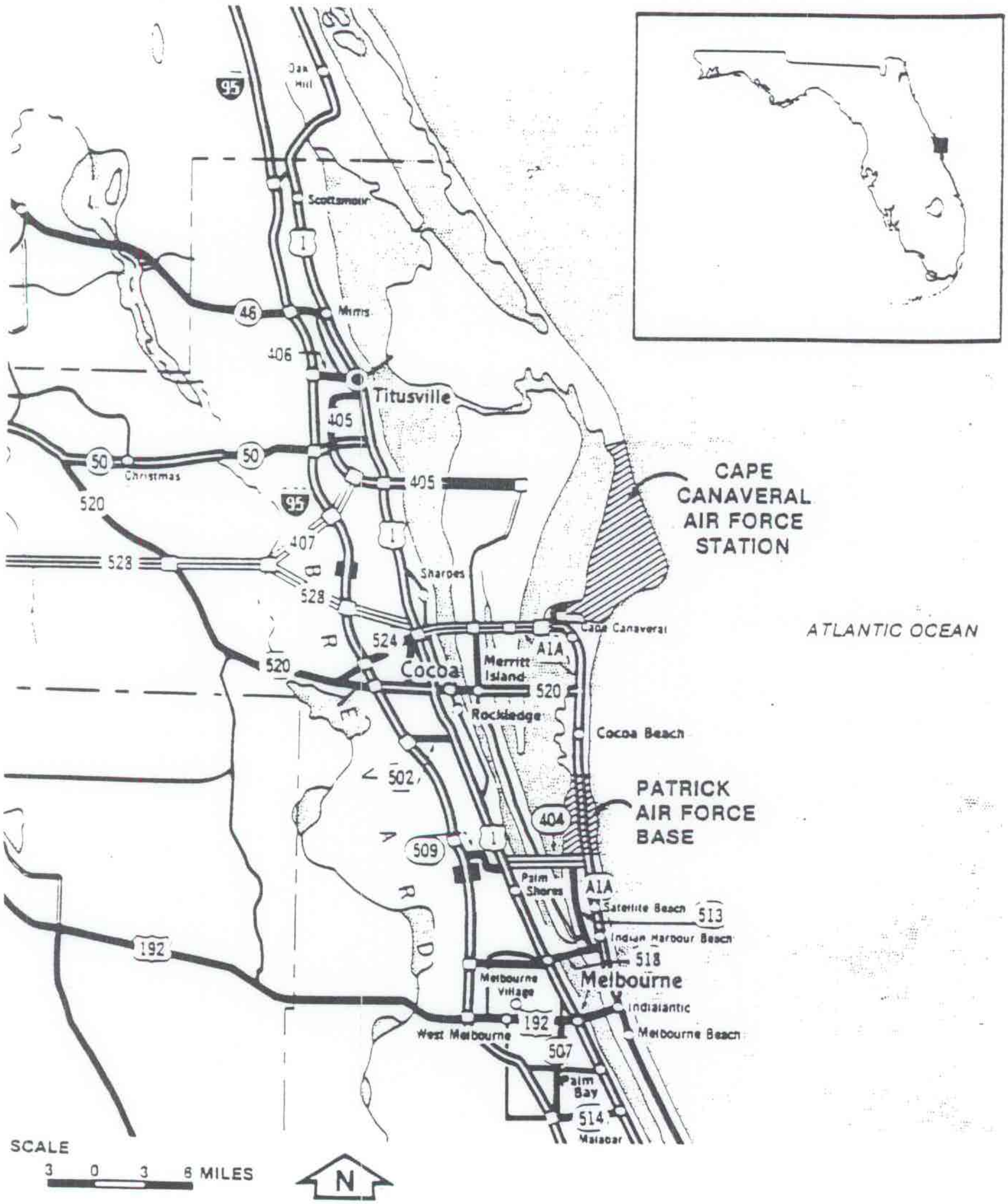


Fig. 1. Regional location of Cape Canaveral Air Force Station in Florida.

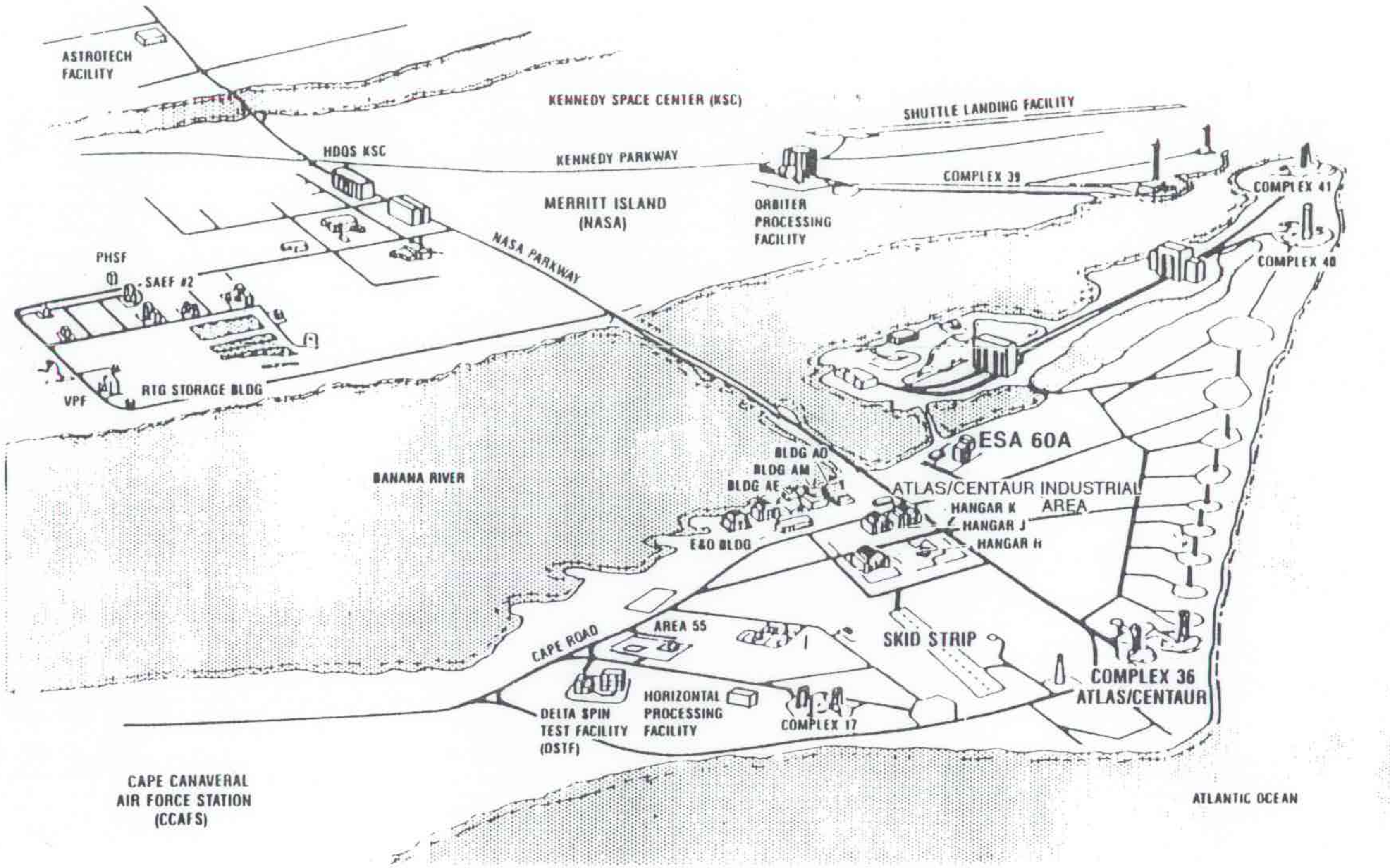


Fig. 2. Location of Launch Complex 36 and Atlas/Centaur support facilities at Cape Canaveral Air Force Station, Florida.

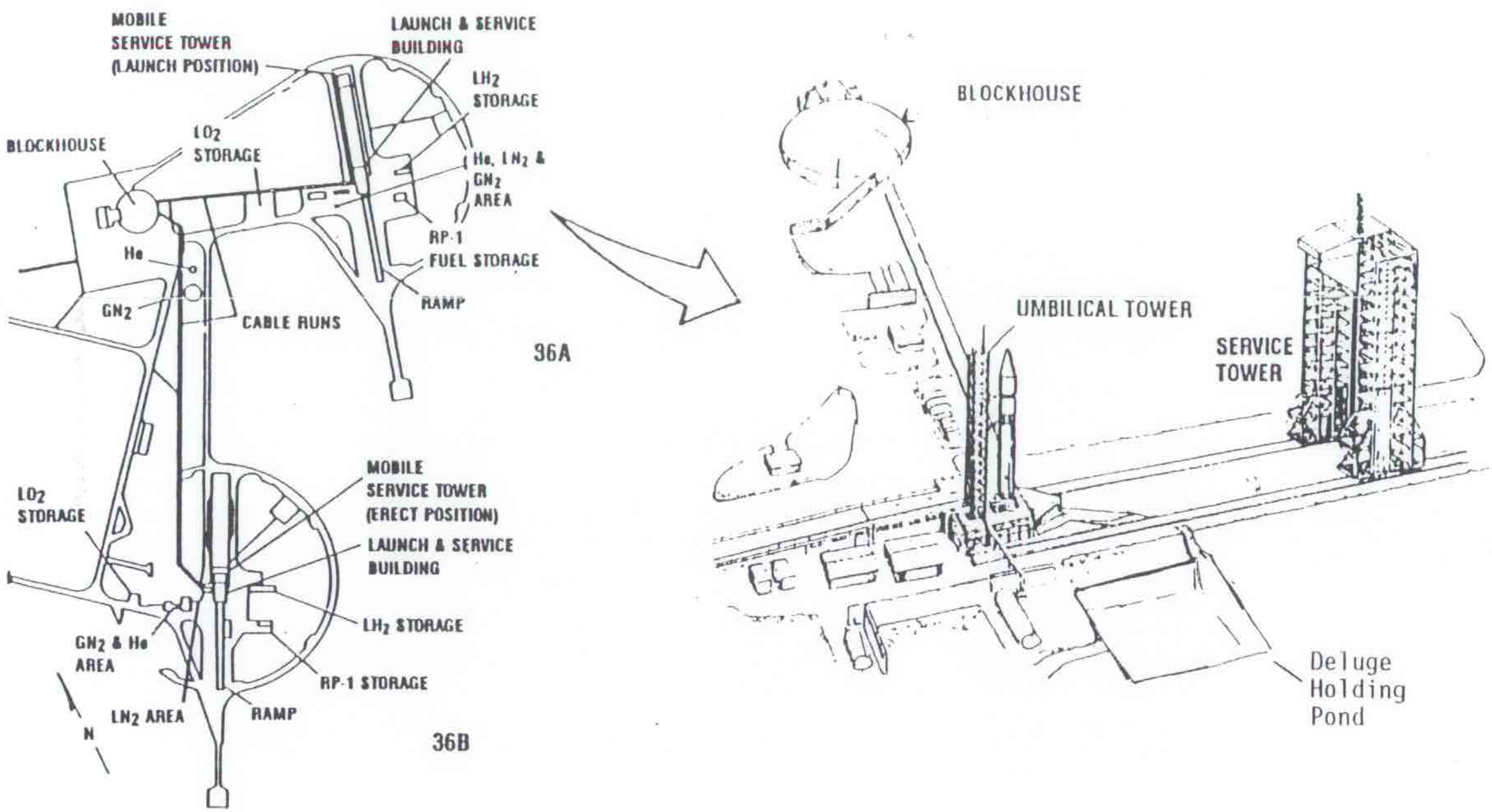


Fig. 3. Layout of space launch complexes A and B at Cape Canaveral Air Force Station, Florida.

(2) subsequent preparation and launching of Atlas II launch vehicles to place military communications satellites in orbit.

1.1.3.1 Background

The USAF, Headquarters Space Division (Los Angeles), will execute the MLV II program, which is proposed to begin in 1991 with three launches and continue through 1994, with four, two, and two launches per subsequent year, respectively. Launches of commercial satellites by General Dynamics at Pad B would also occur over this same period, with a maximum of six launches per year, bringing the total maximum launches possible per year from LC 36 A and B to 10.

LC 36 was constructed in 1959 as a single-pad, single-blockhouse complex (Pad A) to function as an Atlas launch facility for NASA. A second pad (B) was completed in 1965. Pad A has been inactive since May 1983. Pad B was last active as a NASA satellite launch facility in March 1987 and is presently undergoing routine maintenance.

1.1.3.2 Modifications and new construction

Existing facilities at LC 36 and the Industrial Area would be remodeled or expanded and new facilities would be constructed to correct poor working conditions and technical obsolescence, replace program facilities being displaced from other portions of CCAFS, and respond to new program requirements (e.g., vehicle size). Major renovation projects would include (1) addition of a 40-ft vertical extension to the Pad A Mobile Service Tower (MST), (2) construction of a new umbilical tower (UT) at Pad A, (3) asbestos removal, (4) repair or replacement of water mains, (5) construction of a 30,000-ft^2 launch support/office building, and (6) construction of a 46,500-ft^2 Advanced Operations Center. Details regarding these projects and the layout of new facilities are provided in Appendix A.

1.1.3.3 Launch operations

Launch Vehicle

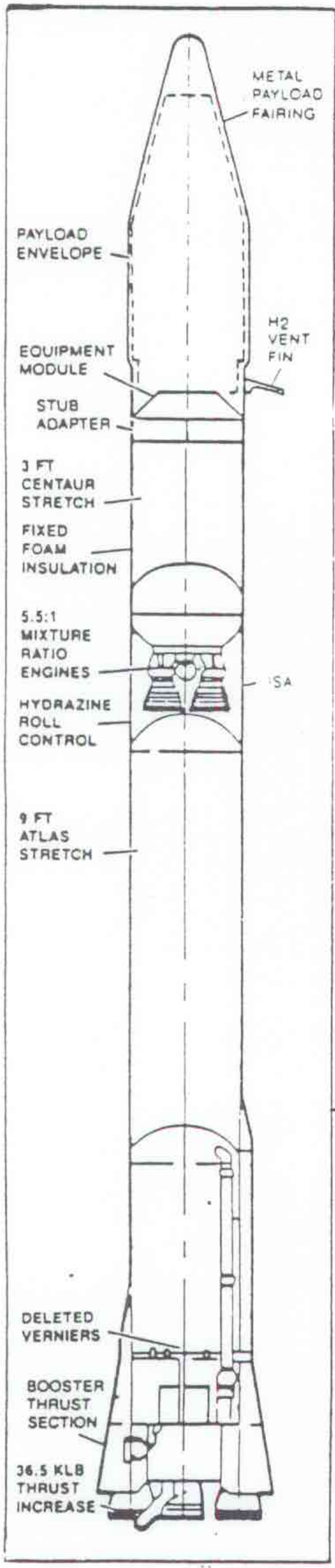
The MLV II would consist of an upper stage (Centaur II), a lower stage (Atlas II), and an interstage adapter (Fig. 4). The Atlas II vehicle has a constant 10-ft diameter with a total length of 81.7 ft. The propellant tanks are of thin-wall, corrosion-resistant, stainless steel construction. The fuel tank, which contains 108,000 lb of space vehicle propellant-1 (RP-1), a kerosene-type hydrocarbon, and the oxidizer tank, which contains 242,000 lb of liquid oxygen (LO_2), are separated by an ellipsoidal intermediate bulkhead. Atlas II propulsion is provided by the Rocketdyne MA-5A engine system. The Atlas and Centaur stages are separated in flight by the firing of eight solid propellant retro rockets mounted around the aft end of the Atlas tank.

The Centaur II upper stage vehicle is also 10 ft in diameter and is 33 ft long. The Centaur II uses liquid hydrogen and LO_2 propellants separated by a double-wall, vacuum-insulated, intermediate bulkhead. The propellant tanks, like those of the Atlas II, are constructed of thin-wall, corrosion-resistant, stainless steel and contain 31,350 lb of LO_2 and 5900 lb of liquid hydrogen (LH_2). In addition, the Centaur II uses a hypergolic propellant [hydrazine (N_2H_4)] in its reaction control system.

An interstage adapter, which provides roll control by means of a hydrazine-powered roll control module, separates the Atlas and the Centaur.

Fuel Storage and Handling

RP-1, LO_2, and LH_2 fuels for the Atlas II vehicle would be stored on-site in existing aboveground tanks at the launch pads. The storage tanks are surrounded by a concrete berm with sufficient capacity to contain their entire contents. The RP-1, LO_2, and LH_2 fuel-loading systems are closed-loop systems with no atmospheric venting and are designed to minimize spills during transfer.



ATLAS II SYSTEM SUMMARY	CENTAUR II SYSTEM SUMMARY
INTERSTAGE ADAPTER FEATURES: SIZE: 10 FT DIA × 13 FT LONG WEIGHT: 1,067 LB	PAYLOAD FAIRING FEATURES: SIZE: 10.8 FT × 34.0 FT LONG WEIGHT: 3,032 LB
ATLAS II FEATURES: SIZE: 10 FT DIA × 81.7 FT LONG PROPELLANT: 344,450 LB LO_2 & RP-1 GUIDANCE: FROM CENTAUR	CENTAUR II FEATURES: SIZE: 10 FT DIA × 33 FT LONG PROPELLANT: 37,000 LB LH_2 & LO_2 GUIDANCE: INERTIAL
SUBSYSTEMS: STRUCTURE: PRESSURE STABILIZED STAINLESS STEEL TANKS SEPARATION: BOOSTER ENGINE PACKAGE —PNEUMATICALLY ACTUATED SEPARATION LATCHES (10) SUSTAINER SECTION —RETRO ROCKETS (8)	SUBSYSTEMS: STRUCTURE: PRESSURE STABILIZED STAINLESS STEEL TANKS ALUMINUM SKIN/STRINGER STUB ADAPTER & EQUIPMENT MODULE
PROPULSION: ROCKETDYNE MA-5A HYDRAZINE ROLL CONTROL	PROPULSION: PRATT & WHITNEY HYDRAZINE ENGINES — 12 (6-LB) THRUSTERS)

Fig. 4. Summary description of the Atlas/Centaur II space launch vehicle.

A maximum of 210 lb of hydrazine would be loaded onto the launch vehicle (i.e., for the Centaur reaction control system and for the interstage adapter roll control module) at the pad. No permanent hydrazine storage is proposed at the launch complex: rather, the hydrazine would be transported, as needed, to LC 36. The hydrazine would be transported from existing hydrazine storage tanks at CCAFS in 55-gal stainless-steel drums on portable loading carts. No hypergolic storage or handling would be required at LC 36 for the payload.

Hydrazine loading of the launch vehicle at the pads would be performed by the range fuels and gases contractor, using a portable transfer system. The system would include a servicing panel and vapor vacuum pump skid, vapor scrubber, drum eductor and drain panels, drum gauge and relief assemblies, vehicle interface fill and sample panel, and interconnecting flex hoses. Hydrazine vapors generated during fueling operations would be routed through an existing scrubber at the pad which absorbs with greater than 99% efficiency. After transfer operations were complete, the system's hydrazine vapor scrubber would be drained to a waste drum for disposal or reuse (see Sect. 2.1.1.6). Spills or accidental releases would be collected in catch vessels beneath the transfer system and disposed of in accordance with the CCAFS Hazardous Substance Pollution Contingency Plan (OPLAN 19-1).

Prelaunch Processing

The prelaunch processing flow is shown in Fig. 5. For military and commercial launches, the Atlas II and Centaur II stages would be transported to CCAFS by air, unloaded onto trucks, and then transported to storage in Hangar J (see Fig. 2). The military payload would be received by truck [with air transport (C5A) backup] and unloaded at a spacecraft processing facility at CCAFS for encapsulation in the payload "fairing." Hypergolic propellants hydrazine, monomethylhydrazine (MMH), and nitrogen tetroxide (N_2O_4) would be loaded onto certain payloads at an existing hazardous materials processing facility at CCAFS. Commercial payload processsing would be conducted offbase at a contractor facility at Titusville, Florida, ~20 miles to the northwest.

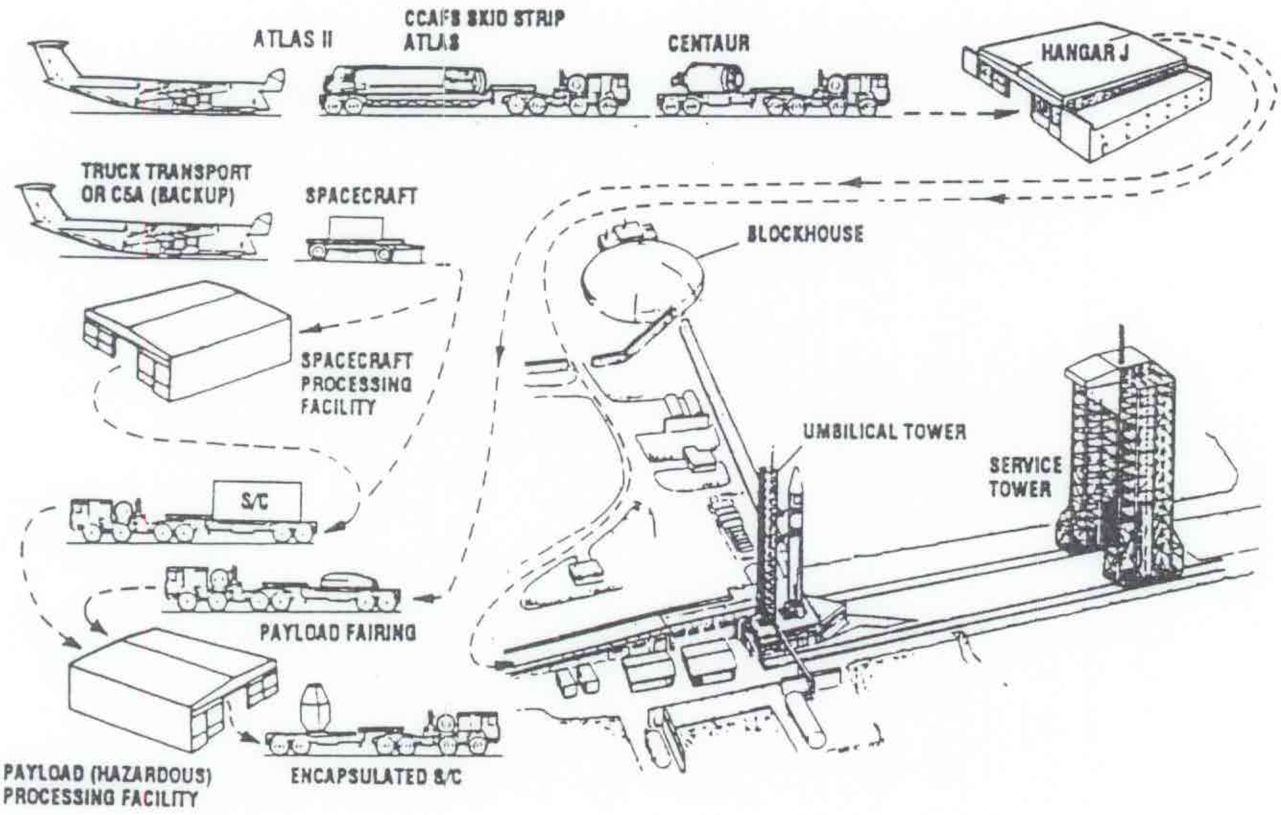


Fig. 5. Pre-launch processing flow for Atlas/Centaur space launch vehicle in the MLV II program.

The Atlas and Centaur would be transported by truck from the storage hangar to the launch complex and erected there. The fueled military payloads would also be transported by truck to the launch pad in a ground transport vehicle which has a nitrogen atmosphere surrounding the payload for safety purposes. Commercial payloads would be transported from off-site over ~3 miles of public roads. The remainder of the transportation route would be on KSC and CCAFS roads.

Countdown and Launch

Launch operations control for both pads would be performed in the blockhouse, which is located in the northwest corner of the complex (see Fig. 3). The blockhouse contains all the necessary electrical and communications equipment to remotely operate and monitor the testing and launch operations.

The launch pad milestone schedule in Fig. 6 describes activities during the countdown to support four USAF launches per year at Pad A. The countdown for commercial launches at Pad B would be identical. Final system checkout and vehicle-propellant loading would occur during the 8 days before launch. Various vehicle testing and checkout procedures and launch complex operations would require the release of deluge water as follows: (1) a water test to verify the integrity of the deluge water piping system; (2) a terminal countdown demonstration (TCD), which is a mock launch that includes deluge water discharge; (3) discharge of the deluge water during the actual launch; and (4) a final water test to determine if any of the deluge piping was damaged during the launch. The initial and final water tests use 96,000 gal each, the TCD uses 273,000 gal, and the actual launch 280,000 gal, for a total deluge water usage of 745,000 gal. Except for that which is vaporized during launch, all deluge water is discharged to grade.

The sequence of events following lift-off is depicted in Fig. 7. Following ignition and launch, the Flight Termination System is capable of initiating engine shutdown and vehicle destruct action during flight before

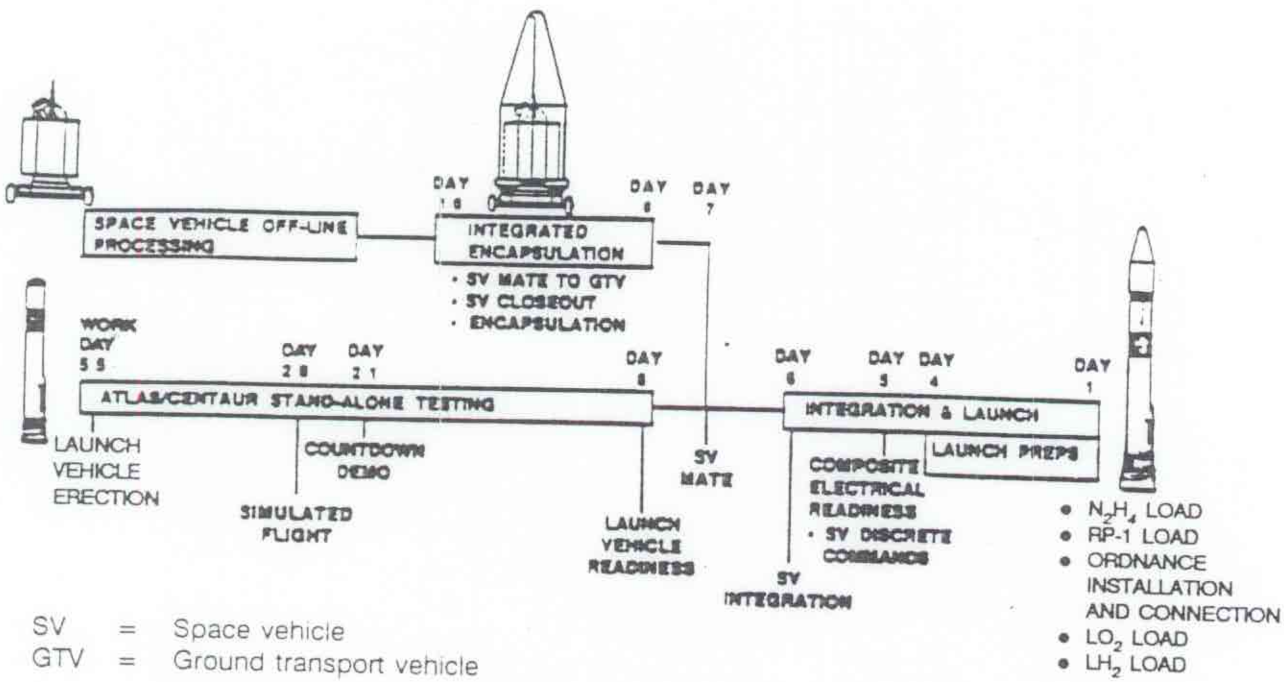
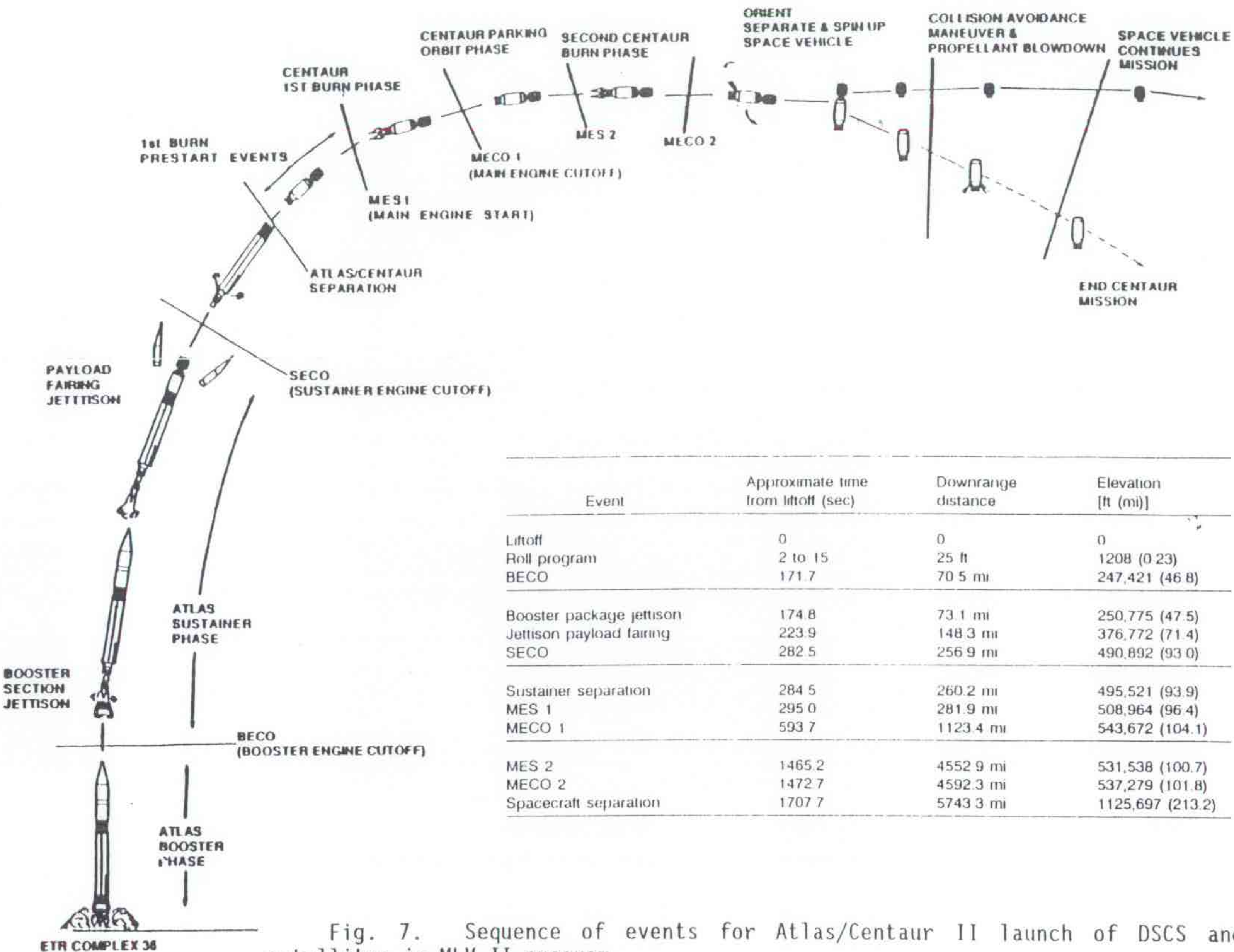


Fig. 6. Integrated launch pad schedule for MLV II program.



Event	Approximate time from liftoff (sec)	Downrange distance	Elevation [ft (mi)]
Liftoff	0	0	0
Roll program	2 to 15	25 ft	1208 (0.23)
BECO	171.7	70.5 mi	247,421 (46.8)
Booster package jettison	174.8	73.1 mi	250,775 (47.5)
Jettison payload fairing	223.9	148.3 mi	376,772 (71.4)
SECO	282.5	256.9 mi	490,892 (93.0)
Sustainer separation	284.5	260.2 mi	495,521 (93.9)
MES 1	295.0	281.9 mi	508,964 (96.4)
MECO 1	593.7	1123.4 mi	543,672 (104.1)
MES 2	1465.2	4552.9 mi	531,538 (100.7)
MECO 2	1472.7	4592.3 mi	537,279 (101.8)
Spacecraft separation	1707.7	5743.3 mi	1125,697 (213.2)

Fig. 7. Sequence of events for Atlas/Centaur II launch of DSCS and STP satellites in MLV II program.

orbit insertion in response to range-transmitted radio frequency commands by the USAF Range Safety Officer in the event of vehicle malfunction.

1.1.3.4 Personnel requirements

Construction and renovation at LC 36 and the Industrial Area would occur over a 30-month period beginning in 1989. Construction employment would reach a peak level of ~300 employees in April 1989. More than 100 workers would be required for ~15 months, and >200 for about 7 months. Construction employees would be provided by subcontractors and would be drawn from the current labor force of Brevard County and nearby counties.

Operation of the MLV II program at LC 36A would be performed by the same employees who conduct commercial launches at LC 36B. Operations employment would peak at ~350 persons near the end of 1989. About 190 of these operations personnel are currently stationed at CCAFS. Of the remaining 160 employees, ~80 would be hired from the local labor pool and 80 would be relocated from other areas. By the third quarter of 1990, employment is expected to decline slightly to ~310 persons; this level would be maintained for the remainder of the commercial and military launch programs.

1.2 ALTERNATIVES TO THE PROPOSED ACTION

1.2.1 No-Action Alternative

No action would not satisfy the DOD mission requirement to place communications satellites in orbit, in the face of the backlog of satellites awaiting launch by the Space Shuttle. Launch delays would amount to a loss of communications capability, inasmuch as satellites would not be placed in orbit, under present payload priorities for the Space Shuttle, in time to replace existing communications satellites or to fulfill new mission requirements. Environmental impacts associated with the MLV II program would not be realized if no action is taken.

1.2.2 Alternatives Eliminated from Detailed Consideration

1.2.2.1 Alternate sites

Selection criteria for a suitable launch site included economics, ability to meet the technical requirements of the Atlas II vehicle, and availability for launching the satellites on schedule. The use of sea platforms or construction of a new launch site were eliminated for technical and economic reasons, respectively. Selection of a launch site for the MLV II vehicle was narrowed to the Space Launch Complexes at Vandenberg AFB near Santa Barbara, California, and Launch Complexes at CCAFS. The Vandenberg site was eliminated from detailed consideration as a reasonable alternative because it is restricted to launching satellites into polar, rather than equatorial, orbits; the DSCS III and STP satellites are planned to function in equatorial orbits. Launches from Vandenberg into equatorial orbits are prohibited because the vehicle would travel over heavily populated areas following launch and would, therefore, subject the public to the risk of catastrophic accidents.

