Final Environmental Assessment for Expanded Use of the Shuttle Landing Facility

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John F. Kennedy Space Center

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FINAL ENVIRONMENTAL ASSESSMENT FOR THE EXPANDED USE OF THE SHUTTLE LANDING FACILITY

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Abstract

This Environmental Assessment addresses the potential impacts associated with three action alternatives and one no action alternative evaluated for expanding uses at the Shuttle Landing Facility (SLF) on Kennedy Space Center. The Proposed Action alternative includes construction of several facilities at two sites (south-field and mid-field) within the SLF area that would be needed to support new activities. Construction would include new hangars and other support buildings, taxiways, and related infrastructure. Under the Proposed Action, expanded uses would include horizontal spaceflight development, commercial spaceflight program and mission support, aviation testing, airborne research and technology development, and ground-based research, training, and testing. The activity levels associated with the Proposed Action are estimated to be less than activity levels previously experienced at the SLF. Alternatives to the Proposed Action include limiting expansion of SLF facilities to the south-field site only (Alternative 1) and limiting expanded uses to existing SLF facilities, some of which could be modified (Alternative 2). Under each of these alternatives, it is anticipated that the proposed activities would still occur, but at a reduced level of approximately 60% and 40%, respectively, as compared to the Proposed Action. The No Action alternative assumes that there would be no expansion of uses from those which are currently occurring at the SLF; therefore the level of activity at the SLF would be expected to decrease greatly after the end of the Space Shuttle Program in 2010. The environmental impacts from construction and operations associated with each of these alternatives were classified as “none,” “minimal" or "minor". Under the Proposed Action and Alternative 1, mitigation would be required for loss of impacted habitats; these mitigation plans would be designed during the permitting processing.

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Abbreviations and Acronyms

ac.	acres
ARFF	Airfield Rescue and Fire Facility
AST	Federal Aviation Administration Office of Commercial Space Transportation
BASH	Bird Air Strike Hazard
BMP	Best Management Practice
C	Celsius
CatEx	Categorically Excluded
CCAFS	Cape Canaveral Air Force Station
cm	centimeters
CNS	Canaveral National Seashore
CO	carbon monoxide
COTS	Commercial Orbital Transportation Services
dBA	decibels, A-weighted
DoD	Department of Defense
E	Endangered
EA	Environmental Assessment
ECS	Environmental Control System
EDMS	Emission and Dispersion Modeling System
EDS	Earth Departure Stage
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EO	Executive Order
EPA	Environmental Protection Agency
F	Fahrenheit
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FPL	Florida Power and Light
ft.	foot/feet
gal.	gallons
ha	hectares
HAP	hazardous air pollutant
HC	hydrocarbons
INM	Integrated Noise Model
ISS	International Space Station
in.	inch
IRL	Indian River Lagoon
km	kilometers
KSC	Kennedy Space Center
kV	kilovolt
l	liters
LACB	Landing Aids Control Building
LC	Launch Complex
LOx	liquid oxygen
m	meters
MDD	Mate/Demate Device

mi.	miles
MINWR	Merritt Island National Wildlife Refuge
MOU	memorandum of understanding
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOAA	National Oceanographic and Atmospheric Administration
NOx	nitrogen oxides
NPD	Noise-Power Distance
NPS	National Park Service
NSR	new source review
O_3	ozone
OSHA	Occupational Safety and Health Administration
PAMS	Permanent Air Monitoring System
Pb	lead
PM-10	10-micron particulates
PSD	prevention of significant deterioration
RLV	Reusable Launch Vehicle
SHPO	State Historic Preservation Office
SLF	Shuttle Landing Facility
SO_2	sulfur dioxide
SR	State Route
SSTO	single stage to orbit
STA	Shuttle Training Aircraft
SWMU	Solid Waste Management Unit
T	Threatened
TNM	Traffic Noise Model
UAV	Unmanned Aerial Vehicle
UMAM	Unified Mitigation Assessment Method
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAB	Vehicle Assembly Building
VLA	Very large Aircraft
Zero G	Zero Gravity

EXECUTIVE SUMMARY

This Environmental Assessment has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. §§ 4321-4370d) and according to the Procedures of Implementation of NEPA for the National Aeronautics and Space Administration (NASA) [Title 14, Code of Federal Regulations, part 1216 subparts 1216.1 and 1216.3].

Purpose and Need

The Space Shuttle Program is scheduled to end in 2010, and NASA operations at the Shuttle Landing Facility (SLF) are expected to greatly decrease thereafter. In order for NASA to sustain the SLF as a valuable, unique asset supporting agency missions and goals, the John F. Kennedy Space Center has been exploring the expansion of uses beyond those currently occurring. Moreover, the expansion of uses at the SLF would provide opportunities for increased participation by the commercial sector in supporting the nation's Vision for Space Exploration. If uses at the SLF were expanded, construction of new facilities and/or modifications to existing facilities would likely be required. The purpose of this EA is to document potential environmental impacts from those changes and the activities associated with increasing SLF operational capabilities.

Proposed Action and Alternatives

Three action alternatives and a no action alternative were analyzed. Under the Proposed Action alternative, new facilities would be constructed at the south-field and mid-field sites. Additional hangars, a fuel farm, and aircraft taxiways would be built. These upgrades would allow the SLF to support a variety of new operations, including horizontal spaceflight development, commercial spaceflight program and mission support aviation, aviation test operations, airborne research and technology development, and ground-based research, training, and testing.

Alternative 1 would involve construction of new facilities at the south-field site only. It is anticipated that the proposed new activities would still occur, but at a reduced level (approximately 60% of that projected for the Proposed Action) due to limited permanent housing facilities for aircraft and increased competition for existing capabilities.

Under Alternative 2, SLF activities would expand as described, but would be limited to the capacity and capabilities of existing facilities. Lack of permanent housing and competition among users for existing resources would limit the potential expanded use activity level to approximately 40% of that projected for the Proposed Action.

The No Action alternative states that uses of the SLF and the associated construction and/or modification of facilities would not occur. When the Space Shuttle Program is completed in 2010, activity level and operations at the SLF would greatly decrease. Many facilities, including those addressed in this EA, would either be maintained at a reduced level, maintained in long-term storage mode, or disassembled.

Affected Environment and Consequences

KSC encompasses nearly 56,451 hectares (ha) [139,490 acres (ac.)] on the east coast of central Florida. Approximately 3,035 ha (7,500 ac.) of KSC are actively used to support space mission operations, with the remaining lands being managed by the U.S. Fish and Wildlife Service as wildlife habitat. Resources identified that could be impacted by any of the action alternatives include transportation, utilities, air quality, wildlife, threatened and endangered species, cultural resources, geology and soils, noise, surface and groundwater quality, socioeconomics, and land use. Four classifications of environmental impacts were pre-determined, and the resources were evaluated in terms of these classifications: none (no impacts expected); minimal (impacts would not be expected, or are too small to cause any discernable degradation to the environment); minor (impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation); or major (impacts could individually or cumulatively be substantial).

Some impacts from construction under the Proposed Action alternative were classified as minor in the categories of habitats/vegetation, noise, surface water quality, socioeconomics, and land use. Construction would be expected to minimally impact transportation, air, wildlife, threatened and endangered species, cultural resources, geology and soils, and groundwater quality; these effects would be localized and temporary. Mitigation requirements for the loss of impacted habitats would be planned during the permitting process. Impacts from operations under the Proposed Action would be none or minimal for all resources except noise and socioeconomics, where effects would be minor.

Impacts to KSC resources under Alternative 1 are expected to be similar to those determined for the Proposed Action, except that they would be limited to the south-field site. Construction impacts would be minimal to all resources except habitats and vegetation, noise, surface water quality, and land use, where effects are predicted to be minor. Under this alternative, impacts of the new operations planned for the SLF would have minor effects on noise and socioeconomics, while all other resources would not be affected or would be minimally affected.

Alternative 2 would have fewer impacts to KSC resources than either of the preceding two alternatives. Under this alternative, there would be no construction. Operational impacts would be none for utilities, cultural resources and geology and soils, while effects on transportation, air quality, biological resources (including threatened and endangered species), surface and ground water quality and land use would be minimal. There would be minor impacts from the planned new operations at the SLF on noise and socioeconomics resources.

Under the No Action alternative, socioeconomics would be the only resource potentially affected. These impacts would be minor due to the anticipated loss of jobs at KSC, and the primary and secondary effects on the economy of the surrounding area.

None of the four alternatives would be expected to produce any consequences related to Environmental Justice as all activities are located away from population centers. The expanded uses would not be expected to affect the surrounding communities any differently than the current programs at KSC.

1.0 INTRODUCTION, PURPOSE, AND NEED

The National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [U.S.C.} 4321, *et seq*.), and related regulations and agency policies, direct the National Aeronautics and Space Administration (NASA) to consider environmental consequences when planning for, authorizing, and approving federal actions. When NASA initiated the Space Shuttle Program in the 1970s, it assessed the environmental consequences of Space Shuttle-related activities at the Kennedy Space Center (KSC), including the construction and operation of the Shuttle Landing Facility (SLF) for Shuttle Orbiter landings and associated mission training and support aviation. Expanding the SLF for a broader set of uses not contemplated or assessed in the 1970s analysis is a federal action subject to review, as required by NEPA. NASA is the lead federal agency for preparation of this Environmental Assessment (EA), and the Federal Aviation Administration (FAA) is a cooperating agency.

1.1 Background

NASA was created in 1958 to lead the U.S.'s civilian space exploration and aeronautical technology development activities. It subsequently established in the 1960s a Launch Operations Center in Florida on Merritt Island (Figure 1-1). Today, it continues to operate KSC as a federal spaceport. NASA developed and operates the Space Shuttle Program, currently scheduled to retire in 2010, and is engaged in developing new capabilities to implement the Vision for Space Exploration (NASA 2004a). NASA also procures commercial launch services from providers who launch agency-developed and operated spacecraft aboard expendable launch vehicles (ELV) from a number of sites, including Cape Canaveral Air Force Station (CCAFS) adjacent to KSC.

NASA anticipates some continued requirements for the SLF well beyond the retirement of the Space Shuttle system. However, NASA plans to expand utilization of this unique national asset in order to improve the efficiency of its operation, and increase opportunities for the private sector to participate in and support U.S. space exploration and development.

In 2005, KSC initiated a Shuttle Landing Facility Expanded Access Pilot Program which has demonstrated some of the potential new uses contemplated in this action as "pathfinder" projects. Examples of these projects are shown in Figure 1-2. Subsequently, NASA developed the following Proposed Action to expand uses of the SLF, including construction of the required support infrastructure that would enable these and other new applications to occur on a regular basis. Under the Proposed Action, NASA would enter into the appropriate agreements, enabling the SLF to accommodate: 1) landings of commercially operated suborbital vehicles and "fly back" booster stages that are launched vertically from other sites; 2) horizontal launch of both suborbital and orbital vehicles from carrier aircraft, and the return of carrier aircraft and suborbital vehicles to the SLF; 3) horizontal launch and landing of single element suborbital vehicles; and 4) expanded categories of aviation and non-aviation uses, as described fully in this document. Under the Proposed Action, the SLF infrastructure would be upgraded to accommodate these new uses.

1.2 Federal Agency Involvement

Two federal agencies are involved directly in this proposed action, NASA and FAA. In addition, the U.S. Fish and Wildlife Service (USFWS) and National Park Service (NPS) have management responsibilities for properties on KSC. The U.S. Air Force 45th Space Wing (USAF) coordinates use of the restricted air space over KSC and Cape Canaveral Air Force Station (CCAFS) and manages launches conducted at the Eastern Test Range (ETR).

1.2.1 Role of NASA

Within NASA, KSC is responsible for operating and maintaining the SLF to support agency space and aviation requirements. In addition, KSC provides oversight of current non-NASA uses, and would be responsible for establishing and coordinating appropriate use agreements and operating procedures for those activities outlined in the proposed action. Non-government aviation activities at the SLF are required to be in compliance with all applicable FAA regulations.

1.2.2 Role of FAA

The FAA regulates and establishes requirements for airfield facilities and operations used by commercial aviation, including those commercial operators who use the SLF. It also has the lead federal role for the promotion and regulation of the commercial space launch industry. Through its Office of Commercial Space Transportation, the FAA's responsibility is protection of the noninvolved public, property, and national security and foreign policy interests of the U.S. during a commercial launch or reentry activity, and to encourage, facilitate, and promote U.S. commercial space transportation. The FAA is also responsible for regulating civil aviation for all aircraft operating in U.S. In coordination with NASA and the USAF, the FAA would oversee airspace management of the spaceflight and aviation uses evaluated in this EA. The FAA would issue experimental permits or launch/reentry licenses, as appropriate, for commercial space transportation operators utilizing the SLF. In addition, should NASA subsequently enter into any agreement with a non-federal entity to operate the SLF for commercial use, the FAA would issue a Launch Site Operator license and regulate the activities of the non-federal spaceport operator in addition to regulating the operation of the SLF as a non-federal or joint-use airfield supporting civil aviation.

1.2.3 Role of USFWS and NPS

USFWS and NPS, both agencies of the U.S. Department of Interior, have management responsibilities for land which could potentially be affected by the activities evaluated in this EA. Through official agreement with NASA, USFWS manages the acreage of KSC not specifically used for space or related operations as Merritt Island National Wildlife Refuge. Canaveral National Seashore, managed by the National Park Service, was established by Congress and is located adjacent to and north of KSC. NASA coordinates all land uses and activities that may have impacts on these agencies' responsibilities and missions.

1.2.4 Role of USAF

By agreement with NASA, the USAF 45th Space Wing headquartered at Patrick Air Force Base, Florida, is responsible for managing the KSC and CCAFS restricted airspace on behalf of both federal users. Both NASA and USAF coordinate airspace use and requirements with the FAA. In addition, commercial space launch activities at the Eastern Test Range are managed in accordance with agreements between NASA, the USAF, and the FAA.

1.3 Site Operator and Spaceflight/Aviation Operator Involvement

KSC currently operates the SLF through its support contractors, and anticipates continuing to do so at least through the retirement of the Space Shuttle. The SLF is operated as an integral part of a federal spaceport, and is a FAA Part 139-compliant airport facility (Code of Federal Regulations Title 14 Part 139) which already accommodates limited non-governmental use. After FAA discontinued certifying federally operated airfields for Part 139 compliance, NASA voluntarily continued to assure SLF facilities compliance with Part 139.

Sometime after 2010, NASA may opt to enter into interagency agreements with entities such as Space Florida, the Titusville-Cocoa Airport Authority, or a similarly structured organization to serve as a site operator for the space launch and/or aviation activities conducted at the SLF. Transitioning to a non-NASA site operator for commercial space and aviation activities may increase the effectiveness of the SLF serving as a joint-use spaceport/airfield facility. Any Site Operator other than NASA would have to apply for and be granted a Site Operator's license from the FAA to facilitate horizontal space launch and landing activities at the SLF. Issuance of a Site Operator's license or other FAA licenses or permits would require a separate NEPA review. The analyses from this EA could be used in part to support those determinations.

Regardless of whether NASA or some other entity acts as the Site Operator at the SLF, commercial Spaceflight Operators must obtain the appropriate license from FAA's Office of Commercial Space Transportation (AST). Additionally, non-federal Aviation Operators must hold the appropriate FAA licenses and certifications to operate at the SLF.

1.4 Purpose and Need

NASA's purposes in developing the Proposed Action alternative are to 1) enable improved access to KSC's space launch and test operation capabilities by commercial and other non-NASA users; 2) foster a commercial space launch and services industry that could advance NASA's mission; and 3) improve the return on investment by the taxpayers on facilities that, while still required for government purposes, would otherwise be underutilized.

The Proposed Action to expand capabilities of the SLF and facilitate improvements to the SLF that may be needed to support such expanded uses is responsive to and fully consistent with National Space Policy (OSTP 2006), as established by the President, and with similar policy direction from Congress, as detailed in the Commercial Space Launch Activities Act of 2004 and the Space Act of 1958 as amended. In addition, such use is consistent with the agency's implementation of the Vision for Space Exploration, and its plan for property management of underutilized assets.

In accordance with the 2004 National Space Transportation Policy directive, NASA has a responsibility to "… operate Federal launch bases and ranges in a manner so as to accommodate users from all sectors…provide stable and predictable access to Federal launch bases and ranges and other government facilities and services, as appropriate, for commercial purposes…encourage private sector and state and local government investment and participation in development and improvement of space infrastructure…".

Congress has enacted a Commercial Space Launch Activities Act of 2004 which has as one of its purposes "the strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of U.S. space-related activities."

Moreover, the expansion of compatible uses for the SLF as NASA transitions from the Space Shuttle Program to the Vision for Space Exploration provides an opportunity for continued utilization of a unique national asset. It would have the potential to significantly expand private sector participation in the exploration and development of space, especially the expansion of commercial services in low earth orbit. Such activities would assist NASA in meeting its national mission while providing the capability to foster space commerce and its related economic benefits.

The Proposed Action helps assure that the substantial Federal investment in the SLF and its related support facilities will continue to provide benefits to both the government and the private sector after the retirement of the Space Shuttle Program in 2010. The SLF offers an ideally suited facility for the safe and efficient operation of non-governmental launch and landing systems that will augment and complement U.S. national capabilities.

Both NASA and FAA seek to foster and support the emergence of such commercial space transportation capabilities and will cooperate in the planning, development, and operation of the SLF as a commercial spaceport operations site.

1.5 Public Review

As part of the public involvement for this project, NASA initiated a 30-day public review and comment period for the Draft Environment Assessment for the Expanded Use of the Shuttle Landing Facility on the John F. Kennedy Space Center, Florida by publishing a notice in the *Florida Today* newspaper on July 16, 2007, and by providing copies to the Florida State Clearinghouse and other interested parties. Copies were available to the general public in six Brevard County libraries as noted on the notice. The public review period closed on August 20, 2007.

NASA received several comment letters from the public. These included several letters of support from local government and business organizations. The Florida State Clearinghouse also provided comments. The Canaveral National Seashore (CNS) submitted a comment letter citing concerns regarding the impacts of noise on wildlife and CNS visitors. All comments have been considered in the preparation of this Final EA. Copies of the comment letters as well as the specific response made to the CNS regarding their concerns may be found in Appendix 7.

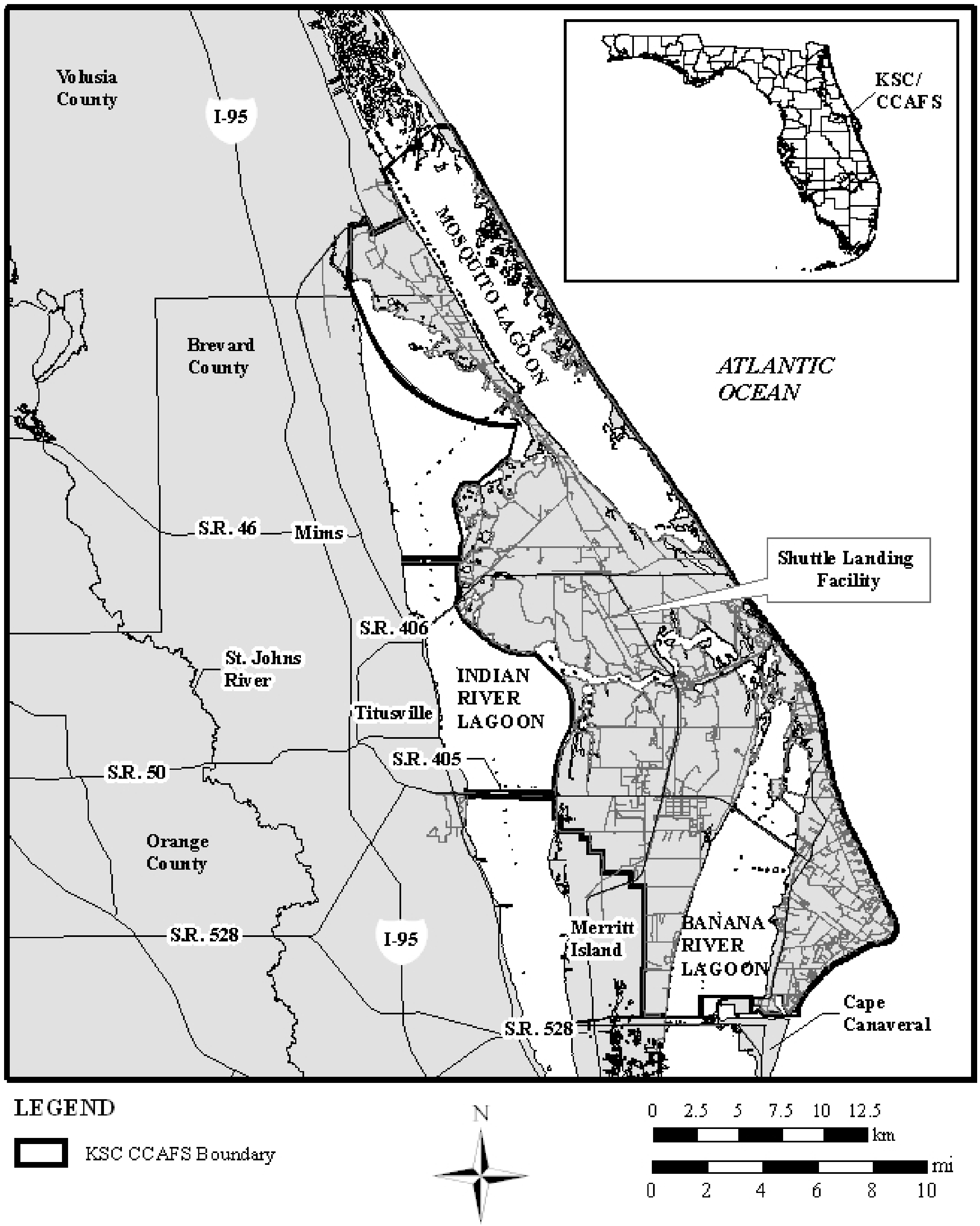

Figure 1-1. General Location of the SLF on Kennedy Space Center, Florida

Zero Gravity Corporation's 727 lands after parabolic flight operation.

Starfighter's F-104 prepares for suborbital flight simulation.

Virgin Atlantic GlobalFlyer is readied for world-record flight.

Air Force C-5 on SLF apron prior to system calibration flight activity.

Figure 1-2. Photographs of expanded access "pathfinder" projects that utilized the SLF in 2005-2007.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Chapter 2 describes the Proposed Action and three alternatives (Alternative 1, Alternative 2, and No Action Alternative) which were analyzed and are presented in this EA. The Proposed Action is to allow expansion of the uses of the SLF to include a variety of activities that are not currently occurring but would be anticipated to occur by 2015. To fully take advantage of the capabilities of the SLF, new construction would be done at both the south-field and mid-field sites. Alternative 1 would be to reduce the number and/or types of activities that would take place by developing the south-field site only. Under Alternative 2, no new construction would occur, although there could be some modification of existing facilities, and expansion of uses would be limited to those that could be accommodated within the existing facilities. The No Action alternative states that there would be no expansion of the current uses of the SLF.

2.1. Existing Facilities and Current Uses

The SLF was designed and constructed in the 1970s to serve as the primary landing and recovery site for the Space Shuttle orbiter. In order to support the Shuttle's horizontal landings, the SLF is 4,572 m (15,000 ft.) long and 91.4 m (300 ft.) wide. It has 305 m (1,000 ft.) of paved overruns at each end and the paving thickness is 38.1 cm (15 in.) at the center. Figure 2-1 is a graphic rendering of existing conditions at the SLF. The environmental impacts of building and operating the SLF were identified and analyzed in the original Space Shuttle Program Environmental Impact Statement (NASA 1979); it was anticipated at that time that as many as 40 Shuttle Orbiter landings would occur each year. Over the 26-year operational history of the Space Shuttle Program, the actual number of orbiter landings has been considerably lower, averaging four or five per year.

In addition to the runway, the SLF has other valuable tangible resources. These include:

- Convoy equipment shelter
- Support office complex
- Flight operations and flight crew support facilities provided at the Landing Aids Control Building (LACB)
- A 4,645 m^2 (50,000 $ft.^2$) environmentally controlled hangar facility constructed in 1999 by the State of Florida to support reusable launch vehicles and/or aircraft employed in orbital launch operations
- A control tower constructed in 2004 at the mid-field site
- The Airfield Rescue and Fire Facility (ARFF) completed in 2007 at the south-field site

Besides orbiter landings, Space Shuttle Program activities at the SLF predominantly include return of the orbiter via ferry flights from alternate landing sites; Shuttle Training Aircraft (STA) operations that allow astronaut flight crews to practice repetitive simulated approaches and landings to the SLF in a variety of conditions; T-38 aircraft training and mission support flights; NASA mission management flights to and from KSC; and mission support including security flights, weather observation, chase vehicle flights, and payload delivery operations for Shuttle missions.

Table 2-1 shows the number of operations that have occurred at the SLF between 1998 through 2006.

The SLF will be required by NASA for support of the Space Shuttle Program through the anticipated retirement of the system in 2010. Thereafter, some residual aircraft ferry flight operations for transport of Shuttle orbiters and other Shuttle Program requirements will continue. NASA will also require the use of the SLF for a variety of agency aircraft operations related to the new Vision for Exploration, general mission management, and institutional security and property management activities. The annual projected flight operations from continued NASA usage and other existing uses is not anticipated to exceed 6,000 operations annually, as shown in Table 2-2, and is anticipated to decline after 2010. Flight operations from new categories of uses in the Proposed Action would, when combined with existing uses, still be well below previous peak years (Table 2-1).

The SLF is used to a lesser extent by the Department of Defense (DoD) for non-Shuttle related aircraft operations. This includes delivery of large payloads to be processed in commercial facilities and launched aboard commercially operated expendable launch vehicles (ELV) from CCAFS.

During 2005-2006, NASA initiated several demonstration projects at the SLF for other types of uses. Subsequently, Zero Gravity (Zero G) Corporation was approved for recurring flight activity of a commercially operated parabolic flight program under a Categorical Exclusion (CATEX) (Appendix 1). The Zero G activity has been included as an expanded use for the SLF in this EA (Table 2-3), but would continue as permitted even if the No Action alternative (discussed below in Section 2.5) is adopted.

2.2 Proposed Action

NASA's Proposed Action is to broaden the user base at the SLF to include commercial and other non-NASA entities. The Proposed Action alternative would allow for the greatest support of new activities. Two other alternatives are evaluated in this EA, as well as a No Action alternative that would not allow for any change from the current uses of the SLF.

2.3 Proposed Action Alternatives

The Proposed Action alternative would increase SLF capabilities to support a number of diverse activities encompassed in the following broad categories:

- Horizontal spaceflight development and operations
- Commercial spaceflight program and mission support aviation
- Aviation test operations
- Airborne research and technology development
- Ground-based research and training

An expansion of the support facilities associated with the SLF at both the south-field and mid-field sites would be required to fully facilitate the activities envisioned to occur between 2008 and 2015 (Figure 2-2). The south-field expansion would take place in the near future (by 2011) (Figure 2-3);

in the longer term, but potentially before 2015, the Proposed Action alternative calls for expansion of facilities and functions to the SLF mid-field site as required (Figure 2-4). Figure 2-5 is a graphic rendering of the proposed south-field and mid-field expansion sites.