1.2.2.2 Alternate complexes at CCAFS

Launch complexes are designed and constructed for a specific launch vehicle or family of launch vehicles. Only those launch complexes at CCAFS that have previously launched the Atlas I space vehicle (LCs 12, 13, 14, 15, and 36) were considered for use in the MLV II program because of economic, technical and scheduling reasons. Of these, LC 36 is the only operational Atlas launch complex. Other complexes at CCAFS were designed for launch vehicles other than the Atlas, and they are still being used to support those vehicles and the DOD mission designed for them. (These include LC 41 - Titan IV; LC 40 - Titan 34D; LC 39, Space Shuttle; and LC 17 - Delta II.) To modify other complexes to support the Atlas II vehicle would result in the displacement of the design vehicles and their corresponding missions not being met. In addition, since other complexes were designed for non-Atlas vehicles, the modifications required to support the Atlas II would be more extensive than at LC 36, which was designed to support the Atlas vehicle. Therefore, for DOD mission, economic, technical, and scheduling reasons these other pads were eliminated from further consideration.

1.2.2.3 Alternate launch vehicles

Selection of a space launch vehicle depends upon two primary factors: (1) the specific payload to be supported; and (2) the availability of existing space launch vehicles to meet the payload requirements. Payload requirements such as the weight, the specific orbit the payload is to be placed in, and the size of the payload must be considered. Given the high cost of space launch activities, economics dictate that the space vehicle selected not have significant heavier payload lift capabilities in excess of the payload it is being selected to support. In addition, given the cost and schedule associated with the development of a new space vehicle, significant consideration is given to the applicability of space launch vehicles currently in DOD's inventory whch could meet the technical payload requirements of the specific program.

In consideration of the above, the selection of the MLV II vehicle was based upon the technical requirements of the DSCS III payload and to meet the DSCS III schedule; it was also based upon the evaluation of current space launch vehicles. These two criteria resulted in the Atlas II and Delta II space launch vehicles being identified as the vehicles that best met the technical, economic, and schedule requirements. Delta II had been previously selected to support the MLV I program and the launch of the Global Position System (GPS) Navstar satellite. Given the high national defense priority of both the GPS Navstar Program and the DSCS III Program, the USAF decided that both programs should not rely upon the same space launch vehicle. Therefore, the use of the Delta II space launch vehicle was eliminated from further consideration.

Also considered was the use of the larger Titan IV launch vehicle, which is planned as a backup to the Atlas II. The Air Force does not consider exclusive use of the Titan IV for the MLV II program as reasonable because of the much higher costs associated with it and because of competition for its use to launch other higher priority (i.e., national security) satellites.

Use of the Space Shuttle to launch the DSCS satellites was discounted because the capacity of the Shuttle to launch satellites is limited. As noted earlier, the loss of the Challenger and resulting shutdown of the program created a substantial backlog of civilian and military payloads. To accommodate the civilian sector demands, the DSCS III satellites were removed from the scheduled Shuttle launch manifest. Although these satellites could be placed back on the manifest, the present Shuttle launch schedule and other current payload priorities of national significance would delay DSCS III launch unacceptably (see Sect. 1.1.1).

1.2.2.4 Alternatives other than launch

There are no alternate means of deploying DSCS satellites for use in the defense communications network. Discontinuing the use of satellites in government and civilian telecommunications networks would be a counterproductive, technological step backwards which would negate the advances made in recent decades.

1.3 SCOPE OF THIS ENVIRONMENTAL REVIEW

This EA has been prepared by the USAF, Headquarters Space Division, to satisfy the environmental review requirements set forth in the National Environmental Policy Act of 1969 (NEPA; Public Law 91-190). It was prepared in accordance with the President's Council on Environmental Quality regulations implementing NEPA (40 *CFR*, Parts 1500-1508) and Air Force Regulation 19-2 (August 10, 1982).

Based upon the requirements of the MLV II program and the environmental setting of CCAFS, this EA focuses on the potential for impacts to air and water quality, federal- and state-listed threatened and endangered species, and historic resources. Socioeconomics, noise, and geology are discussed in less detail because of the low potential for adverse impacts.

LC 36, Pad A, is the preferred site for launch of the USAF satellites; however, Pad B could serve as a reasonable alternative if Pad A is not functional. Therefore, this EA discusses the environment of both pads at LC 36 to cover the optional use of either and to provide NEPA documentation for all future launches of military vehicles at the complex. This EA discusses commercial activities at LC 36 and the Industrial Area only to the extent necessary to fully characterize the worst-case scenario, a maximum of ten launches per year, at LC 36.

2. THE AFFECTED ENVIRONMENT, IMPACTS FROM NORMAL OPERATIONS, AND MITIGATION

2.1 MAN-MADE ENVIRONMENT

2.1.1 Community Resources

2.1.1.1 Existing environment

Land Use

CCAFS occupies ~15,800 acres on the Cape Canaveral Barrier Island in Brevard County, Florida (see Fig. 2). The base is bordered by the KSC to the north, the Atlantic Ocean to the east, the city of Cape Canaveral to the south, and the Banana River and Merritt Island Wildlife Refuge to the west. Nearby population concentrations and growth centers are the cities of Cape Canaveral (0.5 mile south), Cocoa (7 miles southwest), Cocoa Beach (8 miles south), Titusville (12 miles northwest), and Patrick AFB (15 miles south).

The primary function of CCAFS is to support DOD, NASA, and commercial users by providing launch, tracking, and other facilities. Launch complexes and support facilities occupy ~30% of the land area of the base; the remaining area is unimproved.

The pattern of developed land use on the base consists of launch complexes along the eastern edge with supporting facilities located in the central and western portions of the base. The launch complexes are the main use of developed land on the base. More than 40 complexes, many of which have been deactivated or dismantled, line the eastern edge of the base (see Fig. 8). Other facilities include a small Industrial Area (near the center of the western border of the base), the Air Force Space Museum, Trident and Poseidon submarine wharfs (at the southern boundary of the base), NASA Mission Control, and a skid airstrip (near the center of the base). Numerous hangars, located mostly on the western portion of the base, are used for assembling and testing purposes. No major changes are foreseen in the pattern of land use on the base.

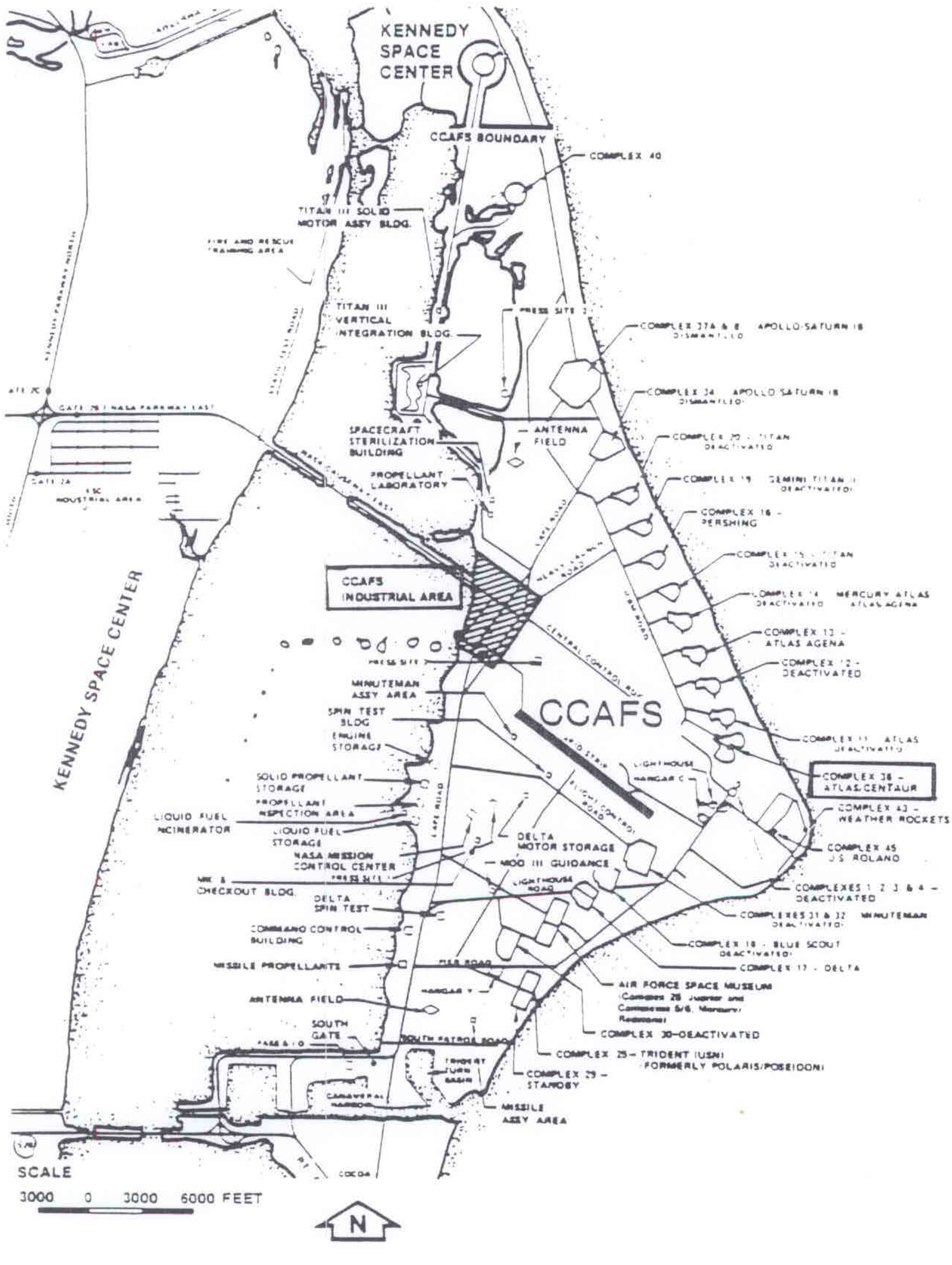


Fig. 8. Launch complexes and support facilities at Cape Canaveral Air Force Station, Florida. Launch Complex 36 and the Industrial Area are highlighted.

LC 36 occupies ~45 acres near the center of the eastern boundary of the base. This area includes two launch facilities, Pads 36A and 36B, which cover approximately equal amounts of land. Facilities at LC 36 include

1. a launch control building,
2. a sentry house.
3. two launch and service facilities,
4. two service structures.
5. a shop and administration building,
6. a water booster pump house.
7. three paint storage buildings.
8. two RP-1 storage areas.
9. two LH_2 storage areas.
10. two LO_2 storage areas.
11. two liquid nitrogen storage areas,
12. three gaseous nitrogen storage areas,
13. a storage building,
14. a storage shed.
15. an air conditioning building,
16. two optical alignment buildings,
17. two high-pressure gas storage areas.
18. two valve pits.
19. a fire pump pad.
20. two theodolite buildings,
21. two deluge water holding basins,
22. a maintenance shop,
23. a wind-measuring tower,
24. an electric substation,
25. a sewage lift station, and
26. a sewage treatment plant.

Demography

Each decade since World War II has brought a change in the character of the population of Brevard County. Through the 1940s, the county was predominantly rural. Subsequent activation of CCAFS in the 1950s brought military personnel into the population. In the 1960s the county became decidedly more urbanized. The number of retirees moving to the county increased during the 1970s. The county's population was 323,055 in 1984, with principal urban centers in the cities of Melbourne (51,116), Titusville (36,701), Palm Bay (31,276), and Cocoa (16,848) (see Fig. 1). By the year 2000, the county's population is projected to reach 491,700, a 52% increase over the 1984 level.

No permanent residents are located on CCAFS. Most people working on the base are employees of contracting companies associated with missile testing and space-launch operations. These employees live in surrounding communities. All military personnel at CCAFS are assigned to Patrick AFB.

Housing

The average household in Brevard County in 1984 included 2.56 persons, and most of the dwelling units were owner occupied. The county had 113,900 dwelling units in 1983, of which ~25.4% were rental units. The vacancy rate in the county was 10.6%.

Economy

The labor force of Brevard County included ~140,134 persons in 1984, and the unemployment rate was 5.3%. In addition to resident employees, many people commute from surrounding areas to work in the county. While services, manufacturing, and retail trade are the principal means of employment, ~9% of the residents work for government-related enterprises. Major employers include KSC, Port Canaveral, CCAFS, Martin-Marietta, Harris, and Dictaphone.

The total personal income of Brevard County residents in 1983 was $2.42 billion, with government-related employment accounting for $0.44 billion (18%). Military income contributed $0.08 billion of the government-related income. The annual per capita income of county residents was $11,481.

Transportation

Transportation services in the region are provided by highway, rail, airport, and harbor facilities. Federal, state, and local roads provide highway service to Brevard County. Principal routes include Interstate 95, U.S. 1, and State Routes A1A, 407, and 520 (see Fig. 1). Bridges and causeways link the urban areas on the beaches to Merritt Island and the mainland. The Florida East Coast Railway provides rail service to the county, with a main line through the cities of Titusville, Cocoa, and Melbourne. Spur rail lines serve other parts of the county, including CCAFS. Several commercial and general aviation airports are located in the vicinity of CCAFS, the closest being Melbourne Regional Airport, ~30 miles south of the base. Port Canaveral, located at the southern boundary of CCAFS, provides seaport facilities to the area. Industrial and commercial facilities are located at the port, and cruise ship use is increasing.

The onbase road system, which is linked to the regional highway system by the NASA Causeway, provides access to launch complexes, support facilities, and industrial areas. A branch rail line, maintained on the base by USAF, links the base to the main line at Titusville. A skid airstrip near the center of the base is used by government aircraft and for the delivery of launch vehicles. Water transportation is provided to the base by Port Canaveral.

Roadways at CCAFS and offbase are adequate for the traffic volumes they carry. Traffic slows during peak hours, but flow remains steady, and significant delays seldom occur. All vehicles must stop for security checks at CCAFS.

Water

Potable water is supplied to the central portion of Brevard County by the city of Cocoa. Water is drawn from wells in the confined aquifer in Orange County (see Sect. 2.2.2.2) that have a capacity of 32 million gal/day (mgd). CCAFS receives water under a contract with the city through a 24-in. main with a capacity of 3 mgd. Potable water is supplied to LC 36 through an 18-in.

main, and water for the deluge system and fire protection is supplied by a 20-in. main. The mains at LC 36 have a history of leaks and are unreliable. New water mains are planned in the MLV II program improvements.

Waste Management

Sanitary sewage treatment at LC 36 is provided by a sewage treatment plant located near the launch control building. The plant has a capacity of 12,500 gal/day (gpd) and currently treats ~1,000 gpd.

Nonhazardous solid waste at CCAFS is managed according to the nature and quantity of the waste. The CCAFS sanitary landfill, which is located near the skid airstrip, accepts only construction debris. Debris from large construction projects is usually disposed of offbase by the contractor.

Hazardous wastes at CCAFS are managed by a joint USAF/NASA contractor certified to conduct hazardous waste disposal. Wastes not incinerated or recycled would be placed in interim storage at a designated area that meets interim status performance standards for up to 90 days before being transported to a permitted storage site or off-site for disposal. The contractor would handle disposal in accordance with state and federal regulations and the Eastern Space and Missile Center (ESMC) Hazardous Waste Management Plan (OPLAN 19-14). Hazardous wastes generated in support of commercial launches would be disposed of by a General Dynamics contractor.

Power

Electricity is supplied to CCAFS by Florida Power and Light Company through a 240/138-kV switching station. LC 36 is served by 13.2-kV lines.

Security and Fire Protection

Police service on CCAFS is provided by Pan American Security. Fire protection is provided through a mutual agreement among the city of Cape Canaveral, KSC, and the Range Contractor at CCAFS.

Health Services

Basic health services at CCAFS are provided by a dispensary that is operated under contract to NASA. The dispensary normally operates 40 h/week but is staffed during all phases of missile launches. The dispensary handles accident cases, physical examinations, and emergencies that occur on the base. Hospitals at Patrick AFB and in Cocoa, Titusville, and Melbourne are used when appropriate medical services cannot be provided by CCAFS dispensary.

2.1.1.2 Impacts

Land Use

Because construction and operations activities would not be expected to result in any significant increase in the local population, no impacts to community land use patterns would occur. The proposed modifications to LC 36 and the Industrial Area of CCAFS would not change the industrial nature of land use at these sites.

Demography

Construction employees would be drawn from the current labor force of Brevard County and surrounding counties; thus, there would be no impact on the size or composition of the local population. Approximately 80 employees would be relocated to Brevard County from other regions for project operations. Assuming that the families accompanying these employees would include 3.1 members (Malhotra and Manninen 1981), the county's population would be increased by about 248 persons. This increase, which amounts to ~0.08% of the county's 1984 populations, would have a negligible impact on the size and composition of the local population.

Housing

No impact on housing would occur during the construction period since construction workers would be drawn from the local labor pool and would be expected to commute from their present residences. The small population increase of ~248 persons expected during project operations would have a negligible impact on the existing housing market, which includes ~12,000 vacant units.

Economy

Construction employment for the proposed project would peak at ~300 employees, who would be drawn from the current labor force of Brevard County and nearby counties. (Recent data indicate that ~500 county construction workers are unemployed.) The total payroll during the 30-month construction period would be ~$7.2 million. Information for the first quarter of 1988 from the Florida Department of Labor and Security indicates that the basic income multiplier for Brevard County is 1.56; that is, each dollar of "new" money brought in from outside the county circulates in the local economy until it has increased total income by ~$1.56.) Application of this multiplier to the estimated construction wages indicates that the total (direct and secondary) economic impact of construction employment would be an increase of ~$4.5 million in the total annual personal income of Brevard County averaged over 30 months [($7.2 million X 1.56) / 2.5 yrs]. This increase amounts to ~0.19% of the county's 1983 income. Based on economic information from 1983 and 1984, this increase in economic activity would generate ~93 new jobs in the county in addition to the direct project construction employment.

Approximately 160 new employees would be required during operation of the proposed program. The annual payroll for these employees would be ~$4.2 million. Application of the basic income multiplier indicates that the total (direct and secondary) economic impact of the operations employment would be an annual increase of ~$6.6 million in the total personal income of Brevard County ($4.2 million X 1.56). This increase, which amounts to ~0.27%

of the county's 1983 income, would generate ~136 new jobs in the county in addition to the direct project operation employment.

The most noticeable impact on the local economy would occur during the second half of 1989, when both construction and operation staffing are at high levels. During this period the total impact of project activities would be the addition of ~612 jobs in Brevard County. This increase amounts to ~0.42% of the county's labor force and only ~7.4% of the ~8300 persons who were unemployed in the county in August 1988 (Taylor 1988). In-migration, then, would be limited to the 80 operations employees and their families who would be transferred to the area. Thus, the expected changes in income, employment, and population are so small in the socioeconomic context of Brevard County that the project would have a negligible impact on the local population, economy, public services, and housing market.

Transportation

Because construction and operation activities associated with the MLV II program would not be expected to result in any significant increase in the local population, no impacts to transportation networks would occur. The proposed modifications to LC 36 and the Industrial Area would not necessitate any changes in the transportation network of CCAFS. The volume of traffic on the base would increase temporarily while modifications of the launch complex are under way. This increase would most likely occur on the NASA Causeway and the Central Control Road and would not result in traffic volumes exceeding the capacities of these roadways. More frequent, brief delays would result from an increased number of security checks at the base entrance.

Water

The current water supply to LC 36 is adequate for the needs of the MLV II program; however, some existing leaking mains serving the complex would be replaced as part of the program.

Waste Management

Construction and expansion of facilities for the MLV II program would generate conventional wastes (wood and metal scrap, excess concrete flashing, etc.), which would be disposed of either at the onbase site or at an approved offbase site (probably the Brevard County Solid Waste Disposal Facility) as prescribed by the USAF in the project specifications.

Nonhazardous solid waste generated during operation of the program would consist of standard domestic waste (e.g., trash from offices) and sludge from the sewage treatment plant at LC 36. Standard domestic waste would be collected by a range contractor and disposed of offbase at the Brevard County Solid Waste Disposal Facility.

Sanitary sewage would be treated by the treatment plant at LC 36. Based on the number of people expected to be involved in operations at the launch complex, the volume of wastewater to be treated would average ~5,700 gpd. Assuming that the peak flow would be no greater than twice the average daily flow, the maximum flow of wastewater through the treatment plant would not exceed 11,400 gpd. No modifications would be required to the existing treatment plant, which has a capacity of 12,500 gpd. Sludge from the sewage treatment plant would be analyzed to determine if it contains hazardous substances. If so, it would be treated as hazardous waste; if not, it would likely be spread over the onbase solid waste landfill.

Conventional hazardous wastes, such as paint wastes, solvents, and potentially contaminated oils, are anticipated to result from construction. These wastes would be managed by a certified contractor as described in Sect. 2.1.1.6, and no significant impacts would be expected. Asbestos encountered during refurbishment would be removed by a licensed contractor in accordance with National Emissions Standards for Hazardous Air Pollutants (40 *CFR* 61), which the state of Florida has incorporated into its regulations by reference, and disposed of at the CCAFS sanitary landfill in accordance with ESMC OPLAN 19-15. The quantities of hazardous waste from construction for the MLV II program would not significantly impact landfill capacity.

Hazardous waste generated during project operations would consist of trichloroethylene (TCE) from cleaning operations (50-100 gal per launch) and Freon (~50 gal per launch for cleaning and propulsion). The TCE would either be recycled on-site or incinerated off-site. The Freon wastes would be collected and recycled by a KSC contractor. Another liquid waste generated during operation. hydrazine vapor scrubber effluent (~20 gal of liquid waste per launch), would consist of deionized water contaminated by <1 lb of hydrazine. The effluent has been exempted from hazardous waste classification by the Florida Department of Environmental Regulation (FDER) (see Appendix C), and would be disposed of at an onbase fire training pond having a concrete structure and a syntnetic liner. Smaller quantities of hazardous wastes would be generated by operation of the MLV II program than from previous activities at LC 36 and the wastes would be recycled, incinerated, or reused; therefore, no significant impacts would be expected.

Other

The current electrical service to LC 36 is adequate for the needs of the MLV II program. and no modifications would be warranted. The small amount of new construction associated with the program and the small increase in population would not require additional security personnel, fire protection equipment and personnel, or health service facilities and personnel. The minor increase in area population due to the project would have an negligible impact on public utilities and services in Brevard County.

2.1.1.3 Mitigation

No significant impacts to community resources would be expected from the MLV II program; therefore, mitigation would not be necessary.

2.1.2 Cultural Resources

2.1.2.1 Existing environment

Archaeological and historical surveys of CCAFS were conducted in 1984 (Levy, Barton, and Riordan 1984; Barton and Levy 1984). The surveys identified 32 prehistoric and historic sites and several uninvestigated historical localities associated with the 4000- to 5000-year human occupation of the cape. Many of the identified sites were reported to have been disturbed by construction associated with the development of CCAFS. The survey recommended further evaluation for 11 sites to determine if they were eligible for the National Register of Historic Places.

LC 36 is within an area identified (Levy, Barton, and Riordan 1984) as the historic archaeological site of Canaveral Town (sites BR238, CC22), a development planned in 1924 to consist of 29 residences, central electrical and water systems, a store, a garage, a clubhouse, and a hotel. A road system and some of the structures were built. The site has been heavily disturbed by construction activities, including the excavation of a borrow pit near the center of the development and the construction of LCs 11 and 36A. The archaeological and historical survey indicates that undisturbed remnants of the development may exist west of LC 36A.

LC 36 is also among the 21 launch complexes that Barton and Levy (1984) identified as potentially eligible for inclusion in the National Register of Historic Places because of their significance to the U.S. Space Program. They note that "within these launch complexes are buildings and structures which contribute to the 'engineering significance' of the complexes." The study recommends site preservation as the ideal alternative but proposes that data recovery measures be taken whenever preservation is not possible.

2.1.2.2 Impacts

Because excavation in undisturbed areas is not proposed during modifications to support the MLV II program, no impact on the archaeological site of Canaveral Town is anticipated. The historic integrity of LC 36 in the space program could be affected by some of the proposed improvements (construction of a new UT and one new building, extension of the existing MST, and removal of several existing structures). Comments were requested by the USAF from the State Historic Preservation Officer (SHPO) (see Appendix B) to assist in assessing the impacts of the proposed action on historic and archaeological resources. Because LC 36 is a historic site eligible for the National Register, the USAF submitted a finding of No Adverse Effect for the MLV II program to the SHPO and to the Advisory Council on Historic Preservation (ACHP), in accordance with Section 106 of the National Historic Preservation Act. This finding is supported by a Memorandum of Agreement (MOA) among the USAF, SHPO, and ACHP regarding mitigation to be undertaken to preserve the historic eligibility of LC 36. Correspondence on this issue is provided in Appendix B.

2.1.2.3 Mitigation

Mitigation of impacts to the historic integrity of LC 36 are provided in Appendix B in correspondence among the USAF, SHPO, and ACHP.

2.1.3 Noise

2.1.3.1 Existing environment

Monitoring of ambient noise levels at CCAFS has not been performed. Noise levels at LC 36 would be expected to approximate those present in an urban industrial area, 60-80 dBA.

2.1.3.2 Impacts

The MLV II program would not produce a sustained increase in noise that would be perceived as a change in the "normal" level. Instead, the noise impacts of the program would be associated with brief, infrequent but intense sound events that would be noticeable when superimposed on ambient levels.

The operations of space vehicle engines and launch vehicles produce significant sound levels. Four types of noise occur:

1. combustion noise emanating from the space vehicle chamber,
2. jet noise generated by the interaction of the exhaust jet with the atmosphere,
3. combustion noise resulting from the postburning of the fuel-rich combustion products in the atmosphere, and
4. sonic booms.

The first three types of noise combine to produce the loud, predominantly low-frequency noise observed in the immediate vicinity of the launch pad. This noise, while intense, is of relatively short duration and occurs on the infrequent occasions when vehicles are launched. Based on modeling results (USAF/Space Division model), the noise level during launch of Atlas II vehicles would be expected to reach a peak of 93 dBA at a distance of 3.1 miles from the launch site (the approximate distance to the Industrial Area and the USAF Space Museum). This level is within the range of recorded levels for previous KSC and CCAFS launches. Lower noise levels would be experienced in areas outside of CCAFS, the closest of which is 5.2 miles south of LC 36.

Workplace noise exposure for unprotected employees is limited to 5.3 h/d at 93 dBA by the Occupational Safety and Health Administration regulations (29 *CFR* Part 1910.95). However, standards have not been established for short-term noise exposure for the general population. The launching of space vehicles from CCAFS has become a part of the socioeconomic environment of the Cape Canaveral area. The noise from launch vehicles is normally perceived in surrounding communities only as a rumble in the distance. The noise, at worst, seems to be an infrequent nuisance as opposed to a health hazard.

Sonic booms are generated during lift-off of the vehicle and during reentry of the suborbital and orbital stages. These noise events are an unavoidable consequence of flight speeds exceeding the speed of sound. The intensity of the sonic booms depends on the size, configuration, and velocity of the vehicle as well as altitude and atmospheric conditions. The loudest sonic booms occur during the ascent of the vehicle, although less intense booms occur during the descent of the spent suborbital booster stages and during the random reentry of spent orbital stages. Sonic booms associated with the ascent of MLV II vehicles will occur ~25 nautical miles downrange over the Atlantic Ocean and will be directed upward and toward the front of the vehicle. The overpressures of these events are predicted to be <2.0 lb/ft^2. Sonic booms from stage reentry would occur over the open ocean. In neither case would the noise events impact developed areas. Ships likely to be in the area affected by sonic booms are routinely warned of impending launches, and the sonic boom, if observed at all, is of no practical consequence.

2.1.3.3 Mitigation

Routine measures would be used to protect personnel from the intense noise occurring near the launch pad. Personnel in the immediate vicinity of the launch pad would either be confined to structures that attenuate sound pressure to an acceptable level or be provided with suitable ear protection devices. Road blocks established on access roads at a minimum of 5000 ft from the launch site would exclude onbase personnel from hazardous noise areas at launch time.

2.2 NATURAL ENVIRONMENT

2.2.1 Climate and Air Quality

2.2.1.1 Existing environment

The climate at CCAFS is strongly influenced by its coastal setting. Annual variations in atmospheric temperature and moisture content are slight because of the moderating effects of the Atlantic Ocean. The annual average temperature at CCAFS is 71°F. Average daily minimum temperatures range from 51°F in February to 73°F in August. Average daily maximum temperatures range from 69°F in January to 88°F in July. Between 1968 and 1978, the lowest recorded temperature at CCAFS was 19°F; the highest was 98°F. Surface-based temperature inversions are infrequent, occurring ~2% of the time. Temperature inversions aloft caused by sea breeze circulations and by subsidence associated with the Bermuda high-pressure feature are much more common.

Relative humidity at CCAFS is usually between 70 and 100% because of the proximity of the ocean and inland waterways. Fog is uncommon during most of the year but occurs about 1 out of 4 days during the winter. Annual average precipitation in CCAFS area is 45 in., with the monthly maximum occurring in September and the monthly minimum occurring in April.

The sea breeze and land breeze circulations, caused by uneven solar heating and surface radiation properties of the land and ocean, are very common in summer and less common in winter. The sea breeze (onshore or easterly winds) occurs during the daytime, while the land breeze (offshore flow) occurs at night. Figure 9 is a wind rose showing the frequency distribution of wind speeds and directions at CCAFS. Winds predominate from the southeast quadrant. The air quality at CCAFS is very good because of the absence of nearby pollutant sources. Air quality monitoring data for the CCAFS vicinity are sparse. Recent (1986) ambient air quality data indicate that there were two monitoring sites operated at Titusville and two on Merritt Island but that these sites measured only total suspended particulate matter (TSP). Concentrations of TSP measured at these sites in 1986 were well below the National Ambient Air Quality Standards (NAAQS) for TSP (FDER 1987). Effective July 31, 1987, the Environmental Protection Agency (EPA) replaced the NAAQS for TSP (150 $\mu g/m^3$ 24-h average and 75 $\mu g/m^3$ annual average) with NAAQS for particles <10 μm in diameter (PM_{10}). The new PM_{10} standards were set at 150 $\mu g/m^3$ and 50 $\mu g/m^3$ for 24-h and annual average concentrations, respectively. Even if all TSP measured at Titusville and Merritt Island in 1986 were under 10 μm in diameter, the new PM_{10} NAAQS would still have been met.

No long-term measurements are available from the CCAFS vicinity for the other five criteria air pollutants: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and lead (Pb). However, episodic measurements for some pollutants have been made in conjunction with previous launch programs at CCAFS and KSC. CCAFS and the vicinity are considered by EPA to be either "in attainment" or "unclassifiable" with respect to NAAQS for

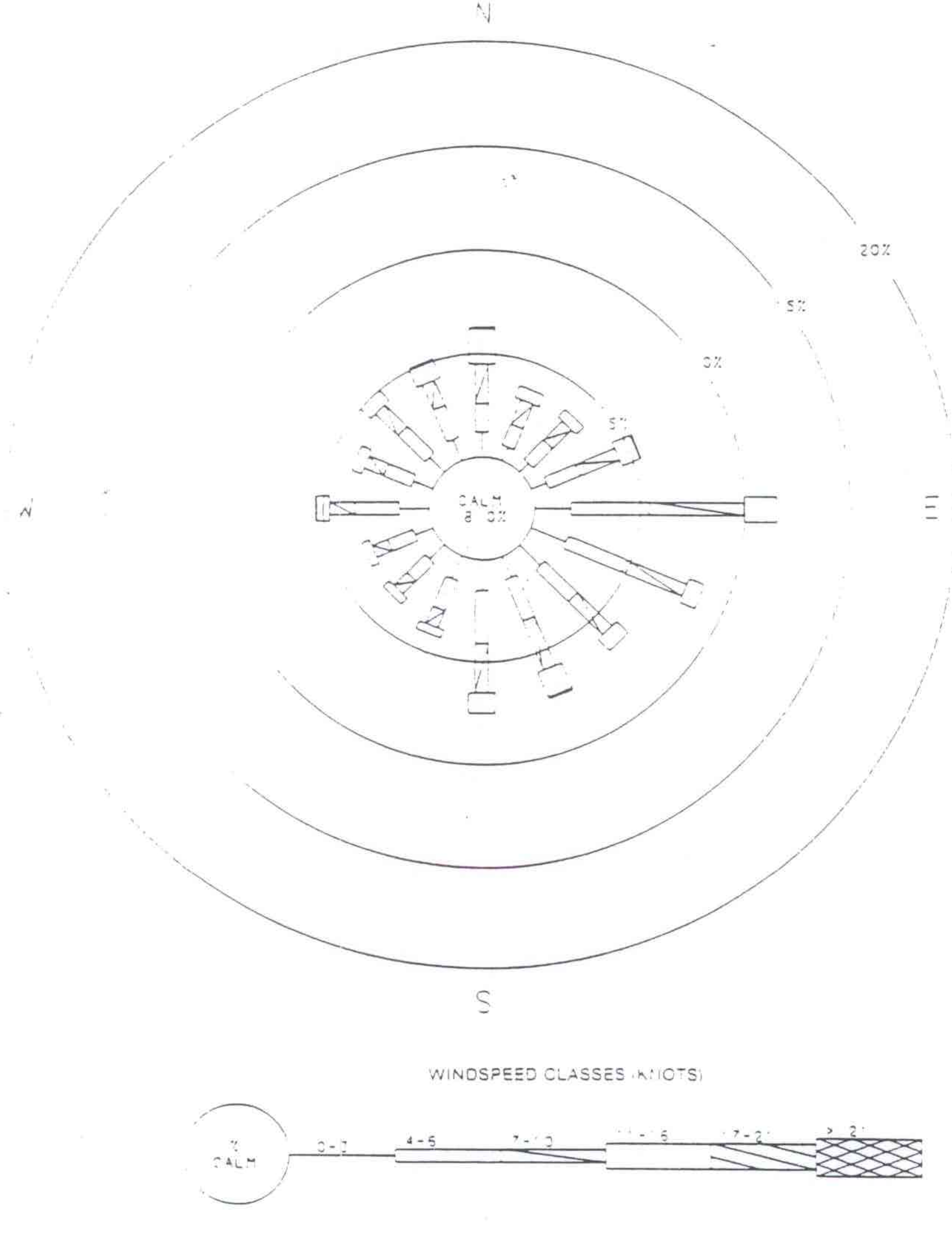


Fig. 9. Annual wind rose for Cape Canaveral Air Force Station, Florida, from data collected during 1968 to 1978.

criteria pollutants (40 *CFR* Part 81). There are no designated "non-attainment" areas in Brevard County.

2.2.1.2 Impacts

Potential sources of air pollutants in the MLV II program would be construction/renovation activities; stationary sources, such as the back-up electrical generator, paint spray booth, and fuel-loading system; and the launch vehicle itself.

Construction and renovation at LC 36 and the Industrial Area would not disturb more than an acre or two of unpaved surfaces. Some fugitive dust would be generated during earthwork, but quantities would be negligible and would be rapidly dispersed by natural breezes. Offsite areas would not be expected to be impacted. Vehicle exhaust emissions would be temporary, localized air pollutants that would not result in significant impacts.

Another source of air pollutants would be stationary sources, such as the paint-spray booth, fuel-loading system, and back-up generator. Electrical power for launch and prelaunch activities would be provided by two 300-kW diesel generators and two 150-kW diesel generators, which would be permitted by the FDER. Assuming a maximum of ten launches per year and 4 d/year of commercial power interruption, the two 300-kW generators would operate ~24 d/year and the two 150-kw generators would operate ~14 d/year.

Table 1 presents the total estimated annual pollutant emissions from backup electric generators at LC 36, based on EPA emission factors (U.S. Environmental Protection Agency 1985).

Pollutant emissions from the generators would be small relative to thresholds that are typically used by regulators to determine if an air quality permit and air quality impact analysis are required. For the types of pollutants in Table 1, "Prevention of Significant Deterioration" (PSD) regulations (40 *CFR* Part 52) require a permit for certain new sources if they emit over 100 tons/year (TPY) of one pollutant and for other sources if they emit over 250 TPY of one pollutant. The amounts shown would not require a PSD permit and would not have a significant impact on ambient (off-site) air quality because of the distance (~5 miles) from LC 36 to the nearest off-site area.

Table 1. Total estimated annual emissions from backup generators at LC 36[a]

Pollutant	Emission factor (g/kWh)	Annual emissions (tons per year)
Nitrogen oxides (NO_x)	18.8	9.3
Carbon monoxide (CO)	4.06	2.0
Volatile organic compounds (VOC)	1.50	0.7
Particulate matter (PM)	1.34	0.7
Sulfur dioxide (SO_2)	1.25	0.6

[a]Based on EPA emission factors (U.S. Environmental Protection Agency 1985) and ten launches per year.

Volatile organic compounds and particulate matter would be emitted during sandblasting and painting of existing and new structural material. Emissions from painting of ground-support equipment would be controlled by conducting these operations in a paint-spray booth (permitted by FDER) with a filtered ventilation exhaust system.

The RP-1 fuel-loading system is a closed loop with no atmospheric venting; therefore, significant air quality impacts would not be expected to result. Incidental quantities of vapor would be emitted during loading operations for the reaction control system on the Centaur II vehicle and the roll control system on the interstage adapter. About 210 lb of hydrazine would be loaded to the launch vehicle for these systems. Hydrazine vapor emissions during loading would be controlled by using a scrubber (permitted by FDER), which would allow only a few grams to be released to the ambient air. Because of the toxicity of hydrazine and the possibility of an accidental spill, the launch pad area would be cleared of nonessential personnel during the loading operations, and those participating in the hydrazine loading would wear protective suits.

Space vehicle launches meet the definition of a mobile source and are exempt from the air emission permitting requirements of the State of Florida. The air-quality impacts from normal launches of the Atlas II vehicle would be insignificant because of the relatively innocuous nature of the propellants [RP-1 (kerosene) and LO_2] and their combustion products. As mentioned in Sect. 1.1.3.3, the lower stage (Atlas II) of the launch vehicle would contain ~108,000 lb of RP-1 and 242,000 lb of liquid oxygen. The emissions at the engine nozzles of the lower stage, following ignition, are given in Table 2. The emissions listed in Table 2 would be distributed along the entire launch trajectory until sustainer engine cutoff (see Fig. 7). The only combustion product of concern in Table 2 is CO. However, in the lower atmosphere, rapid oxidation would be expected to convert most of the CO to CO_2 within a few seconds after emission. Thus, significant air-quality impacts would not be expected at ground level from a normal launch.

During launch, hydrazine would be burned during the latter stages of the vehicle trajectory (see Fig. 7). Less than 40 lb would burn in the lower atmosphere, and the combustion products would be water (~66%) and nitrogen (~33%). Only a trace of unburned hydrazine emissions would result.

Some missions would require that ~600 lb N_2H_4, 1,040 lb MMH, and 1,720 lb nitrogen tetroxide (N_2O_4) be carried on the payload for use as propellants in orbit. As with hydrazine, MMH and N_2O_4 are quite toxic. However, these fuels would be burned by the satellite only after it reached orbital altitudes, thus resulting in no emissions of combustion products in the lower atmosphere. Loading of MMH, N_2O_4, and N_2H_4 to the payloads would be conducted at existing permitted on-site (military) and off-site (commercial) hazardous materials processing facilities. The potential air quality impacts of launch-pad spills of hydrazine, MMH, and N_2O_4 from the payload are addressed in Sect. 3.2.

2.2.1.3 **Mitigation**

The Air Force and NASA currently maintain extensive meteorological monitoring capabilities and forecasting facilities and personnel at CCAFS and KSC (Taylor and Schumann 1986). One function of the meteorological facilities and staff is to provide forecasts of toxic Potential Hazard Corridors (PHCs) before certain hazardous operations are conducted. The CCAFS meteorological forecasting staff use site-specific atmospheric dispersion models, together

Table 2. Combustion products of the Atlas II propulsion system using RP-1 and liquid oxygen propellants[a]

Combustion product	Weight fraction	Emissions per launch[b] (lb)	Maximum annual emissions[c] (tons)
Ionic hydrogen (H^+)	0.0015	525	2.6
Hydrogen (H_2)	0.0099	3,465	17.3
Oxygen (O_2)	0.0133	4,655	23.3
Hydroxide ion (OH^-)	0.0350	12,250	61.3
Ionic oxygen (O^{-2})	0.0059	2,065	10.3
Water (H_2O)	0.2522	88,270	441.4
Carbon monoxide (CO)	0.4388	153,580	767.9
Carbon dioxide (CO_2)	0.2433	85,155	425.8

[a]The combustion products listed are those expected at the engine nozzle exits. Within a few seconds after ignition, the only combustion products present in significant quantities would be H_2O and CO_2.
[b]Emissions are based on total output of the vehicle. During launch, these emissions occur along the entire trajectory until sustainer engine cut-off.
[c]Maximum annual emissions are based on a maximum of ten launches per year from LC 36, Pads A and B.

with real-time or forecast meterological input data and potential source strength data, to predict the length and angular width of PHCs.

Before conducting operations with a potential for toxic spills (fuel-loading, vehicle assembly, launching, etc.), the forecasting staff would provide the appropriate PHC forecasts to the personnel responsible for ordering such operations. If the PHC forecasts indicate that either onbase or offbase populations could be exposed to adverse chemical concentrations in the case of an accidental spill, the operations would be postponed until favorable meteorological conditions are forecast.

2.2.2 Surface Water

2.2.2.1 Existing environment

Hydrology

LC 36 is located on a barrier island between the Atlantic Ocean and the Banana River (see Fig. 2). Because the drainage divide of the island is inland of the dune line, ~90% of the surface runoff from the complex and vicinity percolates into the soil. Surface-water drainage in some locations at CCAFS is collected by a series of man-made canals that drain into the Banana River: these canals are about one mile from the LC 36 site. Surface drainage from the LC 36 site is to the Atlantic Ocean.

The only surface water present at LC 36 is a confined palustrine wetland of ~5 acres between LC 36A and 36B outside the exclusion fence of each facility (Fig. 10). The wetland does not discharge to any surface water body.

The closest freshwater body is a borrow pit, to the northeast (Fig. 10), which provides habitat for alligators and a variety of common fish species (see Sect. 2.2.5) on CCAFS but does not provide a water source for on-site use (George 1987). Major inland water bodies near CCAFS are the Banana River and Indian River to the west and the Mosquito Lagoon to the north. These are shallow lagoons, except for the portions that are maintained as part of the Intracoastal Waterway between Jacksonville and Miami. The Indian and Banana rivers have a combined area of 150,000 acres in Brevard County; the combined drainage area is 540,000 acres. The Indian River is connected to the Atlantic Ocean to the south of CCAFS by Sebastian Inlet and to the north through Haulover Canal to the Mosquito Lagoon and subsequently through Ponce de Leon Inlet. The waters of the Merritt Island Wildlife Refuge, Sebastian Inlet State Recreational Area, Canaveral National Seashore, and the Banana River Aquatic Preserve (see Fig. 11) are classified as Outstanding Florida Waters as part of the Florida Surface Water Criteria (Environment Reporter 1988) and, as such, are afforded the highest degree of protection by the FDER. Mosquito Lagoon to the north and the Indian River south of CCAFS from Malabar to Sebastian are not included in the classification (Environment Reporter 1988).

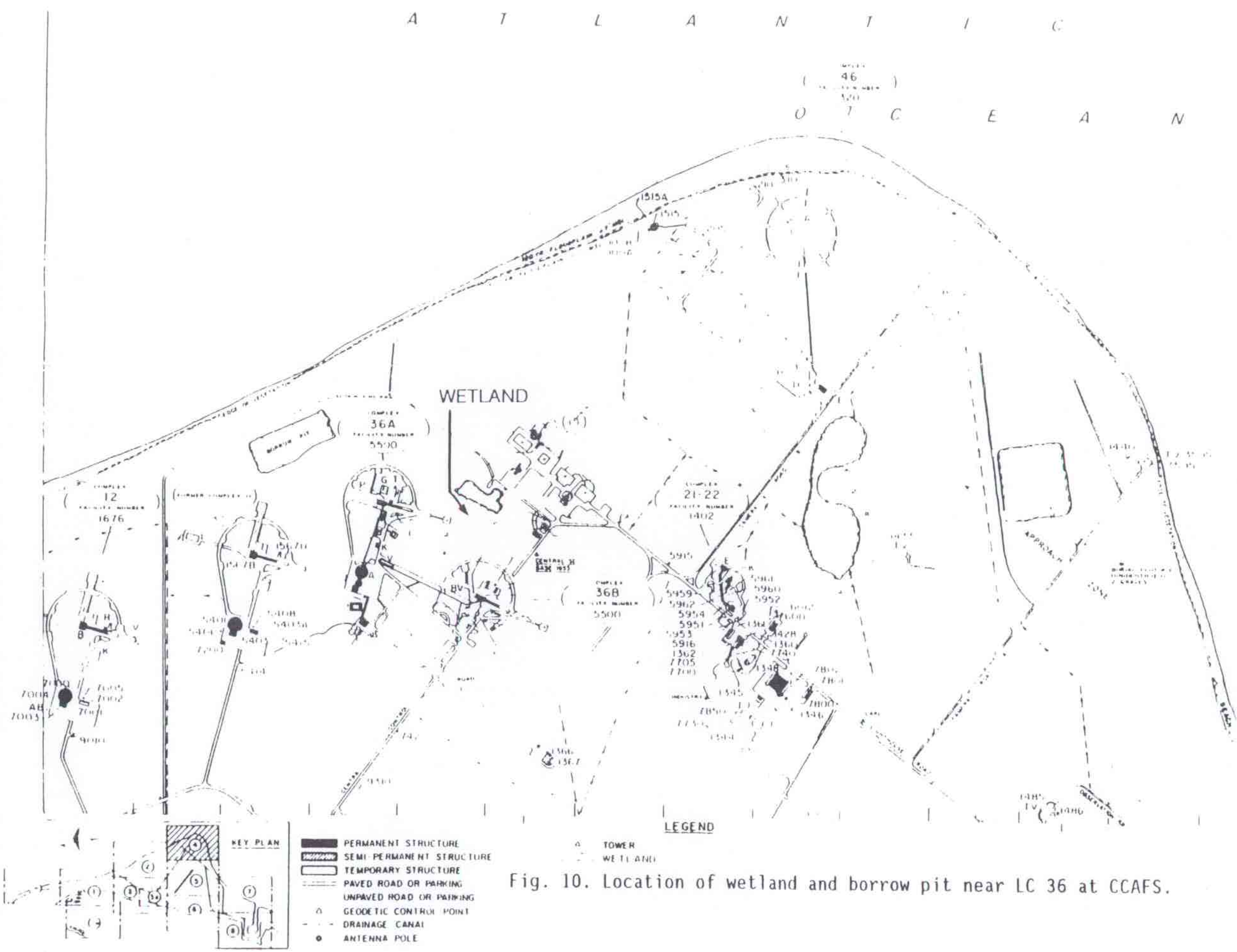


Fig. 10. Location of wetland and borrow pit near LC 36 at CCAFS.

ORNL-DWG 88-14805

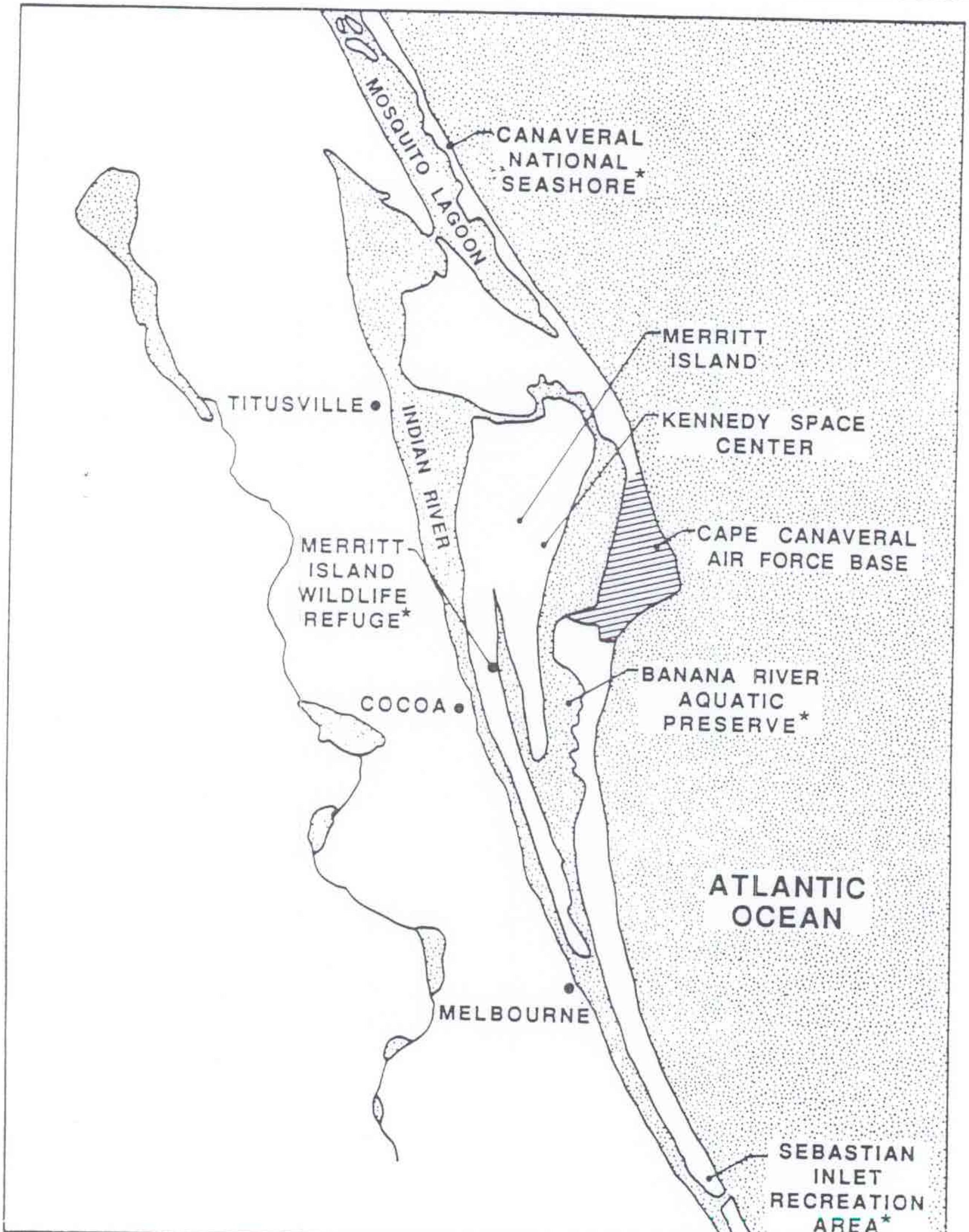


Fig. 11. Outstanding Florida Waters (marked with an asterisk) near Cape Canaveral Air Force Station, Florida

Water Quality

Surface water quality monitoring at CCAFS occurs at the four locations shown in Fig. 12. The closest monitoring site to LC 36 is ~3 miles from the site at the Banana River. The Banana River, which has good water quality, is an estuarine environment with mean salinity values ranging from 17.8 parts per thousand (ppt) near the NASA Causeway (No. 1 on Fig. 12) to 23.8 ppt at Florida State Route 528 (No. 4 on Fig. 12). Mean dissolved oxygen in the river is >5.5 mg/L, the lower limit for protection of aquatic life (Florida Water Quality Standards, Environment Reporter 1987), and biochemical oxygen demand is <2.5 mg/L. Nutrients (nitrogen and phosphorus), chlorophyll a, and turbidity are representative of estuarine conditions.

Recent groundwater sampling in the wetland indicated background concentrations of trichloroethylene (TCE) at 3.3 μg/L. No other water quality data for the wetland are available. Contamination is believed to result from untreated discharge of TCE cleaning solutions at LC 36 between 1961 and 1981. The TCE concentration in the wetland would not be exacerbated by the MLV II program because current practice is to collect TCE for recycling or incineration. In addition, surface and groundwater monitoring in the wetland is planned during the MLV II program.

2.2.2.2 Impacts

Construction at LC 36 and the Industrial Area would occur in previously disturbed areas; therefore, little change in existing storm-water runoff patterns would be expected. Because of the rapid infiltration rate in on-site soils (>20 in./h), precipitation runoff would be minimal; water would discharge to storm drains in paved areas and infiltrate to the groundwater in unpaved areas. Gate valves are planned to be installed in all storm drains at LC 36. Collected water will be retained for percolation to groundwater and will not be permitted to flow offsite. Because runoff quantities and patterns are not expected to change from present conditions, significant impacts would not be expected.

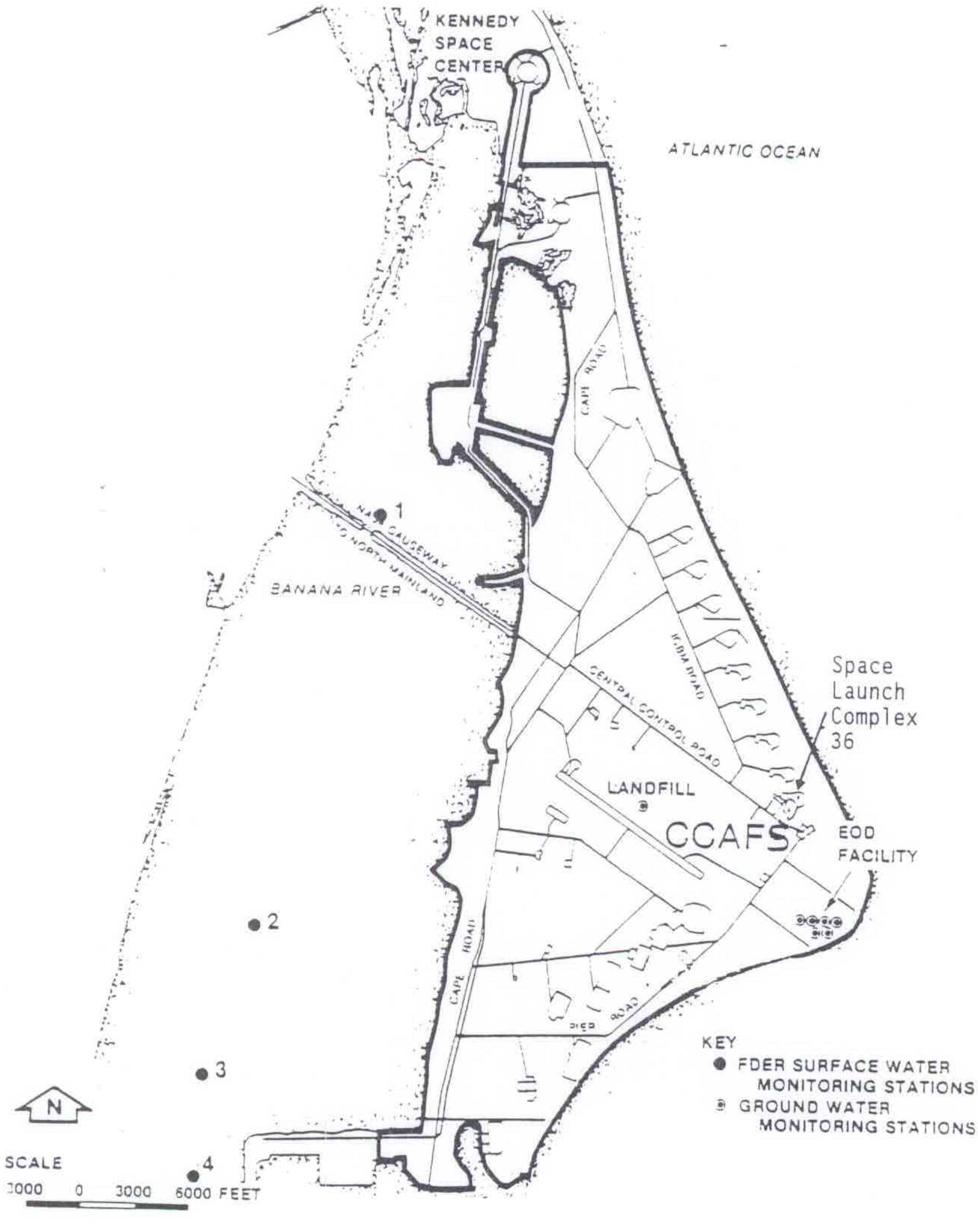


Fig. 12. Surface- and groundwater monitoring stations at Cape Canaveral Air Force Station, Florida.

No direct discharges to surface waters at CCAFS would occur during the MLV II program. However, the spent deluge water following vehicle launch is a potential source of contamination to the wetland and to the groundwater at LC 36. The potential impacts of deluge water to groundwater are discussed in Sect. 2.2.3.2.

Only one set of data is available to characterize the deluge water following the launch of an Atlas vehicle. Table 3 presents results of an analysis of the deluge water following a 1986 launch at LC 36 in comparison with Florida water-quality standards for Class III waters (state protected for recreation and propagation and maintenance of a healthy, well-balanced population of fish and wildlife) and Class G-II groundwater standards. Results show that the spent deluge water met the Class III criteria for all parameters except pH and all Class G-II standards except for iron and pH. Because of the limit of detection for silver and lead, it is not possible to state conclusively whether or not these standards were exceeded.

Pads A and B have deluge water holding ponds with capacities of ~110,000 gal each. This volume is not sufficient to contain the total volume of water from either the TCD or the actual launch (273,000 and 280,000 gal, respectively). Deluge water, which is potable water, would be released to the deluge trench and flame bucket during the TCD and launch (see Sect. 1.1.3.3) at the rate of 255 and 650 gal/min (gpm), respectively, for a total of 248,875 gal in ~4.5 h (275 min). The remainder of the total deluge water per launch (~25,000-30,000 gal) would be discharged to the pad and adjacent land surface within the first eight minutes after launch. Approximately 110,000 gal would be retained in the holding ponds; therefore, a maximum of 170,000 gal would be lost directly to the paved and unpaved areas surrounding the launch pads. Deluge water which does not reach the storm drainage system would infiltrate directly through the soil to groundwater (see Sect. 2.2.3). The elevation of the site (5-10 ft above sea level), the surrounding man-made rise (3-5 ft), and the high infiltration rate of on-site soils would prevent unconfined deluge water from directly discharging to off-site surface water; therefore, significant impacts would not be expected.

Discharge from the deluge holding ponds would be to a swale. To avoid damaging the cover grasses on the site, deluge water would be released at a

Table 3. Chemical characteristics of the deluge water after a 1986 launch compared with Florida standards for Class III surface waters and Class G-II groundwater

Parameter	Spent deluge water[a] (mg/L)	Class G-II standards for groundwater[b] (mg/L)	Class III standards for freshwater[c] (mg/L)
Cadmium	<0.01	0.010	0.00008
Copper	<0.03	1.0	0.03
Fluoride	0.87	2.0	
Iron[d]	0.723	0.3	1.0
Mercury	<0.0002	0.002	0.0002
Lead	<0.05	0.005	0.3
pH[e]	9.08[f]	6.5 (min)	6.0-8.5
Selenium	<0.01	0.01	0.025
Silver	<0.03	0.05	0.00007
Zinc	0.01	5.0	0.03

[a]Collected from flame bucket after passing through flame bucket trench following a launch in 1986.
[b]FDER 1987b, 1988.
[c]Environment Reporter 1988.
[d]The incoming potable water was monitored prior to its use as in the deluge system for the 1986 launch; the iron concentration was 5.95 mg/L. Leaching from pipes during an extended idle period at LC 36 is suspected to have contributed to the high iron concentration.
[e]pH in log units is not converted to mg/L. The pH must not vary more than one unit above or below natural background of predominantly freshwater and coastal waters or more than 0.2 units above or below natural background of open water (Florida Water Quality Standards, Environment Reporter 1987).
[f]The pH of the potable water supply prior to launch was 8.97.

rate appropriate to control excessive runoff. The swales from the holding ponds ultimately lead to the wetland outside the exclusion fences between LC 36A and B. Gate valves in concrete culverts at the end of the swales would prevent water released from the deluge ponds from flowing to the wetland. Significant surface-water impacts would not be expected because there would be no direct discharges to surface-water bodies and the gate valves would prevent discharge from the swales to the wetland. In addition, deluge water discharge would be carried out in accordance with an FDER permit, which would not be granted if significant impacts were likely to result.

The impacts to surface water from accidental spills at LC 36 are discussed in Sect. 3.3.

2.2.2.3 Mitigation and monitoring

Because deluge water discharge to grade would be carried out in accordance with an FDER permit, significant impacts would not be expected and mitigation would be unnecessary.

A surface- and groundwater monitoring program at LC 36 has been proposed to FDER in the project application for an industrial wastewater discharge permit (see Sect. 4.2.1). Incoming potable water, spent deluge water in the holding ponds, and surface- and groundwater in the wetland are proposed to be sampled and analyzed for parameters listed in state water-quality standards. If the water in the holding ponds exceeds standards, it will not be released to the swales until appropriate mitigation measures (i.e., wastewater treatment, such as neutralization of pH) have been employed to reduce concentrations to acceptable levels. Monitoring in the wetland would provide an indication of the quality of the deluge water released and would allow necessary modifications to operations to improve the quality of future deluge water discharges. The high iron concentration and elevated pH reported from the 1986 sampling of the deluge water may be anomalies. Future monitoring of incoming potable water and spent deluge water on a routine basis will help indicate whether mitigation will be required to decrease iron content and lower pH.

In addition, a surface-water monitoring site has been proposed for the adjacent wetland to characterize background water quality and to detect changes that would indicate possible contamination. The site is proposed to be monitored following each USAF and commercial launch. During periods of low launch frequency, the USAF proposes to monitor semiannually. After five launches, the site is proposed to be monitored annually. The frequency of monitoring will be defined in the discharge permit.

2.2.3 Groundwater

2.2.3.1 Existing environment

Hydrology

Groundwater at CCAFS occurs under both confined (artesian) and unconfined (nonartesian) conditions. Confined groundwater is located in the Floridan Aquifer, the recharge for which originates in the northern and central portions of Florida. The Floridan Aquifer is composed of numerous limestone formations several thousand feet thick and serves as the principal groundwater source and potable water supply in much of the coastal lowland areas. Although water of good quality may be obtained from much of the aquifer throughout the state, water in the formation beneath CCAFS is highly mineralized and not used for domestic or commercial purposes. The hydraulic head of the Floridan Aquifer is above the land surface, resulting in free-flowing conditions when wells are located in this formation. The combination of the confining clays of the Hawthorn Formation and the artesian conditions of the Floridan Aquifer limits the potential for contamination of this formation in the CCAFS area.

The underlying shallow unconfined aquifer at CCAFS is composed of both Recent and Pleistocene Age surface deposits that range typically from ground surface to 5 ft below the surface. The aquifer is recharged along the coastal ridges and dunes by rainfall, with little recharge occurring in the low-lying swamp areas. When the water in the unconfined aquifer reaches the saturated zone, it moves laterally toward the Atlantic Ocean or the Banana River. The unconfiend aquifer in the CCAFS area ranges in depth from ~50 ft at the coastal ridge to <20 ft in the vicinity of the St. Johns River to the west of CCAFS and is ~40 ft thick. The upper boundary or the water table surface ranges from 3.5 to 4.9 ft below land surface; the lower boundary is a confining unit of sandy clay and marl ~50 ft thick having a hydraulic conductivity of <0.01 ft/d. The aquifer, which has an average conductivity of 9.3 ft/d, is composed of a series of interbedded sediments consisting of fine to coarse quartz sand, silt, and coarse shell fragments.

The greatest hydraulic gradient and groundwater velocities calculated from a 2-year period of record are 0.01 ft/ft and 0.36 ft/d, respectively. The effective porosity of this aquifer is estimated at 0.30 ft/d by the St. Johns River Water Management District. From these hydraulic measurements, the maximum movement of groundwater in the unconfined aquifer is estimated to be 106 ft/year. A study of LC 39, which is near LC 36, found that there was evidence of stratification of the unconfined aquifer below the launch sites as shown by a discontinuous, semiconfining layer ~10 ft below land surface. Above this layer, there was a lens of fresher water with slightly more mineralized water below. Groundwater velocities were calculated to be somewhat higher above the confining layer than below it. The geohydrology of LC 36 has not been characterized; however, such information has been requested by FDER during its review of the application for an industrial wastewater discharge permit. A geohydrological characterization study will be performed prior to deluge water discharge during MLV II launches.

Water Quality

Groundwater of the confined (Floridan) aquifer beneath CCAFS is highly mineralized as the result of dissolution of the limestone substratum (Seaman 1985) and is not used as a major domestic or commercial water source (see Table 4). Levels of chloride, sodium, and total dissolved solids in the confined aquifer exceed national drinking water standards.

The unconfined aquifer beneath CCAFS is of good quality and meets state of Florida Class G-II and national drinking-water quality standards for all parameters except iron (Table 4). Class G-II groundwater is defined by the state of Florida as suitable for potable use if there is <10,000 mg/L total dissolved solids content. At locations influenced by saline surface waters, chloride and total dissolved solids levels in the unconfined aquifer may also exceed drinking-water standards.

Groundwater is currently monitored at the landfill (Fig. 12), which is 1 mile from LC 36. The stations at the Explosive Ordinance Disposal (EOD) site on Fig. 12 consist of PVC pipe embedded in the sand and are not truly representative of inland groundwater. Water-quality data for unconfined

Table 4. Water-quality characteristics of the confined (Floridan) and the unconfined aquifers at CCAFS

Parameter	Confined aquifer[a] (mg/L)	Unconfined aquifer[b] (mg/L)	Maximum contaminant level[c] (mg/L)
Nitrates (as N)	<0.01	<0.02-0.14	10
Chloride	540	8.5-21.4	250
Copper	<0.01	<0.03	1.0
Iron	0.02	0.733-1.56	0.3
Manganese	<0.001	0.03	0.5
Sodium	1400	6.12-10.76	160
Sulfate	85	13.88-19.33	250
Total dissolved solids	1425	194-258	500
Color[d]	1		15
pH[e]	7.6	6.92-7.78	6.5–8.5
Zinc	<0.01	<0.01-0.166	5.0
Arsenic	<0.01	<0.05	0.05
Barium	0.02	<0.15	1.0
Cadmium	<0.001	<0.01	0.01
Chromium	0.001	<0.04	0.05
Lead	<0.001	<0.05	0.05
Mercury	0.0005	<0.002	0.002
Selenium	0.006	<0.01	0.01
Silver	<0.001	<0.03	0.01
Fluoride		0.45-0.48	2.0

[a] Sampling in June 1984 at Facility 1717 well.
[b] Range of values for 1986 sampling at the landfill monitoring station indicated on Fig. 11.
[c] Maximum contaminant level (MCL), National Interim Primary Drinking Water Regulations and National Secondary Drinking Water Regulations (U.S. EPA 1986).
[d] Platinum-cobalt color units.
[e] pH in log units is not converted to mg/L. The pH must not vary more than one unit above or below natural background of predominantly freshwater and coastal waters or more than 0.2 units above or below natural background of open water (Florida Water Quality Standards, Environment Reporter 1987).

aquifer monitoring sites in the vicinity of LC 36 (Table 4) indicate a pH near neutral and compliance with the interim standards for national primary and secondary drinking-water sources for all parameters except iron.

2.2.3.2 Impacts

Spent deluge water that infiltrates through the soil in unpaved areas around the launch complex and in the swales from the holding ponds is a potential source of contamination to groundwater. Previous sampling has shown concentrations of chemical constituents that would degrade groundwater quality (see Table 4). The FDER will consider the potential for significant groundwater contamination at LC 36 from unconfined deluge water in its review of the application for an industrial wastewater discharge permit. Because deluge water discharge would be carried out as specified by the FDER, no significant impacts would be expected.

The impacts to groundwater from accidental spills are discussed in Sect. 3.3.

2.2.3.3 Mitigation and monitoring

Because no significant impacts to groundwater would be expected if deluge water is discharged in accordance within FDER permit, no mitigation would be necessary.

As part of the monitoring program described in Sect. 2.2.2.3, groundwater monitoring wells are proposed to be installed at the following locations: (1) 30-35 yards north of the LC 36A perimeter fence, (2) within the area of the land-spread irrigation on the site, (3) outside the perimeter fence adjacent to the deluge water holding pond discharge culvert, and (4) within the wetland area between LC 36A and B. Each well would be constructed to a depth of 15 ft with a screen extending from ~3 ft below ground surface to the total depth. All sampling sites are proposed to be monitored after each launch cycle or on a schedule established by FDER in a wastewater discharge permit. During periods of low launch frequency, the sites would be monitored at least semiannually. After five launches, monitoring would occur annually for the duration of the program. Each sampling site would be analyzed for the parameters listed in the Florida Primary and Secondary Drinking Water Criteria. In addition, pH, conductivity, and total organic carbon would be measured. This monitoring program is intended to identify the background water quality in the wetland and LC 36 vicinity and to provide data for use in determining if the deluge discharge is contaminating groundwater.