2.3.1 Proposed South-field Facility Expansion

The improvement of SLF support facilities at the south-field site (Figure 2-3) would include:

- modification of the existing LACB to accommodate expanded flight operations, planning, and passenger/cargo processing functions
- construction of a second taxiway from the northwest corner of the existing ramp to the runway
- construction of one multi-user hangar facility
- construction of up to six smaller hangars and/or maintenance/processing bays for individual aircraft or suborbital vehicles along the expanded ramp
- specialized propellant and/or ordnance staging and support facilities (fuel farm)

A multi-user hangar of approximately 4,645 m^2 (50,000 $ft.^2$), with a climate-controlled office annex would be sited north of the Mate-Demate Device (MDD) on a new foundation adjacent to the existing ramp. The hangar would not be climate controlled. The expansion would also provide sites for construction of smaller hangars and processing/support facilities to the north side of the multi-user hangar, and an additional aircraft parking ramp would be added along with the second taxiway to facilitate improved operational efficiency. One or more of these might be climate controlled if required. Space for a stormwater retention area would also be included. The site characteristics for this expansion are shown in Figure 2-3. The multi-user hangar is anticipated to be similar in size to a facility studied for NASA's own use in 2003 (KSC-TA-5958).

A fuel farm would be constructed on the north side of Astronaut Road leading to the south-field site (Figure 2-3). The aviation fuel storage facility would be similar in size, capability, and function as the one described in a concept study performed in April 2003 (KSC-TA-6063). This facility was studied for the storage of JP-8 jet fuel, but would be no different if it was used to store Jet-A commercial aviation fuel or both. The facility would be sized to support both government and commercial users. Vehicles requiring LOX, kerosene or propellants other than aviation fuel would be fueled from mobile tankers called to the SLF as required for mission support.

2.3.2 Proposed Mid-field Facility Expansion

The expansion of SLF support facilities (Figure 2-4) would include:

- modification of the Control Tower first two levels to accommodate flight operations, planning, and passenger/cargo processing functions
- construction of two taxiways to the runway midpoint
- construction of an expanded ramp area
- construction of one large hangar facility

- construction of up to six smaller hangars and/or maintenance/processing bays for individual vehicles
- construction of specialized propellant and/or ordnance staging and support facilities

A large hangar facility would be required to house a Very Large Aircraft (VLA) of up to 85 m (280 ft.) wingspan (Figure 2-6). While exact dimensions and requirements are not known in detail at this time, it is estimated that such a facility would require 10,500 m^2 (113,021 ft^2) of hangar space (Lufthansa 2007). The footprint for the proposed expansion of the mid-field site is shown in Figure 2-4.

2.3.3 Proposed Activities

Table 2-4 shows the various proposed activities and anticipated annual flight frequencies.

2.3.3.1 Horizontal Spaceflight Development and Operations

Suborbital Horizontal Launch and Landing

This use of the SLF involves the developmental and operational flights of space vehicles flying suborbital trajectories, and returning to the landing strip upon mission completion. The primary anticipated application of these flight systems is for commercially owned and operated services offering a brief spaceflight experience for customers which FAA calls “spaceflight participants.” In addition, these operators are expected to provide commercial flight services to government, academic, and industry customers performing research, technology development/demonstration, and low-gravity testing. NASA may be a customer of such services in support of its exploration programs.

All suborbital spaceflight operations conducted from the SLF are anticipated to launch northward and bank eastward over Mosquito Lagoon and Canaveral National Seashore (CNS)(Figure 2-2). In a typical flight, the aircraft/spacecraft would cross the coastline at approximately 6.1 km (20,000 ft.) altitude, reaching transonic speed at 24 km (15 mi.) east of the coastline at approximately12 km (40,000 ft.) altitude. Suborbital flight missions performed from KSC are expected to achieve an apogee (the highest point in the trajectory) of about 100 km (62 mi.) or more and provide up to 5 minutes of microgravity time.

Suborbital horizontal launch and landing systems are expected to fall into two general categories: single, aircraft-like vehicles that takeoff and land under their own power, and winged, rocket-powered spacecraft taken aloft by a carrier aircraft that returns to the SLF after deploying the suborbital vehicle out over the Atlantic.

Concept X vehicles, as classified by FAA (FAA 2006a), take off under conventional jet engine power and ignite rocket engines at between 5,486 - 9,144 m (18,000 - 30,000 ft.) to achieve their suborbital trajectory and velocity. For return to the SLF, Concept X systems may make powered landings using their jet power, like an aircraft, or glide unpowered to the runway touchdown.

Concept Z suborbital vehicles (FAA 2006a) are attached to a carrier aircraft on take off. Carrier aircraft takeoffs under jet power will be similar in concept to the Shuttle Carrier Aircraft (modified Boeing 747) and the White Knight carrier designed and flown by Scaled Composites to launch SpaceShipOne – the first privately built and operated suborbital vehicle. Other representative Concept Z flight systems may include a modified Russian M-55 high-altitude aircraft carrying a rocket-powered suborbital vehicle. Other aircraft-suborbital vehicle system configurations may emerge based on the general concept described here.

Separated from the carrier aircraft east of KSC over the Atlantic Ocean at altitudes that are anticipated to range from 10,668 – 18,288 m (35,000 - 60,000 ft.), the rocket-powered suborbital vehicles are expected to ignite rocket engines to fly a suborbital trajectory, achieving an apogee of 100 km (62 mi.) or more, and then glide unpowered to their landing on the SLF. Following the deployment of the suborbital vehicle, carrier aircraft will return to the SLF for a conventional aircraft landing.

A third type of horizontally-launched suborbital vehicle takes off under its own power using rocket propulsion ignited on the runway. These are classified by FAA as Concept Y vehicles. Concept Y vehicles, though under development, are not included in this analysis for reasons described below in section 2.6.1.3.

Projected time-lines for suborbital flight operations begin as early as 2008 with developmental flights of test vehicles in atmospheric tests which do not achieve suborbital altitudes. Operational flights may occur by 2010 and, based on potential demand for space tourism and research/technology services, it is assumed for purposes of this analysis that 2-4 operators from the SLF would conduct up to a combined average of four missions per week by 2015.

Orbital Horizontal Launch and Landing

This use of the SLF involves the development and operation of space vehicles flying orbital trajectories, deployed from large carrier aircraft that return to the landing strip after air launch of the rocket-powered upper stage and its payload. These flight systems are expected to be commercially owned and operated to offer payload-to-orbit services for government and private customers. Payloads for government users may include small to medium-sized satellites, cargo or crew delivery to the International Space Station (ISS) or other low-earth orbit destinations, and DoD missions. NASA may be a customer of such services in support of its exploration programs. Other commercial missions may include space tourism applications and commercial orbital or exploration activities

All horizontal orbital spaceflight operations conducted from the SLF are anticipated to launch northward and bank eastward over Mosquito Lagoon and CNS utilizing a similar airspace corridor and flight pattern as that identified for suborbital operations. Deployment of rocket-powered vehicles from carrier aircraft will occur well east of KSC, over the Atlantic Ocean at altitudes ranging from approximately 10,668 - 18,288 m (35,000 - 60,000 ft.). The proposed air corridor for all orbital flight missions is illustrated in Figure 2.2.

Orbital horizontal launch systems expected to be operated from the SLF until at least 2015 will require a large carrier aircraft to take the orbital vehicle and its payload aloft. Flight systems which may use the SLF for conduct of orbital launch operations include the Orbital Sciences Corporation's L-1011 jet aircraft carrying a Pegasus launch vehicle or derivative. Other carrier aircraft systems taking off from the SLF may include a modified version of the Boeing 747 (already long employed as the Space Shuttle carrier aircraft) and a larger version or derivative of the White Knight carrier designed and built by Scaled Composites.

Several companies are working on systems requiring Very Large Aircraft (VLA) to significantly increase the payload capacity for orbital missions launched in this fashion. These aircraft are expected to use conventional aviation propulsion and fuel but may have wingspans of 73 - 82 m (240 - 270 ft.) or greater. Some innovations in aircraft systems and orbital vehicle deployment techniques can be expected between 2008 and 2015; however these systems can be expected to operate within the parameters typical for today's largest aircraft.

It is possible that by 2013, one or more operators will wish to base a VLA system at the SLF, requiring a correspondingly large hangar to shelter the carrier aircraft and support orbital launch preparations. The existing Reusable Launch Vehicle (RLV) hangar on the Shuttle tow-way is sized to accommodate an L-1011, but a larger aircraft would require a new hangar if permanently based at the SLF.

Recovery of Fly-back Booster or Suborbital Vehicle after Vertical Launch

Other non-NASA systems that could potentially use the SLF are being designed or considered by government and private operators to employ a vertical launch from CCAFS, with the first stage booster returning to an aircraft-like landing on the SLF. It is assumed that early demonstrations of this technology will be developed and flown by the DoD and by 2015 may include both scale vehicle demonstrators and full-scale testing. These vehicles, called hybrid launch systems, are assumed to be unpiloted and to glide to an unpowered landing on final descent.

Another concept that may be commercially developed is a vertically launched suborbital vehicle that would fly back to land on the SLF after its brief flight into space. For purposes of this analysis, since vehicle design and operating characteristics for such a system are not yet known in any detail, it is assumed that this returning suborbital vehicle would glide to an unpowered landing on final descent, similar to the other systems described above.

2.3.3.2 Commercial Spaceflight Program & Mission Support Aviation

Parabolic Flights for Training and Research and Development

This commercial use of the SLF has been demonstrated and initially permitted for recurring operations as part of the 2005-2007 demonstration program. Parabolic flight operations from the SLF conducted by the Zero G employ a modified Boeing 727 cargo aircraft to conduct both training and research flights.

Flights conducted in airspace east of KSC perform multiple zero-gravity parabolas, giving flyers and researchers 25-30 second intervals (for a total of up to five minutes) of conditions identical to what astronauts experience constantly in earth's orbit. The aircraft can also provide simulations of the lunar or Martian gravity.

Just as NASA has used this type of training to orient astronauts to orbital conditions prior to actual spaceflight, the provision of this type of commercially available service will support the emerging market for suborbital and orbital spaceflight by private citizens. The flights have already proven popular as a means to inspire science and math teachers, introduce would-be space travelers to the experience of weightlessness, and support microgravity research and technology activities.

Flight rates at the SLF are projected to increase between 2008 and 2015, and are expected to be provided by one or more operators using 727 or similar aircraft. It is possible that one or more operators would prefer to base operations at the SLF, and may require greater access to ramp space, hangar, and support facilities than has been needed for a transient aircraft.

High Altitude/High Performance Flights for Training and Research and Development

Similar to parabolic flights, the use of high altitude and/or high performance jet aircraft flights would serve as a method for introducing potential suborbital/orbital spaceflight participants to the characteristics of spaceflight. In addition, such flights can help develop technology and perform tests of spacecraft and range systems.

One or more operators are expected to use the SLF to offer such commercial services to government and private customers. Aircraft anticipated to be used in performing these flights include the F-104 and T-38 jet aircraft and similarly capable systems. The F-104 in particular has high altitude capabilities well suited to this application.

It is anticipated that one or more operators would prefer to base such aircraft at the SLF. Appropriately sized ramp space, dedicated or shared-use hangars, and support facilities would be required to enable such programs to be resident at the SLF.

Heavy Payload Cargo Flights

This expanded use of the SLF by commercially operated heavy-class cargo carriers builds on the past activity associated with satellite and spaceflight hardware deliveries to KSC for NASA, DoD, and commercial launch operations. It is anticipated to be required for support of diversified commercial operations at KSC. Aircraft representative of this category include the Guppy, Beluga, Boeing 747, C-17, C-5, and the Antonov AN-22, AN-124, and AN-225.

Anticipated activities that may be serviced by heavy payload cargo flights include the commercial payload and launch system requirements for Commercial Orbital Transportation Services (COTS) providers, disposition of large Space Shuttle Program hardware, support of horizontal suborbital and orbital launch systems, other cargo operations supporting activities that may be permitted at NASA's Exploration Park and other leased sites.

In addition, commercial launch operators and their customers may seek transient use of the SLF for such aircraft as an intermediate stop on the way to or from launch facilities in French Guiana or elsewhere.

Medium Payload Cargo Flights
Increased cargo operations such as those described above are likely to require medium capacity cargo aircraft such as the Boeing 727 or Airbus 300 to offer lower cost transportation when the heavy lift capability is not required.

Light Payload Cargo Flights

Commercially provided services for the delivery of small critical components or time-sensitive space mission payloads have been required on occasion in the past and may be expected to increase with the diversity of commercial and government users anticipated at KSC and CCAFS.

Mission Support Aircraft

A variety of support aircraft are anticipated to be required in association with the developmental and early flights of new commercially operated suborbital and orbital systems expected to be launched from KSC and CCAFS. These will include fixed-wing aircraft and/or helicopters to provide flight systems monitoring, photo/video documentation, and other mission-related support functions.

2.3.3.3 Aviation Test Operations

This new function for the SLF involves its use to host and support aircraft systems ground and flight testing by commercial and government developers and operators. Test operations involving fixed-wing aircraft were the predominant use demonstrated during the SLF Expanded Access Pilot Program of 2005-2007.

The SLF is well suited to this application because of its length, the restricted airspace environment, low frequency of flight operations at KSC, and other factors. This is envisioned to become a significant share of the post-Shuttle era utilization of the SLF's capability. Representative examples of this type of activity are described below. Other similar uses that do not significantly increase flight rates, potential hazards, or impacts would be permitted as they are identified.

FAA certification tests are required for new aircraft or modified existing aircraft in the civil aviation fleet. Examples are tests of new braking or instrumentations systems on aircraft ranging from Piper single engine class to the largest new aircraft – such as Boeing's 787. Tests could include maximum braking demonstrations involving a simulated aborted takeoff. Many other potential tests could be accommodated by the SLF with aircraft remaining on the ground or performing repeated approaches and landings.

Demonstration flights of experimental aircraft and new systems development would include vehicles such as the experimental, composite aircraft GlobalFlyer, which set a world distance record after launch from the SLF. NASA has discussed with other developers testing of such diverse aircraft as a battery-powered piloted aircraft, quiet super-sonic business jets, and aircraft utilizing alternative fuels. Such experimental flights would be expected to represent a relatively small share of projected flight operations and would be carefully managed to minimize hazards and potential impacts. Other testing performed under this category could include conventional aircraft which have had new systems installed to accommodate alternative fuels, advanced avionics, modified structures, or other innovations which must be test flown for validation and calibration prior to incorporation and FAA certification.

A third subcategory is the testing of new modernization systems on DoD aircraft. A good example is the modernization of instrumentation aboard the USAF C-5 cargo transport. Such improvements were tested in a "pathfinder" demonstration at KSC in January 2007. Further tests of C-5 enhancements and similar improvements to other aircraft in the DoD fleet are anticipated in this category.

Finally, it is anticipated that several varieties of unmanned aerial vehicles (UAVs) will utilize the SLF for development and demonstration of new technologies.

2.3.3.4 Airborne Research and Technology Development

This category is distinct from aircraft and flight systems testing in that it involves the use of conventional aircraft for the conduct of airborne research or the development of technology aboard these aircraft for various applications such as weather or environmental sensing, detection of security threats, and others. This category would also provide an opportunity for significant expansion of non-NASA use to support both the development and operations of airborne remote sensing, meteorological data gathering, homeland defense applications, and other applications.

The National Oceanic and Atmospheric Administration (NOAA) fixed-wing aircraft, for example, would use the SLF to launch research missions into general weather or climate studies, airborne remote sensing of marine environments, lightning and severe weather studies, etc. Similar flights would be performed by aircraft operated by research universities or other government agencies.

Other aircraft operated by international partners would use the SLF as a base for launching research missions. Representative of this activity would be research flight applications of the Russian M-55 Geophysica, a modified version of which was already cited as a potential carrier aircraft for a new suborbital vehicle. The M-55 is an example of an aircraft that performs high-altitude stratospheric research and earth surface studies.

Helicopters, UAVs, as well as fixed-wing aircraft would use the SLF to launch technology development missions to test and demonstrate the effectiveness of sensors developed for a number of potential applications in defense or civil purposes.

2.3.3.5 Ground-based Research & Training

The Proposed Action alternative envisions the SLF being used to support a variety of ground-based research and training activities. Representative activities are described in the following subsections, and the anticipated frequency of operations (on a non-interference basis) is shown in Table 2-5.

Straight-line Aerodynamic Engineering Tests of High Performance Cars

This use involves the testing of high performance cars operated in professional racing events. Straight line tests measure lift and drag characteristics of vehicles being tested. The SLF has demonstrated its utility to support such testing during pathfinder projects conducted in 2006 and 2007.

Laser Test Range

This use of the SLF takes advantage of its extraordinarily level surface and long distance for such tasks as performing atmospheric propagation tests, using mobile instrumentation set up on the runway when available during an absence of flight activity.

Ground-based Training for Contingency Response and Defense Applications

This use of the SLF takes advantage of its low flight rate activity and isolated, secure location to enable support of contingency response training and other test, training, and calibration exercises supporting non-NASA civil and military organizations. These activities may or may not involve aircraft operations. NASA has and would continue to use the SLF for similar exercises related to the contingency response to Space Shuttle mishaps on or near the runway.

2.4 Alternatives to the Proposed Action

2.4.1 Alternative 1 (Limit Expansion of SLF Facilities to the South-field Site)

Under this alternative, expansion of SLF facilities would be limited to the improvement of the south-field site (Figure 2.1A). It is anticipated that the proposed new activities would still occur, but at a reduced level (approximately 60% of that projected for the Proposed Action) due to limited permanent housing facilities for aircraft and increased competition for existing capabilities.

2.4.2 Alternative 2 (Limit Expanded SLF Uses to Existing SLF Facilities)

Under this alternative, SLF activities would expand as described, but would be limited to the capacity and capabilities of existing facilities. Lack of permanent housing and competition among users for existing capabilities would significantly limit the potential expanded use activity level to approximately 40% of that projected for the Proposed Action.

2.5 No Action Alternative

Under the No Action alternative, NASA would not expand uses of the SLF beyond the current level and activities. These include NASA use for the Space Shuttle, agency mission support requirements, currently approved commercial use, and the infrequent, incidental, non-NASA use required for unforeseen, non-recurring circumstances. It is anticipated that activities would greatly decrease at the SLF after the Space Shuttle retirement in 2010.

2.6 Alternatives Considered But Not Carried Forward

2.6.1 Alternative Uses and Operations

2.6.1.1 Reentry Vehicles Landing at the SLF

There are no new orbital winged reentry vehicle systems currently in design or development that can be reasonably expected to use the SLF anytime before 2015. Should such a system emerge, a supplemental environmental analysis would be required. This type of vehicle would require reentry trajectories from the west, locating it above populated areas.

2.6.1.2 Single Stage to Orbit (SSTO) Vehicles

No single stage to orbit (SSTO) horizontal systems are foreseen until well after 2015, even if such technology eventually becomes economically and operationally feasible. Should such a system emerge, a supplemental environmental analysis would be required.

2.6.1.3 Concept Y Suborbital Vehicles

Suborbital vehicles classified by the FAA as Concept Y (FAA 2006a) are single component vehicles that take off under rocket propulsion ignited on the runway. While vehicles of this concept are under development, their suitability for takeoff from the SLF, which would require a turning maneuver soon after the rocket-powered takeoff to achieve the desired eastward trajectory, is not sufficiently understood to include in this EA. Given the increased risk believed to be associated with this concept, it is not being considered for near-term operational use at the SLF.

Should the concepts under development demonstrate performance characteristics judged compatible with the SLF and its other uses, a supplemental EA would be performed to assess the concept's suitability for the SLF. In addition, if one or more developmental tests are proposed for demonstration at the SLF, further analyses may allow such limited flight tests to be performed on a case-by-case basis.

2.6.1.4 LOX-fueled Aircraft

It is possible prior to 2015 that high performance aircraft fueled with liquid oxygen (LOX) or other exotic propellants would be developed and proposed for testing or certification flights at the SLF. Such concepts are not sufficiently mature to include in this EA, but a supplemental analysis would be performed in the future to include such new concepts if/as they emerge.

2.6.2 Alternative Location of Expanded Support Infrastructure

Expanding support infrastructure to the north portion of the runway, and/or development to the west side of the runway were considered as potential options to facilitate commercial user access from outside KSC's currently controlled area. However, this was not considered to be reasonable or necessary given the proposed uses and flight rates.

2.6.3 Alternative Expansion of SLF Facilities to Connect the South-field and Mid-field Improvements with a Parallel Taxiway

With a sufficient number of flight operations and uses, a parallel taxiway connecting the proposed improvements at the south-field and mid-field sites could increase the overall efficiency of the SLF. However, the projected number of annual operations through 2015 and well beyond, is far below that needed to justify analysis of this alternative at this time.

Table 2.1. The number of flight operations (takeoffs and landings) that have occurred at the SLF between 1999 and 2005.

Year	Number of Flight Operations
1998	14,645
1999	16,602
2000	18,743
2001	14,283
2002	6.535
2003	3,572
2004	3,264
2005	3,529
2006	3,533

Table 2-2. Anticipated frequency of flight operations under existing SLF activities.

CATEGORIES OF EXISTING NASA AND NASA-RELATED USES	2008	2011	2013	2015
SPACE SHUTTLE PROGRAM OPERATIONS				
Unpowered End-of-mission Landings by Orbiter	4			
Shuttle Carrier Aircraft Ferry Flights of Orbiter Vehicle	1	2		
Astronaut Flight Crew Training & Mission Preparation (T-38 fleet)	1500	800	800	1000
Shuttle Training Aircraft Operations (modified Gulfstream)	2000			
NASA PROGRAM & MISSION SUPPORT AVIATION				
Mission Management Aircraft (Grumman Gulfstream fleet)	1000	1600	1800	1800
NASA Helicopter Support Flights	700	500	500	700
Heavy Payload Cargo Flights (e.g. Guppy/Beluga/Boeing 747/C5)*	30	30	60	60
Light Payload Cargo Flights (e.g. Citation/Gulfstream/Lear)	4	4	6	8
DoD USE: SPACE OPERATIONS & SUPPORT				
Various Aircraft Types (e.g. C-5, helicopter, jet aircraft)	50	50	75	75
TOTAL	5289	2986	3241	3643
* Includes payloads delivered to SLF for NASA and existing commercial launch operators at CCAFS				

Table 2-3. Proposed uses, vehicle types, and associated power systems.

Use Category	Vehicle Type	Examples	Launch Power	Landing Power
Horizontal Spaceflight Development and Operations				
Suborbital Horizontal Launch and Landing				
	single, aircraft-like vehicles	Concept X	jet engine; rocket engines between 18K-30K ft.	jet engine or unpowered
	rocket-powered; launched over ocean by conventional carrier aircraft	Concept Z	carrier - jet engines; rocket engines between 35K-60K	carrier - jet engine; suborbital - unpowered
Orbital Horizontal Launch and Landing				
	conventional or very large aircraft (VLA) as carriers to launch orbital vehicles and payloads over Atlantic, east of KSC at 35K-60K ft.	L-1011; modified Boeing 747; modified White Knight	jet engine	jet engine
Landing of Vehicles Launched from CCAFS				
	hybrid launch system with fly-back booster	in design	not applicable	unpowered
	suborbital vehicle vertically launched, landing horizontally	in design	not applicable	unpowered
Commercial Spaceflight Program and Mission Support Aviation				
Parabolic Training , Research and Development				
	jet aircraft	modified Boeing 727 or similar; Zero Gravity Corporation	jet engine	jet engine
High Altitude/Performance - Training and Research and Development				
	jet aircraft	F-104, T-38, and	jet engine	jet engine

Use Category	Vehicle Type	Examples	Launch Power	Landing Power
		similar		
Heavy Payload Cargo Flights				
	jet aircraft	Guppy, Beluga, Boeing 747, C-17, C-5, and similar	jet engine	jet engine
Medium Payload Cargo Flights				
	jet aircraft	Boeing 727, Airbus 300, and similar	jet engine	jet engine
Light Payload Cargo Flights				
	jet aircraft		jet engine	jet engine
Mission Support				
	fixed-wing aircraft, helicopters		propeller, rotary	propeller, rotary
Aviation Test Operations				
Certification, Demonstration, Modernization of Existing Systems, New Systems Development				
	jet aircraft, fixed-wing aircraft	Piper single engine aircraft, Boeing 787, Global Flyer composite aircraft, alternatively fueled aircraft, quiet super-sonic business jets, other conventional aircraft, C-5 cargo jet, unmanned aerial vehicles (UAV)	jet engine, propeller, various alternative fuels as specifically permitted	jet engine, propeller, various alternative fuels as specifically permitted
Airborne Research and Technology Development				
Weather and Environmental Remote Sensing, Security Threat Detection, Other Various Civil and Military Applications				

Use Category	Vehicle Type	Examples	Launch Power	Landing Power
	jet aircraft, fixed-wing aircraft, helicopters	NOAA fixed-wing aircraft, Russian M-55 Geophysica, UAV	jet engine, propeller, rotary	jet engine, propeller, rotary
Ground-based Research and Training				
Straight-line Aerodynamic Engineering Tests				
	high performance cars	NASCAR	unleaded gasoline	not applicable
Laser Test Range				
	mobile instrumentation	atmospheric propagation tests	not applicable	not applicable
Training for Contingency Response and Defense Applications				
	ground-based vehicles and various aircraft	exercises supporting non-NASA civil and military organizations, exercises related to emergency responses for Space Shuttle mishaps	jet engine, propeller, rotary, gasoline	jet engine, propeller, rotary, gasoline

Figure 2-4. Anticipated average annual flight frequencies (take-offs and landings) under the Proposed Action.

CATEGORIES OF EXPANDED USES	2008	2011	2013	2015
SPACEFLIGHT DEVELOPMENT AND OPERATIONS				
Suborbital horizontal launch and landing				
- Single, aircraft-like vehicles	18*	168	264	336
- Carrier aircraft with suborbital vehicle		150	200	300
Orbital horizontal launch and landing	4	16	24	36
- Large aircraft (L1011 class) deploying orbital stage				
- Very Large Aircraft deploying orbital stage				
Fly-back booster vehicle recovery after vertical launch	0	4	6	12
SPACEFLIGHT PROGRAM & MISSION SUPPORT AVIATION				
Parabolic flights for training/R&D	144	400	600	800
High altitude/performance flights for training/R&D	48	100	200	300
Heavy payload cargo flights (e.g. Guppy/Beluga/Boeing 747/C5)	3	6	48	100
Medium payload cargo flights (e.g. Boeing 727/Airbus 300)	6	100	400	600
Light payload cargo flights (e.g. Citation X/Gulfstream/Lear)	6	100	400	600
Mission support aircraft (e.g. chase aircraft)	18	280	100	100
AVIATION TEST OPERATIONS				
Aircraft systems ground and flight testing				
- FAA certification tests (e.g. Boeing 787)	8	24	24	30
- Development/demonstration flights of experimental	4	24	48	48
aircraft, new systems development				
- Military aircraft (e.g. C-5 test program)	24	100	200	200
- UAVs	12	36	72	72
AIRBOURNE RESEARCH AND TECHNOLOGY DEVELOPMENT				
Weather studies/earth remote sensing (e.g. NOAA aircraft)	12	12	24	48
Sensor development flights (e.g. helicopters/UAVs)	12	24	48	72
MISC. INCIDENTAL, TRANSIENT USE (various aircraft)	48	72	72	72
TOTAL	367	1616	2730	3726
*** Developmental tests in atmosphere, not achieving suborbital altitude**				

Table 2-5. Anticipated average number of days of ground operations (non-interference basis) under the Proposed Action.

CATEGORIES OF EXPANDED USES	2008	2011	2013	2015
STRAIGHT-LINE AERODYNAMIC TESTS (high performance cars)	15	30	45	45
GROUND RESEARCH & TECHNOLOGY DEVELOPMENT	7	14	20	20
Laser test range applications				
Ground systems testing & calibration				

Figure 2-1 Graphic rendering of existing conditions at the SLF.

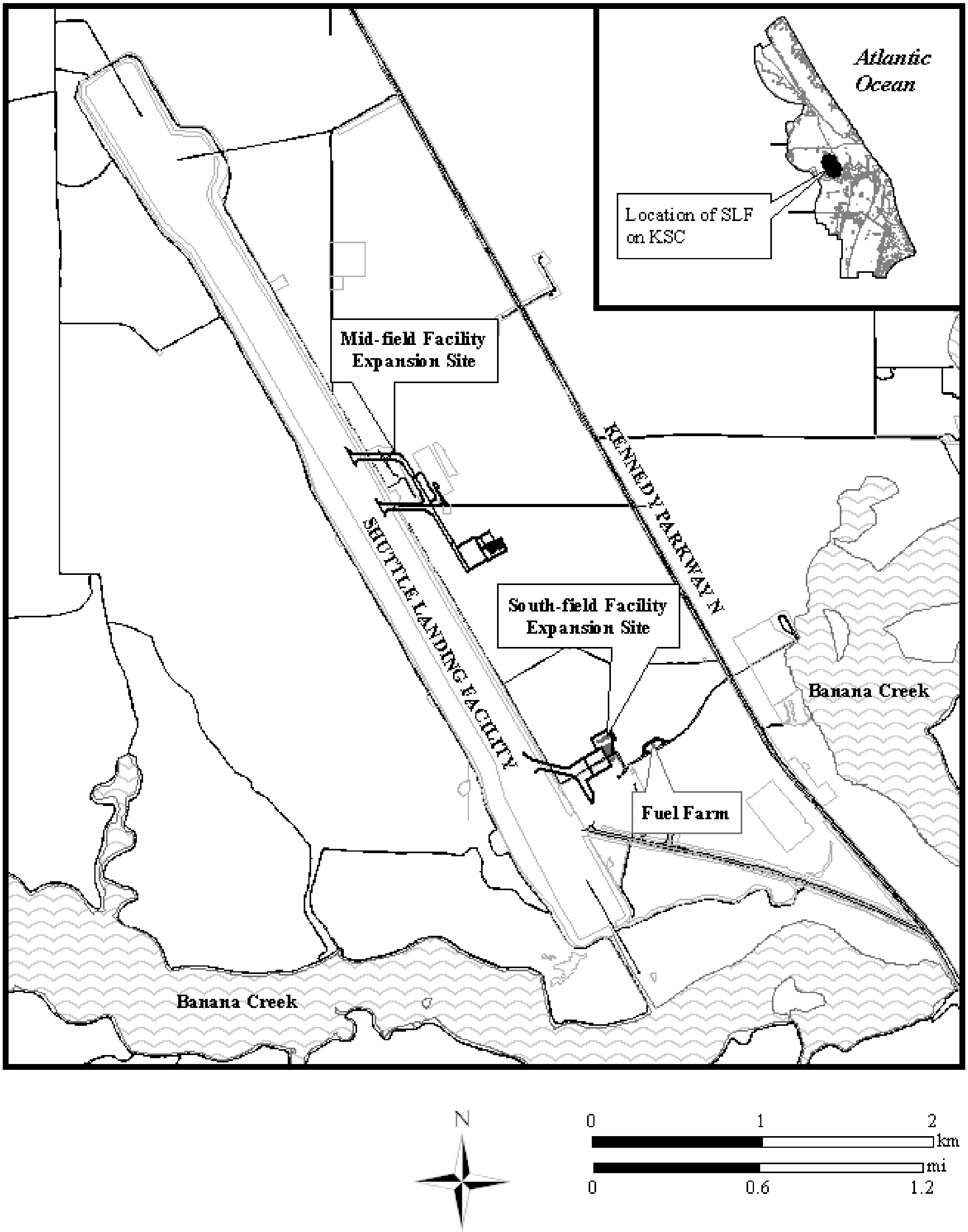

Figure 2-2. Proposed SLF expansion sites on Kennedy Space Center, Florida.

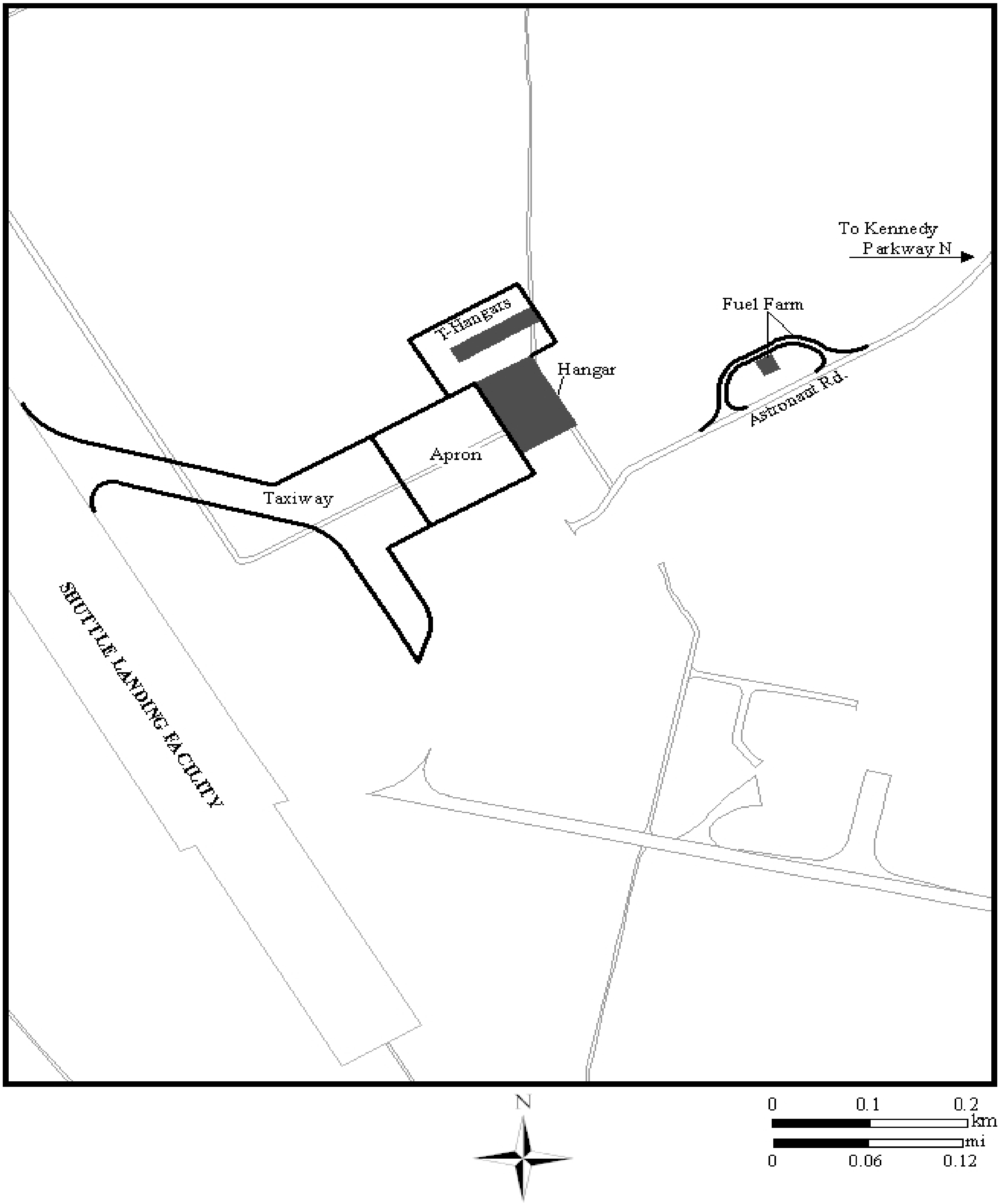

Figure 2-3. South-field facility expansion and fuel farm site components.

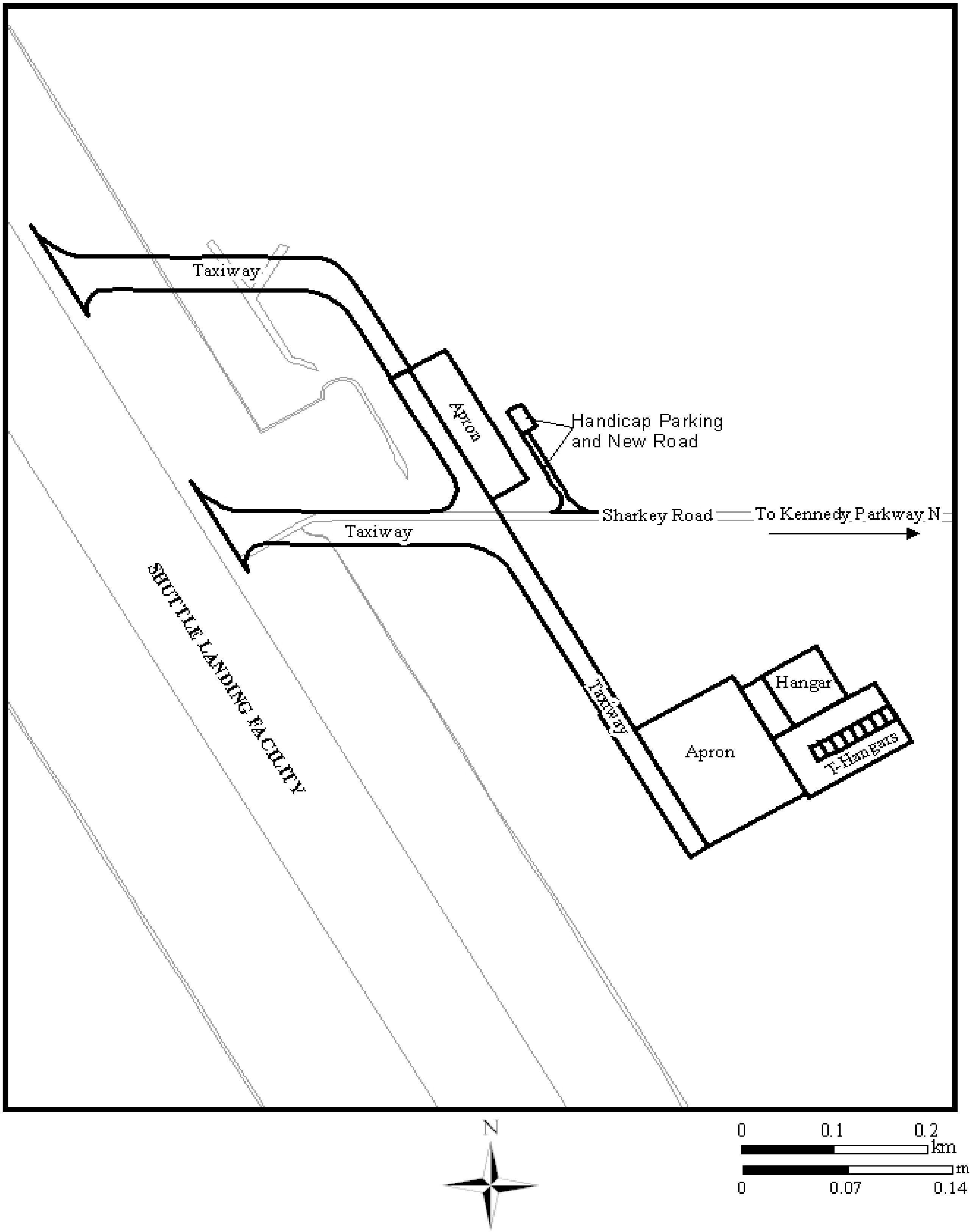

Figure 2-4. Mid-field facility expansion site components.

Figure 2-5. Graphic rendering of proposed south-field (top) and mid-field (bottom) expansion sites.

Figure 2-6. Graphic rendering showing a Very Large Aircraft (VLA) prepared with orbital launch vehicle and payload.

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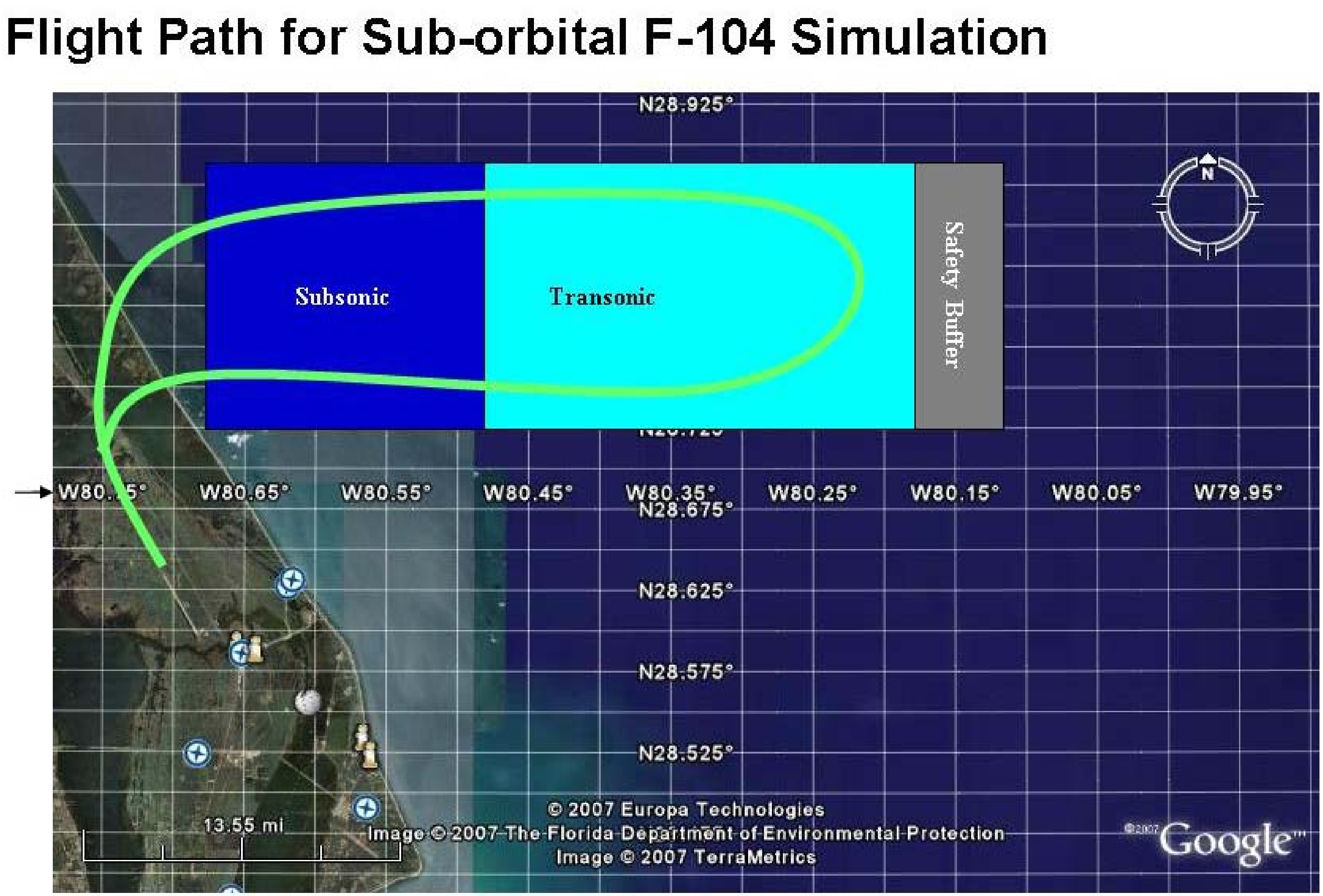

Figure 2-7. Proposed air corridor.

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3.0 Affected Environments

Chapter 3 describes the environmental resources that could potentially be affected by the action alternatives evaluated in this EA. KSC encompasses 56,451 hectares (ha) (139,490 ac.) on the east coast of central Florida (Figure 1-1). KSC is the launch site for NASA's Space Shuttle program and is the primary eastern U.S. Shuttle landing site. Approximately 3,035 ha (7,500 ac.) of KSC are actively used to support space mission operations; the remaining lands are managed by the USFWS as the Merritt Island National Wildlife Refuge (MINWR) and by the NPS as CNS. This unique relationship between space flight and protection of natural resources is carefully orchestrated to ensure that both objectives are achieved with minimal conflict.

3.1 Facilities and Infrastructure

There are over 700 facilities located on KSC. Uses range from storage of toxic chemicals to launch support to offices.

3.1.1 Transportation

KSC is serviced by over 340 kilometers (km) [211 miles (mi.)] of roadways, with 263 km (163 mi.) of paved roads and 77 km (48 mi.) of unpaved roads. NASA Causeway is the primary entrance and exit for cargo, tourists, and personnel. This four-lane road originates on the mainland in Titusville as State Route (SR) 405 and crosses the Indian River Lagoon (IRL) onto KSC. Once passing through the Industrial Area, the road reduces to two lanes of traffic, crosses over the Banana River, and enters the CCAFS. The major north-south artery for KSC is Kennedy Parkway (SR 3). It can be accessed from the north where it intersects with US 1 south of Oak Hill, and from Titusville via SR 406/402. The southernmost entrance and exit for KSC is on SR 3 at north Merritt Island.

3.1.2 Wastewater Treatment

Approximately 80% of the sanitary sewer service at KSC is provided by two collection/transmission systems, one located in the Industrial Area and one in the VAB area. These systems collect and transport raw wastewater to the Regional Plant located on CCAFS. There are also a number of septic tank systems throughout KSC that typically support small offices or temporary facilities (NASA 2003).

3.1.3 Electricity and Natural Gas

The electric power distribution system at KSC is a combination of a Florida Power and Light Company (FPL) transmission system and two NASA-owned distribution systems. FPL transmits 115 kilovolts (kV) to KSC, which are distributed to two major substations. The C-5 substation serves the LC 39 Area, providing 13.8 kV, and the Orsino substation serves the Industrial Area, providing 13.2 kV, for a total of 25 % of the electricity currently allocated to KSC. From 2001 through 2006, electricity use on KSC ranged between 270,000 and 293,000 megawatt-hours; electricity consistently provides 71 % of KSC's total energy (SGS 2006).

In 1994, KSC began converting some facilities, equipment, and vehicles to natural gas. A 40 km (25 mi.) pipeline was constructed by City Gas Company of Florida, which distributes the gas within KSC. In 2006, 3.6 million therms of natural gas were used, accounting for approximately 28 % of KSC's total energy use (SGS 2006).

3.1.4 Communications

The KSC Communications System provides a variety of services including: 1) conventional telephone services; 2) transmission of voice data and video; 3) voice data and video services; and 4) operation and maintenance of KSC's cable plant. There are three major distribution and switching stations located in the Industrial Area (First Switch) and in the Vehicle Assembly Building (VAB) Area (Second and Third Switches). These three stations provide service for over 18,500 telephones on KSC.

3.1.5 Potable Water

KSC's potable water is supplied by the City of Cocoa, which obtains its water from artesian wells located west of the St. Johns River in Orange County. Water enters KSC along SR 3 from a 60 centimeters (cm) [24 inch (in.)] water main and extends north along SR 3 to the VAB Area. The average demand for water is 3.8 million liters (l)/day [1 million gallons (gal.)/day] (NASA 2003). Total storage capacity at KSC is approximately 15 million l (4 million gal.) in ten above-ground storage tanks (NASA 2003).

3.2 Air Quality

The ambient air quality at KSC is predominantly influenced by daily operations such as vehicle traffic, utilities fuel combustion, and standard refurbishment and maintenance operations. Other operations occurring infrequently throughout the year, including launches and prescribed fires, also play a role in the quality of air at KSC as episodic events. Air quality is influenced to some extent by emissions sources outside of KSC, primarily two regional oil-fired power plants located within a 18.5 km (10 mi.) radius of KSC.

Air quality is monitored by a Permanent Air Monitoring System (PAMS) station located north of the Industrial Area. The PAMS station continuously monitors concentrations of sulfur dioxide, nitrogen dioxide, carbon monoxide, and ozone, as well as meteorological data. KSC is currently located within an area classified as attainment with respect to the National Ambient Air Quality Standards established by the Environmental Protection Agency (EPA) and Florida Department of Environmental Protection for all criteria pollutants (NASA 2003).

Total inhalable 10-micron particulates (PM-10) were monitored historically (1983 – 1989, 1992 – 1999) at the PAMS and two other sites on KSC. During those times, there was only one exceedance in PM-10; this occurred during the ground clearing for the International Space Station (ISS) (Drese 2006).

3.2.1 Meteorology

The climate at KSC is characterized as maritime-tropical with humid summers and mild winters. The area experiences moderate seasonal and daily temperature variations. Average annual temperature is 22° centigrade (C) [71° Fahrenheit (F)] with a minimum monthly average of 13° C (60° F) in January and a maximum of 28° C (81° F) in July. During the summer, the average daily humidity range is 70 to 90 %. The winter is drier with humidity ranges of 55 to 65 % (Mailander 1990).

Prevailing winds during the winter are steered by the jet stream aloft and are typically from the north and west. As the jet stream retreats northward during the spring, the prevailing winds shift and come from the south. During the summer and early fall, as the land-sea temperature difference increases and the Bermuda high-pressure region strengthens, the winds originate predominantly from the south and east.

The central Florida region has the highest number of thunderstorms in the U.S. during the summer months (May – September), and over 70 % of the annual 122 cm (48 in.) of rain occurs in the summer. During thunderstorms, wind gusts of more than 97 kilometers/hour (60 mi./hr.) and rainfall of over 2.5 cm (1.0 in.) often occur in a one-hour period, and there are numerous cloud-to-ground lightning strikes. Hurricanes can also develop, typically between August and October. The most active hurricane season in KSC's history was 2004, when damages to facilities exceeded $100 million. Additionally, many habitats, such as marshes, shoreline, and dunes were affected, at least temporarily, due to the storm surge and beach erosion (NASA 2004b).

3.3 Biological Resources

Biological resources include vegetation, wildlife, and the habitats in which they live. Protected species and the overall biodiversity of an area are also considered in this section. The habitats found on KSC and the adjacent federal properties provide for the greatest wildlife diversity among Federal facilities in the continental U.S. (Breininger et al. 1994). This diversity can be attributed to several factors. KSC is located within a biogeographical transition zone, having faunal and floral assemblages derived from both temperate Carolinian and tropical/subtropical Caribbean biotic provinces (Ehrhart 1976, Sweet et al. 1979, Greller 1980, Stout 1979, DeFreese 1991). The area is encompassed within the Indian River Lagoon (IRL) watershed, considered to be the most diverse estuarine system in North America (The Nature Conservancy 2007). KSC is bordered on the west by the IRL, on the southeast by the Banana River, and on the north by the Mosquito Lagoon. Further to the west of KSC lies the St. Johns River Basin ecosystem, one of the largest freshwater marsh systems in the state. In addition, KSC's proximity to the coast encourages an abundance of migratory birds. All of these factors combined contribute to the exceptional species diversity found here (Breininger et al. 1994).

3.3.1 Habitats and Vegetation

Florida's geological history has largely been determined by sea level changes that directly influenced soil formation and topography, and resulted in the plant communities present today. A "ridge and swale" topography is present on KSC where there are adjacent bands of uplands and wetlands running in a generally north/south direction across the island. The dominant uplands communities are scrub and pine flatwoods (Provancha et al. 1986). Long, narrow freshwater marshes are interspersed among the bands of uplands. Forests occur on higher areas among marshes and lower areas among scrub and pine flatwoods (Breininger et al. 1994). Adjacent to the estuary that surrounds much of KSC are salt marshes, various wetland shrub habitats, and mangrove swamps. A detailed list of habitat types and acreages found on KSC is in Appendix 2.

3.3.2 Wildlife

3.3.2.1 Invertebrates and Fish

The IRL was designated as an "estuary of national significance" in 1990 by the EPA. The IRL supports over 400 species of fishes (Gilmore 1977, Snelson 1983), 260 species of mollusks, and 479 species of shrimps and crabs (Woodward-Clyde 1994). Commercially important species include game fish (e.g., snook, *Centropomus undecimalis*, seatrout, *Cynoscion nebulosus*, and tarpon, *Megalops atlanticus*) and crabs. In addition, several areas of the IRL are important shellfish harvesting areas. Lagoon habitats serve as nursery grounds for virtually all fish resident within the lagoon, as well as many offshore species. Studies of terrestrial invertebrates have been limited to research aimed at controlling salt marsh mosquitoes, *Ochlerotatus taeniorrhynchus* and *Ochlerotatus sollicitans* (Platts et al. 1943, Clements and Rogers 1964). A detailed biological survey of terrestrial invertebrates has not been performed on KSC.

3.3.2.2 Herpetofauna

Fifty species of reptiles and 19 species of amphibians have been documented as occurring on KSC (Seigel et al. 2002). Six of these species are federally protected as Threatened (T) and Endangered (E) and will be further discussed in Section 3.4.1, including three species of sea turtles that nest along the coastline during the summer months, and use the surrounding lagoons as developmental habitat for juveniles.

Three species of the 69 documented are not federally listed, but are protected by the State of Florida. These include the Florida gopher frog (*Rana capito aesopus*), the gopher tortoise (*Gopherus polyphemus*), and the Florida pine snake (*Pituophis melanoleucus mugitis*). The Florida gopher frog and Florida pine snake are uncommon on KSC and little is known about their numbers or distribution. Conversely, the gopher tortoise is common, wide-spread, and well studied on KSC. The gopher tortoise inhabits the uplands where it excavates burrows for shelter from weather, climate, predators and fire. Many other vertebrate and invertebrate species also use the tortoise burrows, and for this reason, the tortoise is considered a keystone species. Because gopher tortoises prefer the uplands habitats that are typically used for development, and are often found in previously disturbed areas, conflicts with operations occasionally arise. In these situations, the approach is to 1) avoid disturbing gopher tortoises or their burrows whenever possible by working with project managers to reconfigure projects; 2) to remove tortoises from harm's way when temporary impacts cannot be avoided so they can remain or be returned to their original home range once the project is completed; or 3) to relocate away from the project site if the impacts are widespread and permanent.

3.3.2.3 Birds

KSC provides habitat for 330 bird species (USGS 2007); nearly 90 species nest on KSC, many of which are year-round residents. There are over 100 species that reside in the area during the winter.

The remaining species regularly use KSC lands and waters for brief periods of time, usually during migration. KSC lies within the Atlantic flyway, a major migratory bird corridor that extends from the Artic coast of Alaska to the mainland of South America. Millions of songbirds, seabirds, birds of prey, and waterfowl follow the Atlantic flyway every fall and spring.

MINWR manages 6,000 – 6,500 ha (15,000 - 16,000 ac.) of impounded wetlands with a focus on waterfowl and other wetland migratory birds. MINWR's wetlands rank highest in Florida regarding numbers of migrating waterfowl counted during the official U.S. Midwinter Waterfowl Inventory, and historically has ranked as one of the highest regarding the number of successful waterfowl hunters (birds per hunter-trip). Within the Atlantic Flyway, no other site winters such large numbers of lesser scaup - a waterfowl species declining dramatically in recent years in North America to all-time low levels. The refuge is an area of national importance, harboring up to 62% of all Atlantic Flyway wintering scaup and 15% of the continental population. However, scaup populations wintering at MINWR have declined in recent years. Additionally, MINWR is a highly important area for east coast pintails. Historically and currently, MINWR has ranked second in wintering pintail populations along the Atlantic Coast. Pintail populations have steadily declined on the refuge over the past decades from a mid-winter count of about 20,000 in 1978, to 8,315 birds in 1989, to 3,141 in 1999, and to a low of 1,376 birds in January 2003 (a 93% decline from 1978). Pintail populations are a major management concern because their populations throughout North America also have dramatically declined to record low levels. MINWR's impoundments and their freshwater/brackish vegetative communities also provide year-round habitat for the mottled duck, a subspecies endemic in Florida. Because migration chronologies of waterfowl and shorebirds vary seasonally (e.g., residents, over-wintering birds, early spring migrants, and late spring migrants), management must provide suitable habitat conditions and food resources for a variety of species at different times. Providing variety within the complex of wetlands meets resource needs for multiple species. Management emphasizes achieving desired habitats for the different waterfowl and shorebird species and is prescribed by a draft Comprehensive Conservation Plan, which proposes a refuge-wide management alternative for wildlife diversity.