Monitoring of the deluge water in the holding ponds is proposed (see Sect. 2.2.2.3) to identify potential contaminants before discharge, to implement mitigation measures, if necessary, before release to the swales, and to enable operational changes to be made in response to the quality of deluge water discharge.

If monitoring of groundwater at LC 36 identifies levels of containments that are above levels approved by FDER, treatment of the contaminated water could be required by FDER. If solvents are identified as contaminants, treatment of groundwater would most effectively occur by 1) pumping the contaminated water to the surface and treating by air stripping, which is a standard method and is one that is allowed in Florida, and 2) passing the contaminated water through an activated carbon column for sorption of the contaminant, or to biological treatment, depending on the contaminant. If metals are identified as the contaminants, treatment of the contaminated groundwater would most effectively occur by pumping the water to the surface and treating by precipitation of the metal or by ion exchange to remove the metal.

2.2.4 Geology and Soils

2.2.4.1 Existing environment

LC 36 is located in the southeastern portion of CCAFS on a barrier island composed of relict beach ridges (remnants of ancient beach structure) formed by wind and waves. The island is ~4.5 miles wide at the widest point. The land surface ranges from sea level to 20 ft above mean sea level (msl) at its highest point. The complex is underlain at depth by a series of limestone formations several thousand feet thick. The upper few hundred feet consist of formations constituting the Floridan Aquifer. The formations are the Avon Park (oldest) and the Ocala (youngest). Overlying the artesian Floridian Aquifer are the confining beds of the Hawthorn Formation. The confining beds are overlain by Pleistocene and Recent Age unconsolidated deposits. A geologic cross section for CCAFS is presented in Fig. 13.

Soils on CCAFS have been mapped by the U.S. Department of Agriculture Soil Conservation Service (SCS). Soil types identified by SCS in the vicinity of LC 36 are Urban Land, Canaveral Complex, and Canaveral-Urban Land Complex. In 1983 the SCS conducted a soil inventory of CCAFS and evaluation for agriculture use. The SCS concluded that agricultural use of CCAFS was not feasible. Correspondence between the USAF and the SCS regarding this inventory is included in Appendix B.

2.2.4.2 Impacts

No impacts to the local geology or soils are anticipated because of construction and operation of the MLV II program. Erosion would be very slight because (1) soil disturbance in undisturbed areas would not be necessary for project construction activities, (2) the high permeability of the on-site soils (20 in./h) permits rapid percolation of precipitation, and (3) existing storm-water runoff patterns would not change. Because the land at CCAFS is unsuitable for agricultural use, significant impacts to prime farmland would not be expected.

2.2.4.3 Mitigation

Because no significant impacts to geology and soils would be expected, no mitigation measures would be necessary.

2.2.5 Aquatic Ecology

2.2.5.1 Existing environment

Flora and fauna

CCAFS occurs in the transition zone between temperate and tropical climates; consequently, the aquatic biota in the area includes

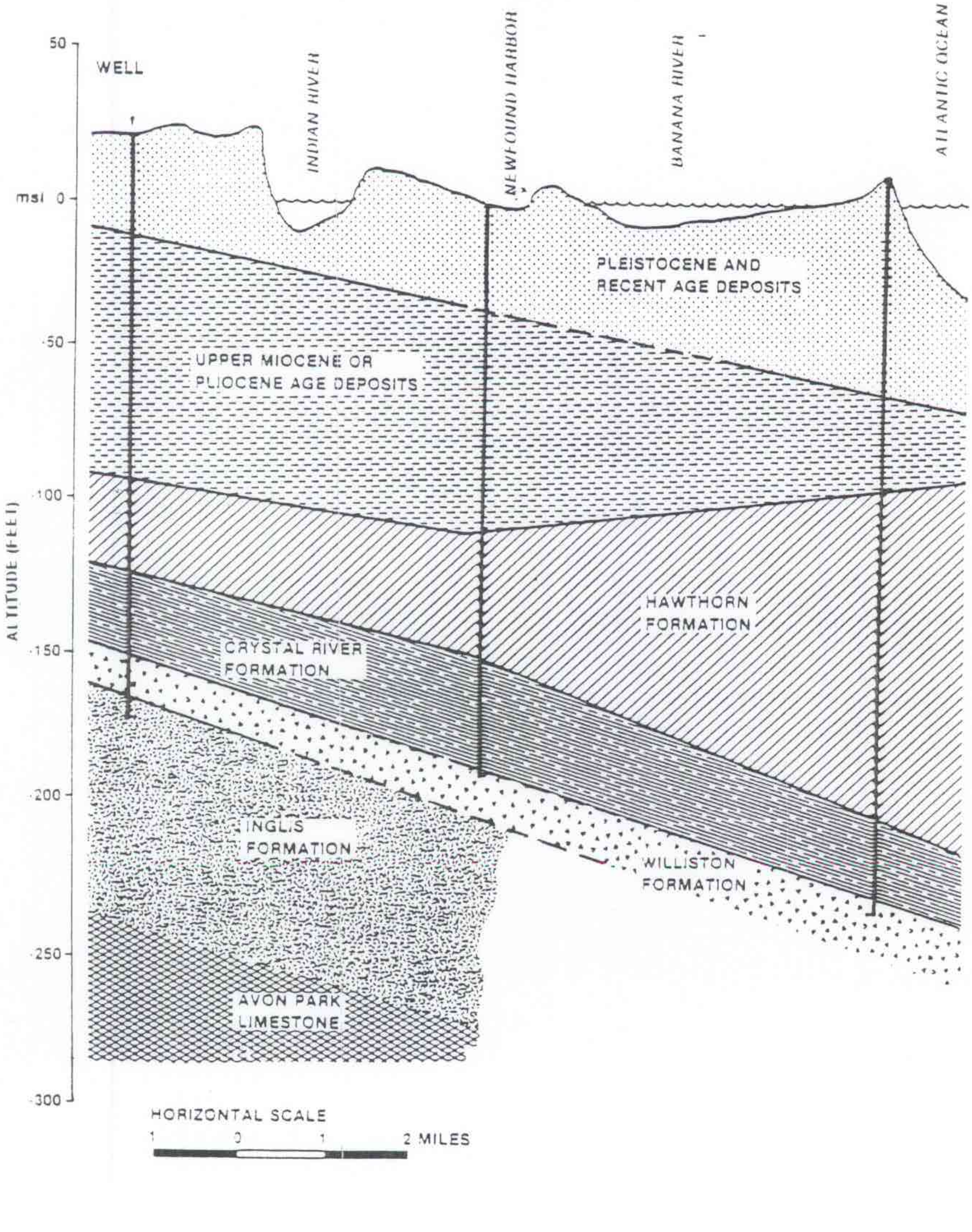


Fig. 13. Geologic cross-section at Cape Canaveral Air Force Station, Florida.

representatives from both. The surface waters in the area include marine (the Atlantic Ocean), estuarine (the Indian and Banana rivers and Mosquito Lagoon), and freshwater (the St. Johns River to the west of CCAFS) habitats. The only freshwater in the LC 36 area is the borrow pit to the northeast and the surface water drainage canals located on CCAFS; none of these canals occur in the vicinity of the site. A 5-acre freshwater wetland area, which has no outlet, is adjacent to the site.

Because the Indian and Banana rivers are shallow (<6 ft) in the vicinity of CCAFS and because of the limited connections of these estuarine river systems to the Atlantic, both are subject to wide fluctuations in temperature, salinity, and dissolved oxygen, which limit the types of aquatic biota that can survive. Aquatic vegetation, particularly seagrass, plays an important role in the lagoon environments of the Banana and Indian rivers by providing substrate stabilization, a food source and habitat for crustaceans and small fish, and a nutrient source (Mulligan and Snelson 1983). Seagrasses common to the area are turtle grass (Thalassia testudinum), manatee grass (Syringodium filiformis), Cuban shoal grass (Halodule wrightii), and Halophila engelmannii. These grasses are generally found in sandy, shallow areas that are <3 ft deep.

The benthic macroinvertebrate community of the Banana River and the northern portion of the Indian River is dominated by polychaete worms, mollusks, and various crustaceans that are typical of estuarine systems (Reish and Hallisey 1983). Horseshoe crabs, blue crabs, and penaid shrimp also are found in these water bodies. Mosquito Lagoon to the north of CCAFS is considered an important commercial shrimp nursery area; blue crabs also spawn in the area. Fish species diversity in the northern part of the Indian River has been found to be low compared with that of the southern portion because of low habitat diversity, limited ocean access, and the transition zone nature of the upper portion of the lagoon (Snelson 1983; Mulligan and Snelson 1983). In studies of the upper portion of the Indian River, Snelson (1983) reported 139 species of fish and Mulligan and Snelson (1983) 57 species.

As noted in Sect. 2.2.2.1, there is limited freshwater habitat on CCAFS. Only a few fish species inhabit the freshwater resources in the area. Fish found in the borrow pit near LC 36 include bass, bream, garfish, crappie, silversides, livebearers, killifish, and golden shiners. The wetland at LC 36 is a palustrine system (USFWS 1979) characterized by scrub-shrub wetland areas, emergent wetland vegetation, and limited area of open water that may contain submerged vegetation. There is no available information on aquatic life present in the wetland.

Threatened and endangered species

No threatened or endangered fish or invertebrate species have been identified in the surface-water bodies near the site. Endangered sea turtles near CCAFS are discussed in Sect. 2.2.6. In compliance with Sect. 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service (USFWS) has been contacted for information on threatened and endangered aquatic species and comment on the proposed MLV II program. Results of correspondence with the USFWS are provided in Appendix B.

2.2.5.2 Impacts

Renovations and construction planned for LC 36 and the Industrial Area would occur in previously disturbed areas and would not have significant long-term negative impacts (e.g., as a result of erosion and sedimentation or spills) to water quality or aquatic biota in the wetland adjacent to the site. Because no significant impacts to surface water quality or habitat would be expected from operation, no significant impacts to aquatic biota would be expected.

The discharge from the deluge system would be to the storm drains, the ground surface, and the deluge holding pond. The grass cover maintained on the site and the high porosity of the soil would minimize erosional effects of runoff. Infiltration of deluge water to groundwater and subsequent discharge to the wetland is potentially an indirect source of effects to the wetland from normal operations. Given the nature of the chemical constituents in the deluge discharge, there should be no significant impacts from normal operations on aquatic species in the wetland.

The impacts to aquatic biota from accidental spills are discussed in Sects. 3.3 and 3.4.

2.2.5.3 Mitigation and monitoring

Because no significant impacts to aquatic biota are expected, mitigation would be unnecessary. The proposed monitoring of surface and groundwater in the wetland (see Sects. 2.2.2.3 and 2.2.3.3) will help detect changes in water quality that could impact aquatic biota. Mitigation measures and remedial actions would be implemented based on the nature of any contamination which is detected. If contamination of the deluge discharge is identified, the first mitigation measure would be to identify the source and eliminate the potential for future contamination. If contaminants reached groundwater as a result of deluge infiltration which could not be contained or treated to prevent contamination, groundwater might have to be treated as discussed in Sect. 2.2.3.3. Ultimately, the type of treatment required would be determined in consultation with the FDER.

2.2.6 Terrestrial Ecology

2.2.6.1 Existing environment

Flora and fauna

The predominant vegetation on the 15,800-acre CCAFS comprises ~9400 acres of coastal scrub and 2300 acres of coastal strand (George 1987). Wetlands on CCAFS include 20 acres of freshwater wetlands, 450 acres of mangrove swamp, and 140 acres of salt marsh (George 1987).

Coastal scrub is characterized by a single layer of woody vegetation varying from 3 to 20 ft high, comprising such species as live oak, myrtle oak, Brazilian pepper tree, scrub hickory, and saw palmetto (George 1987). The vegetation is often thick but clumped, forming patches separated by areas of bare sand. Herbaceous ground cover is sparse or lacking. Coastal scrub may develop into xeric flatwoods, sand pine scrub, or a xeric coastal hammock (George 1987; Layne 1978).

Coastal strand consists of several community types in bands parallel to the shoreline — beach, foredunes (those dunes in the salt-spray zone relatively close to the shoreline), and back dunes (Layne 1978). Beaches may be devoid of vegetation or, like foredunes, may support some plants capable of establishing themselves in salt spray and shifting sands. The foredune zone, also referred to as "coastal dune" (George 1987), has one layer of vegetation including beach morning glory, railroad vine, sea oats, and dwarf shrubs such as gopher apple. The zone of back dunes, also referred to as "coastal strand" (George 1987), has a single layer of vegetation 3 to 13 ft high that is more woody than that of the foredunes and often similar to the coastal scrub habitat of old dunes farther inland. Backdune vegetation includes saw palmetto, tough buckthorn, wax myrtle, and dwarf scrubby oaks (George 1987; Layne 1978).

Construction activities for the proposed project would be limited to the LC 36 and an Industrial Area (see Fig. 8). Vegetation in these areas primarily consists of grasses and a variety of native herbaceous species. A 5-acre wetland is present between Pads A and B outside the launch complex perimeter fence. The complex is surrounded by coastal scrub habitat but, being only ~1100 ft west of the beach, is also near coastal strand. Coastal scrub also surrounds the Industrial Area.

Numerous wildlife species use the natural habitats provided by CCAFS (see USAF 1986). Various species of gulls, terns, sandpipers, other shorebirds, and endangered sea turtles use the beaches. Scrub habitats are inhabited by gopher tortoises, several species of snakes, and many species of birds and mammals. Representative species include rat snake, corn snake, bobwhite, mourning dove, bobcat, armadillo, spotted skunk, eastern cottontail, and opossum. LC 36 is inhabited by few wildlife species and does not provide significant habitat for wildlife other than the gopher tortoise that inhabits the site's herbaceous habitat.

Threatened and endangered species

Threatened and endangered species that may potentially occur at CCAFS are those that have been observed in Brevard County or on CCAFS itself, as listed in Table 5. In compliance with Section 7 of the Endangered Species Act, the USFWS has been contacted by the USAF for information on species at CCAFS (see Appendix B). Resident species that are known to occur or probably occur in the immediate vicinity of LC 36 include the alligator, gopher tortoise, indigo snake, kestrel, scrub jay, and Florida mouse. One other resident, the Florida gopher frog, which has been observed in Brevard County, but not on CCAFS, may find suitable habitat there and in the vicinity of LC 36. Suitable year-round habitats or nesting habitats for the other species listed in Table 5 are not present, and there is little potential for these species to regularly occur near LC 36. At certain times of the year, the loggerhead, green, and leatherback sea turtles come ashore to bury their eggs in the sandy beaches, where the hatchlings would be within the influence of night lighting for LC 36 and other CCAFS facilities.

2.2.6.2 Impacts

Construction activities and laydown of construction materials would be restricted to previously disturbed areas within LC 36 and the Industrial Area. Therefore, little plant and animal habitat would be destroyed, and impacts on biota would not be significant. Loss of gopher tortoise habitat (herbaceous) and tortoise fatalities might result from construction. Tortoise fatalities would be minimized by relocation of the animals before construction. Noise associated with construction would be a temporary disturbance to wildlife. Wildlife near LC 36 and the Industrial Area are probably accustomed to human activities occurring at CCAFS and would not experience a population decline because of construction noise.

Operation of the modified complex would result in atmospheric emissions, the release of spent deluge water, and noise. Emissions from the vehicle exhausts would not significantly affect air quality (Sect. 2.2.1) and would

Table 5. Threatened and endangered species in Brevard County and their status on Cape Canaveral Air Force Station[a]

Species	Federal status[b]	State status[b]	CCAFS[c]
Florida gopher (Crawfish) frog		T	Resident not observed
Gopher tortoise		T	Resident
Loggerhead [sea turtle]	T	T	Occurs on beach
Green sea turtle	E	E	Occurs on beach
Kemp's ridley [sea turtle]	E	E	Occurs on beach, no known nests
Leatherback [sea turtle]	E		Occurs on beach
Eastern indigo (Indigo) snake	T	T	Resident
Atlantic salt marsh (Southern) water snake	T	E	Resident not observed
American alligator	T(S/A)		Resident
Brown pelican		T	Visitor over water
Rothchild's magnificent (Magnificent) frigate-bird		T	Transient
Roseate spoonbill		T	Visitor
Wood stork	E	E	Visitor
Osprey		T	Nesting resident
Bald eagle	E	T	Visitor
Arctic peregrine (Peregrine) falcon	T	E	Transient
Southeastern American (American) kestrel		T	Visitor
Audubon's (Crested) caracara		T	Visitor not observed

Table 5 (continued)

Species	Federal status[b]	State status[b]	CCAFS[c]
Florida sandhill (Sandhill) crane		T	Visitor not observed
American oystercatcher		T	Visitor at beaches
Least tern		T	Nests on beaches
Red-cockaded woodpecker	E	E	Visitor not observed
Florida scrub (Scrub) jay	T	T	Resident
Kirtland's warbler	E	E	Transient not observed
Dusky seaside (Seaside) sparrow	E	E	Probably extinct
West Indian manatee	E	T	Resident in waters
Sherman's fox (Fox) squirrel		T	Resident not observed
Southeastern beach (oldfield) mouse	P		Resident
Florida mouse		T	Resident

[a]*Sources:* George (1987): Pritchard (1978); USFWS (1987, 1988). The species are listed in the order presented by Banks et al. (1987), to which the reader is referred to obtain scientific names. For those species whose common names as listed by the sources differ from those giver by Banks et al. (1987), the common names used by Banks et al. are indicated in parentheses.

[b]E = endangered; P = proposed for listing as threatened; S/A = similarity of appearance; T = threatened.

[c]Resident = a species that occurs on CCAFS year-round; visitor = a resident bird species that occurs on CCAFS but does not nest there; transient = a bird species that occurs at CCAFS only during the season of migration: resident, visitor, or transient not observed = a species that is a resident, visitor, or transient, respectively, in the Brevard County area but has not been observed on CCAFS.

not produce toxic substances that would damage vegetation or wildlife habitat. Deluge water would be sampled and analyzed prior to release to grade during normal operations (Sect. 2.2.2); therefore, it would not contain toxic substances that would impact terrestrial biota. Emissions and effluents from other routine launch operations at CCAFS have not been observed to adversely affect terrestrial biota.

Launches would generate intense noise levels of predominantly low frequencies and short duration (<1 min) at CCAFS (Sect. 2.1.3.2). These noise levels could possibly impair the hearing of animals residing near the launch complex. Although information is lacking for animals exposed to space launch noise, individual animals of several species have shown hearing loss when exposed to intense off-road vehicle noise of relatively short duration (e.g., 95 dBA for 8 min) (Brattstrom and Bondello 1983). The survival of individual animals that experience hearing loss could be jeopardized (for example, because of increased susceptibility to predators) and a small decrease in population density could occur near LC 36.

Sonic booms would be expected to occur only over the Atlantic Ocean and to be inaudible to wildlife at CCAFS or other coastal areas. The booms could produce a startle response in certain marine birds and mammals on or above the water surface but would not be expected to affect the abundance or health of their populations. Sonic booms have generally been found to have no significant effect on wildlife populations (Jehl and Cooper 1980; Teer and Truett 1973; Runyan and Kane 1973).

Threatened and endangered species, with the exception of the sea turtles, would not be expected to be significantly affected by the proposed project because little loss of habitat would be expected; however, illumination of the pad at night would exacerbate an existing problem affecting sea turtles at CCAFS. Emerging sea turtle hatchlings have been observed to be attracted inland from the beach by artificial lighting, whereupon they experience increased mortality due to desiccation and predation (Murphy 1987; Witham 1982). Lights at LC 36 would contribute to this impact. In accordance with formal consultation requirements in section 7 of the Endangered Species Act, the USAF has consulted the USFWS with regard to project operation and security lighting effects on sea turtles at CCAFS and the options for mitigation (e.g., pressure sodium lights). Results of this consultation are provided in Appendix B.

The hearing of threatened and endangered species such as scrub jays, Florida mice, and others near the launch pad might be adversely affected by intense launch vehicle noise. A limited amount of mortality could indirectly result from hearing loss (e.g., because of increased susceptibility to predators). However, because loss of habitat is not expected, long-term population levels of these species would not be significantly decreased.

2.2.6.3 Mitigation

Prevention of impacts of the proposed project would include standard practices necessary to control erosion and handling of hazardous substances that could affect wildlife and/or their habitats. On-site gopher tortoises would be relocated at CCAFS prior to construction to prevent fatalities from direct injury. Appendix B contains information regarding mitigation required by the USFWS to protect sea turtles. Only low-pressure sodium lights would be used for security illumination of the launch pads to provide less attraction to sea turtle hatchlings. Because the proposed project would not result in significant habitat loss or significant reductions in terrestrial wildlife populations, no additional mitigation for impacts on terrestrial biota would be necessary.

2.3 CUMULATIVE IMPACTS

The MLV II program is one of seven proposed or existing space launch programs at CCAFS described in Tables 6a and 6b.

The National Environmental Policy Act (NEPA) requires that the environmental review of a proposed federal action consider the contribution of the action to cumulative impacts in the region. To meet this requirement, the impacts of the MLV II program must be evaluated in combination with impacts from the other space launch programs at CCAFS and with those of other projects in the area, including urban and industrial development, road construction, and harbor improvements.

Table 6a. Proposed or existing space and missile launch programs at CCAFS

Launch vehicle	Launch complex	Launch operation	Vehicle fuel[a,b]	Vehicle exhaust emissions[c]	Maximum deluge water per launch[d] (gal)
Delta II	17a, 17B	Military, commercial	Solid-liquid	HCl, Al_2O_3, CO, NO_x	29,500
Atlas, I, II	36A, 36B	Military, commercial	Liquid	CO	280,000
Titan III, IV, 34D	40, 41	Military, commercial	Solid	HCl, Al_2O_3, NO_x	400,000
Trident	46	Military	Solid	HCl, Al_2O_3, NO_x	None

[a]Solid fuel is typically an ammonium perchlorate-based propellant generically known as hydroxyl-terminated polybutadiene (HTPB).
Liquid fuels are typically RP-1, LO_2, LH_2, and aerozine-50 (a 50:50 mixture of hydrazine and unsymmetrical dimethylhydrazine).

[b]Fuel burned during vehicle trajectory in lower atmosphere.

[c]HCl = hydrochloric acid; Al_2O_3 = aluminum oxide; CO=carbon monoxide; NO_x = nitrogen oxides.

[d]Quantity discharged to grade at actual launch. Lesser quantities may be discharged during pre-launch testing.

Table 6b. Planned launch rate per year for existing and future space and missile launch programs at CCAFS

Program/vehicle	1989	1990	1991	1992	1993
MLV I and Commercial/ Delta II	5	6	6	6	6
MLV II and Commercial/ Atlas I, II	1	2	6	5	4
Titan IV and Titan III (commercial)/Titan IV, III	6	6	6	6	12
Trident	1	0	0	0	0
TOTAL LAUNCHES	13	14	18	17	22

The proposed MLV II program is a successor to previous NASA programs at LC 36, which used Atlas I vehicles to launch interplanetary and other space exploration missions. No significant adverse impacts have been observed because of previous launch activities at LC 36 except for slight TCE contamination (3.3 μg/L) of groundwater in the confined wetland between Pads A and B (Sect. 2.2.2.1). As described in Sects. 2.1 and 2.2, the MLV II program is not expected to result in significant adverse impacts to air and water quality, geology and soils, aquatic ecology, and the socioeconomics of the region.

The following discussion of cumulative impacts is general and qualitative, rather than quantitative, for one or more of the following reasons: (1) project information is classified; (2) project is planned but has not yet been implemented; (3) baseline data/information is not available; or (4) monitoring was not conducted before/during/after launch.

2.3.1 Air Quality

Table 6a indicates the nature of the primary pollutants associated with existing and proposed launch programs at CCAFS and KSC. The vehicles used in these programs will use either liquid or solid propellants or a combination of both. In general, liquid propellants produce combustion products which have less potential than solid fuels for producing adverse environmental impacts. Solid or solid/liquid propellant combustion will generate hydrogen chloride (HCl), aluminum oxide (Al_2O_3), NO_x, and CO emissions. Combustion of RP-1, LO_2, and LH_2 will primarily generate CO, H_2, and O_2. Significant short-term cumulative air quality impacts are not expected from the MLV II program launches because the exhaust emissions would be separated in space and time from emissions of other launch programs (i.e., launches of different vehicles would not be conducted at the same time and would occur at different launch complexes). Long-term cumulative air quality impacts would also be insignificant because of the brief, sporadic nature of emissions from the various launch programs.

2.3.2 Surface-Water and Groundwater Quality

Groundwater and surface-water quality could potentially be affected by cumulative impacts of the various launch programs at KSC and CCAFS. The launch vehicles in some programs utilize solid propellants, which produce HCl and Al_2O_3 as the primary combustion products. While Al_2O_3 is quite insoluble in water, HCl forms a strong acid in water. Thus, launches in which solid propellants are burned would result in the production of acidic deluge water and surface deposition of acidic droplets and particles from the ground exhaust cloud. In contrast to this, the deluge water and ground cloud deposition produced by the MLV II vehicle would be nontoxic because of the nature of the combustion products (see Tables 1 and 6). In addition, the deluge water and exhaust cloud would be only very slightly acidic, as CO_2 forms a weak acid in water. Thus, the MLV II program would not contribute significantly to the cumulative impacts on groundwater and surface-water resources in combination with other launch programs.

Deluge water (280,000 gal total per launch) from the MLV II launches would be released to grade in accordance with an FDER permit. Launches of vehicles in other programs would also release deluge water to grade (see Table 6a). The MLV II deluge water would add to the total quantity of water that would infiltrate to groundwater at CCAFS. The maximum annual quantity of deluge water discharged would occur in 1993, when 22 total launches are planned; total deluge discharge would be about 6.1 million gallons. The contribution of the MLV II program would be about 18% of the annual total. Because all programs would use potable water as a source of deluge water and because all discharges would be permitted by FDER, cumulative significant adverse impacts would not be expected.

2.3.3 Socioeconomics

The MLV II project would result in an estimated population increase of 248 in Brevard County, which would not contribute to a significant cumulative impact on the population of the region. Increased economic activity resulting from about 612 new jobs (direct and secondary) and increased spending would contribute to a slight positive cumulative impact in Brevard County. Additional direct and secondary employment would be is ~7.4% of the ~8300 unemployed people in the county in August 1988. The demand for public services would increase correspondingly with the increased population resulting from in-migration of new employees and their families (~248 persons), but this should not unduly stress local services when combined with effects from other programs at CCAFS and new projects in Brevard County. The proposed project would not change land use patterns or land use designation. Traffic volumes in some areas may increase during construction, but only temporarily, and would not overload roads, even during peak traffic periods. Any long-term increase in traffic would be insignificant.

2.3.4 Ecological Resources

Without mitigation, the proposed project would contribute to the cumulative impacts of artificial illumination from launch complexes at CCAFS that affects sea turtle hatching mortality. To comply with Section 7 of the Endangered Species Act, the USAF is presently preparing a Biological Assessment for LC 40 and 41 to address this (and any other) impacts to threatened and endangered species at CCAFS (see Appendix B).

2.3.5 Noise

The brief, infrequent but intense noise levels associated with the proposed launch of the Atlas II vehicle would correspond to the brief increase in noise resulting from other launches at CCAFS, but because launches would not occur simultaneously, a cumulative impact in noise intensity would not result at a given point in time. However, the MLV II program and the commercial launches at LC 36 would increase the number of launches by up to ten per year, thereby increasing the number of launch noise disturbances in the region by ten per year.

2.3.6 Cultural Resources

Coordination is under way with the SHPO to determine the project's impacts on historic and archaeological resources and to identify any actions appropriate to preserve the historic integrity LC 36.

2.3.7 Hazardous Waste

Any hazardous waste generated as a result of the MLV II program would be managed in accordance with applicable federal and state regulations. Freon would be recycled, and TCE would be either recycled or incinerated; therefore, these wastes would not decrease existing capacity at local or regional hazardous waste disposal facilities. Construction wastes, spent solvents, oils, grease, and waste asbestos would be generated in incidental quantities that would not exacerbate local or regional hazardous waste disposal when considered alone, but which could stress local capacities when combined with quantities of wastes from other programs.

2.3.8 Safety

The MLV II program would increase launch frequencies from CCAFS by ten per year; therefore, the probability of accidents would increase. However, the hazards associated with accidents would be primarily occupational and would be dealt with as prescribed in the project safety plan. Because of the lack of data for catastrophic failures of launch vehicles affecting the public, an estimate of risk cannot be made. However, past experience with the Atlas/Centaur vehicle would indicate that the risks are quite small. [Eleven of 67 previous launches of the Atlas/Centaur have failed (see Appendix D); none of these failures in any way impacted the public.] The safety and disaster planning and preparedness of the MLV II program would address public safety concerns.

3. IMPACTS OF ACCIDENTS

3.1 ACCIDENT SCENARIOS

Accidents during the MLV II program that could affect the environment include (1) spills of toxic or hazardous materials, (2) fires/explosions, and (3) failure or premature detonation of the launch vehicle. A chronological summary of launches of the Atlas/Centaur, which is included in Appendix D, shows that none of the previously unsuccessful flight missions has resulted in significant adverse impacts.

Safety aspects of prelaunch, launch, and postlaunch phases are discussed in the Accident Risk Assessment Report (ARAR) for the MLV II program. The purpose of the MLV II ARAR is to provide the system users/operators with a comprehensive description of the hazardous subsystems and operations associated with the program. It provides comprehensive identification and evaluation of the accident risks assumed during the processing and operation of the Atlas II throughout its life cycle. It also provides the means of substantiating compliance with program safety requirements, and it summarizes all system safety analyses and testing performed on each system. A preliminary hazards analysis resulted in the nine potential accident events given in Table 7. The ARAR identifies design and operating limits to be imposed on system elements to preclude or minimize accidents that could cause injury or damage.

Responsibility for safety during the ascent phase of USAF space launch vehicles is assigned to the commander of the Eastern Test Range. General policies and practices for range safety at CCAFS are provided in ESMC Regulation 127-1. In the vicinity of CCAFS, the Wildlife Refuge and beaches are closed before launch, and access to a safety zone in the ocean immediately east of the base is denied.

3.2 AIR QUALITY

The potential air-quality impacts of accidents associated with the Atlas MLV II program would not be significant. If the launch vehicle were accidentally or intentionally detonated, most of the RP-1, LO_2, LH_2, and

Table 7. Preliminary hazard analysis results for MLV II program

Hazardous Event	Cause Category	Phase
Personnel Injury During Processing	S/M, ELE, PRS, PYR, RAD, T/A, IMP, OPE, PRE	0 - 7, 11, 12
Collision/Impact During Handling/Transportation	S/M, MAT, IMP, OPE, PRE	0, 1, 3, 4, 11, 12
Fire/Explosion (Non-Ordnance)	CON, ELE, CHE, ENV, PRS, THE, IMP, OPE, PRE	0, 2, 4 - 9, 11, 12
Rupture/Implosion of Pressurant/Propellant System Components	S/M, MAT, CON, ELE, ENV, PRS, PYR, PRO, IMP, OPE, PRE, SWE	0, 2, 5, 6 - 9, 11, 12
Structural/Mechanical Failure Under Load	S/M, MAT, CON, CHE, ENV, PRS, PYR, PRO	0, 2 - 12
Inadvertent Ordnance Initiation	CHE, ELE, ENV, PYR, EMI, THE, IMP, OPE, PRE, SWE	4, 6 - 10
Premature/Inadvertent Activation or Failure of Flight Termination System	S/M, ELE, ENV, PYR, EMI, THE, OPE, PRE, SWE	4, 5, 7, 8, 9
Vehicle Position Requires Destruct	S/M, ELE, PRS, PRO, RAD, SWE	8, 9
Element Recontact During Flight	S/M, ELE, ENV, PYR, PRO, IMP, SWE	8, 9, 10

Phase Codes: 0. Launch Site Activ, 1. Sub Manuf, 2. Sub Test, 3. Transp, 4. Veh Assy & Process, 5. Sys Test, 6. Prelaunch Serv, 7. Countdown, 8. Flight Phase I, 9. Flight Phase II, 10. Payload Sepr, 11. Refurb, 12. Maint

Cause Category Codes: S/M: Struc/Mech, MAT: Material, CON: Contam/Corr, ELE: Elect, CHE: Chemical, ENV: Environ, PRS: Press, PYR: Pyrotechnics, PRO: Propulsion, RAD: Radiation, EMI: Electromagnetic Intf, T/A: Toxic/Asphyx, THE: Thermal, IMP: Impact/Collision, OPE: Op Error, PRE: Procedure Error, SWE: Software Error hypergolic propellants would likely be consumed in the explosion and fireball. Some small amounts of these liquid propellants may go uncombusted in such a detonation. Any uncombusted propellant would probably be in the form of vapor and small droplets immediately after an explosion. The heat caused by the fireball would generate significant buoyant rise of the cloud containing these constituents, thus. tending to minimize ground-level air quality impacts from small amounts of uncombusted propellant. The combustion products from the majority of the propellant quantities which are consumed in such an explosion would be primarily carbon dioxide and water.

Hydrazine for the roll control module and reaction control system (~210 lb) would be delivered to the launch pads in 55-gal stainless steel drums and loaded by a portable transfer system (see Sect. 1.1.3.3). Hydrazine is quite toxic and is a potential carcinogen. Based on the results of a number of animal studies, the National Academy of Sciences (NAS 1985) has recommended a maximum 1-h average hydrazine limit in air of 0.12 ppm. Fortunately, hydrazine has a high boiling point (236^{o}F) and does not evaporate rapidly under normal environmental conditions. Ille and Springer (1978) have calculated the evaporation rate of hydrazine as a function of spill volume for a set of typical ambient temperatures. Their calculations indicate that for a high-temperature (worst-case) environment of 30^{o}C (86^{o}F), a 200-L (202-kg) spill of hydrazine would evaporate at a rate of ~10 kg/h.

Hydrazine loading would be conducted only when meterological conditions are such that the predicted PHC would not overlay offbase areas (see Sect. 2.2.1.3). A loading accident could result in a maximum of 55 gal hydrazine being spilled. If a spill occurs, the slow rate of evaporation would allow personnel time to contain and collect the hydrazine before a substantial portion evaporates. Because of the reactive nature of hydrazine (it spontaneously decomposes when in contact with air) and its slow evaporation rate, most or all of it would probably be depleted before it was carried off-site. Thus, the modest amount of hydrazine that might be vaporized in such an accident would not constitute a threat to off-site populations, the nearest of which would be ~5 miles from LC 36.