Four species of birds that occur on KSC are federally protected and discussed further in Section 3.4. In addition, there are 11 species that are protected by the State of Florida (Table 3-1). Six of these belong to a group of birds commonly called waders (Order Ciconiiformes). Monthly surveys of wading bird feeding habitats have been flown since 1987, and surveys of nesting colonies are also done during the spring (Figure 3-1). The wading bird population on KSC is very large; it is estimated that between 5,000 and 15,000 birds are present at any given time, depending on the season (Smith and Breininger 1995). The largest numbers occur during the spring and the fewest birds are present in the winter.

Of the remaining five State-listed bird species, two are common year-round residents (eastern brown pelican, *Pelecanus occidentalis carolinensis*, and black skimmer, *Rynchops niger*), the least tern (*Sterna antillarum*) is common, but leaves in the winter, and the remaining two species are common in the winter (Arctic peregrine falcon, *Falco peregrinus tundrius*, and Southeastern American kestrel, *Falco sparverius paulus).*

3.3.2.4 Mammals

Thirty species of mammals inhabit KSC lands and waters (Ehrhart 1976). Typical terrestrial species include the opossum (*Didelphis virginiana*), hispid cotton rat (*Sigmodon hispidus*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), and bobcat (*Lynx rufus*). Due to the regional loss of large carnivores such as the Florida panther (*Puma concolor coryi*) and red wolf (*Canis rufus*), the bobcat and otter now hold the position of top mammalian predators on KSC. Additionally, a proliferation of mid-level predators such as the raccoon and opossum has resulted from an imbalance of predator/prey ratios. Opportunistic species such as the cotton rat and eastern cottontail rabbit (*Sylvilagus floridanus*) account for a large portion of the small mammal biomass, rather than habitat-specific species such as the State-listed Florida mouse (*Podomys floridanus*) and the federally protected southeastern beach mouse (*Peromyscus polionotus niveiventris*). At least three species of bats have been documented. They occasionally use facilities as roosts sites, and when conflicts occur, they must be excluded. Several bat houses have been erected on KSC to help mitigate the impacts. A very large, reproductively active bat roost is located in the bridge on SR 3 where it crosses over SR 405, just inside the KSC security gate. Several thousand bats are thought to use this bridge year-round. Two mammal species common in the waters of the IRL are the Atlantic bottlenosed dolphin (*Tursiops truncatus*) and the West Indian manatee (*Trichechus manatus*).

3.4 Threatened and Endangered Species

3.4.1 Listed Wildlife

Seventeen federally listed wildlife species have been documented on KSC/MINWR, more than on any other national wildlife refuge in the continental U.S. Six of these are only incidentally present and do not make important contributions to the area's biota: hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempi*), snail kite (*Rosthrhramus sociabilis*), Audubon's crested caracara (*Polyborus plancus audubonii*), piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii*). The American alligator (*Alligator mississippiensis*) was once on the brink of extinction, but recovery efforts enabled populations throughout its range to rebound strongly. They are abundant on KSC and can sometimes cause problems related to traffic safety and encounters with people around and within facilities. However, because the alligator is similar in appearance to another listed species, the American crocodile (*Crocodylus acutus*), it remains on the federally protected list.

Ten federally listed species occur on KSC either commonly or occasionally: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), eastern indigo snake (*Drymarchon couperi*), Atlantic salt marsh snake (*Nerodia clarkii taeniata*), wood stork (*Mycteria americana*), bald eagle (*Haliaeetus leucocephalus*), Florida scrub-jay (*Aphelocoma coerulescens*), southeastern beach mouse (*Peromyscus polionotus niveiventris*), and the West Indian manatee (*Trichechus manatus*).

Sea Turtles

Three different sea turtle species nest along KSC, CCAFS, and CNS beaches between March and September. These turtles include the loggerhead (threatened), green sea turtle (endangered), and leatherback sea turtle (endangered). Nesting sea turtle research has taken place on these beaches since the early 1970s, and long-term monitoring has been done for KSC's Life Science Services contract since 1984. The loggerhead accounts for over 95% of the nests on KSC, with an annual average of 1,300 (Popotnik and Epstein 2002). Green sea turtle nest numbers oscillate between 50 nests one year and 200 nests the next. Leatherback sea turtles nest infrequently on KSC, with only one or two nests recorded in a typical year. Management for these species differs among the three beaches (i.e., agencies), but includes yearly monitoring of numbers of nests and false crawls, dune restoration when appropriate, and predator control. Primary nest predators include raccoons, feral hogs (*Sus scrofa*), and ghost crabs (*Ocypode quadrata*).

The IRL surrounding KSC provides developmental habitat for juvenile sea turtles (Mendonca and Ehrhart 1982), with the majority being found in Mosquito Lagoon. Species observed include the loggerhead, green sea turtle and recently, a Kemps Ridley (*Lepidochelys kempii*). Data collected over many years through 2006 have the following general findings: During the 1990s to present, green turtles occur at much higher frequencies than loggerheads, exactly opposite of results from the mid-1970s. The relative numbers of turtles are much lower in Mosquito Lagoon as compared to further south in the IRL. The incidence of the fibropapilloma virus in this area is no different than other sections of the IRL. The animals using Mosquito Lagoon tend to reside there for at least several years prior to departure, based on capture sizes and recapture information (Provancha et al. 2005). The Mosquito Lagoon provides vast seagrass beds for green turtles to forage and shellfish resources are available for loggerheads. This Mosquito Lagoon study area has been recommended as a long-term index study site by the State of Florida (Eaton et al. 2006).

Eastern Indigo Snake

Eastern indigo snakes became federally listed as threatened under the Endangered Species Act in 1978. They are thought to be common on KSC, although actual population numbers would be quite difficult to obtain. Eastern indigo snakes have very large home ranges and use a variety of habitat types that include uplands, wetlands, hammocks, and disturbed areas. Research on home range sizes, habitat use, and trapping methods using radio tagged indigos has been conducted on KSC beginning in the early 1990s (Breininger et al. 2004; Dyer 2004).

Bald Eagle

KSC supports an annual average of 14 breeding pairs of the federally threatened Southern bald eagle; see Figure 3-2 for 2005/2006 nest sites. Production for the 2004 – 2006 seasons averaged between eight and 14 fledglings (Bolt and Cancro 2006). Eagles use mature live pines and pine snags within the pine flatwoods habitats. They also will occasionally build nests on man-made towers. KSC offers an ideal situation for bald eagle nesting due to the wide expanse of relatively undisturbed pine flatwoods, and the freshwater and estuarine wetland complex that provides a diversity of excellent foraging habitats (Hardesty and Collopy 1991).

Florida Scrub-jay

The federally threatened Florida scrub-jay is found in Florida and nowhere else in the world. Habitats occupied by Florida scrub-jays are typically oak scrub, oak/palmetto, and coastal scrub, as well as ruderal and disturbed areas in coastal regions. In order for scrub-jays to persist and flourish, the characteristics of the habitat must fall within a narrow range that is ideally maintained by fire. Florida scrub-jays live year-round in fairly stable territories, mate for life, and the young stay in their natal territory with the family for several years.

KSC and CCAFS together support one of the largest remaining populations of Florida scrub-jays, with an estimate of 550 pairs (USFWS 2007). Scrub-jay habitat is intensively managed on KSC, primarily by controlled burning and mechanical treatment. KSC has a scrub habitat compensation plan that is used to determine mitigation rates when scrub is taken for development (Schmalzer et al. 1994). Mitigation takes place as restoration of degraded scrub habitat elsewhere on KSC. Scrub-jay and scrub habitat research began on KSC in the late 1970s, and over 40 articles have been published in scientific journals or as Master's theses.

Wood Stork

Wood storks are federally protected as endangered. Wood stork populations have declined sharply in Florida, from 60,000 pairs in the 1930s to 11,232 pairs in 2006. Monthly aerial wading bird surveys show that approximately 250 wood storks use KSC impoundments, ditches, and estuaries for feeding and roosting. Wood storks are present on KSC throughout the year, but there is an apparent influx of non-resident birds during the winter. Wood storks were first recorded nesting on KSC in 1972; in subsequent years, 300 – 400 pairs were documented, representing almost 10% of the Florida population. Freezes in the mid-1980s severely reduced the mangrove population, the wood stork's primary nesting substrate in this area, and the number of nests varied from zero to 122 through 1990. Wood stork nesting has not been documented on KSC since 1990, although the mangroves have recovered and support nesting by other species of wading birds (Smith and Breininger 1995).

Southeastern Beach Mouse

The federally threatened southeastern beach mouse is a subspecies of the old field mouse (*P. polionotus*). It inhabits the sand dunes and adjoining scrub along the Atlantic coastline. Extensive coastal development has resulted in the loss and fragmentation of coastal dunes habitat for all of the subspecies of beach mice in Florida. The historic range of the southeastern beach mouse once extended from Ponce Inlet to Miami Beach. Currently, it can only be found from Apollo Beach to Port Canaveral, with isolated small populations at Archie Carr National Wildlife Refuge and Sebastian Inlet State Park. KSC provides habitat and protection for the last remaining core populations of this subspecies. Population monitoring and habitat use evaluations have occurred sporadically since the early 1980s.

West Indian Manatee

The estuarine waters surrounding KSC serve as a year-round safe harbor and foraging areas for West Indian manatees. Monthly aerial surveys of manatees have been conducted over the Banana River since 1977. Manatees can be found at KSC during all months of the year except when winter cold fronts drop water temperatures below 19 C (66 F). KSC generally experiences a spring peak in manatees followed by a fairly consistent number of animals in summer, another increase each fall, and then a drop each winter. The north end of the Banana River, south to near KARS Park I, is protected from entry of motorized watercraft, either by KSC security restrictions or as a designated manatee sanctuary. In 2003, peak counts resulted in over 670 individuals observed on one survey. This represents approximately 20% of the total Florida population and perhaps 40% of the east coast population. It is assumed that the quiet KSC waters (within the sanctuary) combined with extensive seagrass beds (primarily *Halodule* and *Syringodium)* provide good habitat that manatees continue to use and teach their offspring to locate (Provancha and Hall 1991).

3.4.2 Listed Plants

No federally listed plant species have been found to occur on KSC. KSC supports 33 plant species that are protected by the State of Florida, either as threatened, endangered, or commercially exploited (NASA 2002, Schmalzer and Foster 2005).

3.5 Cultural Resources

The SLF area has preliminarily been classified as a Historic District related to the Space Shuttle Program and is awaiting approval by the Florida State Historic Preservation Office (SHPO). The SLF Area Historic District, as proposed, includes three properties: the runway, the Landing Aids Control Building (LACB), and the Mate-Demate Device (MDD). The boundary of the historic district is comprised of the footprints of the three properties. The SLF is the site where all five Space Shuttle orbiters originally arrived at KSC from their assembly plant in Palmdale, California. It currently serves as the main Shuttle landing site, and as a return from landing site when weather or other issues necessitate the use of Edwards Air Force Base (AFB) in California for landing. The SLF functions as the main organizational hub for fire and rescue, security, safety, medical, and other support operations during both shuttle landings and launches. The SLF also supports astronaut training.

3.5.1 Runway

The SLF runway was originally built in 1976 to support the Space Shuttle Program. In the early years of the program, Edwards AFB was the preferred landing site because of more stable weather conditions as well as a choice of concrete and dry lake bed runways. However, in 1984, KSC became the primary landing site because it saved processing time to prepare for the next mission. More than 60% of the Shuttle missions have landed at KSC. The runway in constructed of concrete. It is one of the longest in the world, measuring 4,572 m (15,000 ft.) in length, with an additional 305 m (1,000 ft.) overrun at each end. The runway is 91 m (300 ft.) wide and 38.1 cm (15 in.) thick.

3.5.2 Landing Aids Control Building (LACB)

The LACB was built between April 1975 and October 1976 as part of the second phase of construction at the SLF. It is a single story rectangular structure encompassing an area of approximately 432 m^2 (4,650 $ft.^2$). It houses the equipment and personnel who operate the facility. The LACB is the control center for flight operations which support the landing of the Shuttle Orbiter, and it is the main organizational point for the safety and rescue teams who assist in the transfer of the astronauts from the Orbiter to the Crew Transportation Vehicle and prepare the Orbiter for transfer to the Orbiter Processing Facility. It also aides the Shuttle Training Aircraft program by coordinating sessions for the astronauts to practice landing on the runway. Finally, it manages the transport of the Orbiter on its Boeing 747 carrier, should it land at another NASA Center or need to travel to another center for rehabilitation.

3.5.3 Mate-Demate Device (MDD)

The MDD was built between 1977 to 1978 to provide structural support for the attachment (mating) and detachment (demating) of the Orbiter and the Boeing 747 carrier. It was used to detach the prototype Orbiter, Enterprise, as well as all five operational Orbiters upon their original delivery from Palmdale, California. It also played an important role in the return of the Orbiters to KSC when the main landing site was Edwards AFB (until 1984), and periodically throughout the program when weather or other issues necessitated the use of the Edwards facility for landing. It is also used to mate the Orbiter and Boeing 747 carrier for ferry flights to Palmdale for routine maintenance or significant modifications. The MDD is 32 m (105 ft.) long, 28 m (93 ft.) wide, and 32 m (105 ft.) tall. It is an open steel truss frame resting on a concrete base. There are two Orbiter access arms with a sling between them which is connected to the Orbiter in order to lift it using three 45, 359 kg (50 ton) hoists. Until early 2006, the original navigation equipment for the runway sat on top of the MDD.

3.6 Geology and Soils

3.6.1 Geology

The following information is from "Geology, Geohydrology and Soils of Kennedy Space Center: A Review" (Schmalzer and Hinkle 1990):

Sediments underlying KSC have accumulated in alternating periods of deposition and erosion since the Eocene. Surface sediments are of Pleistocene and Recent ages. Fluctuating sea levels with the alternating glacial interglacial cycles have shaped the formation of the barrier islands. Merritt Island is an older landscape whose formation may have begun as much as 240,000 years ago, although most of the surface sediments are not that old. Cape Canaveral probably dates from <7,000 years before present, as does the barrier strip separating Mosquito Lagoon from the Atlantic Ocean. Deep aquifers beneath KSC are recharged inland but are highly mineralized in the coastal region and interact little with surface vegetation. The Surficial aquifer is recharged by local rainfall. Sand ridges in the center of Merritt Island are important to its recharge. Discharge is from evapotranspiration, seepage to canals and ditches, seepage into interior wetland swales, and seepage into impoundments, lagoons, and the ocean. This aquifer exists in dynamic equilibrium with rainfall and with the fresh-saline water interface. Freshwater wetlands depend on the integrity of this aquifer, and it provides freshwater discharge to the lagoons and impoundments.

3.6.2 Soils

The soils of KSC are mapped in the soil surveys for Brevard County (Huckle et al. 1974) and Volusia County (Baldwin et al. 1980). Fifty-eight soil series and land types are represented, even though Merritt Island is a relatively young landscape and one formed from coastal plain deposits. The primary source of parent material for KSC soils is sands of mixed terrestrial and biogenic origin. The terrestrial material originated from southern rivers carrying sediments eroded from highly weathered Coastal Plain and Piedmont soils; these sediments are quartzose with low feldspar content (Milliman 1972). These sediments moved south through long-shore transport and may have been reworked repeatedly. The biogenic carbonate fraction of the sand is primarily of mollusk or barnacle origin with lesser contributions of coralline algae and lithoclasts; some may be reworked from offshore deposits of coquina and oolitic limestone (Milliman 1972). Soils on CCAFS and the barrier island section east of Mosquito Lagoon are younger than those of Merritt Island and, therefore, have had less time to weather. Well-drained soil series (e.g., Palm Beach and Canaveral) in these areas still retain shell fragments in the upper layers, while those inland on Merritt Island (e.g., Paola and Pomello) do not. The presence of shell fragments influences soil nutrient levels, particularly calcium and magnesium, and pH. The eastern and western sections of Merritt Island also differ in age. The eastern section of Merritt Island inland to about SR 3 has a marked ridge-swale topography, presumably retained from its formation as a barrier island; west of SR 3, the island is flatter, without obvious ridges and swales, probably due to the greater age of this topography. Differences in age and parent material account for some soil differences, but on landscapes of Merritt Island with similar age, topography has a dramatic effect on soil formation. Relatively small elevation changes cause dramatic differences in the position of the water table that, in turn, affect leaching, accumulation of organic matter, and formation of soil horizons. In addition, proximity to the lagoon systems influences soil salinity (NASA 2003).

3.7 Noise

Noise generated at KSC originates from six different sources: 1) launches, 2) Space Shuttle reentry sonic booms, 3) aircraft, 4) industrial operations, 5) construction, and 6) traffic. Noise generated above ambient levels by these sources has the potential to adversely affect both wildlife and humans. Some typical values for noise levels from construction and vehicles are shown in Appendix 3. Research on the effects of noise on wildlife at KSC during the launch of spacecraft has shown that besides an initial startle response, birds and other wildlife quickly return to their normal activities and show no immediate adverse effects. Other studies conducted on wading bird colonies subjected to military overflights at 152 m (500 ft.) altitude with noise levels up to 100 decibels (weighted to the A-scale) documented no productivity limiting responses and only a short-term interruption of the birds' normal routine. Permissible noise exposure limits for humans are established by the Occupational Safety and Health Administration (OSHA). The 8-hour time weighted average noise level on KSC is appreciably lower than the OSHA recommended level of 85 decibels, A-weighted (dBA) (OSHA 2006).

3.8 Surface Water Quality

The surface waters in and surrounding KSC are shallow estuarine lagoons and include portions of the Indian River, the Banana River, Mosquito Lagoon, and Banana Creek. The area of Mosquito Lagoon within the KSC boundary and the northernmost portion of the IRL, north of the Jay Jay Railway spur crossing (north of SR 406), are designated by the State as Class II, Shellfish Propagation and Harvesting. All other surface waters at KSC have been designated as Class III, Recreation and Fish and Wildlife Propagation. All surface waters within MINWR are designated as Outstanding Florida Waters as required by Florida Statutes for waters within national wildlife refuges.

NASA, the USFWS, and Brevard County maintain water quality monitoring stations at surface water sites within and around KSC. The data collected are used for long-term trend analysis to support land use planning and resource management. Surface water quality at KSC is generally good, with the best water quality being found adjacent to undeveloped areas of the IRL, such as Mosquito Lagoon, and the northernmost portions of the Indian River and Banana River (NASA 2003).

3.9 Groundwater Quality

The State of Florida has created four categories used to rate the quality of groundwater in a particular area. The criteria for these categories are based on the degree of protection that should be afforded to that groundwater source, with Class G-I being the most stringent and Class G-IV being the least. The groundwater at KSC is classified as Class G-II, which means that it is a potential potable water source and generally has a total dissolved solids content of less than 10,000 milligrams/liter (parts per million) (NASA 2003). The groundwater at the LC 39 pads has been classified as Class G-III because of their proximity to the ocean. Any future long-term pumping would allow salt water to encroach into the aquifer, rendering it non-potable (NASA 2003). The subsurface of KSC is comprised of the Surficial Aquifer, the Intermediate Aquifer, and the Floridan Aquifer. Recharge to the Surficial Aquifer system is primarily due to the infiltration of precipitation; however, the quality of water in the aquifer beneath KSC is influenced by the intrusion of saline and brackish surface waters from the Atlantic Ocean and the IRL. This is evident by the high mineral content, principally chlorides, that has been measured in groundwater samples collected during various KSC surveys.

3.10 Socioeconomics

KSC is Brevard County’s largest single employer and a major source of revenue for the local economy. KSC operations create a chain of economic effects throughout the region. Each job created within Brevard County’s space industry is estimated to generate an additional 1.93 jobs within the region (NASA 2003). Other large employers in the county are Patrick Air Force Base, the Brevard County School District, and Health First. Approximately 14,595 personnel were employed at KSC in 2005, a number that includes contractor, construction, tenant, and permanent civil service employees (NASA 2005). On KSC, civil service employees account for approximately 12 % of the total workforce. The highest employment levels at KSC were recorded during the Apollo program. In 1968, KSC recorded a peak population of 25,895, with an estimated one in four workers in Brevard County employed at KSC. Employment levels dropped precipitously following the Apollo program to a historic low in 1976, when a total of 8,441 personnel were employed. Employment levels rose sharply in 1979 when KSC was designated as the launch and operations support center for the Space Shuttle program.

Approximately 50 % of the people at KSC have positions directly related to the Shuttle and payload processing operations. The remaining workforce is employed in ground and base support, unmanned launch programs, crew training, engineering, and administrative positions. The largest concentration of personnel is stationed in the LC 39 Area, and the next largest concentration is in the Industrial Area. Remaining personnel are stationed at various outlying facilities.

3.11 Land Use

Land and open water resources of KSC comprise 56,451 ha (139,490 ac.) in Brevard and Volusia Counties, and are located along the east coast of central Florida at 28^{o} 38’N, 80^{o} 42’W (NASA 2003). The majority of the land areas comprising KSC are on the northern part of Merritt Island, which forms a barrier island complex with adjacent Cape Canaveral (NASA 1979). Undeveloped areas, including uplands, wetlands, mosquito control impoundments, and open water areas, comprise approximately 95 % of the total KSC area (NASA 2003). Nearly 40 % of KSC consists of open water, including portions of the Indian River, Banana River, Mosquito Lagoon, and all of Banana Creek (NASA 2003).

KSC was established under NASA jurisdiction for the purpose of implementing the Nation's space program (NASA 2003). NASA maintains operational control over approximately 3,035 ha [7,500 acres (ac)] of KSC. This area comprises the functional area, which is dedicated to NASA operations (Stoeckel, pers. comm.). Undeveloped operational areas are dedicated safety zones around existing facilities or are reserved for planned and future expansion.

The overall land use and management objectives of NASA and KSC are to maintain the Nation's space mission operations while supporting alternative land uses that are in the Nation's "best interest" under the Space Act (NASA 2003). Towards these ends, KSC developed a Land Use Plan in 1999 and then participated in the development of the Cape Canaveral Spaceport Master Plan, in cooperation with the 45th Space Wing and the Florida Space Authority. These plans provide an overall context for future land uses on KSC while not identifying any specific facility or land development projects. Such future projects will be driven by program changes and management decisions as yet undefined.

The designation of MINWR and CNS, in 1963 and 1975, respectively, on the 53,420 ha (132,000 ac) outside of NASA's operational control reflects this "best interest" objective. Both MINWR and CNS effectively provide a buffer zone between NASA operations and the surrounding communities (Figure 1-1). NASA delegated land management responsibilities for MINWR to the USFWS and for CNS to the NPS. The USFWS and NPS exercise management control over agricultural, recreational, and environmental programs within their respective jurisdictions (NASA 2003). NASA remains the landowner and maintains the option to remove lands from the MINWR or CNS as needed to support the space program (NASA 2003). NASA, working in partnership with the USFWS and NPS, has demonstrated that through careful land planning and management, the requirements of space flight and protection of natural resources can be achieved with minimal conflict (NASA 2003).

Table 3-1: Threatened and endangered wildlife species documented from KSC, Florida.

SCIENTIFIC NAME	COMMON NAME	LEVEL OF PROTECTION	
Amphibians and Reptiles		STATE	FEDERAL
Rana capito aesopus	Florida gopher frog	SSC	-
Alligator mississippiensis	American alligator	SSC	T(S/A)
Caretta caretta	Loggerhead	T	T
Chelonia mydas	Atlantic green turtle	E	E
Dermochelys coriacea	Leatherback sea turtle	E	E
Gopherus polyphemus	Gopher tortoise	SSC	-
Drymarchon couperi	Eastern indigo snake	T	T
Nerodia clarkii taeniata	Atlantic saltmarsh snake	T	T
Pituophis melanoleucus mugitus	Florida pine snake	SSC	-
Birds			
Pelecanus occidentalis carolinensis	Eastern brown pelican	SSC	-
Egretta thula	Snowy egret	SSC	-
Egretta caerulea	Little blue heron	SSC	-
Egretta tricolor	Tricolored heron	SSC	-
Egretta rufescens	Reddish egret	SSC	-
Eudocimus albus	White ibis	SSC	-
Ajaia ajaja	Roseate spoonbill	SSC	-
Mycteria americana	Wood stork	E	E
Haliaeetus leucocephalus	Bald eagle	T	T
Falco peregrinus tundrius	Arctic peregrine falcon	E	-
Falco sparverius paulus	Southeastern American kestrel	T	-
Charadrius melodus	Piping plover	T	T
Sterna antillarum	Least tern	T	-
Rynchops niger	Black skimmer	SSC	-
Aphelocoma coerulescens	Florida scrub-jay	T	T
Mammals			
Peromyscus polionotus niveiventris	Southeastern beach mouse	T	T
Podomys floridanus	Florida mouse	SSC	-
Trichechus manatus	West Indian manatee	E	E

Key: E = endangered, SSC = species of special concern, T = threatened, T(S/A) = threatened due to similarity of appearance

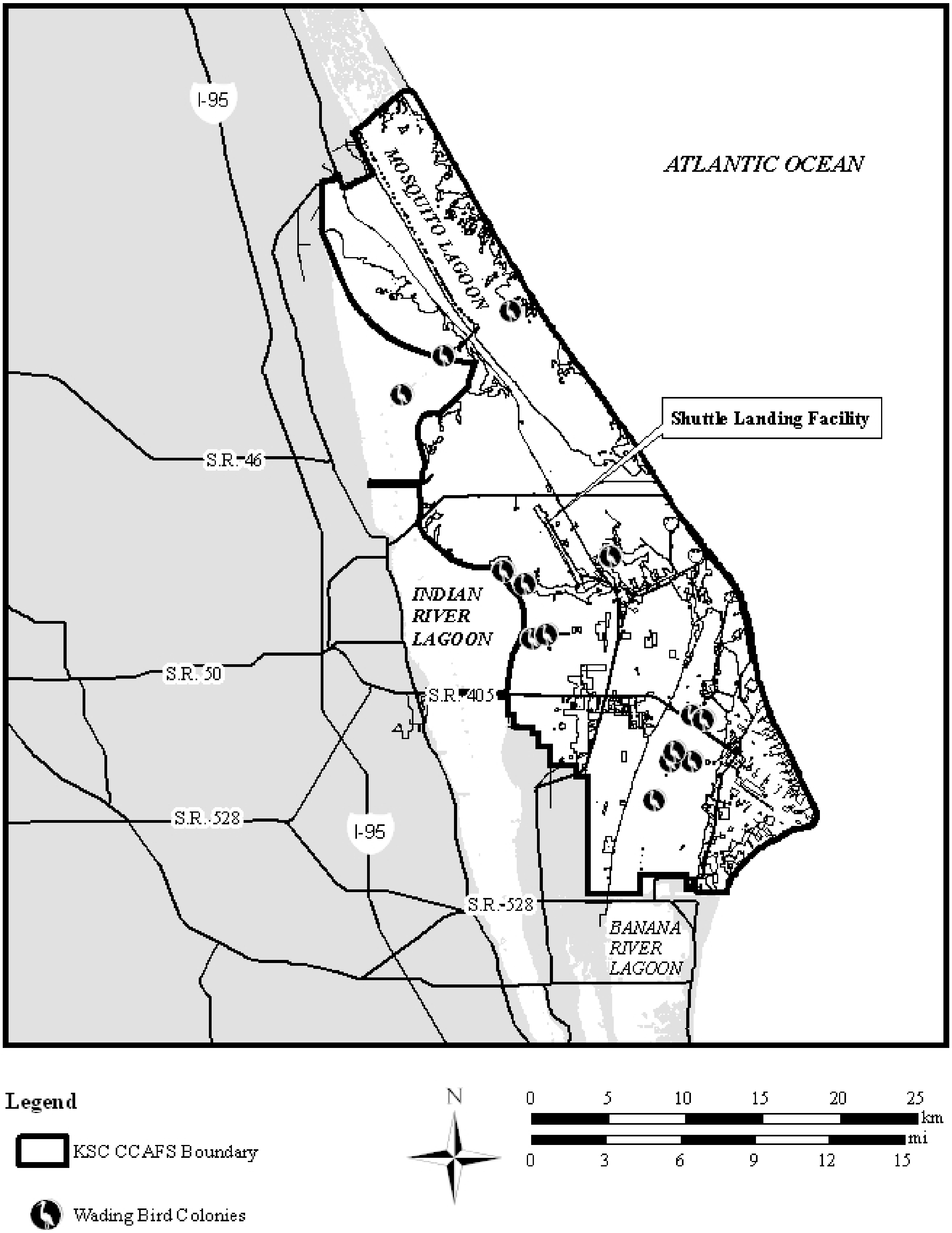

Figure 3-1. Wading bird nesting colonies active on KSC, Florida, 2004 - 2006.