Larger amounts of hydrazine, MMH, and N_2O_4 would be contained in the payload for orbital propulsion. The maximum amounts would be approximately

600 lb, 1040 lb, and 1720 lb, respectively. These hypergolic propellants would be transferred to a payload at existing permitted facilities at CCAFS and offsite at Titusville. However, the hypergolic compounds could be spilled if the payload propellant vessels ruptured during on-pad assembly of the launch vehicle. The potential air-quality impacts of such spills were evaluated with the Air Force Toxic Chemical Dispersion Model (AFTOX) (Kunkel 1987) and compared with the NAS recommended Short-Term Public Emergency Guidance Levels (SPEGLs) for atmospheric concentrations of hypergolic compounds (Table 8). Also shown in Table 8 are concentrations which the National Institute of Occupational Safety and Health (NIOSH 1985) has established as immediately dangerous to life or health (IDLH).

For worst-case meteorological conditions (light wind, stable atmosphere), the AFTOX model results indicated that concentrations at the nearest offbase receptor (~5 mi) could approach (within 50%) or exceed (within 150%) exposure limits recommended by the NAS. AFTOX results also indicated that for a worst-case spill scenario, the IDLH levels for each of the hypergolic propellants would be confined to areas well within the boundaries of CCAFS.

The probability of an accidental spill of this type is low. Nevertheless, off-site exposures greater than the SPEGLs shown in Table 8 would be mitigated by conducting potentially hazardous operations only when meteorological conditions would preclude such exposures (see Sect. 2.2.1.3).

3.3 WATER QUALITY

Impacts to the water quality of the adjacent wetland and the unconfined aquifer would occur in the event of an accidental spill of RP-1 or hydrazine. If the RP-1 and hydrazine reached the wetland, they would form surface films that would evaporate with time. The slow evaporation rate of hydrazine should enable cleanup of spills prior to off-site migration. Spills that reached groundwater would remain there and would be transported along groundwater migration pathways. Spill response equipment would be immediately used to remove spilled fuel to minimize the effects of the spill on water quality.

An in-flight failure could result in launch vehicle and payload hardware and propellants falling into the ocean, surface waters, and land surfaces.

Table 8. Recommended exposure limits for hypergolic propellant concentrations in air

Pollutant	Type of limit	Recommending agency	Concentration (ppm)
Hydrazine (N_2H_4)	[a]SPEGL [c]IDLH	[b]NAS [d]NIOSH	0.12 80
Monomethyl-hydrazine (MMH)	SPEGL IDLH	NAS NIOSH	0.24 5
Nitrogen dioxide[e] (NO_2)	SPEGL IDLH	NAS NIOSH	1 50

[a]Short-term public emergency guidance level (60-min average).
[b]National Academy of Sciences (NAS) 1985. Emergency and Continuous Exposure Guidance Levels for Selected Airborne Contaminants. Committee on Toxicology, National Research Council.
[c]Immediately dangerous to life and health.
[d]National Institute of Occupational Safety and Health (NIOSH) 1985. Pocket Guide to Chemical Hazards. DHEW (NIOSH) Publication No. 78-210. U.S. Department of Health and Human Services.
[e]Nitrogen tetroxide dissociates almost entirely to nitrogen dioxide (NO_2) upon evaporation into the ambient air. Thus, recommended limits are stated in terms of NO_2.

The impacts of such an accident would be confined to the vicinity of the deposition. RP-1 is nonviscous and weakly soluble. The insoluble fractions of this propellant would spread rapidly to form a localized surface film, which would evaporate and degrade within several hours to a few days, depending on atmospheric conditions.

Hardware that falls into the ocean will corrode slowly, releasing metal ions into the water column. Because of the slow rate of corrosion and the large volume of water available for dilution, higher concentrations of metals in the ocean water would be confined to the immediate vicinity of the launch vehicle and payload material.

3.4 ECOLOGY

The extent of the impacts to ecological resources from spills at LC 36 would depend on the amount and type of propellant spilled and the type of habitat affected. It is projected that the maximum volume of fuel that could be spilled would cover an area of ~1.7 miles^2, but the film that would be formed would not interfere with oxygen transfer. Depending on climatic conditions, the film would evaporate and degrade within several hours to a few days; therefore, the impacts to ecological resources would be minimal. If the deposit occurred in a wetland area, surface-breathing insects such as mosquito larvae could be adversely affected. Spill response equipment would be used to remove as much of the fuel as possible to minimize the effects of the spill on water quality and aquatic biota.

An in-flight failure could result in space vehicle hardware and propellants falling into the ocean, surface waters, and land areas (see Sect. 3.3). The localized nature of the propellant film would restrict any effects to ecological resources to the immediate vicinity. Because of the slow rate of corrosion and the large volume of water available for dilution, increased concentrations of metals in the ocean water would be confined to the immediate vicinity of the space vehicle material and would affect only those sessile aquatic biota that were near the corroding material.

Fuel spills, fires, explosions, or inadvertent ordnance initiation would temporarily eliminate some terrestrial biota in the vicinity of LC 36. Following such accidents, vegetation and wildlife would eventually reestablish themselves in the affected areas.

3.5 PUBLIC HEALTH AND SAFETY

No impacts to public health and safety are anticipated during contruction or normal operations. Negligible impacts could occur because of air or water pollution associated with the accidents described in Sects. 3.2 and 3.3. Significant impacts to public health and safety could foreseeably occur only in the event of the simultaneous failure of both the vehicle guidance system and the vehicle destruction system, which could result in the crash and explosion of a vehicle in an inhabited area. The likelihood of such an accident is extremely remote.

3.6 COMMUNITY RESOURCES

Accidents producing air or water pollution (Sects. 3.2 and 3.3) could require the temporary redirection of community services to correct the pollution problem. The extremely remote possibility of the crash of a vehicle in a developed area could destroy elements of the community infrastructure, thus having a long-term impact on public resources.

4. PERMITS AND ENVIRONMENTAL COMPLIANCE

4.1 AIR QUALITY

The FDER regulates air pollutant emissions. Permits are required by the FDER for construction, modification, or operation of many types of potential sources of air pollution (FDER 1986). However, mobile sources such as aircraft are exempt from permitting requirements. Thus, the exhaust emissions of the Atlas/Centaur II vehicle are not subject to permitting by the FDER. Other, ground-based air pollution sources associated with launch preparation and cleanup are subject to review and permitting by the FDER.

According to FDER (Hanks 1988), the following air emission sources would require permits, unless specifically exempted by the FDER after its review of design and operations data: (1) hydrazine vapor scrubber, (2) backup diesel electric generators (900-kW total capacity), and (3) the spray painting facility.

Although the FDER may require permits for these sources, the emissions from these facilities would not be great enough to trigger review under the "Prevention of Significant Deterioration" regulations. Because the CCAFS area is considered to be in attainment or "unclassifiable" with respect to all NAAQS, special nonattainment area permitting requirements would not apply. Because of the generally low expected emissions associated with the Atlas/Centaur II (MLV II) program, it is not expected to pose a threat to NAAQS or Florida Ambient Air Quality Standards, which are equivalent in stringency to the NAAQS.

4.2 WATER QUALITY

4.2.1 Industrial Wastewater Discharge

Wastewater discharges from the MLV II program operations at LC 36 will include deluge water discharged during preparation for launch, at launch, and following launch (see Sect. 2.2.2.2). A permit application has been filed with the FDER under Chapter 17-4 regulations (Maloy 1988) to construct and operate an industrial wastewater treatment and disposal system for LC 36 for discharge of deluge water to grade. The permit will be issued based on demonstration that discharge will neither significantly degrade receiving surface water or groundwater as the result of discharge or infiltration. A monitoring program has been proposed in the permit application for both surface water and groundwater.

If contaminants are present in the deluge water, treatment may be required before discharge. Because of the volume of deluge water discharging to the land surface. corrective measures could be required before subsequent launches.

4.2.2 Storm Water Drainage

Florida's storm water discharge permitting program is designed to prevent adverse effects on surface-water quality from storm-water runoff. Based on discussions with FDER. a storm-water discharge permit is not required for LC 36 because the planned modifications will neither increase storm-water runoff rates nor reduce the quality of the existing runoff (see Sect. 2.2.2.2).

4.2.3 Surface-Water Management

The St. Johns Water Management District administers the surface-water management program for the Cape Canaveral area. The program regulates postdevelopment runoff water quality and quantity to prevent degradation of predevelopment conditions. LC 36 was constructed before the Surface Water Management Program implementation date (January 31, 1977) and is exempt from regulation under this program.

4.2.4 Sanitary Wastewater Discharge

New permits from Brevard County will not be required for potable water or sanitary waste disposal because the existing systems already have permits. In

October 1991. If new water lines are necessary (not replacement lines), a general permit from FDER will have to be obtained.

4.3 SPILL PREVENTION

The EPA's Oil Pollution Prevention Regulation requires facilities to prepare and implement a Spills Prevention Control and Countermeasures (SPCC) plan to prevent any discharge of oil or other petroleum products into waters of the United States. The CCAFS currently operates this plan as part of the Oil and Hazardous Substance Pollution Contingency Plan (OPLAN 19-01). Because LC 36 is not adjacent to surface waters or drainage canals, there would be no direct impacts on surface waters from on-site spills. However, any spilled material containing petroleum products could infiltrate into groundwater beneath the site and be transported to surface waters via groundwater migration pathways. Spill control measures would be implemented to minimize infiltration to groundwater.

RP-1, LH_2, and LO_2 are stored on-site in existing aboveground tanks that are surrounded by a concrete berm of sufficient capacity to contain the contents of the tanks (see Sect. 1.1.3.3). Hydrazine is loaded in the launch vehicle from a portable system. On-pad accidental or emergency releases of small quantities of propellant would be collected and removed by a certified disposal subcontractor in accordance with the CCAFS Hazardous Substance Pollution Contingency Plan (OPLAN 19-14).

4.4 ENDANGERED SPECIES

The Endangered Species Act of 1973, as amended (16 USC 1531 et seq.), is intended to prevent the further decline of endangered and threatened plant and animal species and to help in the restoration of populations of these species and of their habitats. The Act, which is jointly administered by the departments of Commerce and the Interior, requires that a federal agency consult with the USFWS to determine whether endangered and threatened species are known to occur or have critical habitats on or in the vicinity of the site of a proposed action. Consultation with the USFWS is factored into the ecological impact analysis that is conducted as part of the NEPA review and reported in NEPA documents. Informal consultation between the USAF and USWS concerning threatened and endangered terrestrial wildlife and aquatic species at LC 36 and CCAFS has been completed. Results of the consultation are presented in Appendix B.

4.5 CULTURAL RESOURCES

Section 106 of the Historic Preservation Act of 1966 [16 USC 470(f) et seq.] requires that federal agencies with jurisdiction over a federal action provide the Advisory Council on Historic Preservation and the SHPO with an opportunity to comment on the effects that the action may have on properties included in, or eligible for inclusion in, the National Register of Historic Places. Results of consultation with the SHPO are presented in Appendix B.

4.6 COASTAL ZONE MANAGEMENT

The Coastal Zone Management Act of 1972 (Public Law 92-583) declared that the national policy is to preserve, protect, develop, restore, and/or enhance the resources of the nation's coastal zone. While the Act defines "coastal zone" as extending inland from the shoreline only to the extent necessary to control shorelands, it also <u>excludes</u> from the coastal zone lands used solely at the discretion of or held in trust by the federal government. The Act, however, requires that federal agencies which conduct or support activities that directly affect the coastal zone to conduct these activities, to the maximum extent practicable, in a manner consistent with approved state coastal zone management programs. Federal agencies are thus to consider state management plans as supplemental requirements to be adhered to in addition to agency mandates. Management programs provide for adequate consideration of the national interest involved in planning for, and in the siting of, facilities necessary to meet requirements that are other than local in nature.

Based upon this EA, the Air Force has determined that the MLV II Program is consistent "to the maximum extent practicable" with the coastal policies and objectives of the State of Florida for those potential impacts from the program that could occur on non-federal land but within Florida's designated coastal zone. This EA, which provides the supporting documentation for this consistency determination, will be submitted to the State of Florida for consistency review.

5. REFERENCES

Banks, R. C., R. W. McDiarmid, and A. L. Gardner. 1987. Checklist of vertebrates of the United States, the U.S. Territories, and Canada. U.S. Fish and Wildlife Service Resource Publication 166.

Barton, D. F., and R. S. Levy. 1984. An architectural and engineering survey and evaluation of facilities at Cape Canaveral Air Force Station, Brevard County, Fla., March 16.

Brattstrom, B. H., and M. C. Bondello. 1983. Effects of off-road vehicle noise on desert vertebrates. Pp. 167-206 in R. H. Webb and H. G. Wilshire (eds.). Environmental effects of off-road vehicles: Impacts and management in arid regions. Springer-Verlag, New York, N.Y.

Environment Reporter. 1987. Florida State Water Laws, pp. 167-76. The Bureau of National Affairs, Inc., Washington, D.C.

Environment Reporter. 1988. Florida Water Quality Standards, pp. 141-48. The Bureau of National Affairs, Inc., Washington, D.C.

Florida Department of Environmental Regulation (FDER). 1986. Chapter 17-2. Florida Administrative Code—Air Pollution Sources. Oct. 20.

Florida Department of Environmental Regulation (FDER). 1987a. Summaries of ambient air quality data in tabular form. Bureau of Air Quality Management, Tallahassee, Fla., Sept. 16.

Florida Department of Environmental Regulation (FDER). 1987b. Florida Public Drinking Water Systems. Bureau of Groundwater Protection, Tallahassee, Fla.

Florida Department of Environmental Regulation (FDER). 1988. Florida Water Quality Standards. Bureau of Groundwater Protection, Tallahassee, Fla.

Florida Statutes. Chapter 161. 1985. The Coastal Zone Protection Act of 1985.

George, D. H. 1987. Fish and wildlife management plan for Cape Canaveral Air Force Station, Florida. Pan Am World Services, Inc., Cape Canaveral Air Force Station, Fla.

Hanks, W. (FDER). 1988. Personal communication with E. J. Liebsch, Oak Ridge National Laboratory, September 12.

Ille, G., and C. Springer. 1978. The evaporation and dispersion of hydrazine propellants from ground spills (CEEDO-TR-78-30). Civil and Environmental Engineering Development Office, Tyndall Air Force Base, Fla. August.

Jehl, J. R., Jr., and C. F. Cooper (eds.). 1980. Potential effects of space shuttle sonic booms on the biota and geology of the California Channel Islands: Research Reports. Center for Marine Studies Technical Report 80-1, San Diego State University, San Diego, Calif.

Kunkel, B. A. 1987. User's Guide for the Air Force Toxic Chemical Dispersion Model (AFTOX), AFGL-TR-88-0009. Environmental Research Papers, No. 992, Air Force Geophysics Laboratory, Atmospheric Structure Branch, Hanscom AFB, MA.

Layne, J. N. (ed.). 1978. Mammals. Volume 1 in P. C. H. Pritchard (series ed.), Rare and endangered biota of Florida. University Presses of Florida, Gainesville.

Levy, R. S., D. F. Barton, and T. B. Riordan. 1984. An archeological survey of Cape Canaveral Air Force Station, Brevard County, Fla.

Malhotra and Manninen. 1981. Migration and residential location of workers at nuclear power plant construction sites. Nuclear Regulatory Commission Report No. NUREG/CR-2002. Pacific Northwest Laboratory Report No. PNL-3757.

Maloy, R. (FDER). 1988. Personal communication with V. R. Tolbert, Oak Ridge National Laboratory, October 31.

Mulligan, T. J., and F. F. Snelson, Jr. 1983. Summer-season populations of epibenthic marine fishes in the Indian River Lagoon System, Florida. *Florida Scientist* 46, 250-76.

Murphy, S. R. H. 1987. Sea turtle recovery efforts in the southeastern United States, pp. 63-71 in R. R. Odom, K. A. Riddleberger, and J. C. Ozier (eds.), *Proceedings of the Third Southeastern Non-game and Endangered Wildlife Symposium, August 8-10, 1987*, Athens, Georgia. Georgia Department of Natural Resources, Atlanta.

National Academy of Sciences (NAS) 1985. *Emergency and Continuous Exposure Guidance Levels for Selected Airborne Contaminants.* Committee on Toxicology, National Research Council.

National Institute of Occupational Safety and Health (NIOSH). 1985. Pocket guide to chemical hazards. DHEW (NIOSH) Publication No. 78-210. U.S. Department of Health and Human Services.

Pan Am World Services, Inc. 1987. Eastern Test Range, Cape Canaveral Air Force Station, Basic Information Guide, 1987 Revision.

Pritchard, P. C. H. (series ed.). 1978. Rare and endangered biota of Florida. University Presses of Florida, Gainesville (for the Florida Game and Fresh Water Fish Commission).

Reish, D. J., and M. L. Hallisey. 1983. A check-list of the benthic macroinvertebrates of Kennedy Space Center, Florida. *Florida Scientist* 46, 306-13.

Runyan, L. J., and E. J. Kane. 1973. Sonic boom literature survey. Volume I. State of the Art. Federal Aviation Administration Report No. FAA-RD-73-129-I.

Seaman, W., Jr. (ed.). 1985. Florida aquatic habitat and fishery resources. Florida Chapter American Fisheries Society, Kissimmee, Fla.

Snelson, F. F., Jr. 1983. Ichthyofauna of the northern part of the Indian River Lagoon System, Florida. *Florida Scientist* 46, 187-206.

Taylor, G. E., and R. A. Schumann. 1986. A description of the meteorological and range safety support (MARSS) system. Preprints, Fifth Joint Conference on Applications of Air Pollution Meteorology. American Meteorological Society. Boston, Mass.

Taylor, H. (Brevard County, Florida, Economic Development Council). 1988. Personal communication with B. L. Shumpert, Oak Ridge National Laboratory, October 10.

Teer, J. G., and J. C. Truett. 1973. Studies of the effects of sonic boom on birds. Federal Aviation Administration Report No. FAA-RD-73-148.

U.S. Air Force (USAF). 1988. Environmental Assessment: Air Force, Space Division, Medium Launch Vehicle (MLV) Program, Cape Canaveral Air Force Base, Fla. May.

U.S. Environmental Protection Agency (EPA). 1985. Compilation of air pollutant emission factors, Volume II: Mobile Sources, USEPA Publication AP-42. September.

U.S. Environmental Protection Agency (EPA). 1986. National, Primary and Secondary Drinking Water Standards, 40 CFR 141 and 40 CFR 143, August.

U.S. Fish and Wildlife Service. 1979. Classification of wetlands and deepwater habitats of the United States. Office of Biological Services, Department of the Interior, Washington, D.C.

U.S. Fish and Wildlife Service. 1987. Endangered and threatened wildlife and plants (50 CFR 17.11 and 17.12).

U.S. Fish and Wildlife Service. 1988. Endangered and threatened species of the southeastern United States. Region IV Office, Atlanta.

Witham, R. 1982. Disruption of sea turtle habitat with emphasis on human influence. Pp. 519-522 in K. A. Bjorndal (ed.), Biology and conservation of sea turtles. *Proceedings of the World Conference on Sea Turtle Conservation, Washington, D.C., November 26-30, 1979.* Smithsonian Institution Press, Washington, D.C.

6. LIST OF PREPARERS

OAK RIDGE NATIONAL LABORATORY

Technical Staff Member	Contribution
A. W. Campbell, M.S., Biology	Team Leader, Project Description, Geology and Soils
R. L. Kroodsma, Ph.D. Zoology	Terrestrial Ecology
E. J. Liebsch, M.S., Meteorology	Air Quality
B. L. Shumpert, M.S. (in progress), Planning.	Socioeconomics, Noise
V. R. Tolbert, Ph.D., Aquatic Ecology	Water Quality, Aquatic Ecology

USAF/SPACE DIVISION/DEV

Capt. H. E. Malave	Environmental Project Manager

APPENDIX A

PROPOSED MODIFICATIONS TO LC 36 AND THE INDUSTRIAL AREA AT CCAFS

LC 36 Projects

Proposed renovation and construction projects at LC 36 are illustrated in Fig. A-1. The following section briefly describes each project.

1. Asbestos Removal

Asbestos has previously been encountered on both launch pads and has been removed for disposal. It is anticipated that asbestos will be encountered again during renovation. The asbestos will be removed in accordance with state and federal regulations and ESMC OPLAN 19-15.

2. Repair/Replacement of Water Mains

The underground water mains servicing LC 36 have a history of leaks and are unreliable. Initial plans were to reline the mains. Costs, excavation in a wetland, and the identification of gopher tortoise burrows along excavation lines made this approach impractical. The current plan is to install new mains without disturbing the wetland and to carefully monitor work to ensure that existing burrows are not disturbed.

3. Installation of Wetland Culvert Valves

Culvert valves will be installed to control the discharge of wastewater from the interior grassy areas of each launch pad to an adjacent wetland.

4. Expansion of Hazardous Materials Storage

A small Hazardous Materials Storage facility exists due West of Pad B outside of the fenced area on an existing parking lot. Expansion of the facility is being investigated.

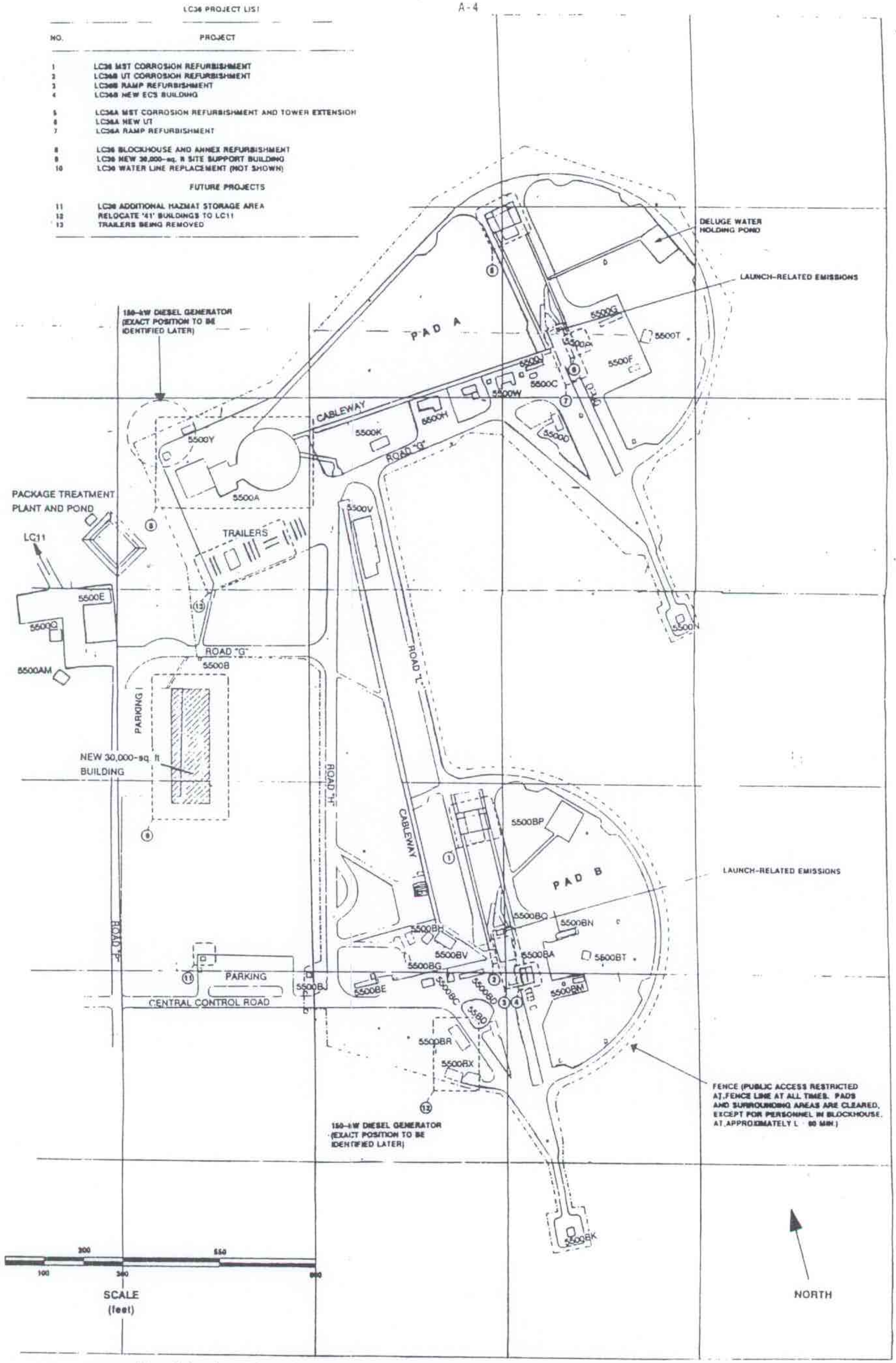


Fig. A.1. Location of renovation and construction projects at LC36 at CCAFS as planned for

5. Refurbishment of Blockhouse and Annex

The Blockhouse and Annex for LC 36 is proposed to be refurbished to improve working conditions, increase operating efficiency, and accommodate relocation of several labs. Refurbishment would include interior painting; removal of combustibles; installation of a vestibule for the Blockhouse entrance; refurbishment of the restrooms in both structures; and improvements to the heating, ventilation, and air conditioning systems.

6. New Launch Support/Office Building

A new building is proposed to be constructed on the parking lot south of the existing Ready Building to provide 15,000 ft^2 of engineering office space and 15,000 ft^2 for storage, shop, locker, and break rooms. Offices, shops, and break rooms currently located below the two Launch Service Buildings would be relocated to this new building. Equipment currently stored at various locations in the industrial area would also be relocated to this new building. No undisturbed ground nor wetland would be affected by this construction.

7. Removal of Trailers

Several NASA-owned trailers located near the Blockhouse would be removed.

8. Relocation of LC 36B Buildings

Several buildings located at LC 36B would be relocated to another complex.

LC 36A Projects

1. Mobile Service Tower (MST) Refurbishment and Extension

The MST provides access to the UT and a lighted, weather-protected area for erection and mating of the launch vehicle and spacecraft. The MST is on a rail system that enables it to be retracted to a safe position during launch. The MST is to undergo sandblasting and recoating, and structural corrosion damage will be repaired. This will include repairs to major structural joints and bolts, floor plates, and stairs and guardrails, as well as interior cleaning and recoating. The MST will also have ~40 ft added to its height to accommodate the larger launch vehicle.

2. New Umbilical Tower (UT)

The UT is a fixed, structural steel tower that extends above the launch pad and provides instrumentation lines, fuel, power, and purging gas to the launch vehicle and spacecraft by means of retractable booms. A new UT, similar to the UT on Pad B (Fig. A-2), which includes horizontal swinging booms, is proposed to be constructed to serve the future launch vehicle. The previous UT was removed from the pad during the Shuttle/Centaur program and is not reusable. In addition, an analysis of the UT foundation is proposed to determine its capability of accepting increased loads. If needed, a new foundation will be constructed.

3. Launch Services Building (Ramp) Refurbishment

This building, which is part of the pad, is proposed to be refurbished internally to improve working conditions, efficiency, and safety. Permanent engineering offices would be moved to a new building and replaced with day support areas for engineers and technicians. Refurbishment would include interior painting, upgrading of restrooms, removal of combustibles, removal of asbestos (as needed), and installation of air conditioning for the mezzanine level.

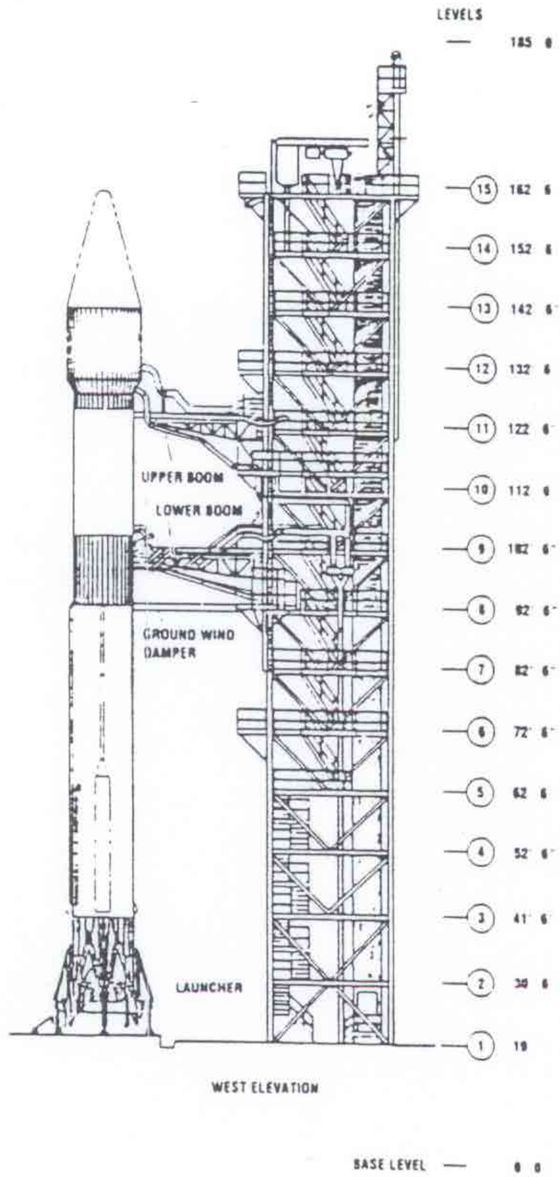


Fig. A-2. Umbilical tower at Pad B, Launch Complex 36, at Cape Canaveral Air Force Station, Florida.

LC 36B Projects

1. MST and UT Refurbishment

Both the MST and UT are presently undergoing routine maintenance (sandblasting and recoating). Structural corrosion damage is being repaired, and interior cleaning and recoating is proposed. A study is under way to determine whether additional modifications are necessary for the UT to accommodate new payload cooling requirements.

2. Refurbish and Relocate Platforms from LC 13 to LC 36 B MST

Several work platforms currently located on the LC 13 MST would be removed, refurbished, and reinstalled on the LC 36 B MST.

3. Launch Services Building (Ramp) Refurbishment

This building is proposed to be refurbished internally to improve working conditions, efficiency, and safety. Permanent engineering offices would be moved to a new building and replaced with day support areas. Refurbishment would include interior painting, upgrading of restrooms, removal of combustibles, and removal of asbestos (as needed).

4. New Environmental Control System (ECS) Building

This new building would contain equipment necessary to maintain the environment within the payload enclosure (fairing) during prelaunch operations.

Industrial Area Projects

Industrial Area projects are illustrated in Fig. A-3 and briefly summarized below.

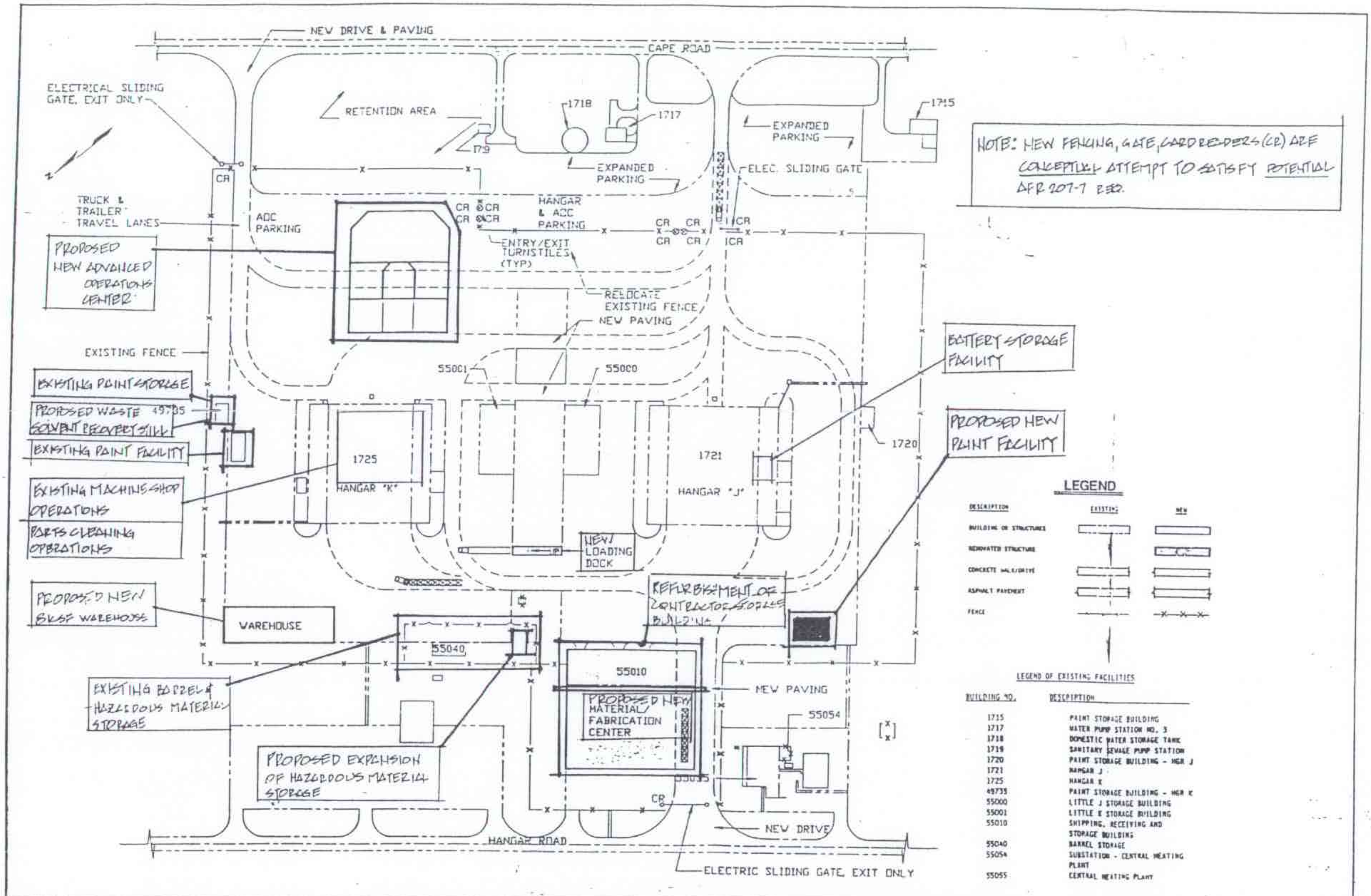


Fig. A-3. Conceptual site development for the CCAFS Industrial Area as planned for the MLV II program.