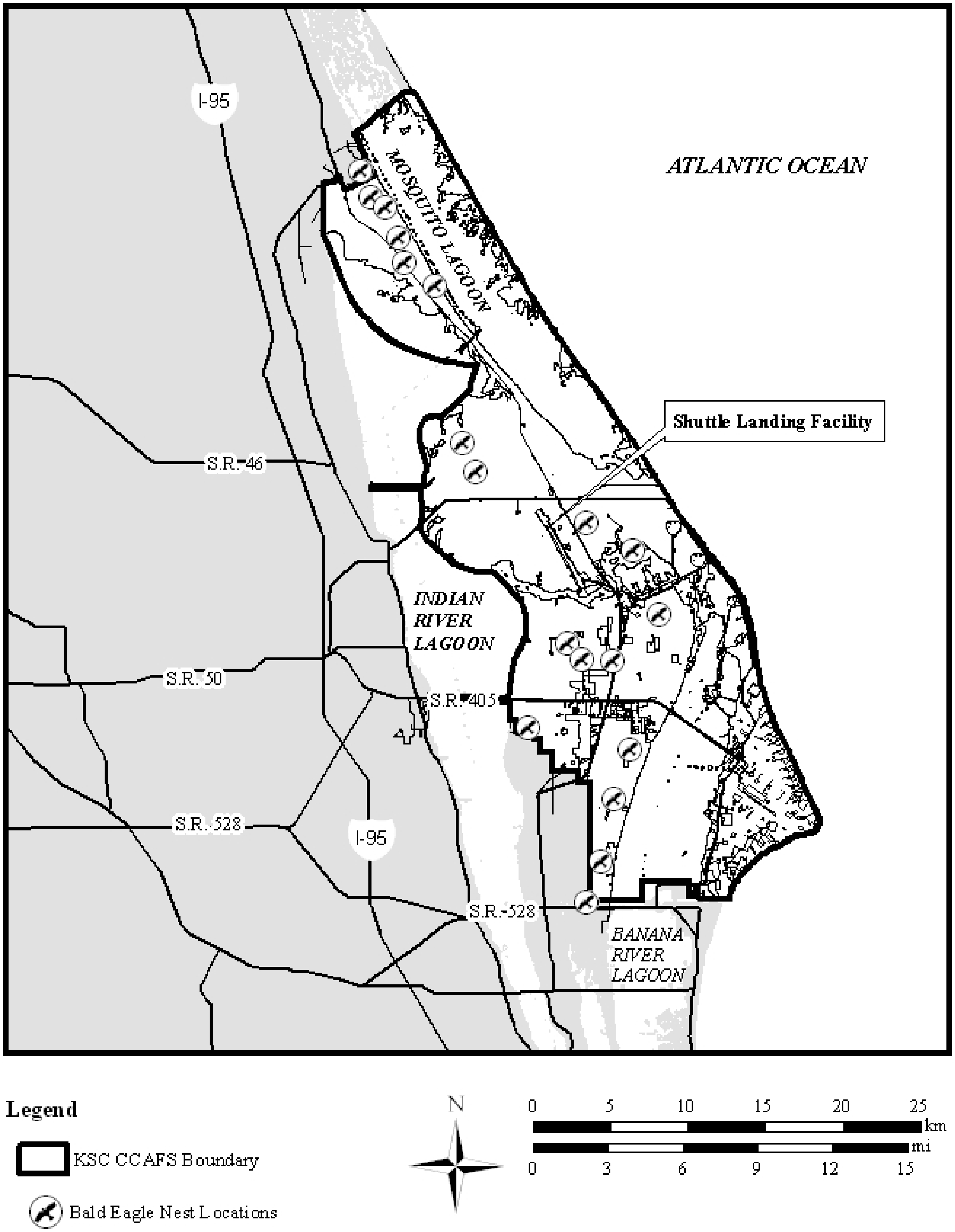

Figure 3-2. Bald eagle nest sites (active and inactive) on KSC, Florida, 2006.

4.0 Environmental Consequences

Chapter 4 summarizes the potential impacts that the four alternative actions (Proposed Action, Alternative 1, Alternative 2, and No Action) could have on environmental resources at KSC. Eleven resource categories were analyzed (Table 4-1).

4.1 Summary and Status of Impacts

Potential impacts to resources resulting from the implementation of the four alternatives were identified and placed into one of the following classifications:

- None – no impacts expected
- Minimal - impacts are not expected to be measurable, or are too small to cause any discernable degradation to the environment
- Minor - impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation
- Major - impacts could individually or cumulatively be substantial

4.1.1 No Action Alternative

Under the No Action alternative, modification and operation of facilities to support increased use of the SLF would not occur at KSC. Commercial space launch activities requiring use of a facility like the SLF would have to operate elsewhere, precluding the potential contribution to diversifying KSC's program base and eliminating anticipated positive economic impacts in aerospace-related employment and commerce. KSC would lose opportunities to support the nation's space policy for expanding commercial sector participation in civil space endeavors and in hosting complementary activities that would help sustain SLF spaceport/airfield capabilities.

Facilities and support infrastructure currently being utilized by the Space Shuttle Program and other programs would become obsolete. Thousands of square feet of hangars, support buildings, office space, and other areas could be abandoned in place or demolished if post-Shuttle agency requirements are insufficient or inadequately funded. Socioeconomics would be the only resource affected under the No Action alternative (Table 4-1). A reduction in the current work force supporting SLF operations would take place. While this would have consequences for the local economy, these impacts would be minimal.

4.1.2 Action Alternatives

Impacts of construction (including modifications of existing facilities) and operation of each of the activities included in the three Action Alternatives vary from none to minor (Table 4.1). A discussion of these impacts follows in Section 4.2.

4.2 Analysis of Impacts from the Action Alternatives

4.2.1 Facilities and Infrastructure

Under the Proposed Action, an incremental increase of up to 175 new permanent employees could become housed at the SLF (100 workers by 2011 with an additional 75 by 2015); the addition of this many people would be considered a minor impact as it represents 1.2% of the current workforce. An administrative space for these people would be necessary and located either within or adjacent to the proposed hangars at the south-field site. Under Alternative 1, fewer people would be permanently housed at the SLF, but an administrative area would still be needed. For Alternative 2, no new building would be constructed and only support personnel that could be fit into existing facilities (with modifications) would be allowed to permanently occupy the SLF.

At the end of the Space Shuttle program in 2010, it is likely that the 2,694 m^2 (29,000 sq. ft.) of office space in the Flight Vehicle Support Building (RLV Hangar) adjacent to the SLF tow way would become available. Allowing permanent tenants of the SLF to occupy that space would reduce the office area necessary at the south-field site. However, at this time, that space at the RLV Hangar has not been committed for any specific use.

Between 2008 and 2011, up to 100 "transient" visitors could come to the SLF each day, with that number increasing to 200 by 2015. These would include flight crews, test teams, aircraft/spacecraft flyers, delivery personnel, etc.

The maximum number of new bodies (permanent workforce and transients) that could potentially make use of SLF facilities by 2015 is 275. This number represents <2.0% of the current number of KSC employees.

4.2.1.1 Transportation

Construction - The construction activities of the new SLF facilities under the Proposed Action and Alternative 1 would be expected to have minimal impacts to transportation routes within KSC. Increased construction traffic would occur during normal working hours and could cause some traffic delays. However, the majority of the construction activities would be in an isolated area and the capacity of all affected roads would not be exceeded by this increase in vehicles. Under Alternative 2, there would be no additional construction and the impacts would be classified as None.

Operation - The operation of the SLF under the Proposed Action would be expected to produce only minimal impacts to roads on KSC as the number of vehicles would not increase substantially, and would represent <1.2% increase over current traffic levels. Traffic delays would not be anticipated as the roadways have sufficient capacity to handle the increased loads; current traffic levels are approximately half of the peak levels that were experienced during the 1960s on KSC. Use of the roads by transient visitors is also expected to be minimal as approximately ¾ of these people would be traveling in buses or other large capacity vehicles.

Operation of the SLF under Alternatives 1 and 2 would have minimal effects on transportation. There might be slight increases in traffic associated with each of these alternatives, but would be less than those associated with the Proposed Action and the roads would be able to absorb these impacts without consequences.

4.2.1.2 Utilities

Construction - The construction of the SLF Proposed Action facilities would require connections to wastewater, electrical, communication, and potable water utilities, but use for construction would be short-term. Each of these utilities presently exists at the site. Construction is expected to present minimal impacts to utilities as there is sufficient capacity to absorb the increases, and construction activities would be temporary. Alternative 1 is a scaled-down version of the Proposed Action, and would have less impact. Alternative 2 would require no new construction and would incur no impacts (Table 4-1).

Operation - The Proposed Alternative and Alternative 1 are expected to have minimal impacts to utilities. An administration office of 2,323 m^2 (25,000 sq. ft.) needed to house 100 additional employees would use approximately 450,000 kWh of electricity per year, which is 0.16% of the average yearly electricity use on KSC (2001 – 2006; SGS 2006), and well below the capacity available. If it were determined that office space for 175 people was necessary, a 4,064 m^2 (43,750 sq. ft.) building would be constructed, using approximately 770,000 kWh of electricity per year [0.27% of the average yearly electricity use on KSC (2001 – 2006; SGS 2006)], still well below the capacity available.

The existing water, sewer, power, and communications lines in the area are sufficient to handle the anticipated increased needs. Therefore, the larger workforce would have a minimal impact on all utilities. Operation of the SLF under Alternative 2 would result in fewer impacts to utilities than the Proposed Action or Alternative 1.

The maximum of 200 transient visitors/day anticipated by 2015 under the Proposed Action would have minimal impacts on utilities. It is expected that they would use modified existing facilities at the south-field and mid-field sites, as well as the RLV Support Complex.

4.2.2 Air Quality

Construction - The site preparation and construction from the activities within the Proposed Action or Alternative 1 would produce minimal impacts to the surrounding air quality. The clearing of land and other construction would generate airborne particulates from earth moving, as well as hydrocarbon exhaust from heavy equipment and generators. Such impacts are expected to be small in scope and of short duration. Best Management Practices would be employed to mitigate for emissions due to earth movement, which would include water spraying for dust control. No impacts are expected from Alternative 2 because no new construction would be done.

Operation - Operational sources of air pollution are categorized based on their emission sources (stationary vs. aircraft vs. ground) and are described in the following sections.

4.2.2.1 Stationary Emission Sources

The following threshold levels are used to describe “major” sources of air pollution:

- Produce threshold quantities for any individual emissions unit or activity that emits or has the potential to emit 227 kg/yr. (500 lbs./yr.) or more of lead and lead compounds, 454 kg/yr. (1,000 lbs./yr.) or more of any hazardous air pollutant (HAP), 1,134 kg/yr. (2,500 lbs./yr.)or more of total HAP, or 4,536 kg/yr. (5 tons/yr.) or more of any other regulated pollutant, and require an individual construction permit prior to construction [Chapter 62-213.300(2) F.A.C.].

- Produce threshold quantities as a facility that emits or has the potential to emit 4,536 kg/yr. (5 tons/yr.) or more of lead and lead compounds, 9,072 kg/yr. (10 tons/yr.) or more of any HAP, 22,680 kg/yr. (25 tons/yr.) or more of total HAP, or 90,720 kg/yr. (100 tons/yr.) or more of any other regulated pollutant, and require a construction and an operating permit [Chapter 62-213.300(2) F.A.C.].

Operation of the facilities under any of the three action alternatives is not expected to produce amounts of stationary emissions above threshold levels. The main potential source of air pollution would be from generators, which would be used on a minimal basis. Tenants of the SLF would be included in the KSC Title V Operating Permit if their operations were directly supporting NASA missions or under NASA contracts. For operations not funded by NASA, tenants would apply for their own operating permits if they expected to have any significant air pollution sources, operations, or processes. Other permits (Chapters 62-4, 62-210, 62-212, F.A.C.) would also be required, including state construction and new source review (NSR) and prevention of significant deterioration (PSD) permits.

4.2.2.2 Aircraft Emissions

Aircraft emissions include hydrocarbons (HC), carbon monoxide (CO), particulate matter less than 10 microns (PM-10), nitrogen oxides (NOx), sulfur dioxide (SO_2), and lead (Pb). The six common (or criteria) air pollutants identified by the Environmental Protection Agency (EPA) are ozone (O_3), CO, PM, NOx, SO2, and Pb. Under the 1970 Clean Air Act, the EPA established National Ambient Air Quality Standards (NAAQS) for these pollutants. Hydrocarbons were not included. CO emissions arise from the incomplete combustion of jet fuel. Ambient CO concentrations may be high in locations where aircraft idle for long periods, such as what can occur at busy commercial airports, but is not expected to occur at the SLF because of low traffic volume. Particulate emissions arise from aircraft. However, these particulate emissions are rarely at levels that would approach the NAAQS. A NAAQS exists for NO_2, which is the primary component of NOx emitted from combustion sources. Aircraft are a source of NOx ; in typical airfield situations, NO_2 levels above the air quality standards are not expected to result from airport emissions. SO_2 emissions at airports and air bases come from the low levels of sulfur in jet fuel, aviation gasoline, diesel and other fuels. However the SO_2 levels produced are very low and are not expected to result in violations of the NAAQS in the area surrounding the SLF. There is no NAAQS for hydrocarbons; as a result HC is not included in this analysis. However, HC and NOx in the atmosphere are precursors to the formation of ozone, which does have a NAAQS standard. Ozone is typically not included in analyses of airport air pollution estimates because its formation in the atmosphere is difficult to model on a local scale, and because the effects of elevated ozone concentrations are generally felt on a regional rather than a local level. Pb air pollution is expected to be minimal because it is not an additive of jet fuel. Small quantities of lead are added to certain piston powered, small engine airplanes (AFCEE 2005). These types of small airplanes will not be utilizing the SLF in any significant frequency to have an effect on the ambient air quality.

Though each aircraft generates relatively small quantities of NAAQS pollutants or precursors, the effect of many aircraft may have an impact on the local air quality. Therefore, an airport might have the potential to significantly impact air quality. In order to predict the effects of a proposed new airport or airbase, FAA developed a modeling system which takes into account the number of flights, ground transportation, wind dispersion and other factors. This Emission and Dispersion Modeling System (EDMS) can be used to determine the expected levels of NAAQS pollutants within a given distance from a proposed airport or expansion project. However, based on numerous studies, the FAA has designed a set of criteria which will help decide if a full EDMS test or NAAQS assessment is required based on the projected air and ground transportation load at a given airport. Below that "level of use" threshold, a NAAQS is not required (FAA 1994). Figure 4.1 shows the threshold for determining whether a NAAQS assessment is needed. Based on the projected number of flights provided in Chapter 2, the air-traffic load at the SLF is expected to remain below the NAAQS assessment level. Air pollution generated by the aircraft operating out of the SLF under the Proposed Action is expected to be minimal and sufficiently low as to exclude the need for a full-scale assessment (EDMS).

Emissions from launch vehicles would not be expected to impact environmental conditions at KSC or nearby areas. Launches would occur from carrier aircraft that would take the vehicles to high altitudes greater than 10.7 km (35,000 ft). altitude 24 km (15 mi.) east of the coastline.

Use of the SLF under Alternatives 1 and 2 will be less than what is proposed under the Proposed Action, and these activities will subsequently have only a minimal effect on the local air quality.

4.2.2.3 Ground Vehicle Emissions

Three sources of ground vehicle emissions could potentially affect the SLF area environment: 1) vehicles driven by additional employees; 2) vehicles driven or used to transport transient visitors; and 3) race cars using the runway for tests. Impacts from these vehicles to air quality are anticipated to be minimal. Under the Proposed Action, the maximum number of new employees at the SLF expected through 2015 is 175. Transient visitors will likely be brought onto KSC by a small number of vans or buses, adding between two and seven vehicles per day, depending on their size. Race car use of the SLF would, at the most (in 2015), occur 36 days per year, and the number of vehicles per test would be small. A high estimate for increased vehicle use per day would be less than 200. This is approximately 1.4% of the vehicles that currently are used on KSC, based on the number of employees (NASA 2005). Typical emission rates from that small number of ground vehicles would not be sufficient to push air quality measurements into noncompliance.

4.2.3 Biological Resources

4.2.3.1 Habitats and Vegetation

Construction – Under the Proposed Action, a total of 14.8 ha (36.5 ac.) of vegetation and existing infrastructure would be taken from the south-field and mid-field sites for facilities and stormwater retention. This includes 12.3 ha (30.3 ac.) of uplands and 1.4 ha (3.5 ac.), which is 0.1% of the total uplands and 0.003% of the total wetlands present on KSC. At the mid-field site, 7.0 ha (17.3 ac.) of uplands and 1.3 ha (3.1 ac.) of wetlands would be developed; 5.3 ha (13.0 ac.) of upland habitat and 0.6 ha (1.4 ac.) of wetlands would be developed at the south-field site. Table 4-2 and Figures 4-2A and 4-2B show the locations, and amounts of the specific impacted habitat types.

There is currently no final design for the Proposed Action or Alternative 1, and therefore, no specific mitigation plans for habitat loss. Pending the outcome of this EA, appropriate plans would be developed as part of the permitting process. Mitigation for the loss of 2.3 ha (5.8 ac.) of potential Florida scrub-jay habitat at the mid-field site would occur at a minimum of a 2:1 ratio and would consist of enhancement or restoration of scrub habitat present on KSC. Mitigation for loss of wetlands at both sites would consist of enhancing, restoring, or creating wetlands of like function on KSC at a minimum of 5:1.

Alternative 1 would require removal of vegetation only from the south-field site, in the same configuration as in the Proposed Action. Alternative 2 would have no impacts to habitats or vegetation because there would be no new construction.

Operation – The addition of facilities at the mid-field and south-field sites (Proposed Action and Alternative 1) would necessitate the removal of those areas from current MINWR Fire Management Units. This would render them unavailable for habitat management, as per the Memorandum of Understanding (MOU) between the USFWS and NASA (DOI 1972). No other impacts would be expected to habitats or vegetation from operations under any of the action alternatives.

4.2.3.2 Wildlife

Construction – The primary impact expected to wildlife from construction for the Proposed Action and Alternative 1 would be due to loss of habitat. Most of the species that might be directly affected by the development are common on KSC and not legally protected (Breininger et al. 1994). The loss of a maximum of 14.8 ha (36.5 ac.) as described in the Proposed Action is approximately 0.03% of the habitat not used for space operations on KSC that is available for wildlife. The impact to the overall wildlife population and biodiversity on KSC from this action is expected to be minimal.

Because there will be no construction associated with Alternative 2, the potential impacts would be classified as None.

Operation – Potential impacts to wildlife during the operational phase of the Proposed Action are expected to be fall into two categories: 1) collisions with aircraft, which are discussed here; and 2) responses to noise, discussed in Section 4.2.7. The civil and military aviation communities widely recognize that the threat to human health and safety from aircraft collisions with wildlife (wildlife strikes) is increasing (Dolbeer 2000, MacKinnon et al. 2001). Globally, wildlife strikes have killed more than 194 people and destroyed over 163 aircraft since 1988 (Richardson and West 2000; Thorpe 2003, 2005). Several factors contribute to this increasing threat. Commercial air carriers are replacing their older three-engine and four-engine aircraft fleets with more efficient and quieter two-engine aircraft. Research has indicated that birds are less able to detect and avoid modern jet aircraft with quieter engines than older aircraft with noisier engines (Burger 1983, Kelly et al. 1999). In addition, the populations of many wildlife species commonly involved in strikes have increased markedly in the last few decades. For example, from 1980 to 2005, the non-migratory Canada goose population in the U.S. and Canada increased at a mean rate of 7.9 % per year. Other species showing significant mean annual rates of increase included red-tailed hawks (1.9 %), wild turkeys (12.7 %), turkey vultures (2.2 %), double-crested cormorants (4.9 %), and sandhill cranes (4.3 %) (Sauer et al. 2006). Some populations of terrestrial wildlife which typically collide with aircraft have also increased dramatically. For example, white-tailed deer populations increased from a low of about 350,000 in 1900 to at least 17 million by 1997 (McCabe and McCabe 1997). Another major factor contributing to increased air strikes has been the rise in air travel nationwide. Air traffic has increased substantially since 1980. Passenger trips in the U.S. increased from about 310 million in 1980 to 731 million in 2005 (3.5 % per year), and commercial air traffic increased from about 17.8 million aircraft movements in 1980 to 29.9 million in 2005 (2.1 % per year, FAA 2006b).

Although the SLF is considered a low-volume airfield, supporting less than 10,000 aircraft operations annually, its location within MINWR and its proximity to a variety of upland and wetland habitats poses the potential for a bird strike hazard. A variety of birds were documented utilizing the SLF during a 1997 study (Larson et al. 1997). A total of 74 species were recorded in 1,151 surveys. Seven species (boat-tailed grackle, turkey vulture, red-winged blackbird, killdeer, tree swallow, white ibis, cattle egret, and black vulture) were recorded in at least 10% of the samples. Other species which were less frequently encountered included tricolored heron, snowy egret, great egret, little blue heron, glossy ibis, osprey, mourning dove, great blue heron, laughing gull, and red-shouldered hawk.

A 1988 study performed by the USAF used a bird strike assessment model to predict the probability of bird collisions with landing shuttles at the SLF (Short 1988). It correlated SLF bird population, habitat types, and behavior data with shuttle flight data to determine the risk of a bird strike, which the author estimated at approximately one per 100 shuttle landings or 1%. The actual number of bird collisions with aircraft at the SLF is four per year, out of approximately 5,000 operations per year (E. Taff, SLF Operations Officer, personal communication, December 2006). This is considerably less than what the 1988 model predicted. Species most commonly struck at the SLF include tree swallows, plovers, sparrows, hawks, and grackles (Larson et al 1994). When converted to the number of strikes per 10,000 operations in and out of the SLF, the average collision rate is 0.08%. The observed SLF bird strike rate value is higher than the range of collision rates (0.005% - 0.02%) documented for civilian aircraft across the U.S. by the FAA between 1990 and 2005 (FAA 2006c). These data are contained in a wildlife strike database that has been compiled from wildlife strike report information. Through a voluntary reporting system, pilots submit Bird/Other Wildlife Strike Report forms after every wildlife collision.

Although the potential for collisions between birds and aircraft at the SLF exists under all three action alternatives, the possibility of these accidents occurring would be minimal. Bird strike risk could be further reduced through implementation of the Wildlife Hazard Management Plan (WHMP) currently being developed as part of the FAA-required SLF Airport Certification Manual. The anticipated completion date for the plan is July 2007 (R. Feile, personal communication, May 2007).

No collisions are expected involving rocket launches and birds. The launch vehicles would be carried by aircraft to altitudes of at least 10.7 km (35,000 ft.) 24 km (15 mi.) east of the coastline.

Nationwide, wildlife strikes involving terrestrial animals are significantly less than those involving birds. During a 16-year period, 38,436 bird strikes were reported compared to only 812 involving terrestrial animals (FAA 2006b). However, in terms of damage and risk of human injury and mortality, terrestrial wildlife strikes are far more dangerous than those caused by birds. Thirteen percent of bird strikes during a 16-year timeframe were associated with negative effects (aircraft damage, human injury or death), while collisions involving terrestrial wildlife caused negative effects 56% of the time (FAA 2006b). The lands and aquatic habitats surrounding the SLF offer a variety of habitats that are utilized by various mammals and reptiles. These include white-tailed deer, feral hogs, bobcats, raccoons, opossums, alligators, and turtles. However, in 30 years and thousands of flight operations, one terrestrial animal has been struck by an aircraft, a bobcat that was killed on the runway by a taxiing T-38 during a nighttime mission. The anticipated maximum number of flight operations at the SLF for the Proposed Action is fewer than have occurred during many of the previous years. Therefore, while opportunities exist for terrestrial wildlife species to be struck by aircraft at the SLF, it is extremely unlikely, and the anticipated impacts would be classified as minimal. As with bird strikes, the chances could further be reduce by implementation of the SLF's WHMP.

4.2.4 Threatened and Endangered Species

Construction – Federally and state-protected wildlife species documented on KSC are listed in Table 3-1. Of these, ten species could potentially occur in the habitat types that would be impacted by the Proposed Action (Table 4-4) and nine species could potentially occur in the habitats impacted in Alternative 1 (Table 4-4). Seven of these species have been documented in the ditch habitat at the SLF (the alligator and all of the birds except the Florida scrub-jay). The amount of ditch habitat that will be lost is very small [0.05 ha (0.1 ac.) in the Proposed Action and 0.03 ha (0.08 ac.) in Alternative 1], particularly when compared to the amount of ditch habitat surrounding the runway. This impact is expected to be minimal.

The eastern indigo snake has been documented using all of the vegetated habitats present within the Proposed Action alternative, and indigo snakes have been recorded as occurring in the area immediately surrounding the SLF. However, the impact to eastern indigos for the loss of 14.8 ha (36.5 ac.) of habitat is expected to be minimal. The average home range size for male indigos in Brevard County was 118 ha (291 ac.) and the smallest range recorded was 65 ha (161 ac.) (Legare et al., unpublished data). Average home range for females was 41 ha (101 ac.) and the smallest recorded was 30 ha (74 ac.). The entire acreage that would be developed for the Proposed Action is approximately half of the smallest home range expected for a single indigo snake.

Gopher tortoises could potentially be found in the oak scrub habitat at the mid-field site and in the ruderal-herbaceous vegetation present at the mid-field and south-field sites. Most of the surrounding habitats are not suitable for gopher tortoises and it is unlikely that they would be present at either site. Before any construction began, surveys for gopher tortoises and their burrows would be done, and if found, the tortoises would be captured and relocated to adjacent suitable habitat in accordance with the KSC Gopher Tortoise Relocation Policy. Impacts would be classified as minimal.

The oak scrub and palmetto scrub present at the mid-field site is potential Florida scrub-jay habitat, although jays are not known to occur there currently. Mitigation for the loss of 2.3 ha (5.8 ac.) of potential Florida scrub-jay habitat at the mid-field site would occur at a minimum of a 2:1 ratio and would consist of enhancement or restoration of scrub habitat present on KSC. Impacts to the KSC scrub-jay population are expected to be minimal after mitigation.

Operation – Impacts to protected species from expanded uses at the SLF fall into either 1) collisions with aircraft, discussed in Section 4.2.3.2; and 2) responses to noise, discussed in Section 4.2.7. None of these species (Table 3-1, Table 4-4) occur in great numbers (Larson et al. 1997) or have been documented as being involved in strike incidents at the SLF. The bald eagle poses a potential strike risk even though its preferred nesting or feeding habitats do not occur in the SLF area. However, eagles fly great distances across the landscape, and each year, KSC has 10-14 active nests between October and March. In surveys done at the SLF (Larson et al. 1997), bald eagles were rarely observed, and they have never been involved in an aircraft collision. With the WHMP plan in place, impacts are expected to be minimal.

Impacts to protected species from noise associated with operations are also expected to be minimal. No wading bird colonies or eagles' nests are located in the near vicinity of the SLF (Figure 3-1 and 3-2, respectively). Data on the acute or long-term effects of noise on wildlife species in natural habitats are scarce, but the noise models and testing that have been done indicate that the levels are safe for humans (Section 4.2.7). No adverse effects on wildlife from current operations at the SLF have been noted.

4.2.5 Cultural Resources

Construction – Construction of the proposed facilities under the Proposed Action or Alternative 1 would not impact any of the existing facilities at the SLF Historic District. While these additional facilities will change the overall configuration of the SLF area, they will be in concert with the basic look and feel of the SLF, and they will be enhancing the basic functionality that already exists.

Operation - The activities proposed for future uses of the SLF would not directly impact the integrity of the SLF Historic District or the individual properties within it, namely the Runway, the LACB, or the MDD. The Runway and the LACB would be maintained specifically to support some of the expanded use activities. The MDD is not currently identified as being needed for any of the proposed future uses of the SLF area, but this could potentially change if requirements were identified later. All three of these facilities would remain in place following the end of the Space Shuttle Program.

It is not expected that the continued operation for expanded uses of the SLF runway and associated facilities will have any impact on the integrity of the SLF Historic District or the properties within it. The proposed additions to the area would be similar in nature to that of any airfield. As none of the specific properties would be directly affected, it has been determined that these proposed modifications would not have an Adverse Effect on the SLF proposed Historic District or its individual properties. Final determination will await review by the Florida State Historic Preservation Office (SHPO).

4.2.6 Geology and Soils

Construction - Any potential impact to the geology and soils of the Proposed Action and Alternative 1 would be due to site preparation activities. The SLF is not a Solid Waste Management Unit (SWMU). Land clearing and excavation for facility foundations and storm water systems would require that the upper layers of the soil strata be removed. This alteration of the site may affect the flow patterns of surface runoff from rainfall events, but would be mitigated for with the site grading and construction of a suitable storm water system to contain and treat runoff.

Operation - None of the activities within the three action alternatives would produce impacts to the geologic strata or soils of the local area or region.

4.2.7 Noise

Construction - Ambient noise levels would likely increase during construction of the Proposed Action and Alternative 1 facilities, but are expected to be below the EPA's recommended upper level noise threshold of 70 dBA, for a 24-hour timeframe. There are no wading bird colonies (Figure 3-1) or eagle nests (Figure 3-2) in close proximity to the areas where construction would occur. The potential noise impacts from construction would be considered minor. No noise impacts are expected from Alternative 2.

Operation – The Federal Aviation Administration (FAA) Integrated Noise Model (INM) was applied to several different types of commercial aircraft that could potentially use the SLF under the Proposed Action and Alternative 1. The INM has been the standard FAA methodology since 1978 and is used extensively world wide. The INM incorporates aircraft spectral class (sound production) data and Noise-Power-Distance (NPD) data with adjustment for atmospheric absorption to compute metrics of sound intensity. The noise models for the Boeing 727-100, Boeing 747-100 (the Space Shuttle ferry aircraft), and the Lockheed L-1011-1 suggest that noise levels quantified as causing discomfort or damage to human ears occurred only upon departure and in the immediate vicinity of the SLF runway. Sound levels between 60 and 90 decibels would be perceptible along the flight path, but these are well below dangerous thresholds and the impacts would be considered minor. The complete noise modeling report is Appendix 4. Noise modeling for the large, heavy commercial aircraft, including the shuttle ferry, should approximate noise levels produced by the vehicles that would be used for Concepts X and Z.

Analogous models for military aircraft could not be run because the necessary data are not available to the public. However, noise testing using dosimeters during F-104 take offs and departures were done in April 2007. Although the weather conditions were not suitable to produce a "worst case scenario" for this aircraft, the noise levels measured at various points of interest (e.g., Black Point Wildlife Drive) were well within safe levels for humans. The complete report is in Appendix 5.

Noise impacts are not expected to occur to terrestrial wildlife from the rocket launches that would take place at altitudes greater than 10.7 km (35,000 ft). altitude 24 km (15 mi.) east of the coastline. Data for the impacts on aquatic marine species from launches and sonic booms at such altitudes over the ocean are not available.

The only available off-the-shelf model available to assess noise levels generated by ground vehicles (e.g., cars) is the Federal Highway Administration (FHWA) Traffic Noise Model (TNM). The Volpe National Transportation Systems Center, developers of TNM, states that the model's noise source data includes speeds up to 80 mph; therefore, TNM assessment of noise generated by racecars well in excess of 100 mph is not valid. Noise measurements using dosimeters were taken during field testing by Andretti-Green race cars in May 2007. Six sample locations were used (Figure 4-3) and one additional dosimeter was placed at the mid-field site to record baseline data from the racecars during the tests. None of the noise levels recorded from the racecar testing at any of the locations exceeded background noise levels. At some locations, disturbances at the site, such as mowers, vehicle traffic, an airboat, and birds, produced levels that were much greater than those of the racecars. The complete noise report is provided in Appendix 6, and hard copies of the data are available upon request.

4.2.8 Surface Water Quality

Construction - The construction of the facilities for the Proposed Action and Alternative 1 would have minimal effects on surface water quality. A surface water management system would be built to treat increased runoff caused by new impervious area. During actual construction activities, impacts to surface waters from erosion and sedimentation would be controlled by using Best Management Practices (BMPs).

Operation - The operation of the SLF for the Proposed Action, Alternative 1, and Alternative 2 would have minimal impacts on the surface water quality. The new storm water management systems at the south-field and mid-field sites would be capable of treating all storm water runoff. The current SLF emergency spill plan for fuels is sufficient to address potential problems associated with expanded uses.

4.2.9 Groundwater Quality

Construction - The groundwater quality at the south-field and mid-field sites is affected by runoff that percolates into the surficial aquifer from roadways and existing facilities. Construction for the Proposed Action and Alternative 1 could temporarily increase the amounts of sedimentation and pollutants that could migrate into the groundwater system. However, employing BMPs and the existence of the stormwater management system would reduce or eliminate this impact to groundwater quality.

Operation – Expanded uses of the SLF as described in the Proposed Action, Alternative 1, and Alternative 2 would have minimal impact to the groundwater quality. Impacts from surface water degradation would be absorbed by the surface water management systems that would be constructed, preventing transfer of pollutants into the groundwater.

4.2.10 Socioeconomics

Construction - A total of 100-150 construction workers are expected to be required for the construction phase of the Proposed Action. These would be drawn from the local workforce with an anticipated positive impact to the area's economy. Given the large numbers of construction workers already employed at KSC, this impact to socioeconomics and the local workforce would likely be minimal. Expansion of the south-field only (Alternative 1) would not contribute a significant addition to the KSC labor force and subsequently not affect local socioeconomics.

Operation - During their operational phase, each of the action alternatives is anticipated to have an impact on socioeconomics. Currently, the SLF is not being used at its full capacity level. With the anticipated end of the Space Shuttle Program in 2010, SLF utilization will be reduced to nominal levels. The three action alternatives are anticipated to generate increased economic activity associated with the various proposed uses at the SLF. Under the Proposed Action, 100 full-time employees would be added between 2008 – 2011, with another 75 employees being added by 2015. Many of labor categories would require advanced degrees and/or training, including pilots, test engineers, software engineers, aeronautical engineers, mechanical engineers, and safety and quality assurance personnel. Additional staff would be comprised of technicians, ground operations personnel, facility personnel, and maintenance workers. The Chief Financial Office at KSC generates annual reports which highlight the economic impacts of KSC locally and state-wide. According to a recent report, average spendable earnings of each KSC worker was estimated at $69,000, almost double the rate for other residents of Brevard County (NASA 2005). Each job at KSC has been calculated to generate more than 2.5 jobs state-wide (NASA 2005), and non-labor purchases by KSC totaled $720 million in fiscal year 2005 (NASA 2005). The results of these economic reports show that in addition to the technical and social benefits derived from the KSC's activities, the economic benefits expand across the state. The total economic impact of the proposed SLF activities could be in the millions of dollars, and would rise with each successive year of increased activity.

The MINWR hosts over 500,000 visitors annually that come to enjoy its natural beauty, habitats, and wildlife. Approximately 600,000 people visit Playalinda Beach. There is potential that some of the expanded uses envisioned for the SLF could conflict with the expectations of those visitors. For example, even though the noise levels anticipated from racecar testing would less impactful than many of the day-to-day activities and conditions experienced on the Refuge and beach, they might be difficult for some visitors to accept as part of KSC operations. This situation could be lessened by good communication between KSC, MINWR, and CNS, including forewarning of upcoming activities that could affect the visitor experience.

4.2.11 Land Use

Construction - A relatively small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. Of the 56,451 ha (131,990 ac.) of total KSC area, 5.4% percent is designated as KSC operational area. The approximately 14.8 ha (36.5 ac.) of land that would be developed under the Proposed Action would represent less than 0.03 % of the total area of KSC; this would be considered a minor impact. Under Alternative 1, only the south-field expansion would occur, constituting a 6.1 ha (15.1 ac.) land use change.
The expansion locations in the Proposed Action and Alternative 1 are adjacent to areas that have already been developed. Such consolidation of facilities minimizes the impacts of additional infrastructure such as power lines, sewage systems, and roads. Both sites can be accessed by existing roads (Sharkey Road and Astronaut Road).

Operation - The operation of the SLF under any of the action alternatives would have minimal impacts to the existing land use. The land use would be consistent with surrounding industrial uses of the SLF facility and KSC in general.

4.3 Cumulative Impacts

4.3.1 No Action Alternative

If no action is taken, minimal cumulative impacts are anticipated for the local economy in light of the current workforce level and economic activity at the SLF. Difficult to project is the potential impact of lost opportunities in sustaining the SLF as a viable spaceport/airfield capability serving a diversified base of users. Continued NASA use of the facility after the retirement of the Space Shuttle is contingent upon the capacity to offset operational costs to NASA by accommodating commercial users. At some utilization level, should NASA be the sole user, the cost of sustaining the SLF may be prohibitive, potentially resulting in its closure as an active facility.

Unused, this historic and valuable asset would deteriorate in an abandoned state. The potential cumulative impacts of positive contributions to the KSC and local economy include diversified employment base and the incidental economic benefits associated with transient and permanently based commercial activities. Besides those occurring related to socioeconomics, no other cumulative impacts are expected from the No Action alternative.

4.3.2 Proposed Action Alternative and Alternative 1

The only anticipated cumulative impact from the Proposed Action and Alternative 1 is related to development of the land. The alteration of pervious to non-pervious surface and the loss of habitat constitute a land use change. However, the acreage of these alternatives is small 14.8 ha (36.5 ac.) as compared to the total amount of undeveloped habitat on KSC 53,416 ha (131,990 ac.). In addition, the expansion is immediately adjacent to an already developed, disturbed area and most of it would occur in habitat types that are common on KSC.

4.3.3 Alternative 2

Because there would be no land clearing and new development associated with Alternative 2, no cumulative impacts would be expected.

Table 4-1. Resources/Issues Matrix for the proposed expanded use of the SLF.

Resource/Issue		Proposed Action[a]	Alternative 1[b]	Alternative 2[c]	No Action[d]
Transportation	C*	minimal	minimal	none	na*
	O*	minimal	minimal	minimal	none
Utilities	C	minimal	minimal	none	na
	O	minimal	minimal	none	none
Air Quality	C	minimal	minimal	none	na
	O	minimal	minimal	minimal	none
Biological Resources *Habitats & Vegetation*	C	minor#	minor#	none	na
	O	minimal	minimal	minimal	none
Biological Resources *Wildlife*	C O	minimal minimal#	minimal minimal#	none minimal#	na none
Threatened and Endangered Species	C	minimal#	minimal#	none	na
	O	minimal#	minimal#	minimal#	none
Cultural Resources	C	minimal	minimal	none	na
	O	none	none	none	none
Geology and Soils	C	minimal	minimal	minimal	na
	O	none	none	none	none
Noise	C	minor	minor	none	na
	O	minor	minor	minor	none
Surface Water Quality	C	minor	minor	none	na
	O	minimal	minimal	minimal	none
Ground Water Quality	C	minimal	minimal	none	na
	O	minimal	minimal	minimal	none
Socioeconomics	C	minimal	minimal	none	na
	O	minor	minor	minor	minimal
Land Use	C	minor	minor	none	na
	O	minimal	minimal	minimal	none

[a] facilities expansion at south-field and mid-field sites, including fuel farm; greatest capacity for additional activities
[b] facilities expansion at south-field site only, including fuel farm; less capacity for additional activities than the Proposed Action alternative
[c] no facilities expansion; less capacity for additional activities than the Proposed Action or Alternative 1
[d] no expansion of facilities or activities
* C = impacts from construction
* O = impacts from operations
* na = not applicable
# = impact levels could be higher, but existing mitigation plans would reduce them to lower levels

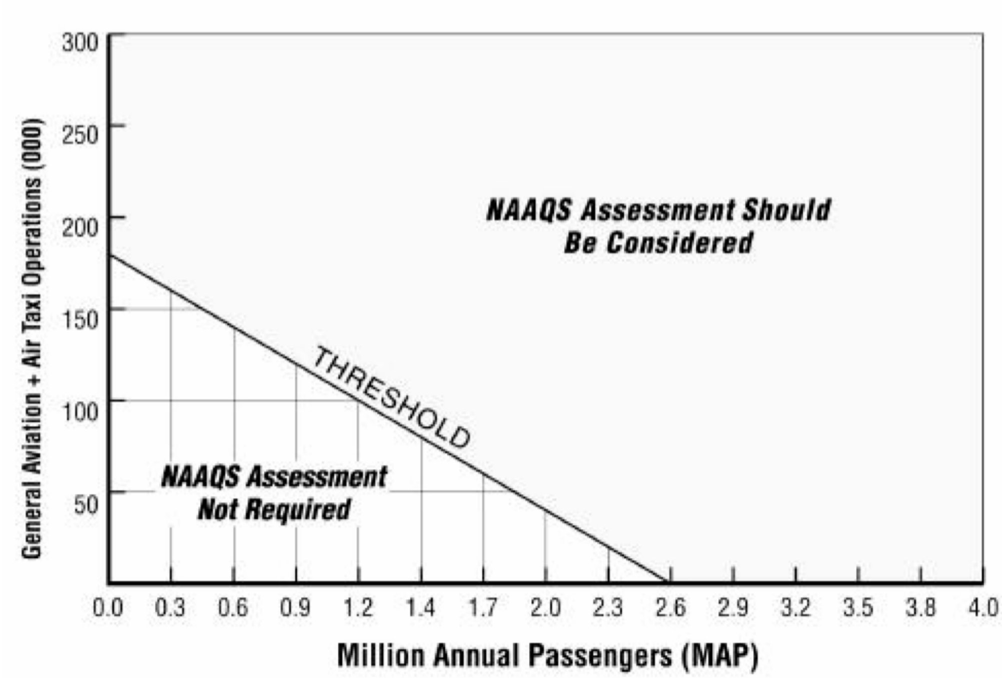

Figure 4.1: FAA Airport NAAQS assessment criteria.

Table 4-2. Habitat types (ha/ac) affected by the Proposed Action Alternatives. The Proposed Action would develop both the south-field and mid-field sites. Alternative 1 would develop the south-field site only.

Habitat Type	Total (Proposed Action)	South-field Site (Alternative 1)	Mid-field Site
Ruderal / Herbaceous	5.7 / 14.2	2.3 / 5.6	3.5 / 8.6
Hardwood Hammock	3.5 / 8.8	2.4 / 5.9	1.2 / 2.9
Wetland Scrub/Shrub	2.5 / 6.2	0.3 / 0.6	1.1 / 2.7
Developed	0.7 / 1.6	0.3 / 0.6	0.4 / 1.0
Australian Pine	0.6 / 1.5	0.6 / 1.5	-
Water	0.4 / 1.1	0.3 / 0.8	0.1 / 0.3
Oak Scrub	0.3 / 0.7	-	0.3 / 0.7
Palmetto Scrub	2.1 / 5.1	-	2.1 / 5.1
Ditch	0.05 / 0.1	0.03 / 0.08	0.02 / 0.05
Area for Stormwater Retention	0.8 / 2.0	0.4 / 1.0	0.4 / 1.0
Total	**15.5 / 38.4**	**6.5 / 16.0**	**9.1 / 22.4**
Total Uplands	**13.7/33.8**	**6. 6/15.5**	**7.4/18.3**
Total Wetlands	**1.3/3.3**	**0.3/0.6**	**1.1/2.7**

Table 4-3. Protected wildlife species potentially occurring in the habitats impacted by the Proposed Action and Alternatives 1 and 2 at the SLF.

SCIENTIFIC NAME	COMMON NAME	LEVEL OF PROTECTION	
Amphibians and Reptiles		STATE	FEDERAL
Alligator mississippiensis	American alligator	SSC	T(S/A)
Gopherus polyphemus	Gopher tortoise	SSC	-
Drymarchon couperi	Eastern indigo snake	T	T
Birds			
Egretta thula	Snowy egret	SSC	-
Egretta caerulea	Little blue heron	SSC	-
Egretta tricolor	Tricolored heron	SSC	-
Eudocimus albus	White ibis	SSC	-
Ajaia ajaja	Roseate spoonbill	SSC	-
Mycteria americana	Wood stork	E	E
Aphelocoma coerulescens	Florida scrub-jay	T	T
Key: E = endangered, SSC = species of special concern, T = threatened, T(S/A) = threatened due to similarity of appearance			

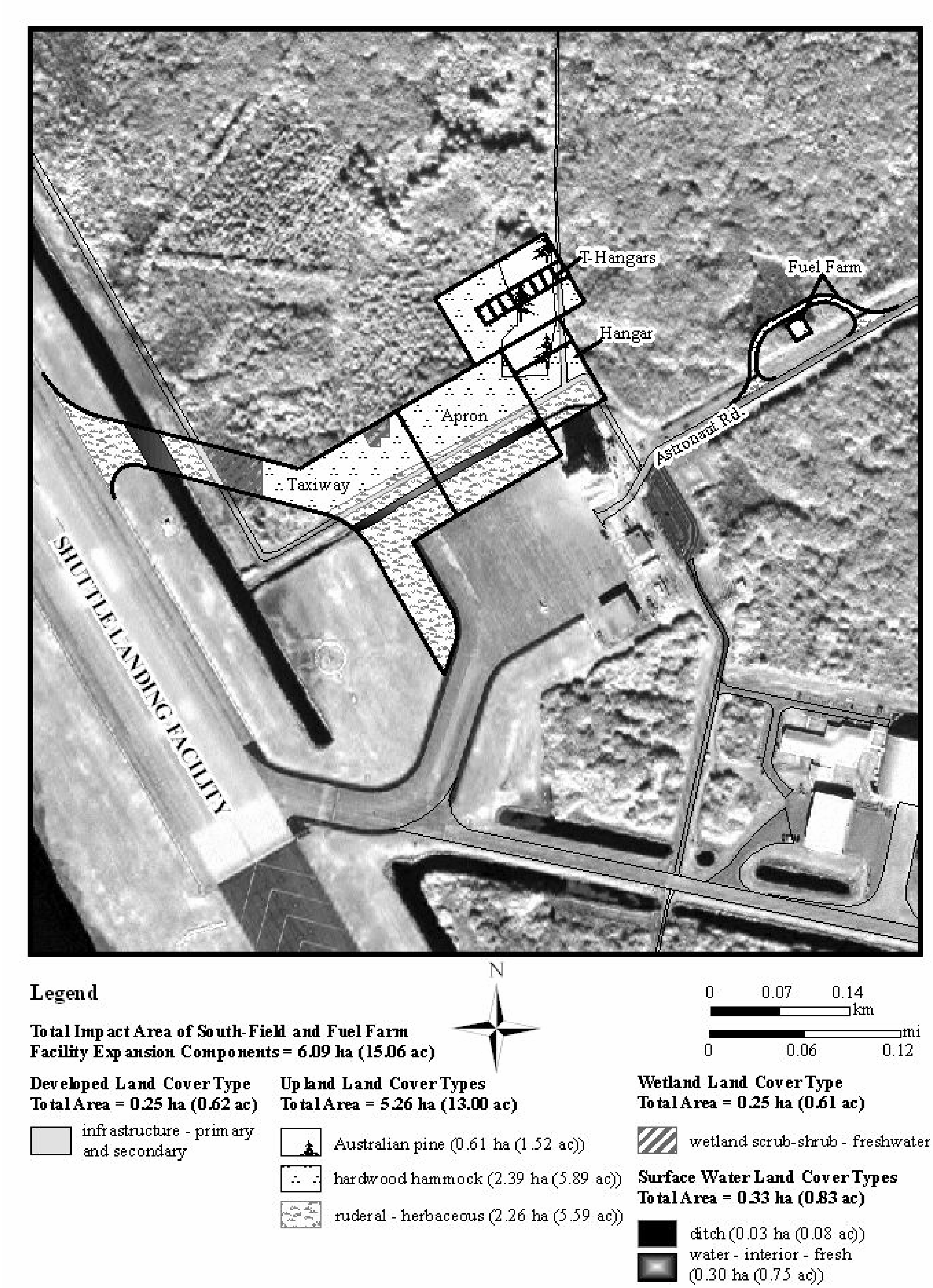

Figure 4-2A. Habitat types potentially impacted by construction of facilities at the south-field site for the SLF expanded uses, Kennedy Space Center, Florida.

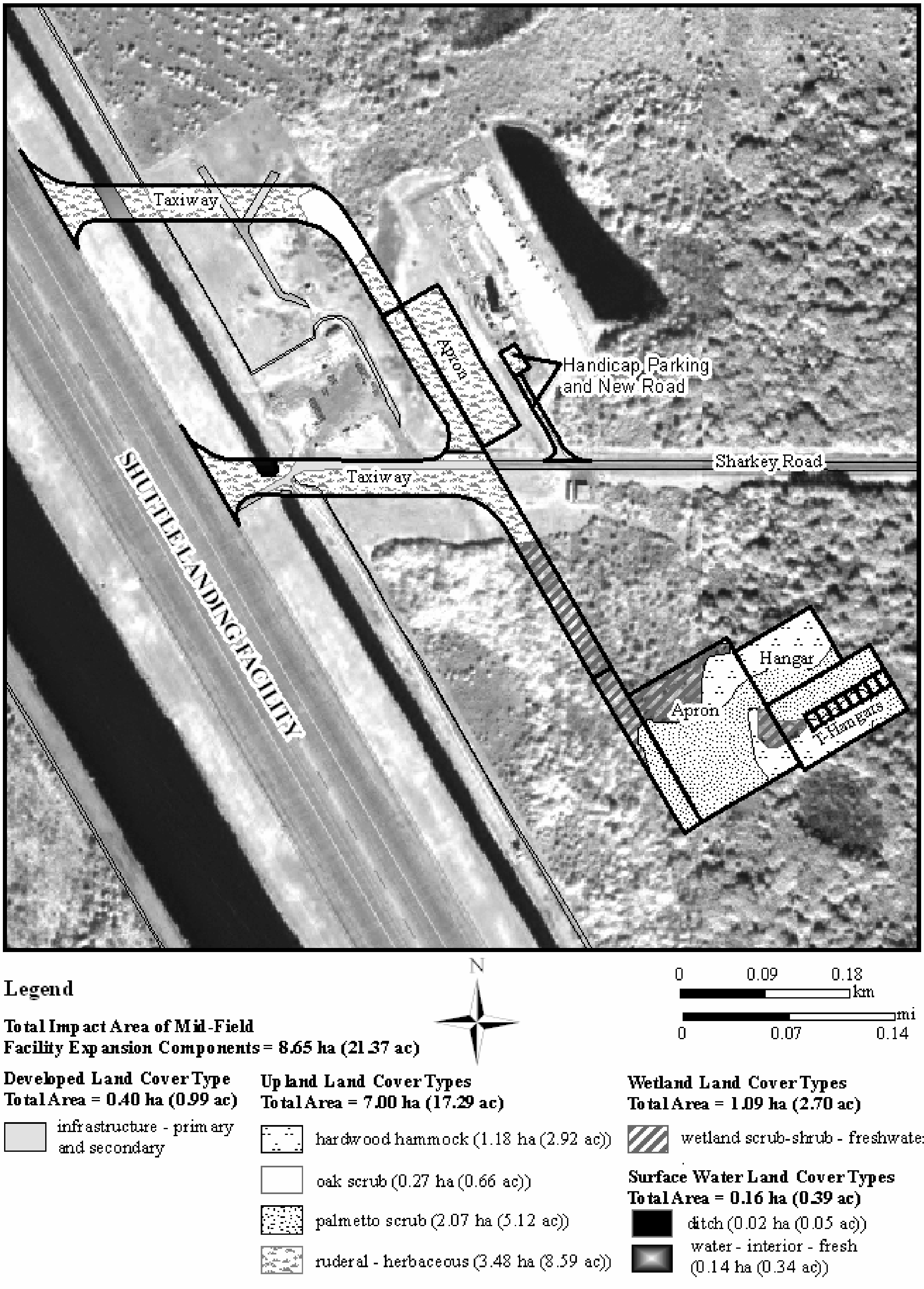

Figure 4-2B. Habitat types potentially impacted by construction of facilities at the mid-field site for the SLF expanded uses, Kennedy Space Center, Florida.