1. New Advanced Operations Center (AOC)

Proposed construction of the AOC would consolidate several office operations currently in need of expansion and several that are losing space to other programs. Space would be provided for future development of a new Telemetry Ground Station and two new Launch Control Centers (LCCs); high bay clean room space would be provided for final assembly procedures for the Atlas and Centaur vehicles. No hazardous operations would be performed in the new AOC. The AOC would be constructed on an existing asphalt parking lot and would consist of:

Office space	10,500 ft^2	(1st floor)
Ground station	10,500 ft^2	(2nd floor)
LCCs	10,500 ft^2	(3rd floor)
High bay space	15,000 ft^2	
Total	46,500 ft^2	(150 by 175 ft footprint)

2. New Machine Shop and Refurbishment of Contractor Storage Building

The existing Contractor Storage Building is to be refurbished internally. This refurbishment would include painting, insulating, new lighting, and interior rearrangement. The new machine shop would contain a precision machining area, low bay fabrication shop, machinist workroom, vending/break room, restrooms, miscellaneous offices, inspection rooms, grinding room, and electrical and mechanical support rooms. An optional second story is being investigated to accommodate expanding office space requirements. The proposed footprint for the new construction is 184 by 120 ft (22,080 ft^2); the optional second floor would be ~11,000 ft^2 and would also require a 3000-lb freight elevator. This construction would be mostly on an asphalt parking lot, although a small amount of unpaved ground would be lost.

3. New Warehouse

A new 8000-ft^2 warehouse is proposed to be constructed in the north corner of the site to replace facilities lost to other programs. This warehouse would have a footprint of 48 by 160 ft and would be a pre-engineered metal building. Heating and ventilation is planned with an option for limited humidity control. This building would be constructed on an existing asphalt parking lot.

4. Paint Facility

The need to construct a new Paint Facility in the west corner of the site is being evaluated. The facility, which would be constructed on an existing asphalt parking lot, would replace the existing facility. All exhaust would be filtered, and the facility would be permitted by FDER.

5. Refurbish Paint Storage Building for Waste Solvent Recovery Still

In conjunction with the above project and after relocation of the painting operations, the Paint Storage Building would be refurbished to contain a Waste Solvent Recovery Still. Installation of this operation would support plans to achieve zero waste disposal requirements. The existing building is equipped with extra-hazard fire protection and explosion-proof electrical systems.

6. New Loading Ramp

A new loading ramp is proposed to be constructed northwest of and centered between the two small hangars on the site. This ramp would facilitate loading and unloading of materials, equipment, and supplies.

7. New Site Entrance

Because of security restrictions dictated by the new Intermediate Nuclear Forces (INF) treaty, an entrance to the site from Hangar Road (from the northwest) is needed. Part of this entrance exists as a parking lot, the remainder will cover an existing pedestrian sidewalk and result in a small loss of unpaved ground.

8. Expansion of Hazardous Material Storage Yard

A small Hazardous Material Storage Facility exists on the northwest side of the site. Expansion of this facility is being investigated.

APPENDIX B

CONSULTATION AND COORDINATION

The following were contacted during preparation of this EA:

Florida Department of Environmental Regulation

Randy Merchant (Tallahassee
Willard Hanks (Tallahassee)
John Turner (Orlando)
Ralph Maloy (Orlando)

St. Johns River, Water Management District

Bill Osberne

Brevard County

Wilson R. Timmons, Jr.
Hank Taylor

Brevard County Job Service Office

Charles Johnson
Tom Clendenning

U.S. Geological Survey

Larry Fayard

Kennedy Space Center

C. Ross Hinkle (Bionetics, Inc.)

Florida State Historic Preservation Officer

George W. Percy

Florida Department of Labor and Employment Security

Mark Zimmerman

U.S. Fish and Wildlife Service

David J. Wesley

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE BASE, PO BOX 92960
LOS ANGELES, CA 90009-2960

7 October 1988

Mr. George W. Percy
State Historic Preservation Officer
Bureau of Historic Preservation
Division of Archives, History, and Records Management
Department of State
The Capitol
Tallahassee, Florida 32301-8020

Dear Mr. Percy:

The U.S. Air Force, Headquarters Space Division, proposes to renovate and modify Launch Complex 36 at Cape Canaveral Air Force Station (CCAFS), Florida, to accommodate the Medium Launch Vehicle II (MLV II) program. Launch Complex 36 is shown in attachment 1. The MLV II program will transport ten (10) Department of Defense Systems Communications satellites over a four-year period beginning in 1991. Present plans call for no more than four (4) launches per year. The MLV II is a modified Atlas vehicle using kerosene-based fuel.

The modification work includes a 40-foot vertical extension of the vehicle support structure and upgrading of utilities, mechanical and environmental systems, and security and lighting to meet the program needs. New support facilities, if any, will be built outside the secure area on previously disturbed land.

As part of the environmental review for this project, we must identify all important archaeological, cultural, or historical resources present at the project site. Two archaeological sites, CC38 and BR 238, have been identified in the vicinity by previous studies (R.S. Levy, D.F. Barton, and T.B. Riordan, 1984): *An Archaeological Survey of Cape Canaveral Air Force Station, Brevard County, Florida* In addition, Launch Complex 36 is within an area identified as potentially eligible for inclusion in the National Register of Historic Places (D.F. Barton and R.S. Levy, 1984): *An Architectural and Engineering Survey and Evaluation of Facilities at Cape Canaveral Air Force Station, Brevard County, Florida*

Please provide us with a listing of any other cultural or historic resources which you believe may be affected by the proposed action in order that we may include them in our analysis. Captain Hector E. Malave can provide you with further details on this project if needed. His phone no. is (213)643-0935. Your prompt response will be appreciated.

Sincerely,

Robert C Mason

ROBERT C. MASON, AICP
Chief, Environmental Planning Division,
Directorate of Acquisition Civil Engineering

3 Atch
1. Map of CCAFS
2. Map of SLC 36
3. Map of Pad 36B

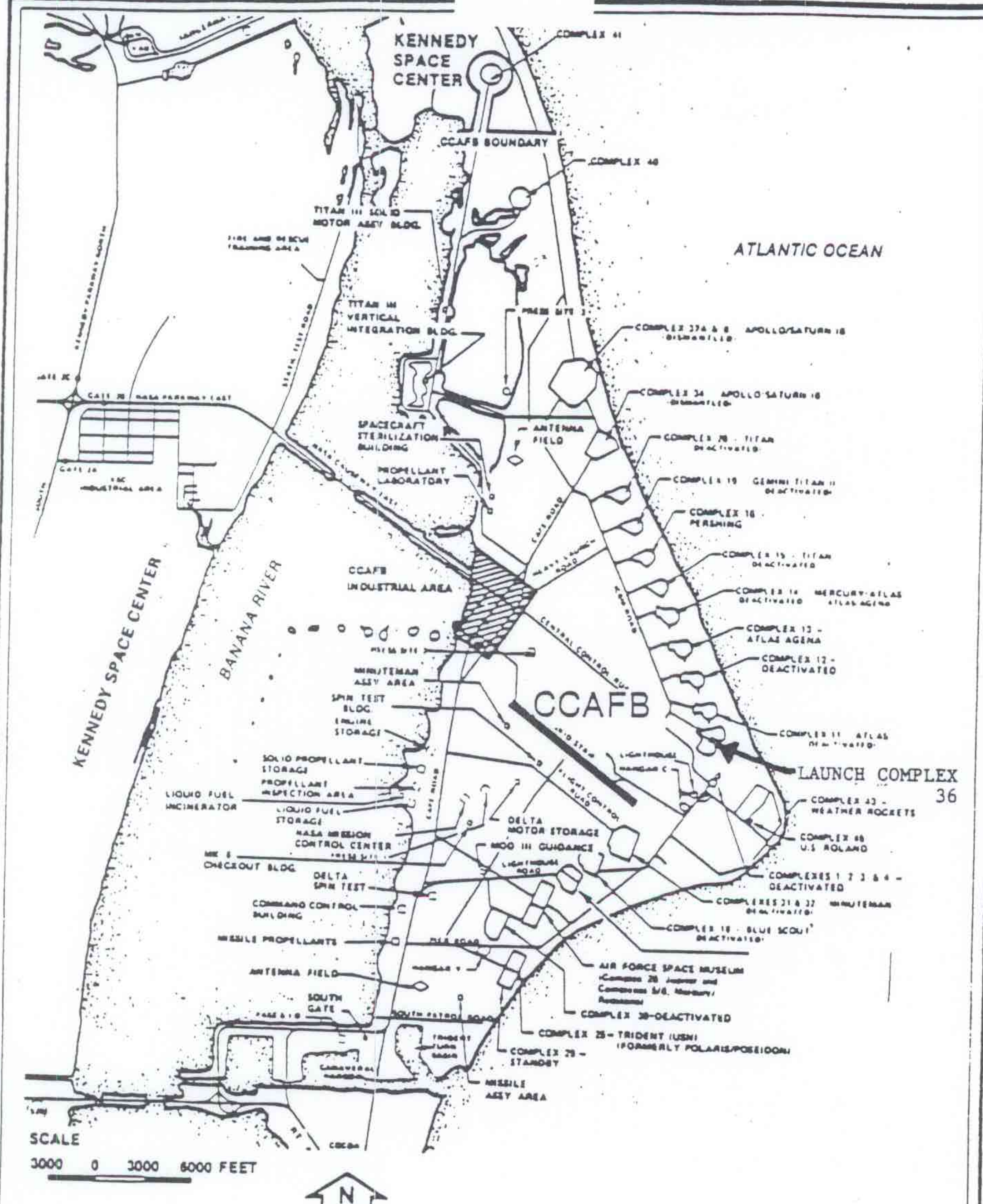
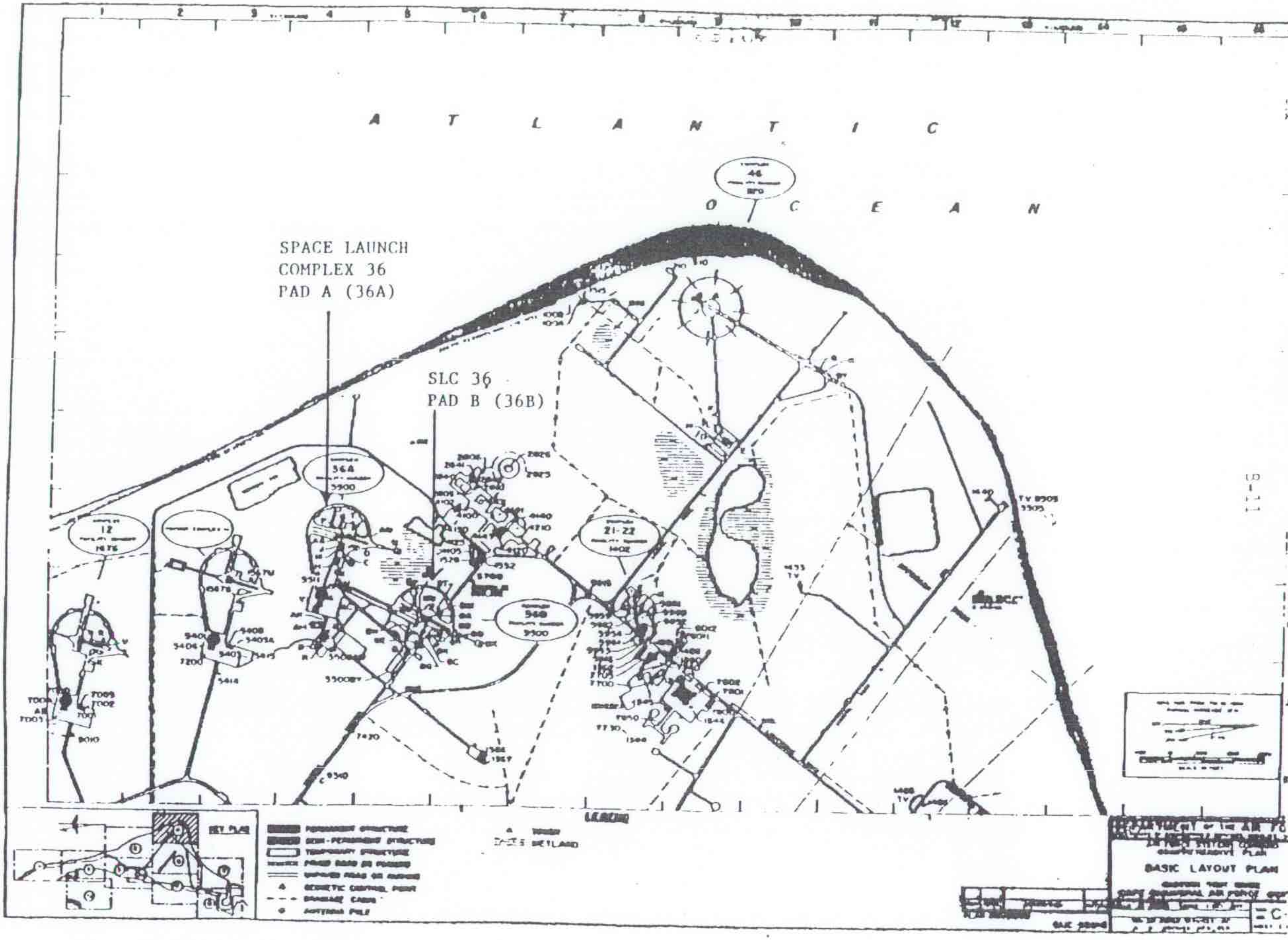


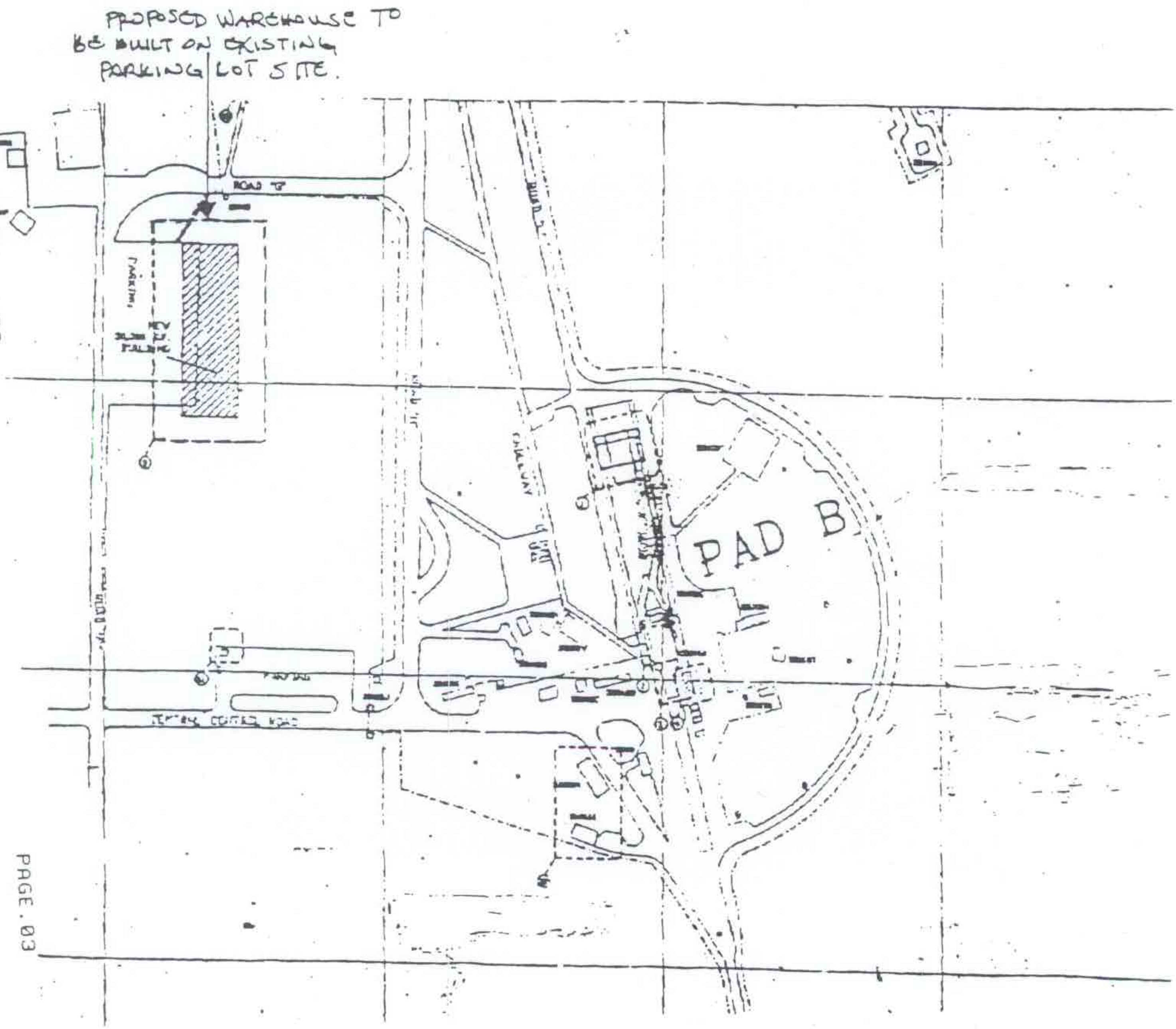
Figure 1.1-2
BASE MAP

SOURCE: ESE, 1988(7).

MLV II

Cape Canaveral Air Force Base


ATLANTIC OCEAN
SPACE LAUNCH
COMPLEX 36
PAD A (36A)
SLC 36
PAD B (36B)
36A
5500
36B
5500
21-22
12
46
LEGEND
WETLAND
KEY PLAN
BASIC LAYOUT PLAN


PROPOSED WAREHOUSE TO
BE BUILT ON EXISTING
PARKING LOT SITE.
PAD B

Atch 3

23 September 1988

Mr. David J. Wesley
U.S. Fish and Wildlife Service
Suite 120
3100 University Boulevard, South
Jacksonville, Florida 32216

Dear Mr. Wesley:

The U.S. Air Force, Headquarters Space Division, proposes to renovate and modify Launch Complex 36 at Cape Canaveral Air Force Station (CCAFS), Florida, to accommodate the Medium Launch Vehicle II (MLV II) program. Launch Complex 36 is shown in attachment 1. The MLV II program will transport ten (10) Department of Defense Systems Communications satellites over a four-year period beginning in 1991. Present plans call for no more than four (4) launches per year. The MLV II is a modified Atlas vehicle using kerosene-based fuel.

The modification work includes a 40-foot vertical extension of the vehicle support structure and upgrading of utilities, mechanical and environmental systems, and security and lighting to meet the program needs. New support facilities, if any, will be built outside the secure area on previously disturbed land.

This letter requests your input on this action. We are including a list of federally listed endangered and threatened species residing or seasonally occurring on CCAFS; please review it and update as necessary. We would appreciate your opinion regarding (1) any possible effects of the proposed project on such species, and (2) suggested measures to avoid or minimize any adverse impacts on these species. Along with this, we are evaluating our security requirements to reach a workable solution to the concerns with the high intensity lighting disturbing the federally listed turtles (Reference your letter to Robert Mason, dated 15 August 1988). All of these items will be fully covered in the Environmental Assessment for this program.

Capt Hector E. Malave can provide you with further details on this project if needed. His phone no. is (213)643-0935. Your prompt response will be appreciated.

Sincerely,

SIGNED

ROBERT C. MASON, AICP
Chief, Environmental Planning Division,
Directorate of Acquisition Civil Engineering

2 Atch
1. End. Species List
2. Map of CCAFS

Table 2.1-15. Endangered and Threatened Species Residing or Seasonally Occurring on CCAFB and Adjoining Waters

Species	Status*	
	USFWS	FGFWFC
MAMMALS		
West Indian manatee (Trichechus manatus)	E	E
BIRDS		
Wood stork (Mycteria american)	E	E
Bald eagle (Haliaeetus leucocephalus)	E	T
Peregrine falcon (Falco peregrinus)	T	E
Southeastern kestrel (Falco sparverius)	--	T
Red-cockaded woodpecker (Picoides borealis)	E	T
Florida scrub jay (Aphelocoma coerulescens)	--	T
REPTILES		
Atlantic green turtle (Chelonia mydas)	E	E
Atlantic ridley turtle (Lepidochelys kempi)	E	E
Atlantic loggerhead turtle (Caretta caretta)	T	T
Eastern indigo snake (Drymarchon corais)	T	T

*Status: E = endangered.
T = threatened.
-- = not listed.

Source: ESE, 1988 (7).

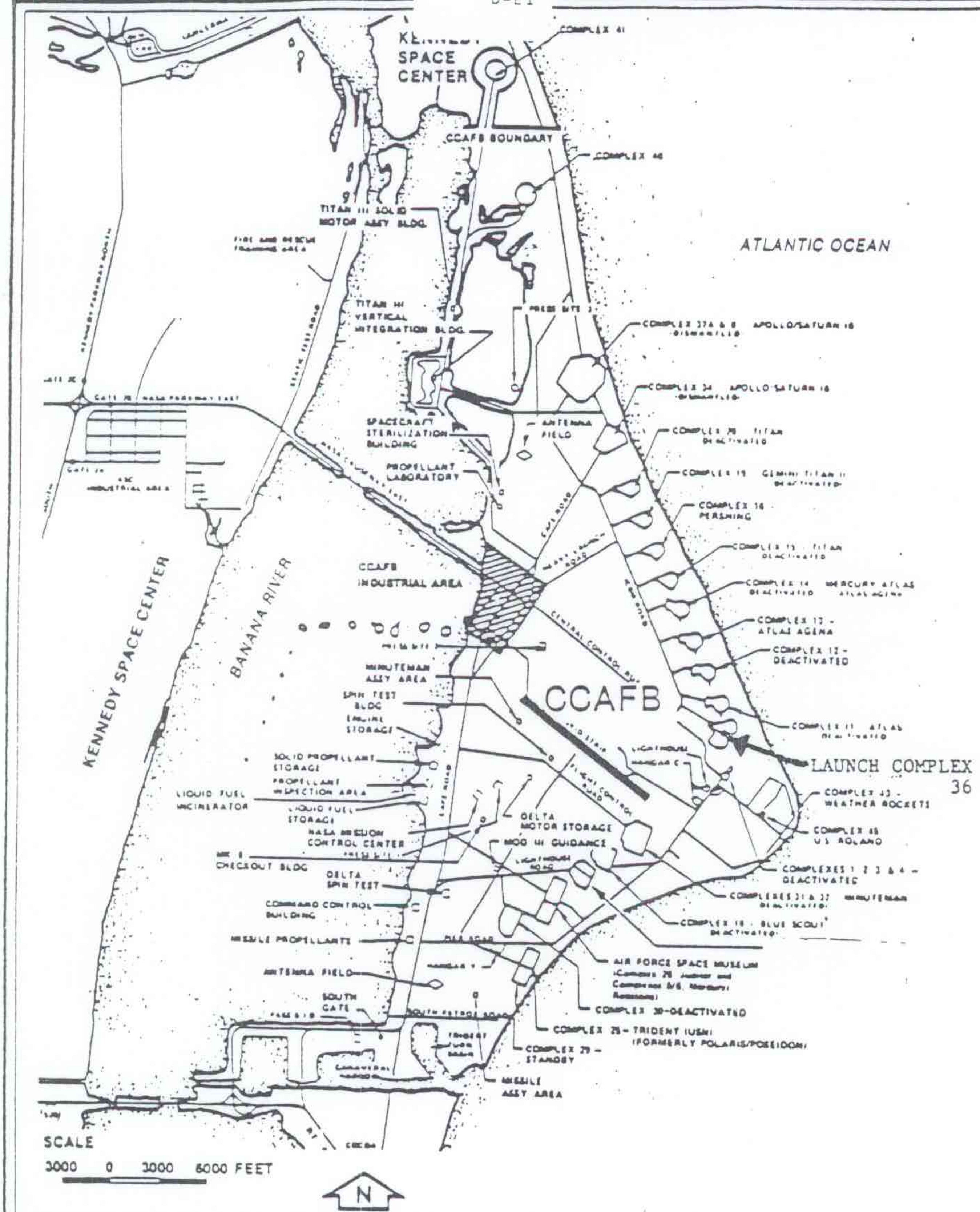


Figure 1.1-2
BASE MAP

SOURCE: ESE, 1988(7).

MLV II

Cape Canaveral Air Force Base

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE STATION, PO BOX [illegible], WORLDWAY POSTAL CENTER
LOS ANGELES, CA [illegible]

1 9 SEP 1988

Mr. David Wesley
U. S. Department of the Interior
Fish and Wildlife Service
3100 University Blvd. South, Suite 120
Jacksonville, FL 32216

Dear Mr. Wesley

This responds to your letter of 15 August 1988 concerning disorientation of hatchlings of three federally listed sea turtles caused by security lighting at Launch Complex 40 and 41 at Cape Canaveral Air Force Station (AFS), FL, and your meeting in April 1988 with representatives from Cape Canaveral AFS.

The Air Force is aware of its requirements under the Endangered Species Act and will cooperate with your agency to the maximum extent practicable to resolve this issue while maintaining the appropriate level of security lighting and other security programs necessary to protect the national defense mission of Cape Canaveral AFS. We are currently evaluating our security requirements and alternatives methods of providing the necessary levels of lighting. Within the next several weeks, we will arrange a meeting with your staff to discuss this issue with the hopes of arriving at a solution that eliminates the disorientation problem while meeting our security requirements.

We look forward to working with you and your staff to reach a mutually agreeable solution to this matter. If you have any questions, please contact me at (213) 643-0933.

Sincerely

SIGNED

ROBERT C. MASON, AICP
Chief, Environmental Planning Division
Directorate of Acquisition Civil Engineering

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE BASE, PO BOX 92960
LOS ANGELES, CA 90009-2960

3 0 SEP 1988

REPLY TO ATTN OF: DE

SUBJECT: Impacts to Federal Endangered Sea Turtles at Cape Canaveral AFS, FL

TO: SD/CLV 6555 ATG/CC 6550 ABG/DE

1. In response to the Supplement to the Environmental Assessment for the Titan IV Program at CCAFS, the U.S. Fish and Wildlife Service (USFWS) submitted a letter to SD/DE concerning adverse impacts to three species of federally protected sea turtles from security lighting at LC 40 and 41 (Atch 1). According to the USFWS, the level of security lighting is causing disorientation of sea turtle hatchlings and is considered by the USFWS to be a unlawful taking of federally listed species under the Endangered Species Act.

2. A recent HQ USAF/LEE policy letter (Atch 2) indicates that in accordance with the Endangered Species Act the Air Force must protect federally listed species which occur on Air Force installations and that recommendations made by the USFWS should be implemented unless they adversely impact the mission. We have discussed the disorientation issue with the SD/JA who in turned discussed it informally with the AFSC/JA. Their recommendation is that we should carefully consider the use of low sodium lights as recommended by the USFWS or other methods which may be available to reduce the disorientation of the protected species. If there are no alternative methods of providing the required security lighting levels which eliminates the disorientation problem, the burden of proof will fall on the Air Force to show why alternative methods are not available. Cost alone may not be sufficient justification for not implementing an alternative method.

3. The USFWS letter referenced an April 88 meeting between their staff and the Air Force to discuss the disorientation issue, at which time it was initially recommended by the USFWS that the Air Force use low pressure sodium lights to resolve the issue. The Air Force representatives at this meeting indicated there was a problem with low sodium lights providing the required lighting levels. This meeting ended without any agreement being reached. By the attached letter, the USFWS is putting the Air Force on official notice that they consider the Air Force to be in violation of the Endangered Species Act.

3. 6550 ABG/DEEV manages a sea turtle hatchling protection program which consists of screening nest sites to reduce disorientation and a raccoon control effort. In addition, as a result of the April 88 meeting, 6550 ABG/DEEV has initiated the preparation of a Biological Assessment to address the disorientation issue and evaluate alternative methods of providing the necessary security lighting not only at LC 40 and 41 but for all activities at CCAFS (i.e., LC 17 and 36). Their recommendations should be available in the next several weeks.

4. When the Biological Assessment is completed, a meeting will be scheduled at CCAFS to discuss this issue in depth and evaluate the alternative being recommended. All Air Force organizations and government contractors who have either a direct role in the resolution of this issue or who may be affected by any resolution will be invited to attend this meeting.

5. The points of contact for SD/DE is Mr. Robert Mason (SD/DEV) at AV 833-0933. The point of contact for 6550 ABG/DEEV is Mr. Olin Miller at AV 854-7288.

WILLIAM E. LEONHARD, JR., Colonel, USAF
Director of Acquisition Civil Engineering

2 Atch
1. USFWS Ltr, 15 Aug 88
2. USAF/LEE Ltr, 27 May 88

cc: SD/JA
EMSC/JA
AFSC/JA
6550 ABG/DEEV

United States Department of the Interior
FISH AND WILDLIFE SERVICE
3100 University Blvd. South
Suite 120
Jacksonville, Florida 32216

August 15, 1988

Mr. Robert Mason
Department of the Air Force
Headquarters Space Division/DEV
P.O. Box 92960
Los Angeles, California 90009-2960

Dear Mr. Mason:

This responds to your July 5, 1988, request for comments on the May 1988 supplement to the Environmental Assessment on the Titan IV Program at Cape Canaveral Air Force Station, Florida; it also relates to your August 8, 1988, discussion with Mr. Earl Possardt, our Southeastern Sea Turtle Coordinator, on this issue.

Three federally listed sea turtles nest on Cape Canaveral beaches and would be adversely impacted by the proposed activity. These are the endangered green turtle (Chelonia mydas), the endangered leatherback (Dermochelys coriacea) and the threatened loggerhead (Caretta caretta). Nesting densities at Cape Canaveral vary from 50-120 nests per km. The majority are loggerhead nests, with approximately 1-2 green nests per km, and only an occasional leatherback nest. Artificial lights deter some nesting females and disorient hatchling sea turtles, leading to high mortality since many disoriented hatchlings never find their way to the ocean. Last year approximately 25 nests were disoriented on Merritt Island NWR because of the present level of lighting from launch complexes 40 and 41. So far this year, hatchling disorientation has been documented from approximately 10 nests because of lighting at these launch pads. More disorientation is expected as the hatching period continues through October. Pan Am employees have also documented hatchling disorientation on Air Force lands from launch complex 40.

Activities at the launch complexes also adversely impact the refuge turtle program in other ways. For instance this summer 2 km of beach were closed for 2 weeks by the Air Force, thereby preventing daily sea turtle nesting surveys and the raccoon control necessary to protect nests.

On April 13, 1988, Mr. Possardt met with a number of individuals from the Air Force and Pan Am Services (see enclosure) to discuss the Air Force's plan to increase security lighting at these launch complexes. We recommended using low pressure sodium lights since these lights do not cause hatchling disorientation. The Air Force and security representatives indicated this option would not meet their security needs. No agreement was reached on an acceptable alternative.

Mr. Possardt informed Air Force representatives of the Section 7 process of the Endangered Species Act, the incidental take provision of the Act, and their application to this situation. He requested the Air Force not only to reevaluate the proposal for lighting but, also to reevaluate the lighting at the launch complexes to eliminate the current problem with hatchling disorientation. There has been no response from the Air Force.

The Service views hatchling disorientation as one of the most serious problems on sea turtle nesting beaches in the southeast and considers disorientation events as unlawful taking, under Section 9 of the Endangered Species Act, by the party responsible for the light.

We would appreciate the Air Force's immediate attention to this issue and request you initiate formal Section 7 consultation with the Service on the proposed action and current situation with launch complexes 40 and 41.

Sincerely yours,

David J. Wesley

David J. Wesley
Field Supervisor

Rcvd AFSC/DEVX 9-7-88 g

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330

27 [illegible] 988

REPLY TO ATTN OF: LEE

SUBJECT: Policy Letter on Endangered Species

TO: HQ AAC/DE
HQ AFLC/DE
HQ AFRES/DE
HQ AFSC/DE
HQ AFSPACECOM/DE
HQ ATC/DE
HQ MAC/DE
HQ PACAF/DE
HQ SAC/DE
HQ TAC/DE
HQ USAFA/DE
ANGSC/DE

1. The Air Force must protect federally listed endangered and threatened plant and animal species and their critical habitat, including species proposed for listing and proposed critical habitat (16 U.S.C. 1536(a)(1) & (4)).

a. We are obligated under law to conserve and improve endangered and threatened species habitat found on Air Force lands. This obligation applies to owned and leased property.

b. Management recommendations contained in published Fish and Wildlife Service (FWS) endangered and threatened species recovery plans should be implemented unless it adversely impacts the mission.

c. Methodology for protecting, conserving and improving endangered or threatened species and their habitat is recorded in a fish and wildlife management plan developed under AFR 126-1. If only plant species are covered, a suitable section may be included in the land management plan instead.

2. Any action that may adversely affect endangered or threatened species or their habitat requires consultation with the FWS and, for impacts offshore, the National Marine Fisheries Service, prior to irreversible commitment of resources. All installations must survey lands under their jurisdiction for endangered or threatened species or their habitat. The presence of species on each installation is listed in the Air Force Atlas of Endangered Species (Atch 1) completed in 1984. This documentation includes verification by the Regional Office of the FWS and differentiates between those species known to be present and those presumed to be present on the installation. If proper habitat is available within the range of distribution of the species, the species is assumed to be present until appropriate censusing indicates otherwise. Request you review this list and provide documentation confirming the list, including additions and deletions, by 1 Dec 88.

3. Final regulations to implement Section 7 of the Endangered Species Act became effective 3 Jul 86 with publication of 50 C.F.R., Part 402. The attached synopsis of 50 C.F.R., Part 402 summarizes changes that affect consultation actions (Atch 2). The full text of this document can be provided if it is not available at your command. A list of contacts for consultation is attached (Atch 3). Please disseminate this information to all your organizations who are impacted by the law. Our point of contact is Dr. A. L. Clark, HQ USAF/LEEV, Bolling AFB DC 20332-5000, AUTOVON 297-3639.

FOR THE CHIEF OF STAFF

GARY S. FLORA
Associate Director
Directorate of Engineering & Services

3 Atch
1. Atlas of Endangered Species
2. Synopsis of 50 C.F.R., Part 402
3. Points of Contact

United States Department of Agriculture

Soil Conservation Service

Rockledge Field Office
566 Barton Blvd., Suite 2
Rockledge, Fl 32955

March 9, 1983

Olin Miller
6550 ABG/DEEV
Patrick Air Force Base, Fl 32925

SUBJECT: SOILS INVENTORY AND EVALUATION FOR AGRICULTURAL USE ON CAPE CANAVERAL AIR FORCE STATION

According to the Brevard Soil Survey and verified by on-site inspection with you on 3-3-83, the soils on Cape Canaveral Air Force Station are composed of the following soil series: Canaveral complex, gently undulating (Ca) 56%; Canaveral-Urban land complex (Cc) 8%; Coastal Beaches (Ck) 5%; Palm Beach sand (Pb) 9%; Pomello sand (Ps) 1%; Welaka sand (We) 11%; Urban land (Ur) 6%; Quartzipsamments, smoothed (Qr) 2%; and the remaining 2% is Submerged Marsh, Tidal marsh (Tm), and Tidal Swamp (Ts). See attached soil map.