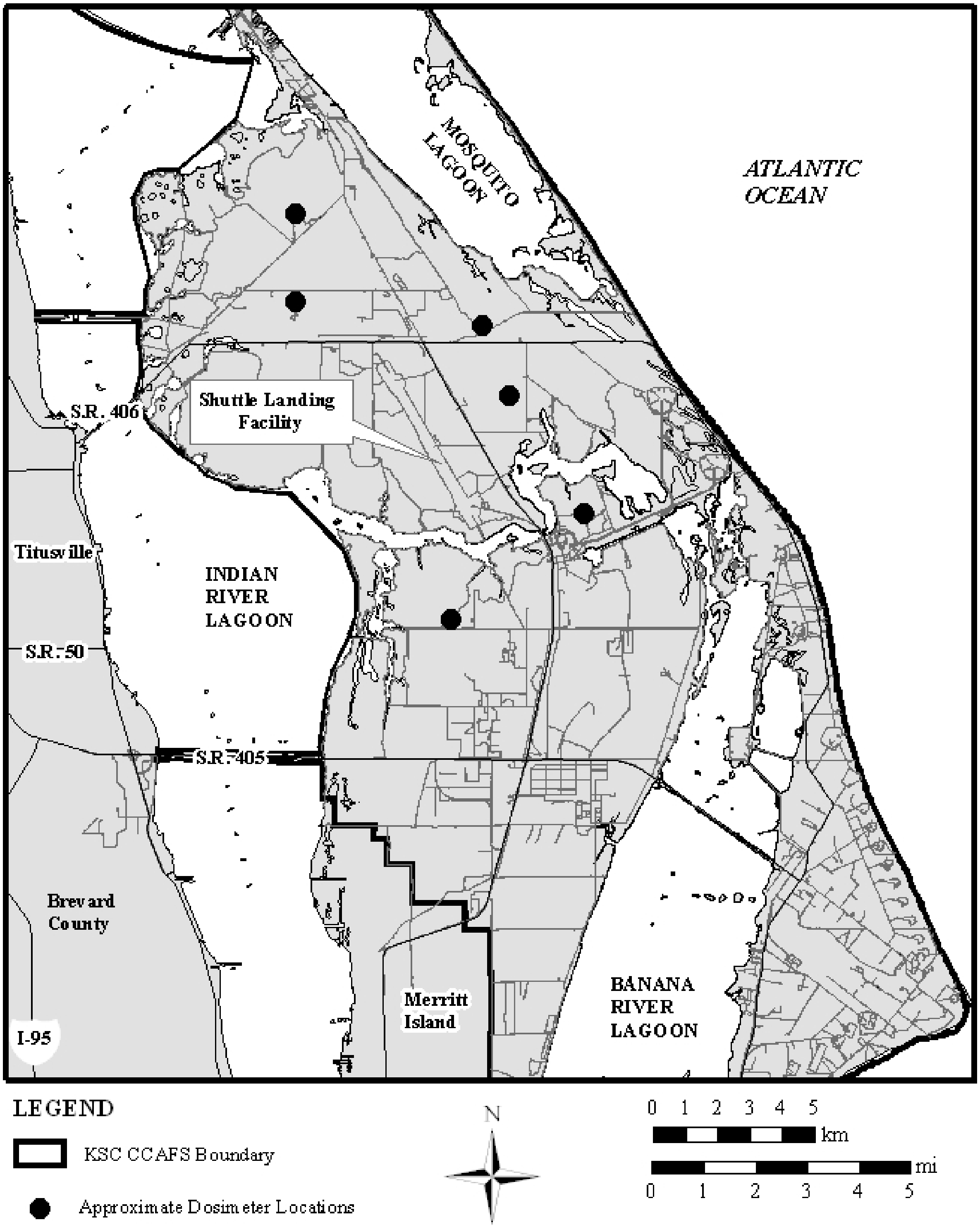

Figure 4-3. Dosimeter locations for Andretti-Green racecar testing.

5.0 Environmental Justice

On February 11, 1994, the President of the U.S. signed Executive Order (EO) 12898, entitled, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.” The general purposes of the EO are to: 1) focus the attention of Federal Agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental justice; 2) foster non-discrimination in Federal programs that substantially affect human health or the environment; and 3) give minority and low income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment. The EO directs federal agencies, including NASA, to develop environmental justice strategies. Further, EO 12898 requires NASA, to the greatest extent practicable and permitted by law, to make the achievement of environmental justice part of NASA’s mission. Disproportionately high adverse human health or environmental effects on minority or low-income populations must be identified and addressed. In response, NASA established an agency-wide strategy, which, in addition to the requirements set forth in the EO, seeks to: 1) minimize administrative burdens; 2) focus on public outreach and involvement; 3) encourage implementation plans tailored to the specific situation at each Space Center; 4) make each Center responsible for developing its own Environmental Justice Plan; and, 5) consider both normal operations and accidents. KSC has developed a plan to comply with the EO and NASA’s agency-wide strategy.

None of the alternatives described in this EA (Proposed Action, Alternative 1, Alternative 2, or No Action) would be expected to produce any consequences related to Environmental Justice. The proposed activities would be implemented within the boundaries of KSC. The closest residential areas are 13 km (9.5 mi.) south on Merritt Island, and 12 km (7.6 mi.) west in Titusville; the distances of these areas from the activity sites preclude any direct impacts from construction. Operational impacts, specifically noise, are expected to be negligible in the residential areas based on data models and surveys. Economic impacts are not expected to adversely affect any particular group. Construction personnel would be drawn from the local workforce and provide economic benefits to the local area. A permanent workforce of 100 by 2011 and potentially 175 by 2015 would also benefit the local economy.

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Appendices

Appendix 1. Categorical Exclusion Documentation for Zero Gravity Use of the SLF.

Avoid Verbal Orders

TO: TA-D1/Environmental Coordinator **DATE:** 2/24/2006
FROM: TA-C3/Lead, NEPA Compliance
SUBJECT: KSC Record of Environmental Consideration (REC)

1. PROJECT INFORMATION

Project Title: Zero Gravity Use of SLF
Project Lead: James Ball, TA-E4, 7-2998 **Directorate Project No.:** KCA#4081 SPACE ACT
EPO Reviewer: FXK **Environmental (ENV) No.:** N/A

2. NEPA DETERMINATIONS

☑ **a. Categorical Exclusion per 14 CFR Part 1216.305(d)**
☐ **b. Environmental Assessment (EA) Required per KHB 8800.6**
☐ **c. Environmental Impact Statement (EIS) Required per KHB 8800.6**
☐ **d. Project on CCAFS:**

3. ENVIRONMENTAL REQUIREMENTS

a. Non-Permit Requirements	☑ **YES**	☐ **NO**
b. Permit Requirements	☐ **YES**	☑ **NO**

3.a.1. HAZARDOUS/NON-HAZARDOUS WASTE: Currently, all hazardous waste and non-hazardous wastes generated on KSC must be managed, controlled and disposed of per the KSC Waste Management requirements outlined in the KNPR 8500.1. In case of an accidental release, it is understood that Zero Gravity will follow KSC policies while operating on KSC and disposal of deminimus spill residue will be handled by the current base operations contractor. The KSC non-spill generated waste may be disposed following KSC policy. A Process Waste Questionnaire (PWQ – KSC form 26-551) along with any supporting documentation (MSDS, product formulation) must be submitted to the JBOSC/CHS Waste Management Office for each waste stream generated. That Office will then generate a Technical Response Package (TRP) which will give you directions on proper handling, storage, and disposal of your waste stream. Please contact JBOSC/CHS Waste Management Services at 867-8840 if assistance is required. No hazardous waste is to taken offsite by unauthorized personnel or contractors.

No other environmental issues were identified based upon the information provided in the KSC Checklist. This Record of Environmental Consideration (REC) does not relinquish the project lead from obtaining and complying with any other internal NASA permits or directives necessary to ensure all organizations potentially impacted by this project are notified and concur with the proposed project.

Due to potential changes in regulations, permit requirements and environmental conditions, statements in this REC are valid for 6 months, and subject to review after this period. The Environmental Program Branch (EPB) will be reviewing open projects twice a year for possible impacts from changes in contaminated sites. If impacts are foreseen, EPB will notify the project lead with a new REC. It is the responsibility of the project lead to notify EPB if the scope of the project (including the design) has changed since the original checklist was submitted.

CC: J. Ball/TA-E4

4 Upon evaluation of the subject project, the above determinations have been made and identified. Contact the Environmental Program Office (TA-C3) at 867-8456 for re-evaluation should there be any modifications to the scope of work.

______________________________ ______________
Date

Appendix 2. KSC Land Cover Types and Areas.

Cover Type	KSC+MINWR Area (ha/ac.)
Infrastructure - primary	533.5 / 1,318.2
Infrastructure - secondary	202.3 / 499.9
Estuary	12,157.0 / 30,040.7
Water - interior - salt	2,559.4 / 6,324.4
Water - interior - fresh	359.2 / 887.5
Barren land - may be inundated	75.6 / 186.9
Beach	26.1 / 64.6
Ditch	126.6 / 312.9
Marsh - saltwater	3,880.0 / 9,587.7
Marsh - freshwater	2,247.5 / 5,553.7
Mangrove	518.2 / 1,280.5
Wetland scrub-shrub - saltwater	636.3 / 1,572.4
Wetland scrub-shrub - freshwater	1,944.6 / 4,805.3
Wetland coniferous / hardwood forest	611.6 / 1,511.2
Wetland hardwood forest	406.2 / 1,003.9
Ruderal - herbaceous	1,382.6 / 3,416.5
Citrus	705.5 / 1,743.3
Ruderal - woody	461.5 / 1,140.3
Australian pine	32.6 / 80.5
Coastal strand	135.8 / 335.5
Oak scrub	4,990.2 / 12,331.2
Palmetto scrub	1,101.4 / 2,721.5
Pine flatwoods	920.0 / 2,273.5
Upland coniferous forest	72.7 / 179.6
Modified from Schaub 2005	

Appendix 3. Noise levels (in decibels, A-weighted) measured on KSC, Florida.

		DISTANCE FROM SOURCE [a]			
SOURCE	NOISE LEVEL (Peak)	15 m (50 ft.)	30 m (100 ft.)	60 m (200 ft.)	120 m (400 ft.)
Construction					
Heavy Trucks	95	84-89	78-83	72-77	66-71
Pickup Trucks	92	72	66	60	54
Dump Trucks	108	88	82	76	70
Concrete Mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Paver	109	80-89	74-83	68-77	60-71
Generator	96	76	70	64	58
Shovel	111	91	85	79	73
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Caterpillar	103	88	82	76	70
Dragline	105	85	79	73	67
Shovel	110	91-107	85-101	79-95	73-95
Dredging	89	79	73	66	77
Pile Driver	105	95	89	83	77
Ditcher	104	99	93	87	81
Fork Lift	100	95	89	83	77
Vehicles					
Diesel Train	98	80-88	74-82	68-76	62-70
Mack Truck	91	84	78	72	66
Bus	97	82	76	70	54
Compact Auto	90	75-80	69-74	63-68	57-62
Passenger Auto	85	69-76	63-70	57-64	51-68
Motorcycle	110	82	76	70	64
[a] Assume 6 dBA decrease for every doubling of distance. Modified from Suter 2002					

Appendix 4. Shuttle Landing Facility-Environmental Assessment, Noise Modeling.

Shuttle Landing Facility - Environmental Assessment
Noise Modeling
May 10, 2007

Submitted to
NASA Environmental Program Office
POC: Mario Busacca

Submitted by
Dynamac Corporation
POCs: Ron Schaub
Rebecca Bolt

Future operations at the Kennedy Space Center (KSC) Shuttle Landing Facility (SLF) include use of existing commercial and military aircraft and aircraft still in design in support of space program operations, and testing of ground vehicles by the National Association for Stock Car Auto Racing (NASCAR) and others. Noise produced by these operations may be beyond what is currently experienced in this area of KSC and is of concern to the National Aeronautics and Space Administration (NASA), the U.S. Fish and Wildlife (USFWS), and the National Park Service (NPS) who share administration of local lands.

Herein an A-weighted decibel metric (dBA), which approximates the human ear, will be applied to assess noise impacts. Examples of human sound experience are in Table 1 for comparison with modeled sound levels.

Table 1. Sound pressure levels in decibels and examples of human experience.

Decibels	Example
120	discomfort, damage
110	chainsaw @ 1m
100	jack hammer @ 1m
90	diesel truck @ 10m
80	heavy car traffic @ 5m
70	vacuum cleaner @ 1m
60	conversational speech

Aircraft

Dynamac has applied the Federal Aviation Administration (FAA) Integrated Noise Model (INM) 6.2a for this analysis to assess the extent of sound produced by candidate aircraft identified in Table 2.

Table 2. Examples of candidate aircraft for use at SLF. Specifications from INM 6.2a.

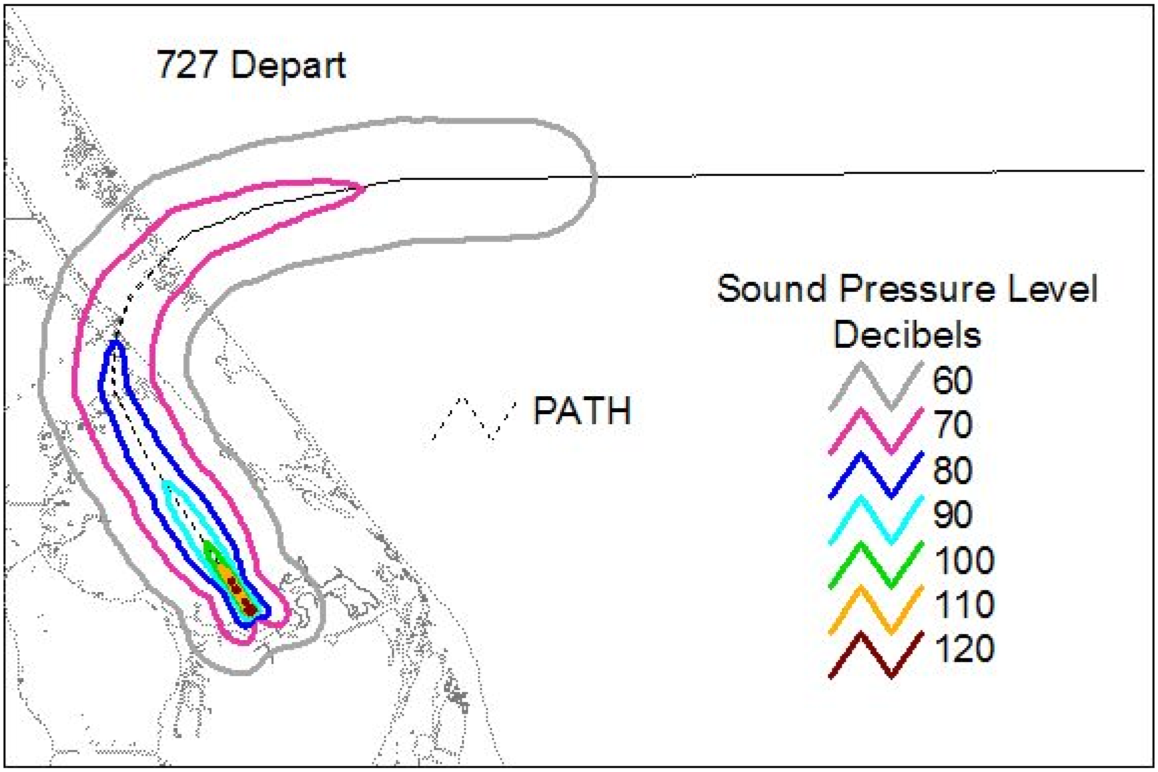
Aircraft	Sector	Engines Number, Type	Weight Class	Takeoff Max Weight Lbs
Northrop Talon T-38A	military	2, jet	Small	12,093
Lockheed F-104 Starfighter	military	1, jet	Large	28,779
Boeing 727-100	commercial	3, jet	Large	169,500
Lockheed L-1011-1	commercial	3, jet	Heavy	430,000
Boeing 747-100*	commercial	4, jet	Heavy	733,000
Lockheed C-5A	military	4, jet	Heavy	769,000

*shuttle ferry

The INM has been the standard FAA methodology since 1978 and is used extensively world wide. The INM incorporates aircraft spectral class (sound production) data and Noise-Power-Distance (NPD) data with adjustment for atmospheric absorption to compute metrics of sound intensity.

The INM has built-in flight 'Procedural Profiles' for commercial but not military aircraft. Procedures for commercial aircraft are those that would be used at a civilian or commercial facility. Additional data input is required to construct INM 'Procedural Profiles' for military aircraft (e.g.: T-38s, F-104s, C-5s). If the commercial aircraft (e.g.: 727s, 747s, L1011s) alter from standard procedures, additional data input would be required to modify the INM Procedural Profiles for those vehicles. INM Procedural Profiles consist of flap and thrust coefficients that may differ during each step of the departure or approach sequence.

For this assessment, Flight Procedural Profiles are set to INM default values using standard depart and approach scenarios. Meteorological conditions are kept constant at temperature = 59 F, pressure = 29.92 in-Hg., and headwind = 8 kt. Figures 1, 2, and 3 display the maximum A-weighted (dBA) sound level (LAMAX) contours generated by INM 6.2a with system defaults for Procedural Profiles.



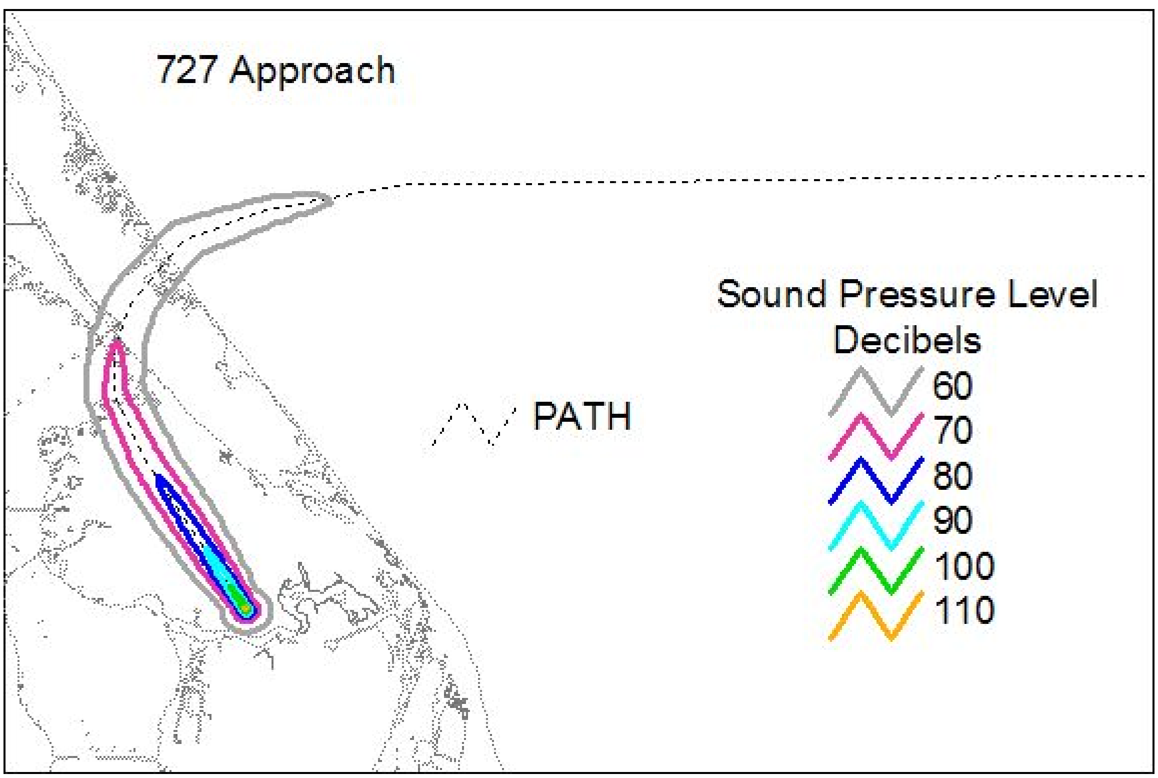


Figure 1. Boeing 727-100 maximum A-weighted (dBA) sound level (LAMAX) contours generated by INM 6.2a with system defaults for Procedural Profiles.

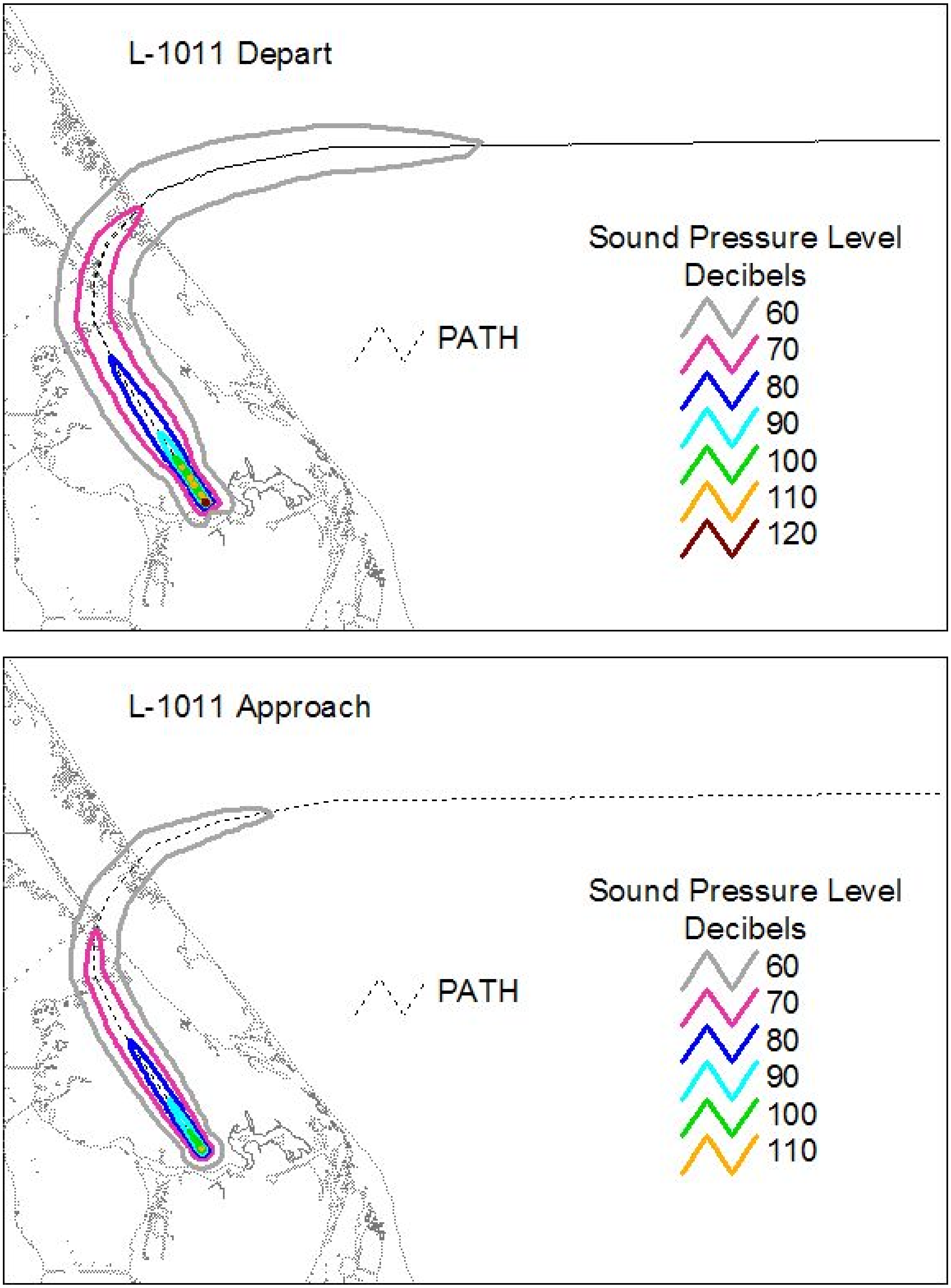
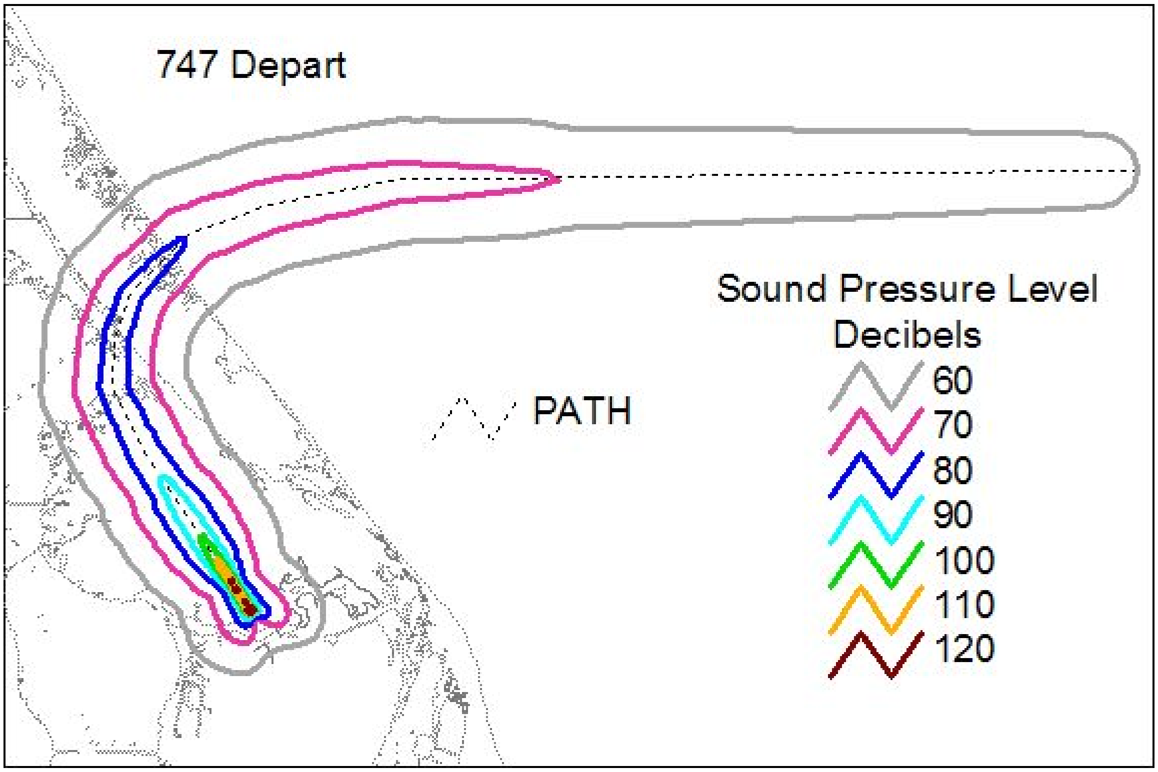


Figure 2. Lockheed L-1011-1 maximum A-weighted (dBA) sound level (LAMAX) contours generated by INM 6.2a with system defaults for Procedural Profiles.



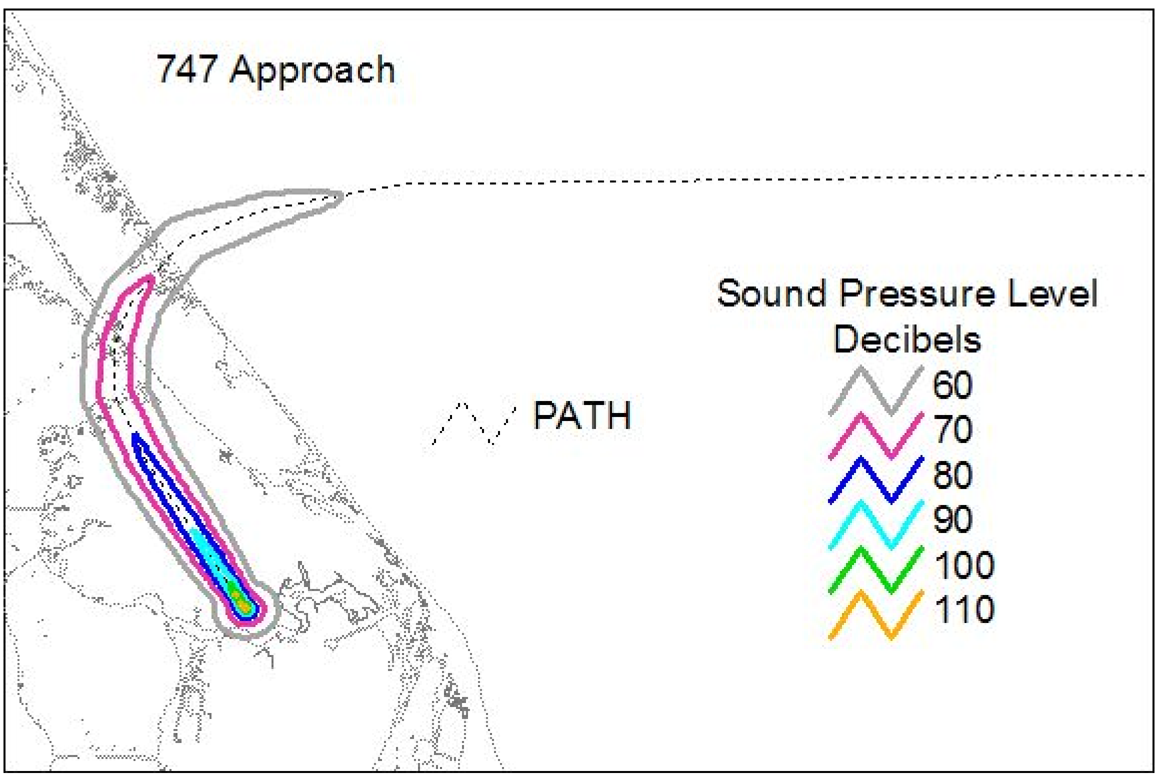


Figure 3. Boeing 747-100 maximum A-weighted (dBA) sound level (LAMAX) contours generated by INM 6.2a with system defaults for Procedural Profiles.