There is no feasible way to use the Canaveral-Urban land complex, Coastal Beaches, Urban land, Quartzipsamments, submerged marsh, tidal marsh, or tidal swamp for agricultural purposes. Following is a brief description of each of the remaining four soils and their agricultural suitabilities.

Canaveral complex, gently undulating (Ca): nearly level and gently undulating, moderately well drained sandy soils mixed with shell fragments. Permeability is very rapid and the available water capacity is very low in all layers. Organic-matter content and natural fertility are low. This soil is not suited for vegetables and citrus, poorly suited for improved pasture grasses. It is in the Sand Scrub Range Site and group 4 woodlands. Management for woodland would encounter severe problems with seedling mortality and equipment limitations. Capability unit VI s-4.

Palm Beach sand (Pb): nearly level and gently sloping excessively drained soil on dunelike ridges, consisting of mixed sand and shell fragments. Permeability is very rapid throughout, available water capacity is very low, organic-matter content and natural fertility are low. This soil is not suited for vegetables, citrus, or improved pasture grasses. It is in the Sand Scrub Range Site and group 5 woodlands, which have low potential productivity, severe equipment limitations, and moderate seedling mortality. Capability unit VII-s.

Pomello sand (Ps): nearly level, well-drained sandy soils on moderately broad ridges interspersed with long narrow sloughs. Permeability is very rapid to 50", moderately rapid 50-62"; and rapid below. The available water capacity is very low as far down as 50", and moderate below. Organic-matter content and natural fertility are low. This soil is not suited for vegetables, and poorly suited for citrus and improved pasture. It is in the Sand Scrub Range Site. Woodland group 4, moderate potential productivity with severe seedling mortality and moderate equipment limitations. Capability Unit VI s-3.

Welaka sand (We): Nearly level, well-drained sandy soils on moderately broad ridges interspersed with long narrow sloughs. Permeability is very rapid and available water capacity is very low in all layers. Organic-matter content and natural fertility are low. This soil is not suited for vegetables and poorly suited for citrus and improved pasture grasses. It is in the sand scrub range site and woodland group 4, with a moderate portential productivity with severe seedling mortality and moderate equipment limitations. Capability Unit VIs-2.

Concerning your question about the suitability of canaveral complex for sanitary landfills, canaveral soils have severe limitations for this use due to seepage and wetness.

If you have any questions, or if I can be of further assistance, please call me at (305) 632-0546.

Sincerely,

Kenneth P. Collar

KPC:gg

Kenneth P. Collar
District Conservationist

United States Department of the Interior
FISH AND WILDLIFE SERVICE
3100 University Blvd. South
Suite 120
Jacksonville, Florida 32216

December 12, 1988

Hector E. Malave, Captain, USAF
Directorate of Acquisition Civil Engineering
Department of the Air Force
Headquarters Space Division (AFSC)
Los Angeles Air Force Base, P.O. Box 92960
Los Angeles, California 90009-2960

Dear Captain Malave:

This is in response to your December 1, 1988 letter, regarding proposed lighting measures at Launch Complex 36 to avoid sea turtle hatchling disorientation on Cape Canaveral beaches. Although the information in the letter is not in sufficient detail to enable the Service to fully evaluate the project we do believe these efforts are in the right direction. To reduce impacts on sea turtles we believe your priorities should be (1) eliminate lights to the maximum extent possible, (2) change remaining lights to low pressure sodium to the maximum extent possible and (3) screen all other lights to prevent lights from shining towards beach. Monitoring the nesting beaches during the nesting season of course is essential if the effectiveness of these measures is to be evaluated. Less obvious however, is the need to determine the effects on hatchlings in the water. Hatchlings can safely reach the surf but may then be adversely affected by artificial lights. This needs to be considered and evaluated in any monitoring program.

These comments do not constitute a Biological Opinion under Section 7 of the Endangered Species Act. When the draft of a basewide lighting management plan is prepared and a biological assessment is complete the Service can prepare a Section 7 Biological Opinion.

The Service appreciates the cooperation and positive efforts the Air Force is making to protect sea turtles on Canaveral Air Force Station.

Sincerely yours,

David R Martin for

David J. Wesley
Field Supervisor

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE BASE, PO BOX 92960
LOS ANGELES, CA 90009-2960

2 2 DEC 1988

Mr. David J. Wesley
U.S. Fish and Wildlife Service
Suite 120
3100 University Boulevard, South
Jacksonville, Florida 32216

Dear Mr. Wesley:

I am writing this letter to follow up on our phone conversation this morning concerning the issue of turtle disorientation due to artificial lighting at Cape Canaveral AFS (CCAFS), specifically Launch Complex 36 (LC 36). I am including a CCAFS-wide Biological Assessment (BA) which includes a Light Management Compliance Plan for your review.

The Medium Launch Vehicle II program at LC 36 consists of certain modifications and new construction to support the launch of ten satellites using the Atlas II space vehicle. A 40-foot vertical extension of the pad A Mobile Service Tower, a new umbilical tower at pad A, the construction of two new support facilities, and the addition of new security lighting to meet operational requirements are the actions which directly contribute to the amount of artificial lighting emanating from the LC 36 area. Immediate actions have been taken to review operational requirements and develop a Light Management Plan for LC 36, in accordance with Part E of the attached BA, to find specific ways to mitigate the turtle disorientation due to artificial lighting (This action will occur before the 1989 hatchling season). The Light Management Plan will be developed in conjunction with your office to ensure that we implement the most effective mitigation solutions.
To help us with our work, could you please send us a copy of any studies or research related to the use of low pressure sodium lighting and other mitigation measures.

I want to stress our commitment to the prompt resolution of the turtle disorientation problem, and I believe that the proposed actions will mitigate this problem. To finalize our Environmental Assessment (EA) for the MLV II program, we are requesting informal consultation based on proposed actions for mitigation. To allow us to finalize the EA in mid Jan 1989, we respectfully request your response to the attached BA and Light Management Compliance Pan during the first week of Jan 89. We will contact you next week to discuss this matter.

We appreciate all the help you have provided us. Please give Capt. Hector Malave a call if you have any questions. He can be reached at (213) 643-0935.

Sincerely

Robert C Mason

ROBERT C. MASON, AICP
Chief, Environmental Planning Division
Directorate of Acquisition Civil Engineering

1 Atch
1. Biological Assessment

BIOLOGICAL ASSESSMENT OF IMPACTS TO THREATENED AND ENDANGERED MARINE TURTLES ON CAPE CANAVERAL AIR FORCE STATION (CCAFS), FLORIDA

A. INTRODUCTION

This Biological Assessment will describe the existing conditions at CCAFS, and the proposed actions to minimize the impact from artificial lighting at CCAFS on sea turtle nesting activity at the adjacent coastal beach. Sea turtles which are affected are the endangered Atlantic Green turtle (Chelonia Mydas), the threatened Atlantic Loggerhead turtle (caretta caretta) and the leatherback turtle (Dermochelys cariacca).

The Department of the Air Force Policy Letter on Endangered Species, dated 27 May 1988 (Attachment 1) states, "The Air Force must protect federally listed endangered and threatened plant and animal species and their critical habitat, including species proposed for listing and proposed critical habitat (16 U.S.C. 1536(a)(1) & (4)). Section 7 of the Endangered Species Act of 1973, as amended, requires Federal agencies to enter into consultation with the Secretary of the Interior when a threatened or endangered species may be present in the area affected by the prospective agency action.

This biological assessment constitutes the initiation of consultation between the U.S. Air Force and the Secretary of Interior.

B. EXISTING SITE CONDITIONS

CCAFS is located on the Cape Canaveral Peninsula in Brevard County, east-central Florida. :Ecological resources on the stations areinfluenced by the Atlantic Ocean on the east, and the Banana River on the west. Vegetation associations and related wildlife habitats are representative of barrier island communities of the region. Major communities at CCAFS include beach, coastal strand and dunes, coastal scrub,lagoons, brackish marsh, and fresh water systems in the form of canals and borrow pits. In addition to these communities found at CCAFS, coastal hammocks and pine flatwoods are found to the northwest on KSC. These communities increase the ecological diversity and richness of the area.

At this time, the following launch complexes are operational at CCAFS 17, 29, 36, 40, 41, 46, and 47 (see figure 1-1). There are considered major sources of direct and indirect (glow) artificial lighting. Other sources are the CCAFS Industrial Area, the Missile Assembly Complex Area (MACA). The Integrated Transfer Launch (ITL) Area and the Trident Wharf Area (see figure 1-1).

The limited public access and controlled land use on CCAFS and nearbyKSC have allowed large areas of land to remain relatively undisturbed. Of 15,438 acres on CCAFS, 11,977 acres has remained or reverted to natural conditions.

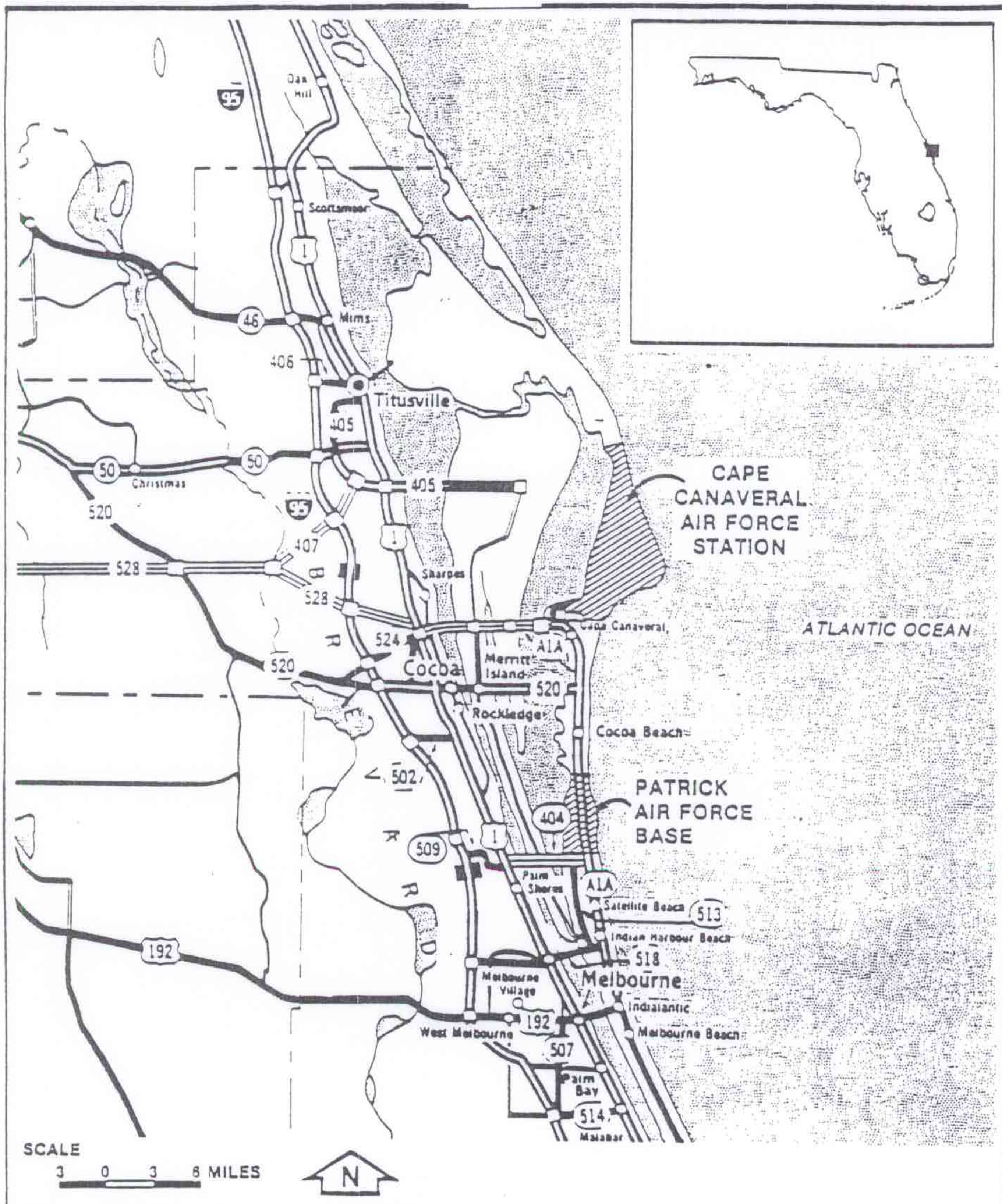


Figure 1-1
LOCATION MAP

SOURCE: ESE, 1986.

Biological Assessment
Cape Canaveral Air Force Station

CAPE CANAV. 1/86

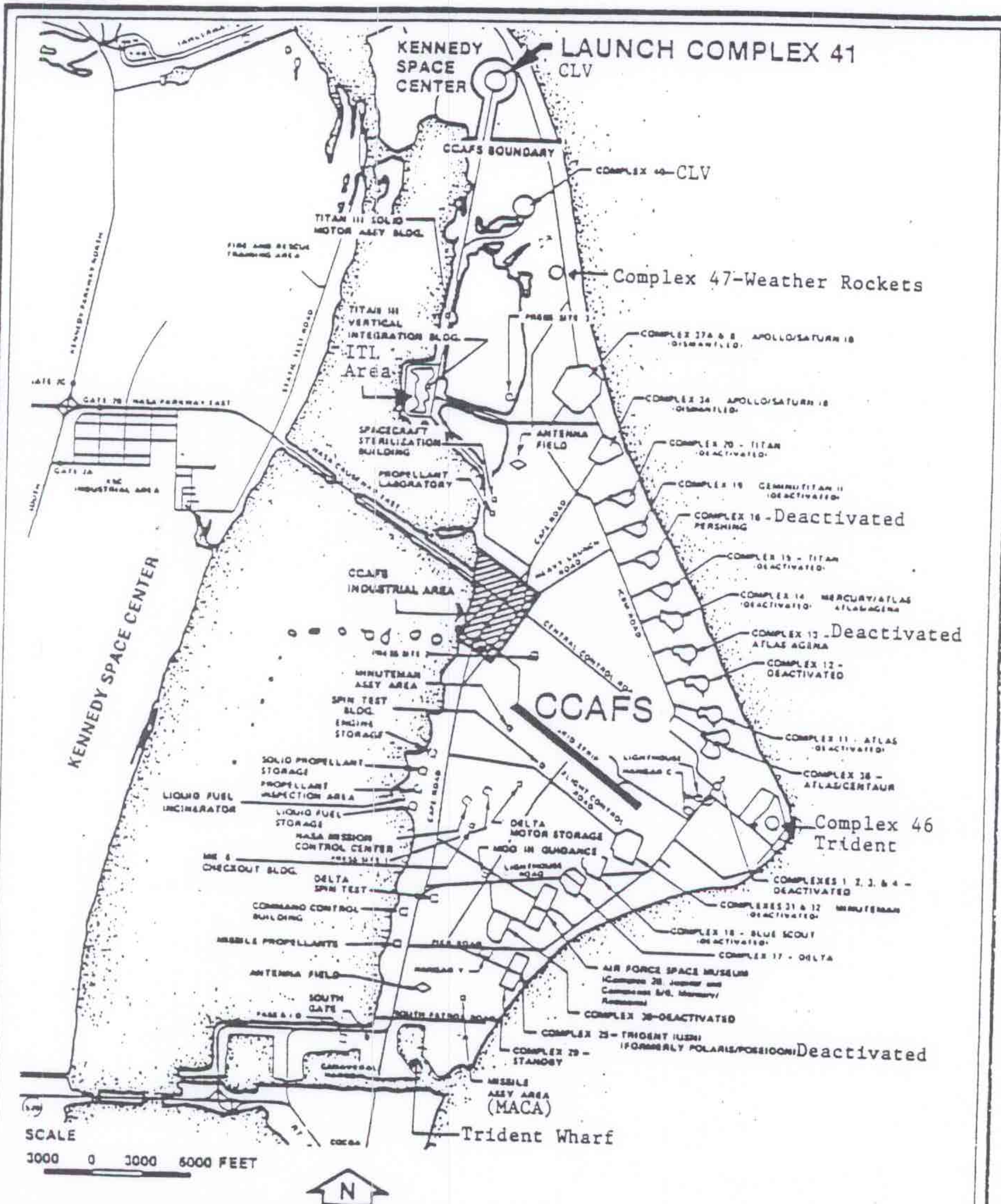


Figure 1-2
BASE MAP

SOURCE: ESE, 1986.

Biological Assessment
Cape Canaveral Air Force Station

D. EFFECTED SPECIES AND HABITAT

The main specie known to be affected by lights from Cape Canaveral AFS (CCAFS) is the federally threatened Atlantic Loggerhead Turtle (Caretta caretta). Nesting densities vary from 50 to 120 nests per kilometer, with the majority of nests occurring within seven kilometers north of the tip of the Cape. In addition, Atlantic green turtle (Chelonia mydas) nests and one leatherback turtle (Dermochelys coriacea) nest have been recorded. The green and leatherback turtles are federally listed endangered species. These species do not usually nest on the section of one beach along CCAFS. Should a green or leatherback turtle nest occur in this area, their hatchlings would be similarly affected.

The loggerhead sea turtle (Caretta caretta) was listed as threatened on July 28, 1978. Within the United States it nests primarily on beaches from North Caroline to Florida. Approximately ninety percent of loggerhead nesting within the U.S. occurs in Florida (Murphy and Hopkins, 1984). The highest density nesting beaches in Florida occur from Canaveral National Seashore, Volusia County, south to John U. Lloyd State Recreation area in Broward County (Conley and Hoffman, 1986). Average nesting densities vary from less than one nest per km for some beaches in the northeast, southwest, and panhandle of Florida, to over 600 nests per km on some stretches of beach in south Brevard County (Ehrhart and Witherington, 1986). The most recent estimate for total annual nesting efforts for the southeastern U.S. is 58,000 nests based on aerial surveys conducted in 1983 (Murphy and Hopkins, 1984). The U.S. loggerhead nesting population, one of the two most significant nesting populations in the world, may represent up to 30 percent of the worldwide loggerhead nesting population (Ross, 1982). This is in contrast to all other sea turtle species where nesting occurs largely outside the U.S. The loggerhead nesting season is from late April to August, with most nesting occurring in June and July and occasional nesting occurring in September. The incubation period is temperature dependent and most nests hatch within 60 days although over 70 days may be required for some nests, particularly in the northern periphery of the nesting range.

Primary threats to loggerheads within the U.S. include: 1) Accidental drowning of sub-adult and adult turtles by commercial fishing activities: 2) degradation of nesting habitat by human activities from beach front developments and the resulting artificial lighting, rip-rap, bulkheads, seawalls, and human disturbances; and 3) excessive nest predation by raccoons or hogs on some major nesting beaches which is also associated with human alteration of the coastal environment.

The Green Sea Turtle (Chelonia Mydas) was listed on July 28, 1978 as endangered in Florida and on the west coast of Mexico and threatened elsewhere. Nesting within the U.S. occurs principally along east-central and southeast Florida beaches. Nesting densities are much lower than for the loggerhead and range from 1-5 nests per km on most beaches within its major nesting range, to 13-20 nests per km on high density green turtle nesting beaches in south Brevard County and South Juniper Island in Palm Beach County (Conley and Hoffman, 1986; Ehrhart and Witherington, 1986). Overall green turtle nesting in Florida has shown an increasing trend, with the highest recorded nesting of 746 occurring in 1985 (Conley and Hoffman, 1986; Dodd, 1981). Nesting occurs from May to September with the peak in July and August. The hatching period is similar to the loggerhead. Major threats to the green turtle within the U.S. are also similar to those of the loggerhead. Green turtles, however, appear to be more sensitive to human disturbances and artificial lighting.

The leatherback sea turtle (Dermochelys coriacea) was listed as endangered throughout the range on June 2, 1970. Nesting within the U.S. occurs primarily in Puerto Rico and the Virgin Islands. Eighty-nine leatherback nests, however, were recorded on Florida east coast beaches in 1986 (Conley and Hoffman, 1986). Nesting begins as early as late February and terminates by late July. Much of the leatherback's nesting effort is centered in Palm Beach County but scattered nesting has been recorded on almost all of Florida's east coast beaches, with the most northerly record being from Blackbeard Island, Georgia (Conley and Hoffman, 1986; Seyle, 1986). The primary threat to this species in Florida is degradation of nesting habitat from beach front developments.

The leatherback, loggerhead, and green sea turtle all nest on the 21 km of CCAFS beach. Loggerheads are the most numerous and deposit an average of 1300 nests each year while green turtles lay only 10-20 nests. The leatherback is a rare nester with only one nest recorded since 1984. Even though nesting density is high, hatchling production is low without human intervention. Prior to a recent predator removal program, raccoons and hogs destroyed over 75 percent of the nests annually (Labisky et al, 1984; Labisky et al, 1986). In 1987, 136 raccoons and 176 hogs were removed from CCAFS and 75% of the nests successfully produced hatchlings (Pan Am World Services, Inc., 1988).

Approximately 9 percent (114) of the nests were lost to tidal inundation or unsuitable soil conditions.

Nesting habitat is a nearly level sandy coastal beach with a very low dune. Beach width varies from 15-17 meters depending upon tides and seasonal sand deposition/erosion. A two lane asphalt road (North Cape Road) parallels the beach in the affected area, approximately 150 meters west of the dune line. Vegetation from the beach to North Cape Road are various species of coastal dune and strand plants indigenous to the central east coast of Florida.

In 1987, USFWS personnel from the Merritt Island National Wildlife Refuge contacted the Commander, CCAFS, regarding the disorientation of sea turtle hatchlings on the KSC beach adjacent to LC 41. The disorientation was attributed to lights used to support night construction activities on the LC 41 service structure. The USFWS requested the service structure lights be turned off until completion of turtle nesting and hatching. This was accomplished when actual work on the service structure was not being conducted, but disorientations continued. In addition, USFWS personnel documented hatchling disorientation further south, toward the KSC/CCAFS border, resulting from lights on LC 40.

Hatchling disorientation was also observed on CCAFS in 1987. Sea turtle researchers conducting nest census and hatchling success data collection would approximate the hatch date for nests which could be susceptible to disorientation and erect lighting screens at the nest. In addition, driftwood was used to create "raceways" to the lower beach slope. The driftwood prevents hatchlings from crawling in a direction other than toward the ocean. These methods were successful in preventing hatchling disorientation, but they are not considered cost effective and do not address the source of the problem.

A joint effort between the National Aeronautics and Space Administration (NASA), the Air Force, the National Park Service (NPS), and the USFWS to evaluate the effects of lights from various CCAFS and KSC facilities was initiated in July 1988. On 15 August 1988, USFWS personnel reported disorientation from 18 loggerhead nests on KSC. The number of hatchlings affected per nest varied from 10 to 100 with an average of 43. CCAFS researchers reported seven loggerhead nests affected during the same period. The number of hatchlings affected per nest varied from three to 65 with an average of 27. Twenty-four hatchling mortalities were estimmated as a result of disorientation on CCAFS. An additional three nests were suspected to have been affected, but this could not be documented due to the erasure of hatchling tracks by heavy rainfall. All disorientation determinations were made by hatchling crawl track observation.

E. PROPOSED ACTION TO OFFSET IMPACTS TO THREATENED AND ENDANGERED SEA TURTLES - CAPE CANAVERAL AIR FORCE STATION (CCAFS) COMPLIANCE PLAN

Recognizing that existing and future security lights and night work lights required at various space launch complex and associated support facilities at CCAFS may result in disorientation of federally protected sea turtle adults and their hatchlings (i.e., the Atlantic Green Turtle, the Atlantic Leatherback Turtle and the Atlantic Loggerhead Turtle); that the Endangered Species Act of 1973, as amended, prohibits the "taking" of federally protected species; and that disorientation of the afore mentioned federally protected sea turtle adults and hatchlings by existing and future security lights and night work lights is defined as a "take" under the Endangered Species Act; the Air Force has developed this Compliance Plan to identify and eliminate, to the maximum extent practicable, the source of lights that result in the disorientation of the afore mentioned federally protected sea turtles adults and their hatchlings at CCAFS while meeting the national security mission requirements of the Air Force.

This Compliance Plan is made up of four (4) interrelated parts whose purpose is to eliminate, to the maximum extent practicable, the light sources at CCAFS that have or may result in disorientation of the afore mentioned federally protect sea turtles and their hatchlings within the next two to three years. All four parts of this plan shall be implemented in a coordinated effort.

1. Lighting Survey:

- Each existing facility at CCAFS shall undergo a lighting survey. This survey shall identify those lights which could cause a disorientation problem.

- Based upon the results of this survey, those lights identified shall be evaluated to determine which of the following corrective actions is most appropriate.

  - elimination of the light
  - redirection of the light
  - shielding of the light
  - use of low profile lights rather than pole/building mounted
  - change to low pressure sodium
  - installation of low light cameras or other appropriate technology

- Based upon this determination, the facility operator shall implement the necessary action to correct the problem.

- For those corrective actions that are easy to accomplish (i.e., elimination, redirection or shielding), the corrective action shall be implemented immediately, but no later than nine months from the approval date of this plan by the U.S. Fish and Wildlife Service, Jacksonville Endangered Species Office.

- Where the appropriate corrective actions require engineering, design and construction efforts, the appropriate method which can achieve the required results in the shortest period of time shall be implemented (i.e., direction to Stearns; direction to facility contract operator - MMC, GD, etc.; AF O&M, MC of MCP, as appropriate). Depending of which method is utilized, a compliance period shall be identified. The goal is to have all identified problems eliminated within 2 years.

- Upon the completion of this lighting program at each facility, a Lighting Survey shall be reaccomplished to ensure that the problem has been controlled at that facility. If problems still exist, the above process shall be repeated.

2. New/Modified Facilities:

- For new programs or programs that call for the modification to existing facilities, the following shall be included in the design criteria.

  - non-essential lights shall be eliminated
  - lights shall be positioned so that they are not visible from the beach
    - in the case of modifications, lights shall be redirected
  - shielding of lights
  - use of low profile lights rather than pole/building mounted, as appropriate
  - low pressure sodium lights shall be used when feasible
  - installation of low light cameras or other appropriate technology as feasible

- upon completion of construction or modification, a Light Survey shall be conducted to ensure that the facility does not have the potential for disorientation.

  - If the Light Survey identifies a problem, Item 1 above shall be implemented and repeated until the facility complies

3. Light Management Plan:

- Each facility which has the potential for causing a disorientation problem shall develop a Light Management Plan. This Light Management Plan shall become a required part of the facility operational plan. The goal of the management plan is to reduce, to the maximum extent practicable, while still meeting AF mission requirements, the light being generated by each facility at CCAFS. This shall be accomplished through but not limited to the following:

- If the facility is not involved in any night work, all lights except for those necessary for security shall be eliminated.

- If night work is required, only those lights necessary for the scheduled work on a particular light shall be used. For example, on a launch complex, only the lights on the actual work level shall be used. This may require rewiring of light control panels to allow for the selection use of lights.

- To the maximum extent practicable, work shall be scheduled so that night work is not required during critical nesting and hatchlings periods. To the extent that this is practicable, those facilities which can be dark (except for required security lighting) shall be dark. These periods need to be identified but should only account for two, one month periods during the year. With enough planning, it seems reasonable that night work could be scheduled to avoid these periods.

- Existing facilities shall prepare the Light Management Plan in conjunction with Item 1, Light Survey. As required, those portions of the Light

Management Plan that require rewiring or other work, shall be incorporated into Item 2.

- New or Modified Facilities shall prepare the Light Management Plan as a part of their operational plan. It shall be available to implement during the design and construction phase to ensure that appropriate light fixtures and light control panels are designed and installed.

4. Interim Measures.

- Since some of these actions may take several years to accomplish the Air Force shall continue and expand as necessary the following:

- Pan Am (or others) shall continue in cooperations with the USFWS and the State of Florida to monitor nest locations and accomplish nesting surveys. If a potential disorientation problem is identified, the facilities involved shall be identified and an evaluation made to determine where they are in the compliance process. If the facility is not yet in compliance, the facility operator shall be contacted to determine if night work is pending during the critical periods and if it is whether or not it can be rescheduled and the facility left dark. If this is not possible due to Air Force mission requirements, appropriate temporary nest screens shall be installed to eliminate the immediate disorientation potential.

F. SUMMARY

The Air Force acknowledges that night operations at active launch complexes result in the disorientation of threatened, and possibly endangered, sea turtle hatchlings on CCAFS. Further, the Air Force realizes the installation of security lights around the perimeter of active complexes will significantly add to the existing problem. According to Department of Defense directives and requirements, there are no alternatives to the scheduled missions to be launched from the active complexes at CCAFS or the level of security which must be provided to protect these facilities. Therefore, the Air Force has identified actions which it believes could, in part or in combination, offset adverse effects to sea turtles resulting from operations at CCAFS and preclude the potential to jeopardize the continued existence of these species.

Recd AFSC/DEVX 9-7-

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330

REPLY TO ATTN OF: LEE

27 [illegible] 1988

SUBJECT: Policy Letter on Endangered Species

TO: HQ AAC/DE
HQ AFLC/DE
HQ AFRES/DE
HQ AFSC/DE
HQ AFSPACECOM/DE
HQ ATC/DE
HQ MAC/DE
HQ PACAF/DE
HQ SAC/DE
HQ TAC/DE
HQ USAFA/DE
ANGSC/DE

1. The Air Force must protect federally listed endangered and threatened plant and animal species and their critical habitat, including species proposed for listing and proposed critical habitat (16 U.S.C. 1536(a)(1) & (4)).

a. We are obligated under law to conserve and improve endangered and threatened species habitat found on Air Force lands. This obligation applies to owned and leased property.

b. Management recommendations contained in published Fish and Wildlife Service (FWS) endangered and threatened species recovery plans should be implemented unless it adversely impacts the mission.

c. Methodology for protecting, conserving and improving endangered or threatened species and their habitat is recorded in a fish and wildlife management plan developed under AFR 126-1. If only plant species are covered, a suitable section may be included in the land management plan instead.

2. Any action that may adversely affect endangered or threatened species or their habitat requires consultation with the FWS and, for impacts offshore, the National Marine Fisheries Service, prior to irreversible commitment of resources. All installations must survey lands under their jurisdiction for endangered or threatened species or their habitat. The presence of species on each installation is listed in the Air Force Atlas of Endangered Species (Atch 1) completed in 1984. This documentation includes verification by the Regional Office of the FWS and differentiates between those species known to be present and those presumed to be present on the installation. If proper habitat is available within the range of distribution of the species, the species is assumed to be present until appropriate censusing indicates otherwise. Request you review this list and provide documentation confirming the list, including additions and deletions, by 1 Dec 88.

3. Final regulations to implement Section 7 of the Endangered Species Act became effective 3 Jul 86 with publication of 50 C.F.R., Part 402. The attached synopsis of 50 C.F.R., Part 402 summarizes changes that affect consultation actions (Atch 2). The full text of this document can be provided if it is not available at your command. A list of contacts for consultation is attached (Atch 3). Please disseminate this information to all your organizations who are impacted by the law. Our point of contact is Dr. A. L. Clark, HQ USAF/LEEV, Bolling AFB DC 20332-5000, AUTOVON 297-3639.

FOR THE CHIEF OF STAFF

GARY S. FLORA
Associate Director
Directorate of Engineering & Services

3 Atch
1. Atlas of Endangered Species
2. Synopsis of 50 C.F.R., Part 402
3. Points of Contact

United States Department of the Interior
FISH AND WILDLIFE SERVICE
3100 University Blvd. South
Suite 120
Jacksonville, Florida 32216

January 10, 1989

Mr. Robert C. Mason
Chief, Environmental Planning Division
Directorate of Acquisition Civil Engineering
Department of the Air Force
Headquarters Space Division
Los Angeles Air Force Base, P.O. Box 92960
Los Angeles, California 90009-2960

Dear Mr. Mason:

This is in response to your December 22, 1988, letter and Biological Assessment pertaining to Launch Complex 36 at Cape Canaveral Air Force Station. Since the construction of the expanded facilities at the launch pad will not affect listed species, we do not object to this aspect of the project.

The use of lights associated with operation of the launch pad, however, probably will cause sea turtle hatchling disorientation if proper precautions are not taken. The lighting plan proposed for the facility is good as a guide indicating what will be done, however it does not give enough specifics. We agree with the plan that lights should be placed only where absolutely necessary, low pressure sodium lights should be used, and lights should be shaded or redirected. However, to fully evaluate the lighting plan we need more information on the lighting configuration, number of low pressure sodium lights, other types of lights, placement of lights, number of screened lights, etc. Drawings of the facilities illustrating these factors would be extremely helpful. After this information is made available to us, we can meet, if necessary, to discuss the proposed lighting plan and develop a monitoring system to assess the adequacy of the plan. These discussions can be continued under the informal Section 7 consultation process, but a Section 7 formal consultation must be completed prior to operating lights during the sea turtle hatching period unless a "no affect" determination can be made concerning implementation of the plan.

The Service appreciates the cooperation and positive efforts the Air Force is making to protect sea turtles on Cape Canaveral Air Force Station.

Sincerely yours,

David J. Wesley
Field Supervisor

Advisory Council On Historic Preservation

The Old Post Office Building
1100 Pennsylvania Avenue, NW. #809
Washington, DC 20004

FEB 1 1989

Mr. Fred A. Bailey
Deputy Range/Base Civil Engineer
Headquarters 6550th Air Base Group (AFSC)
Patrick Air Force Base, FL 32925

REF: Modifications, LC 36, CCAFS, Florida

Dear Mr. Bailey:

The enclosed Memorandum of Agreement for the referenced project has been accepted by the Council. This acceptance completes the requirements of Section 106 of the National Historic Preservation Act and the Council's regulations. Copies of the Agreement have also been sent to NASA, the Florida State Historic Preservation Officer, and General Dynamics.

We appreciate your cooperation in reaching a satisfactory resolution of this matter.

Sincerely,

for Don L. Klima
Director, Eastern Office
of Project Review

Enclosure

MEMORANDUM OF AGREEMENT

WHEREAS, the United States Air Force (USAF) has determined that continued use of Launch Complex 36 (LC-36) located on the Cape Canaveral Air Force Station (CCAFS), for the launching of the modified Atlas/Centuar rocket booster will require periodic modifications over the life of the Atlas/Centaur program, and,

WHEREAS, LC-36 has been identified as potentially eligible for listing in the National Register of Historic Places, and the USAF has determined that these activities will have an effect on LC-36 and the USAF has consulted with the Florida State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (Council) pursuant to the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f),

NOW, THEREFORE, the U.S. Air Force, the SHPO, and the Council agree that the historic value of Complex 36 exists in the engineering significance of its components; that preservation through documentation as stated in 36 CFR 800.9(c)(1), exceptions to Criteria of Adverse Effect, is appropriate; and that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

Stipulations

The Air Force will ensure that the following measures are carried out:

1. Prior to any alteration, dismantling, demolition, or removal action that could affect Complex 36, the Complex will be documented in accordance with the Secretary of Interior's "Standards for Architectural and Engineering Documentation" as published in the Federal Register, 48 FR 190, pp. 44730-44734, September 29, 1983.

   Since the original "as-built" drawings are on file at CCAFS, documentation will include the following action items:

   a. Reproduction of existing "as-built" drawings and site plans for Complex 36 on standard size (19 x 24 or 24 x 36) mylar:

   b. Provision of black and white archival quality photographs of Complex 36 with large format negatives of exterior and interior views of structures, as well as special technological features or engineering details (where avilable); and,

   c. Preparation of a narrative description of Complex 36 including relevant historical data.

2. The original copy of all documentation will be provided to the Secretary of the Interior for incorporation into the National Historic Architectural and Engineering Records with the Library of Congress as

provided in Section 101 of the National Historic Preservation Act and implementing procedures. Copies of the documentation will also be provided to the Florida SHPO, the Air Force Space Museum at CCAFS, Eastern Space and Missile Center Historic Office (ESMC/HO), and the Air Force Museum at Wright-Patterson AFB, Ohio.

Execution of this Agreement evidences that the Air Force has afforded the SHPO and Council an opportunity to comment on the proposed modifications to Complex 36 and the effect of this undertaking on historic properties, and that the Air Force has taken into account the effects of the proposed project on historic properties.

DEPARTMENT OF THE AIR FORCE

BY: Lawrence L Gooch, Col, USAF 19 Dec 88

Commander, Eastern Space and Missile Center (ESMC) Date

FLORIDA STATE HISTORIC PRESERVATION OFFICER

BY: [signature] Dec. 30, 1988

State Historic Preservation Officer Date

ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY: Robert D. Bush 2/1/89

Date

Executive Director

APPENDIX C

STATUS OF HAZARDOUS WASTE STREAMS
TO KENNEDY SPACE CENTER
DISPOSAL FACILITIES

(FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION)

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

CENTRAL FLORIDA DISTRICT
3319 MAGUIRE BOULEVARD
SUITE 232
ORLANDO FLORIDA 32803-3787

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
ALEX ALEXANDER
DISTRICT MANAGER

May 22, 1987

Mr. James D. Phillips
Director of Engineering Development
National Aeronautics and
Space Administration
John F. Kennedy Space Center
Kennedy Space Center, FL 32899

OCF-HW-87-0278

Re: Brevard County - HW
Kennedy Space Center
Hazardous Waste Status of a Variety of
Waste Streams to the FTAT and HPI Units
Implications for HPI Air Permit Renewal

Dear Mr. Phillips:

I have received your letter dated May 6, 1987 requesting a position from the department regarding the hazardous waste status of waste streams to the Hypergolic Propellants Incinerator (HPI) so the air permit application may be processed. The department also has been reviewing the hazardous waste status of waste streams to the Fire Training Area Tank (FTAT).

A listing of each waste stream to the HPI and FTAT units (received from EG&G Florida, Inc. on January 6, 1987) and the district's position regarding the hazardous waste status of each were submitted to Tallahassee for review on April 20, 1987. The Tallahassee hazardous waste staff has agreed with the position taken by the district. This listing is attached for your review.

Using the waste stream numbers as found in the attached list, if HPI waste stream #2 and FTAT waste streams #2, #6 and #7 are manifested off-site as hazardous wastes and excluded from treatment at the HPI and FTAT units and if none of the remaining waste streams exhibit any of the characteristics of a hazardous waste found in 40 CFR 261 Subpart C, then these remaining waste streams can be treated at their designated units (i.e., either the HPI or FTAT) and neither the HPI unit nor the FTAT unit will require a hazardous waste treatment permit. If the hazardous waste streams are treated at the units then hazardous waste treatment permits will be required.

James D. Phillips
OCF-HW-87-0278
May 22, 1987
Page Two

In your August 18, 1986 letter to Mr. Tom Sawicki providing additional information on the HPI air permit application, you identified five waste streams in Attachment 4 that you would like to blend for incineration at the HPI unit. Addressing these waste streams as they appear in Attachment 4:

1) Propellant Vapor Scrubber Solutions - This is the same as HPI Waste Stream #1 on the attached list and is not a hazardous waste provided it does not exhibit any of the characteristics of hazardous waste found in 40 CFR 261 Subpart C.

2) Propellant System Washdown Water - This is the same as HPI waste stream #2 and is considered a hazardous waste for the reasons given in the attached list. The fact that this waste has no flash point is not of consideration since a listed hazardous waste is involved.

3) Propellant system flushes contaminated with hydrazine, methyl hydrazine and 1,1-dimethylhydrazine - This appears to be a combination of HPI waste streams #3 and #4 and FTAT waste stream #7. The flush water from containers holding hydrazine and 1,1-dimethylhydrazine are not regulated as a hazardous waste provided the containers meet the definition of empty found in 40 CFR 261.7(b) prior to flushing. The first three rinses of containers holding methyl hydrazine are a hazardous waste per 40 CFR 261.7(b)(3). Any subsequent rinses are not regulated as a hazardous waste provided the triple rinsing was performed using a solvent capable of removing the methyl hydrazine.

4) Unused aqueous solutions of isopropanol/ethanol - This material is not regulated as a hazardous waste only if it does not exhibit any of the characteristics of a hazardous waste found in 40 CFR 261 Subpart C.

5) Unused aqueous solutions of citric acid/acetic acid - This material is not regulated as a hazardous waste only if it does not exhibit any of the characteristics of a hazardous waste found in 40 CFR 261 Subpart C.

I hope you will find this information helpful in how we view the hazardous waste status of your waste streams. It appears that some of the waste streams in Attachment 4 of your letter dated August 18, 1986 clearly are a hazardous waste. If these must be disposed of at the HPI unit, then a hazardous waste permit will be required.

I share your desire to see this matter resolved as quickly as possible. Please contact me at (305) 894-7555 if you have any questions.

Sincerely,

Richard B. Tedder, Supervisor
Hazardous Waste Section

RBT/sy

Attachment

cc: Satish Kastury (w/attachment)
James Scarbrough (w/a)
John Ryan (w/a)
Richard Campbell (w/a)
Tom Sawicki (w/a)

WASTE STREAMS PROPOSED FOR DISPOSAL AT KSC'S HYPERGOL PROPELLANTS INCINERATOR (HPI)

HPI WASTE STREAM #1

Description:

Spent Scrubbing liquor from air pollution control scrubbers using 14 percent citric acid in water solutions to scrub gases containing hydrazine and/or methylhydrazine vapors generated during launching the space shuttle. The scrubbing liquor is changed when the pH approaches 6.

Composition:

Water and citric acid solution contaminated with hydrazine or methylhydrazine at a concentration of less than 5 percent.

Hazardous Waste Determination:

This waste is not a hazardous waste if it does not exhibit any of the characteristics of hazardous waste found in 40 CFR 261 Subpart C. Though the waste contains U133 and P068 chemicals, they are not present in this stream by being discarded, off-specification, a container residue or a spill residue as defined in 40 CFR 261.33 and, consequently, this waste stream is not a listed hazardous waste. In pages 33115 - 33116 of the May 19, 1980 Federal Register, EPA has clearly indicated that 40 CFR 261.33 is intended to regulate chemicals which are sometimes thrown away in pure or undiluted form not to regulate all waste streams which happen to contain these chemicals.

HPI WASTE STREAM #2

Description:

During the transfer of hydrazine fuel in rubber hoses, some may drip on the ground. Areas where transfer take place are then washed down with water. This water contains some ispropanol in low concentration as part of a drying step prior to transfer.

Composition:

Aqueous solution containing isopropanol at a concentration from 500 ppm to 3 percent and containing hydrazine at a concentration of less than 500 ppm.

Hazardous Waste Determination:

This material is a hazardous waste since it is the mixture of a hazardous waste (discarded pure Hydrazine) and a solid waste (wash water) per 40 CFR 261.3(b)(2). The pure hydrazine when dripped on the ground is a listed hazardous waste since it meets the definition of discard found in 40 CFR 261.2(a)(2)(i), i.e. it is abandoned by being disposed of. The definition of "disposal" found in 40 CFR 260.10 includes the "spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water." Dripping the hydrazine onto the ground constitutes disposed and meets the definition of discarded and is thus a listed hazardous waste. The mixture of this listed waste and water is a hazardous waste.

HPI WASTE STREAM #3

Description:

After use, hydrazine from mobile payload transfer and servicing systems is drained from these systems and returned to virgin storage. These empty systems are then flushed with water to remove any hydrazine residuals and then flushed with isopropanol to dewater/dry the systems. The waste stream consists of the flushing liquids.

Composition:

Aqueous solutions of isopropanol and hydrazine at a concentration of less than 2 percent,

Hazardous Waste Determination:

This material is not regulated as a hazardous waste.

Since the mobile payload transfer and servicing systems are portable devices in which a material is transported, they meet the definition of a "container" in 40 CFR 260.10. If these systems are drained of hydrazine (a U listed chemical) so they meet the definition of "empty" in 40 CFR 261.7(b), then the residue left in the systems is not subject to regulation under Parts 261 through 265.

HPI WASTE STREAM # 4

Description:

This waste stream consists of flushing liquid of mobile payload transfer and servicing systems transferring Aerozine-50 (a blend of 50 percent hydrazine and 50 percent unsymmetrical dimethyl hydrazine). Prior to flushing, these systems are drained of Aerozine-50, and it is returned to virgin storage. The empty systems are then flushed with water to remove Aerozine-50 residuals.

Composition:

Aqueous solution of hydrazine and unsymmetrical dimethylhydrazine.

Hazardous Waste Determination:

This material is not a hazardous waste provided it does not exhibit any of the characteristics of hazardous waste found in 40 CFR 261 Subpart C. The Aerozine-50 cannot be a 40 CFR 261.33 listed waste since it is a blend of two U listed chemicals and thus not a pure chemical. Also, since Aerozine-50 consists of two U listed chemicals (U133 and U098), the residue would not be regulated as in HPI waste stream #3 provided the transfer containers were drained to meet the definition of empty found in 40 CFR 261.7(b).

WASTE STREAMS PROPOSED FOR DISPOSAL At KSC's FIRE TRAINING AREA TANK (FTAT)

FTAT WASTE STREAM #1

Description:

Spent scrubbing liquor from a hydrazine vapor scrubber air pollution control device using demineralized water as the scrubbing liquor. The scrubbing liquor is changed out when the pH approaches 10.

Composition:

Demineralized water contaminated with less than 5 percent hydrazine.

Hazardous Waste Determination:

This waste is not a hazardous waste if if does not exhibit any of the characteristics of hazardous waste found in 40 CFR 261 Subpart C. The scrubbing liquor contains hydrazine (U133 but is not a 40 CFR 261.33 listed waste for the same reasons given for HPI Waste Stream #1.

FTAT WASTE STREAM #2

Description:

Water wash down of propellant areas and payload servicing areas following the transfer of hydrazine where some may have dripped on the ground.

Composition:

Aqueous solutions containing concentrations of hydrazine that are less than 0.1 percent.

Hazardous Waste Determination:

This material is a hazardous waste for the same reason given for HPI Waste Stream #2.

FTAT WASTE STREAM #3

Description:

Flushing of hydrazine mobile payload propellant transfer and servicing systems where the transfer systems are rendered empty of the hydrazine prior to flushing with water. Trace amount of isopropanol are present in the flush water.

Composition:

Aqueous solution containing concentrations of hydrazine at less than 0.1 percent and concentrations of isopropanol at less than 0.05 percent.

Hazardous Waste Determination:

This material is not regulated as a hazardous waste for the same reasons given for HPI Waste Stream #3.

FTAT WASTE STREAM #4

Description:

Water rinsing of residues of hydrazine from empty propellant transfer hardware (e.g. flexhose assemblies, valves) and containers. Hydrazine is drained from the equipment and returned to virgin storage prior to flushing.

Composition:

Aqueous solution containing hydrazine concentrations of less than 0.1 percent.

Hazardous Waste Determination:

This material is not regulated as a hazardous waste for same reason given for HPI Waste Stream #3.

FTAT WASTE STREAM #5

Description:

Waste results from deluge water used to cool and protect the concrete pad surrounding the hypergolic fire demonstration burn pan during schedule fire training exercises. During hypergolic burns some of the hypergol (hydrazine, methylhydrazine or nitrogen tetroxide) may splash onto the surrounding concrete pad. The deluge water rinses this splashed material to the Fire Training Area Tank.

Composition:

Potable deluge water infrequently contaminated with trace levels of hydrazine, methylhydrazine or nitrous/nitric acids at concentrations less than 100 ppm.

Hazardous Waste Determination:

This material is not a hazardous waste provided it does not exhibit any of the characteristics of hazardous waste found in 40 CFR 261 Subpart C.

KSC has indicated that one of the primary purposes for purchasing hypergolic fuel is for conducting fire suppression training exercises at the KSC Fire Training Area (See Attachment 1). This fuel as used does not meet the definition of a 40 CFR 261.33 listed waste since a material used for a primary purpose cannot be considered discarded, and the fuel itself is a mixture of U and P list chemical and thus not a pure chemical.

FTAT WASTE STREAM #6

Description:

During the transfer of methylhydrazine, small amounts may drip to the ground. After transfer these propellant and payload servicing areas are washed down with water. The waste stream consists of this wash water with low concentrations of methylhydrazine.

Composition:

Aqueous solution containing methylhydrazine at a concentration of less than 0.1 percent.

Hazardous Waste Determination:

This material is a hazardous waste since it is the mixture of a hazardous waste (discarded pure methylhydrazine) and a solid waste (wash water) per 40 CFR 261.3(b)(2). The reasons for this determination are the same as for HPI Waste Stream #2.

FTAT WASTE STEAM #7

Description:

Water rinsing of residues of methylhydrazine from propellant transfer hardware (e.g. flexhose assemblies, valves) and containers. Methylhydrazine is drained from the equipment and returned to virgin storage prior to flushing.

Composition:

Aqueous solutions containing concentrations of methylhydrazine less than 0.1 percent.

Hazardous Waste Determination:

This material is a listed hazardous waste. The methyhydrazine (P068) residue left in the transfer hardware and containers is an acute hazardous waste. Once the decision is made to flush the hardware and containers, the residue prior to flushing meets the definition of "intended to be discarded" of 40 CFR 261.33 and becomes a listed hazardous waste. When this is mixed with the rinse water, the mixture also becomes hazardous until the transfer hardware and containers have been triple rinsed using a solvent capable of removing the methylhydrazine. Any rinses after the third rinse would be non-hazardous.

APPENDIX D

CHRONOLOGICAL SUMMARY OF ATLAS/CENTAUR FLIGHTS

Table D-1 lists the Atlas/Centaur flight history in chronological order. All Atlas/Centaur flights are listed, including those designated for research and development (R&D), and the early D-series Centaurs, which were significantly different than the later D-1A and D-1AR series that are similar to the commercial Atlas/Centaur vehicle. The following is a synopsis of the 11 flight failures denoted by (n) in Table D-1.

2. Atlas/Centaur F-1 was the first R&D test flight. Vehicle loss was caused by a structural failure of the Centaur weather shield, which provides an aerodynamic fairing for the Centaur hydrogen tank jettisonable insulation panels. Fairing failure started at approximate 39 seconds from Atlas liftoff (measured at 2 inch riseoff). Aerodynamic forces started to tear the insulation panels loose at 49 seconds, followed by Centaur stage self-destruction at 54 seconds. Atlas propulsion performance decayed rapidly at 55 seconds, followed by Atlas stage self-destruction (loss of all telemetry data) at 57 seconds. The vehicle remained on its correct trajectory throughout into 57 second flight, and no range safety arm or destruct signal was sent. Corrective action was to strengthen the weather shield for subsequent flights.

3. AC-3 was the third R&D test flight. All events through separation of Centaur from Atlas at 232 seconds occurred as planned. Five seconds after Centaur Main Engine Start (MES), the C-2 engine thrust vector control actuators lost hydraulic pressure, causing loss of the C-2 engine position control and Centaur roll rate stabilization. The C-1 engine maintained vehicle trajectory in pitch and yaw, but could not correct for an increasing roll rate that created a vehicle coning motion. This produced a propellant vortex action in the LO_2 tank, causing starvation of the LO_2 boost pump and subsequent engine shutdown. This occurred prematurely at 495 seconds, 118 seconds away from the planned main engine cutoff (MECO). Telemetry data received for 1090 seconds of flight did not indicate any other Centaur anomalies, but the premature engine shutdown resulted in Centaur failing to achieve orbit, and it impacted approximately 2250 NM downrange. No range safety arm or destruct signal was sent. Probable cause of failure was a mechanical fracture at the interface of the C-2 engine turbopump accessory drive and the hydraulic power package. As a result, the accessory drive material was changed for subsequent units.

4. AC-5 was the fifth R&D test flight. At 3 seconds after liftoff, Atlas booster engine thrust was lost and the vehicle fell back into the launcher and was destroyed by explosion and fire. Loss of thrust was caused by inadvertent closing of the Atlas fuel prevalve, which starved the turbopump, causing it to overspeed and shut down the booster engines. All other Atlas and Centaur systems were functioning normally until the vehicle impacted on the launcher. No range safety arm or destruct signal was sent.

Table D-1. Chronological Atlas/Centaur flight summary

Flight Number	Launch Date	Launch Pad	Program	Comment (1) Atlas	Centaur
1	5/8/62	36A	R&D	successful	no trial (2)
2	11/27/63	36A	R&D	successful	successful
3	6/30/64	36A	R&D	successful	unsuccessful (3)
4	12/11/64	36A	R&D	successful	successful
5	3/2/65	36A	R&D	unsuccessful (4)	no trial
6	8/11/65	36B	R&D	successful	successful
7	4/1/66	36B	R&D	successful	unsuccessful (5)
8	5/30/66	36A	Surveyor	successful	successful
9	9/20/66	36A	Surveyor	successful	successful
10	10/26/66	36B	R&D	successful	successful
11	4/17/67	36B	Surveyor	successful	successful
12	7/14/67	36A	Surveyor	successful	successful
13	9/8/67	36B	Surveyor	successful	successful
14	11/7/67	36B	Surveyor	successful	successful
15	4/1/68	36A	Surveyor	successful	successful
16	8/10/68	36A	ATS-D	successful	unsuccessful (6)
17	12/7/68	36B	OAO-A2	successful	successful
18	2/24/68	36B	Mariner 6	successful	successful
19	3/27/69	36A	Mariner 7	successful	successful
20	8/12/69	36A	ATS-E	successful	successful
21	11/30/70	36B	OAO-8	successful	no trial (7)
22	1/25/71	36A	INTELSAT IV	successful	successful
23	5/8/71	36A	Mariner 8	successful	unsuccessful (8)
24	5/30/71	36B	Mariner 9	successful	successful
25	12/19/71	36A	INTELSAT IV	successful	successful
26	1/22/72	36B	INTELSAT IV	successful	successful
27	3/2/72	36A	Pioneer 10	successful	successful
28	6/13/72	36B	INTELSAT IV	successful	successful
29	8/21/72	36B	OAO C	successful	successful
30	4/5/73	36B	Pioneer II	successful	successful
31	8/23/73	36A	INTELSAT IV	successful	successful
32	11/3/73	36B	Mariner 10	successful	successful
33	11/21/74	36B	INTELSAT IV	successful	successful
34	2/20/75	36A	INTELSAT IV	unsuccessful (9)	no trial
35	5/22/75	36A	INTELSAT IV	successful	successful
36	9/25/75	36B	INTELSAT IVA	successful	successful
37	1/29/76	36B	INTELSAT IVA	successful	successful
38	5/13/76	36A	COMSTAR	successful	successful
39	7/22/76	36B	COMSTAR	successful	successful
40	5/26/77	36A	INTELSAT IVA	successful	successful
41	8/12/77	36B	HEAO-A	successful	successful

Flight Number	Launch Date	Launch Pad	Program	Comment: Atlas	Comment: Centaur
42	9/29/77	36A	INTELSAT IVA	unsuccessful (10)	no trial
43	1/6/78	36B	INTELSAT IVA	successful	successful
44	2/9/78	36A	FLTSATCOM	successful	successful
45	3/31/78	36B	INTELSAT IVA	successful	successful
46	5/20/78	36A	Pioneer Venus	successful	successful
47	6/29/78	36B	COMSTAR	successful	successful
48	8/8/78	36A	Pioneer Venus	successful	successful
49	11/13/78	36B	HEAO-B	successful	successful
50	3/4/79	36A	FLTSATCOM	successful	successful
51	9/20/79	36B	HEAO-C	successful	successful
52	1/17/80	36A	FLTSATCOM	successful	successful
53	10/30/80	36A	FLTSATCOM	successful	successful
54	12/6/80	36B	INTELSAT V	successful	successful
55	2/21/81	36A	COMSTAR	successful	successful
56	5/23/81	36B	INTELSAT V (11)	successful	successful
57	8/6/81	36A	FLSATCOM (11)	successful	successful
58	12/15/81	36B	INTELSAT V	successful	successful
59	3/4/82	36A	INTELSAT V	successful	successful
60	9/28/82	36B	INTELSAT V	successful	successful
61	5/19/83	36A	INTELSAT V	successful	successful
62	6/9/84	36B	INTELSAT V	successful	unsuccessful (12)
63	3/22/85	36B	INTELSAT VA	successful	successful
64	6/29/85	36B	INTELSAT VA	successful	successful
65	9/28/85	36B	INTELSAT VA	successful	successful
66	12/4/86	36B	FLTSATCOM	successful	successful
67	3/26/87	36B	FLTSATCOM	no trial (13)	no trial (13)

[1]No trial is a mission where the vehicle did not have the opportunity to perform.
[2]Vehicle self-destruction due to failure of Centaur weather shield.
[3]Loss of C2 hydraulic power at MES +5 sec.
[4]Loss of Atlas thrust during liftoff.
[5]Loss of H_2O_2 precluded successful MES2.
[6]MES2 was not achieved due to blockage of H_2O_2 lines to LO_2 and LH_2 boost pumps.
[7]Nose fairing failed to jettison properly.
[8]Centaur pitch control lost by MES +28 seconds.
[9]Atlas booster section electrical disconnect failure during booster jettison.
[10]Atlas booster engine hot gas leak failed mission.
[11]Spacecraft exhibited degraded operation - cause undetermined.
[12]Anomalous A/C separation and first burn; unsuccessful second burn.
[13]Lightning caused erroneous DOU steering command at 48.36 seconds.

5. AC-8 was the seventh R&D test flight and its purpose was to demonstrate cryogenic propellant management in a near zero-gravity coast, and subsequent Centaur second main engine burn. The flight progressed satisfactorily through the Atlas boost phase and Centaur first burn, and vehicle stability was maintained throughout the 25-minute coast phase between the first and second main engine firings. The second main engine start sequence was initiated at 2047 seconds, but eight seconds later the turbopump speed began to decrease and settling engines lost thrust because of H_2O_2 propellant depletion. Loss of H_2O_2 was attributed to a leak in the attitude control/propellant settling system that occurred during coast phase starting at approximately 1200 seconds. Even though second burn was unsuccessful, Centaur had achieved orbital parameters with a perigee of 88.17 NM and apogee of 104.24 NM. The uneven second burn start caused the Centaur to tumble, but good telemetry data was obtained continuously for 2500 seconds.

6. AC-17 was the eight operational Atlas/Centaur mission and this ATS-D payload launch following seven successful Surveyor missions. The Atlas and first Centaur firing sequences were satisfactory, and the Centaur/ATS-D was placed into a near-perfect parking orbit with a 100.4 NM perigee and 414.1 NM apogee at the start of the 61.2 minute coast. Centaur main engine start for second burn at 4265 seconds was unsuccessful because the boost pumps would not start, caused by no H_2O_2 propellant reaching the boost pumps. Analysis indicated that this lack of flow was caused by freezing of one of the common H_2O_2 feedlines by LO_2 leakage. Although the Centaur had good orbital characteristics, control stability was lost shortly after the unsuccessful second main engine start sequence, and the vehicle began a complex coning/tumbling motion.

7. AC-21 was a operational vehicle carrying the OAO-B spacecraft as its payload. Vehicle flight characteristics were satisfactory until 257 seconds into the flight when the payload fairing failed to separate properly. Centaur carried the partially separated fairing until LO_2 propellant depletion at 710 seconds. The fairing was not completely detached from centaur until spacecraft deployment. Payload fairing failure was attributed to one of the 16 explosive latch assemblies not operating correctly. Because of the added airing weight, Centaur did not achieve the required orbital characteristics, and impacted downrange. Centaur telemetry was continuously maintained until 1820 seconds into the flight. For subsequent missions, redundant fairing separation latches were used.

8. AC-24 was an operational vehicle carrying Mariner 8 as its payload. The Atlas vehicle performed satisfactorily and Centaur staging was normal. Centaur vehicle pitch stabilization was lost at 269 seconds, shortly after main engine start (MES), followed by complete loss of pitch control which tumbled the vehicle and subsequently resulted in engine shutdown. Pitch control loss was caused by an integrated circuit amplifier. Loss of telemetry occurred at 553 seconds, and vehicle impact occurred 600 seconds after launch, approximately 900 NM downrange. No range safety

maintain vehicle stability. Unfortunately, N_2H_4 was depleted at 1361 seconds, 22 seconds prior to second main engine start (MES2). This caused the vehicle to tumble, and MES2 was unsuccessful. The LO_2 leakage had also reduced the oxygen tank pressure, causing reversal and rupture of the intermediate bulkhead. The spacecraft was separated at 2026 seconds but the proper transfer orbit was not achieved and the mission was terminated. No range safety arm or destruct commands were sent. The cause of failure was attributed to a weak weld seam in the LO_2 tank that opened up due to the combination of tank pressure and pyrotechnic shock present at Centaur separation. On subsequent flights, lower tank pressure was employed at separation.

13. AC-67 was an operational vehicle carrying a FLTSATCOM as its payload. The vehicle was launched in bad weather and performed satisfactorily until 48 seconds into the flight. At this time, multiple lighting strikes caused an erroneous DCU command that yawed the engines hard over. This hard nose right yaw maneuver caused the airframe to breakup at 50 seconds due to aerodynamic loading. A vehicle destruct command was issued at 71 seconds by the Range Safety Officer. This failure was considered a "no trial," because established launch constraints should have prevented an OK-to-launch command from being given, and there were no inherent vehicle anomalies except those caused by the lighting strike.

As briefly noted in the preceding summaries, after each flight failure an investigation was performed to isolate the cause, and changes were made to correct each failure. This philosophy resulted in improved demonstrated launch vehicle reliability. Figure C-1 shows this reliability growth based on a 20 vehicle moving average, which currently stands at 95 percent. In addition to an "analyze and fix philosophy," Centaur has undergone three block changes since completion of its R&D flights with the D series vehicle. The D-1A block change introduced new avionics, which remain as the avionics for commercial Atlas/Centaur. The D-1AR block change incorporated mechanical revisions to take advantage of Centaur's improved avionics, including a computer controlled vent and pressurization system (CCVAPS), addition of helium purges, and boost pump ground spin-up for checkout. The third block change, initiated with AC-62, revised the reaction control system propellant from H_2O_2 to N_2H_4, and deleted Centaur's H_2O_2 driven boost pumps. In conjunction with this, the Atlas propellant tank was stretched 81 inches.

arm or destruct signal was sent. The rate gyro package was partially redesigned as a result of this failure.

9. AC-33 was an operational vehicle carrying on INTELSAT IV as its payload. The Atlas vehicle performed satisfactorily during boost phase. At 144 seconds of flight during booster section jettison, the 600/J12 Electrical staging disconnect failed to separate. This ripped apart the electrical harness on the sustainer, causing extensive electrical shorting. Vehicle stability was lost shortly thereafter due to intermittent losses of AC power to the rate gyros and engine feedback transducers. As a result of vehicle instability and acceleration decrease, the Centaur Digital Computer Unite (DCU) issued backup instructions to rapidly step through remaining Atlas sequences at 60 millisecond intervals, then to separate Centaur from Atlas at 197 seconds and start Centaur engines. Despite the adverse conditions, a satisfactory Centaur MES was achieved. However, vehicle stability was not regained. the payload fairing was jettisoned at 219 seconds, and 3 seconds later the telemetry signal was abruptly lost, probably caused by a collision of Centaur with its fairing or Atlas booster. At approximately 416 seconds the Range Safety Officer sent a vehicle destruct command. This flight failure resulted from failure of the 600P/J12 disconnect lanyard/release system to function during the booster jettison sequence. This lanyard installation was subsequently redesigned.

10. AC-43 was an operational vehicle carrying an INTELSAT IVA as its payload. Several seconds after liftoff, Atlas booster gas generator chamber pressure decreased slightly, followed by abnormal temperature rise rates in the Atlas thrust section. A fire started at 36.5 seconds, followed by loss of booster engine performance at 53 seconds. This resulted in loss of vehicle stability and caused structural failure at 55 seconds due to excessive aerodynamic loads. The payload and payload fairing separated from Centaur, and Centaur separated from the Atlas. Telemetry data terminated immediately thereafter at 55 seconds. The Atlas vehicle exploded in the aft region at 56 seconds and finally the Centaur vehicle was destroyed by the Range Safety Officer at 62 seconds. The flight failure was caused by a crack in the upstream omega joint in the booster gas generator ducting to the B2 turbine. The crack opened 2.3 seconds after liftoff, and escaping hot hydrogen-rich gas started the fire that destroyed the vehicle. Omega joint manufacturing/processing steps were revised to correct the cracking problem.

12. AC-62 was an operational vehicle carrying an INTELSAT V as its payload. The Atlas booster and sustainer phases of flight were normal; however, a significant leak occurred in the Centaur liquid oxygen tank (LO_2) at 289 seconds when Centaur separated from Atlas. The loss of approximately 1483 lb of LO_2 during first engine burn had little effect except Centaur first main engine cutoff (MECO1) occurred at 11 seconds early to compensate for the fuel rich mixture ratio caused by this LO_2 propellant loss. During coast, an excessively large use of N_2H_4 attitude control system (ACS) propellant was necessary to counteract the leaking LO_2 and

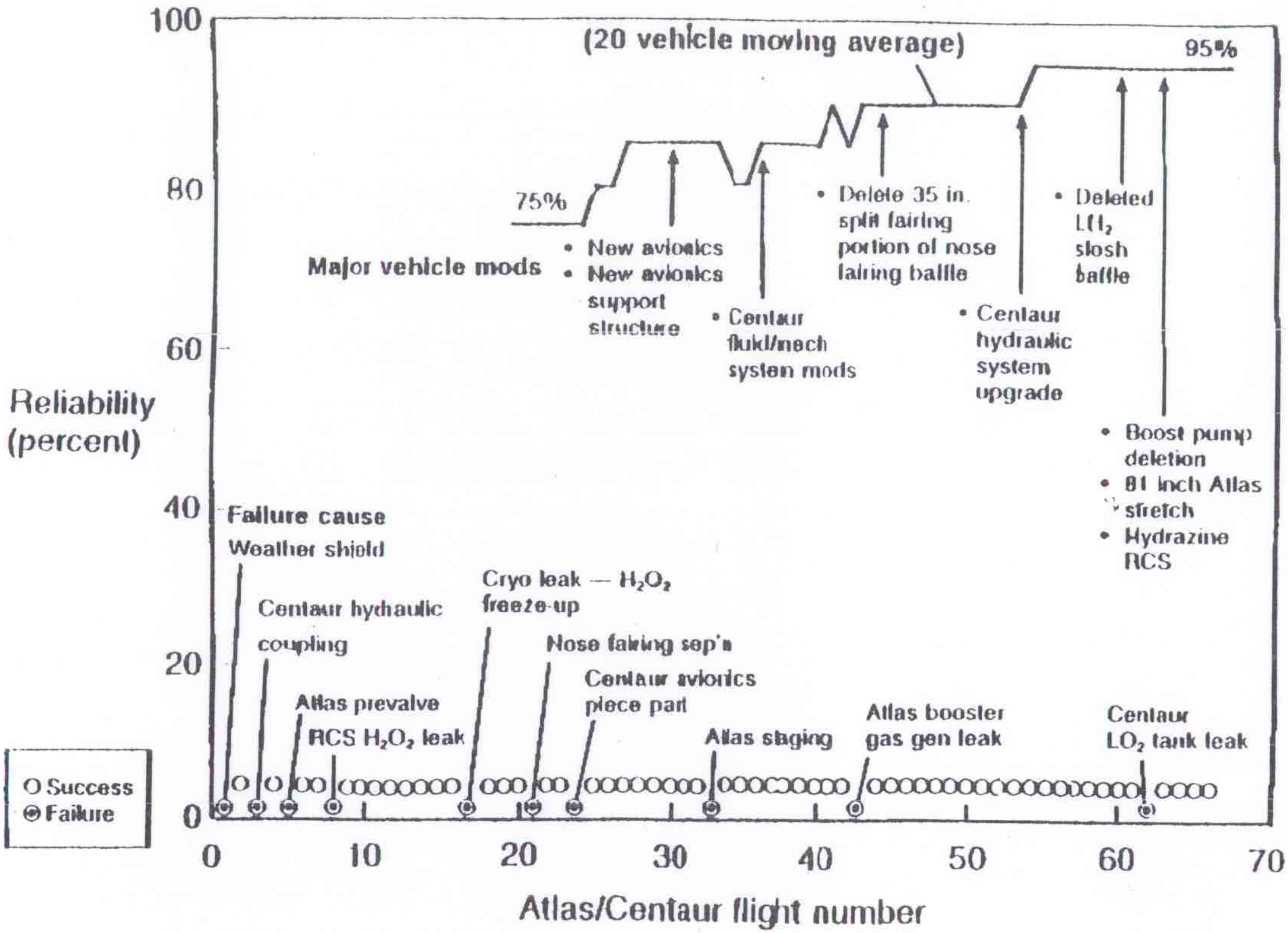


Fig. D-1 Atlas/Centaur reliability record.