<u>Ground Vehicles</u>

Currently, the only off-the-shelf model available to assess noise levels generated by ground vehicles (e.g., cars) is the Federal Highway Administration (FHWA) Traffic Noise Model (TNM). The Volpe National Transportation Systems Center, developers of TNM, states that TNM's noise source data include speeds only up to 80 mph. Therefore, TNM assessment of noise generated by racecars traveling well in excess of 100 mph is not valid. To date, neither NASCAR nor Andretti Green Racing has provided any sources of racecar noise modeling.

Appendix 5. Environmental Noise Assessment, F104 Flight Test at Kennedy Space Center, Florida

Comprehensive Health Services
INCORPORATED

May 1, 2007 T200704-2000

Ms. M. Rebecca Bolt, DYN-5
The Dynamac Corporation
Kennedy Space Center, Florida 32899

RE: Environmental Noise Assessment - F104 Flight Test at Kennedy Space Center

The CHS Industrial Hygiene office has completed the field assessment and data evaluation for the F104 test flight conducted on April 17, 2007. The objective was to monitor sound levels at six specific locations to assist in evaluating the impact of nearby sonic flight originating from flights from the shuttle landing facility at Kennedy Space Center, Florida.

Two test flights were monitored with both data logging noise dosimeters and at one location, with sound level meter. Weather data was also obtained for each flight time. Winds were from the west in the morning with afternoon winds from the north. No sonic boom was observed at any of the manned sampling locations. Sound level data indicated that at the time the aircraft went sonic, sound levels remained below 70 dBA. Real-time monitoring throughout the flight resulted in a common range of 45 dBA to 65 dBA. A report of these findings is attached. Appended to the report are dosimeter printouts of the times relevant to the two flights.

Should another flight test be desired, we suggest trying to schedule it during less favorable wind conditions or closer to worst case conditions.

Please feel free to contact us with any questions regarding this report and assessment.

Best regard,

Gary I. Bergstrom
Industrial Hygiene Office

Attachment:
Environmental Noise Assessment - F104 Flight Test – 4/17/07

cc: Kimberly Manguikian, TA-C3
Mike Cardinale, TA-C2

Environmental Noise Assessment of the F104 Flight Test at Kennedy Space Center, Florida
April 17, 2007
Comprehensive Health Service, Inc. (CHS T200704-2000)

Introduction

Commercial supersonic flights are proposed for an F104 aircraft to take off and land at the shuttle landing facility (SLF) at Kennedy Space Center (KSC), Florida. Two test flights that included supersonic speed were planned for April 17, 2007; the first flight in mid-morning followed by an early afternoon flight. The provided flight path indicated flights extending approximately 32 miles to the east over the Atlantic Ocean with the corner approximately 7 miles north of the shuttle pads. Coastline altitudes were approximately 18,000 to 20,000 feet with a transonic altitude of 40,000 feet. Transonic positions were to be approximately 12 to 15 miles from the coastline (Appendix 2).

Six monitoring stations were selected for measuring sound; the southernmost location was the Firing Range on Swartz Road with the northernmost station at Black Point Wildlife Drive (Appendix 1). Two additional monitoring stations were requested by the Space Business Consultant office at KSC. Data from those locations are not reported here but are available upon request.

Figure 1. **F104 on the SLF runway**.

Methods

Six specified monitoring stations were identified for determining the sound level during the flight with specific interest in the sound from the sonic booms. These stations were identified as Playalinda Beach Site, Black Point Wildlife Dr., Fish & Wildlife Service, Happy Creek, VAB Area, and Firing Range (map, Appendix 1). Of these five locations, Black Point and Playalinda were manned throughout the flight. Representative photographs of Black Point and Happy Creek monitoring stations are shown in Appendix 1. The SLF midfield was manned during the test flights and provided takeoff and landing activity information. Logging noise dosimeters were mounted on tripods at 1.3 meters above grade with microphones at approximately 70 degrees (Fig. 2). Sound level meters were hand held or tripod mounted sound. The dosimeters were intended to provide the primary data source with the sound level meters as secondary monitors.

Figure 2. **Happy Creek monitoring station** with the noise dosimeter mounted on a tripod. All stations used tripods with dosimeters mounted at 1.3 meters above the ground.

Noise dosimeters included two Quest model Q400 data logging instruments and four Quest model Q300. Calibration was performed prior to the assessment, followed by a post-test calibration check to verify conformance. All were set to measure sound pressure level in A-weighted network; and, the Q400 dosimeters had a second internal circuitry set to measure in the C-weighted network. Lower thresholds were set to 40 dB; however, Q400 dosimeters defaulted to the 70 to 140 dB range. Sound pressure level data was recorded with a time constant of 1 minute for the Q300, resulting in 1-minute averages being recorded. The Q400 dosimeters had a shorter time constant capability and they were set to provide 10 second time constant data. Peak values were also measured. Table 1 provides the details of the application and set-up of each dosimeter. All dosimeter clocks were reset using computer time.

Table 1. **Noise Dosimeter Set-up and Calibration Data**
F104 Flight Test, Shuttle Landing Facility
April 17, 2007

Dosimeter Parameters	**Playalinda Beach**	**Black Point**	**FWS HQ**	**Happy Creek**	**VAB Area**	**Firing Range**
Model	Quest, Q400	Quest, Q300	Quest, Q400	Quest, Q300	Quest, Q300	Quest, Q300
Serial Number	QDD080005	QC292	QDD080008	QC7020020	QC9050052	QC7020018
Cal Due Date	5/28/07	8/20/07	5/16/07	10/5/07	8/12/07	9/22/07
Pre-test Calibration	114.0	114.0	114.0	114.0	114.0	114.0
Post-test Cal Check	114.1	114.0	114.0	114.0	114.0	114.0
Windscreen	On	On	On	On	On	On
Exchange Rate	3	3	3	3	3	3
Range	70 - 140	40 – 110	70 – 140	40 – 110	40 – 110	40 – 110
Weighting	A & C	A	A	A	A	A
Time Constant	Fast	Fast	Fast	Fast	Fast	Fast
Logging Interval	10-seconds	1-minute	10-second	1-minute	1-minute	1-minute
Microphone Position	70°	70°	70°	70°	70°	70°
Microphone Height	1.3 meters	1.3 meters	1.3 meters	1.3 meters	1.3 meters	1.3 meters

Footnote:
Calibrators: Quest QC10, QE4020241 cal due 6/12/07; QE7010103 cal due 8/1/07

A Quest model 2200 sound level meter was used at the Playalinda Beach Camera Pad station (Table 2). It is a Type II meters capable of direct reading as well as integrating sound pressures over time. I was set to measure A-weighted sound pressure. A windscreen was used throughout the noise assessment.

Table 2. **Sound Level Meter Identification & Calibration Data**
F104 Flight Test, Shuttle Landing Facility
April 17, 2007

Sound Level Meter Parameters	**Playalinda Beach Site**
Model	Quest 2200
Serial Number	KOF060009
Cal Due Date	6/20/07
Pre-test Calibration	114.0
Post-test Cal Check	114.0
Windscreen	On

Footnote:
Calibrator: Quest QC10, QE7010103 cal due 8/1/07

All dosimeters were positioned and logging prior to flight initiation. Two of the monitoring stations were manned for security and observation or potential sound pressure level measurements with a sound level meter. A base station was maintained to provide communication links and support as needed. Communication among field personnel and the base station were provided through both radio and cellular phones. Weather data was obtained from the 45th Space Wing at 0930 ET and 1330 ET. Those data and location map are appended (Appendix 3).

Results

The noise assessment results for Test Flight 1 and Test Flight 2 include noise dosimetry results, sound level measurements, weather conditions, and general observations by the personnel at each station. A printout of relevant pages of noise dosimetry data are appended (Appendix 4), as well as weather data tower data (Appendix 3). Field observations at the SLF Midfield provided information regarding take-off and landing activities. These times are reported here for general reference and are only approximate (Table 3). Times that the F104 went sonic were not available during the test and were provided after the tests were completed. All times, even provided sonic times are to be considered here as approximate times of an action. Sonic boom detection times at the coastline locations would be expected to occur more than a minute later than times shown because of distance between the action and the monitoring stations.

Table 3. **Observed and Reported Timeline**
F104 Flight Test – *April 17, 2007*

F104 Flight	Action[1]	Time[2]
Flight 1 (morning flight)	F104 Take off	1003
	F104 *sonic outbound*	1007
	F104 *sonic inbound*	1009
	a fly-over[3]	1015
	a fly-over[3]	1017
	a fly-over[3]	1019
	F104 Landing	1025
Flight 2 (afternoon flight)	F104 Take off	1306
	F104 *sonic outbound*	1310
	F104 *sonic inbound*	1312
	F104 Landing	1318

Footnotes:
[1] All actions are observations of personnel at SLF Midfield with the exception of F104 sonic inbound and sonic outbound. The sonic activity was reported but not observed by monitoring personnel.
[2] Times are approximate and based on field observations with the exception of F104 sonic times. Sonic times were reported but not observed by monitoring personnel
[3] Flyovers were observed at SLF Midfield.

Test Flight 1

The first flight, with a take-off time of approximately 1003, was the longer of the two flights. Weather data near the flight time indicated the approximate winds at 7 knots from the west at 300° and a relative humidity of 46%. Two locations, Black Point and Playalinda were manned. At Playalinda flight activity knowledge was only from radio communication and not from real-time visual or auditory cues. At Black Point some flight activity (takeoff, a flyover and a landing) could be heard. Flight action cues were provided by Midfield personnel. A sonic boom was not noticed at any of the manned monitoring stations.

The 1-minute average, noise dosimetry data at four of the monitoring stations is provided in Figures 3 through 6. Details of these data along with other data (eg. slow and fast maximum, and L peak are

Figure 3. **Black Point - Flight 1**
(noise dosimeter results, 1-minute averages)

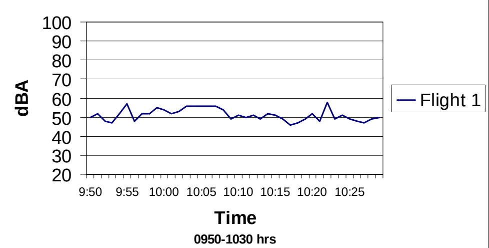
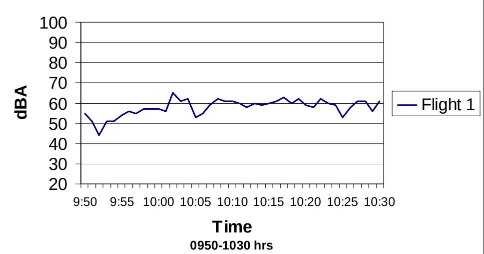
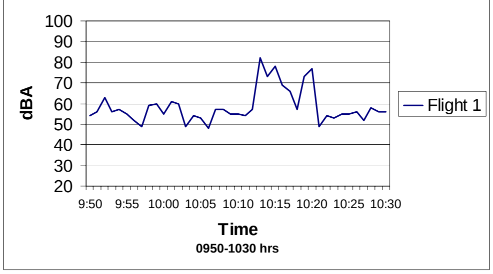


Figure 4. **Happy Creek - Flight 1**
(noise dosimeter results, 1-minute averages)



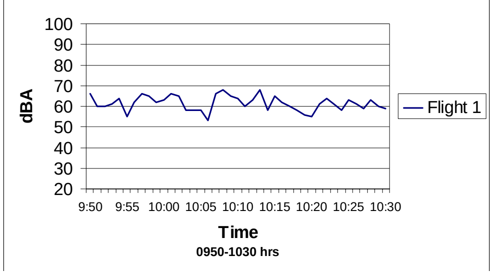
all proved in Appendix 4. Data do show variability during the flight time, but sound levels generally remained low with only the Firing Range (Fig. 5) having an significant increase in sound level after approximately 1010 and through approximately 1020. Times do not match well, however flyovers followed by landing were taking place near those times. This monitoring station was not manned; and therefore, there are no observational notes concerning local activity.

Figure 5. **Firing Range - Flight 1**
(noise dosimeter results, 1-minute averages)



Black Point (Fig 3) had the lowest sound levels with a range of 46 dBA to 56 dBA logged during the flight time. Preflight observations of vehicle activity and helicopter activity were noted, yet none occurred during the test flight. The Playalinda Beach Site, a manned coastline monitoring station did not exceed 70 dBA (10-sec avg) during the times of sonic activity. Based on real-time measurements with a sound level meter, sound pressure levels ranged from 42 dBA to 56 dBA with no observations of any sonic boom. All described background noise was from bird activity and wave actions.

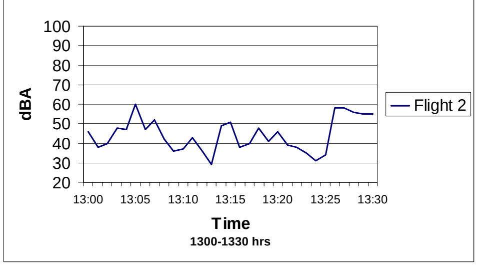
Figure 6. **VAB Area - Flight 1**
(noise dosimeter results, 1-minute averages)



Test Flight 2

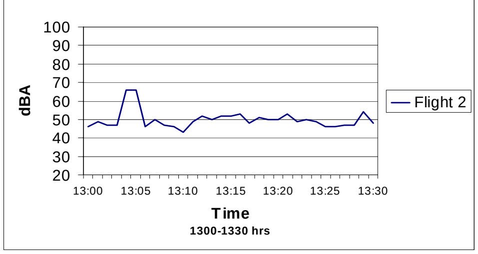
The second test flight began at approximately 1306 and ended at approximately 1318 (Table 2) suggesting a flight time of about 12 minutes. Wind conditions were generally from 360^{o} at 8 knots with the relative humidity remaining at 46% near that time. At Black Point some flight activity could be heard. Flight action cues were again provided by Midfield personnel. A sonic boom was not noticed at any of the manned monitoring stations.

Figure 7. **Black Point - Flight 2**
(noise dosimeter results, 1-minute averages)



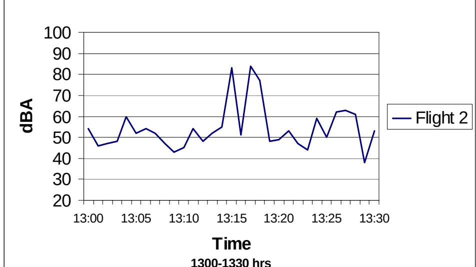
Afternoon sound levels were similar to or lower than morning sound levels. Some stations were more variable than others (Fig 7 vs. Fig 8). Again, the Firing Range monitoring station (Fig 9) reflected significant increases in sound pressure level near the end of the flight test.

Figure 8. **Happy Creek - Flight 2**
(noise dosimeter results, 1-minute averages)

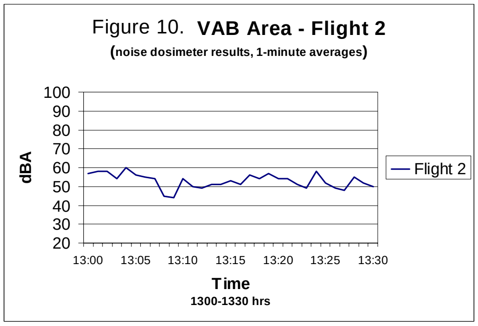


Neither VAB Area (Fig 10) or Happy Creek (Fig 8) varied much during the flight time and sound levels remained near 45 dBA to 55 dBA. Other stations experienced greater variability, but there were no consistent data suggesting detection of sonic activity.

Figure 9. **Firing Range - Flight 2**
(noise dosimeter results, 1-minute averages)



The Playalinda Beach Site, a coastline, manned station, had no detection or observation of any sonic activity. Sound levels there did not exceed 70 dBA



(10-sec avg) during the times of sonic activity. Sound levels remained in the range of approximately 42 dBA and 56 dBA. Background remained influenced by waves and birds.

Logged data from each dosimeter are provided in Appendix 4. Those data include maximum levels and peak data in addition to the 1-minute average data shown above.

Conclusions

1. With the wind direction from the west in the morning and later from the north during the afternoon test, a worst case condition was not experienced.

2. Personnel positioned at selected monitoring stations did not observe any sonic boom activity during the F104 test flight. The SLF midfield location reported flight activity (limited to takeoff, flyovers, and landing) and only some of that was noted by the northern, Black Point monitoring station.

3. The noise dosimeters logged data throughout the flight time and did not indicate sound levels increasing above normal background at the times of sonic activity.

4. Coastline monitoring stations did not detect sound levels exceeding 70 dBA during the time of sonic activity.

Environmental Noise Assessment
F104 Flight Test at Kennedy Space Center
April 17, 2007

Appended Items

1. **Test Flight Environmental Monitoring Stations**

   Dosimeter Locations for F104 Test

   Environmental Monitoring Station Photographs

2. **Test Flight Information**

   Flight Path and Other Monitoring Locations

   Flight Path over Ocean outline

   Altitude during Mission

3. **Weather Data**

   Wind Tower location map

   Tower Data for all towers 0935 local time – 3 pages

   Tower Data for all towers 1330 local time – 3 pages

4. **Noise Dosimeter Data**

   Black Point Wildlife Road, Q300 data – excerpt of 4

   Playlinda Beach Site, Q400 data – excerpt of 8 pages

   Fish and Wildlife Service Headquarters, Q400 data – excerpt of 8

   Happy Creek, Q300 data – excerpt of 6

   Firing Range off Swartz Rd, Q300 data – excerpt of 4

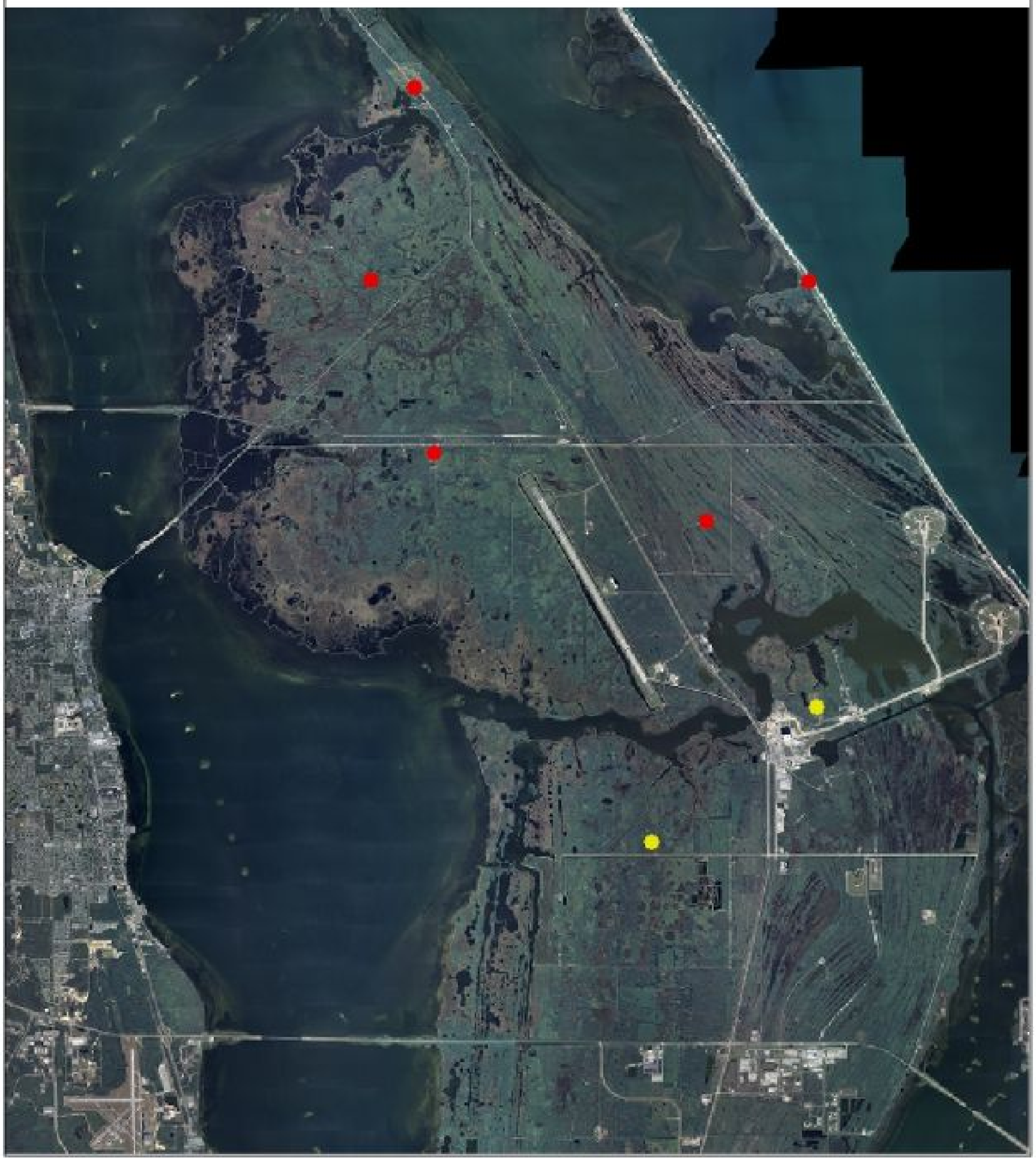
   VAB Area, off Ordnance Rd, Q300 data – excerpt of 4

Appendix 1. **F104 Environmental, Noise Monitoring Stations**

Dosimeter Location for F104 Test

Environmental Monitoring Stations

Dosimeter Locations for F104 Tests



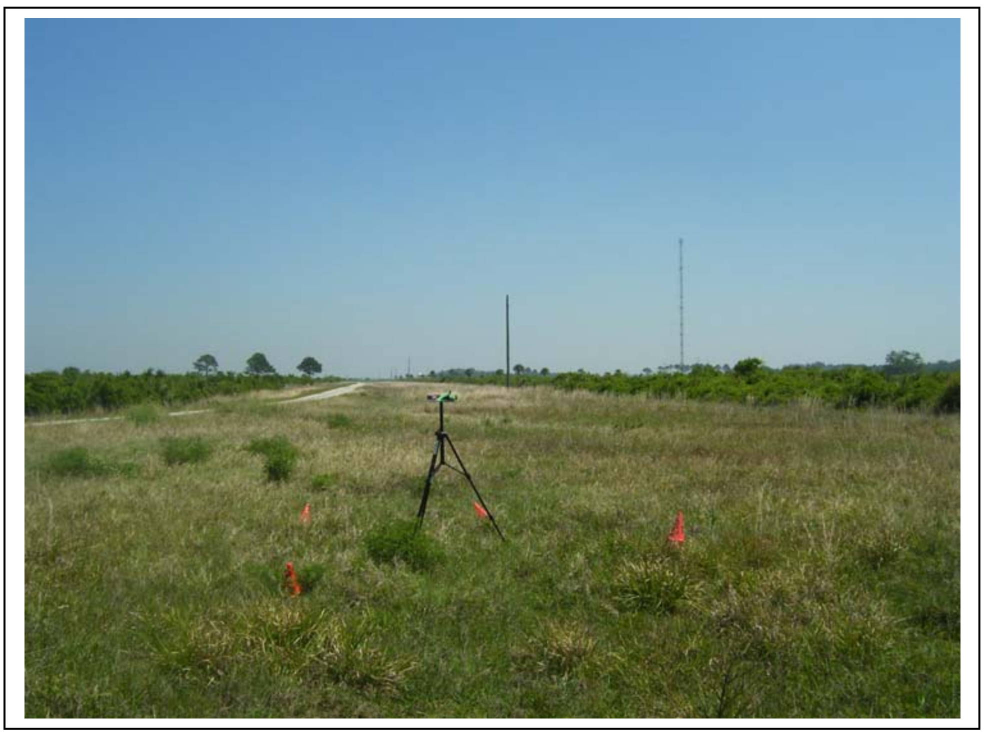
Environmental Assessment - Noise Monitoring Stations

Black Point Wildlife Road (photo next page)
Fish and Wildlife Service HQ (photo next page)
Firing Range on Swartz Road
Playalinda Beach Camera Site
Happy Creek (photo next page)
VAB Area on Ordnance Road (photo next page)

(Shown on map but not included was the State Road-3 site south of Haulover Canal)

Environmental Assessment - Noise Monitoring Stations

Black Point Monitoring Station



Happy Creek Monitoring Station

Appendix 2 - Test Flight Information

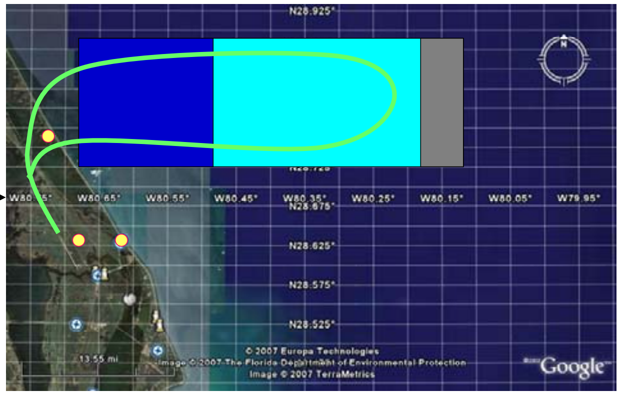
Flight Path and Other Monitoring Locations

Flight Path over Ocean outline

Altitude during Mission

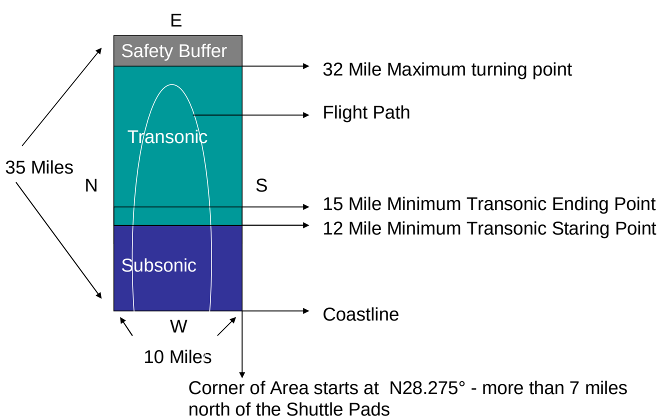
Appendix 2 Flight Information and Other Monitoring Locations

Flight Path for Sub-orbital F-104 Simulation



○ Acoustic Measuring Equipment Locations

Flight Path Over Ocean for Sub-orbital F-104 Simulation



Altitude During Mission

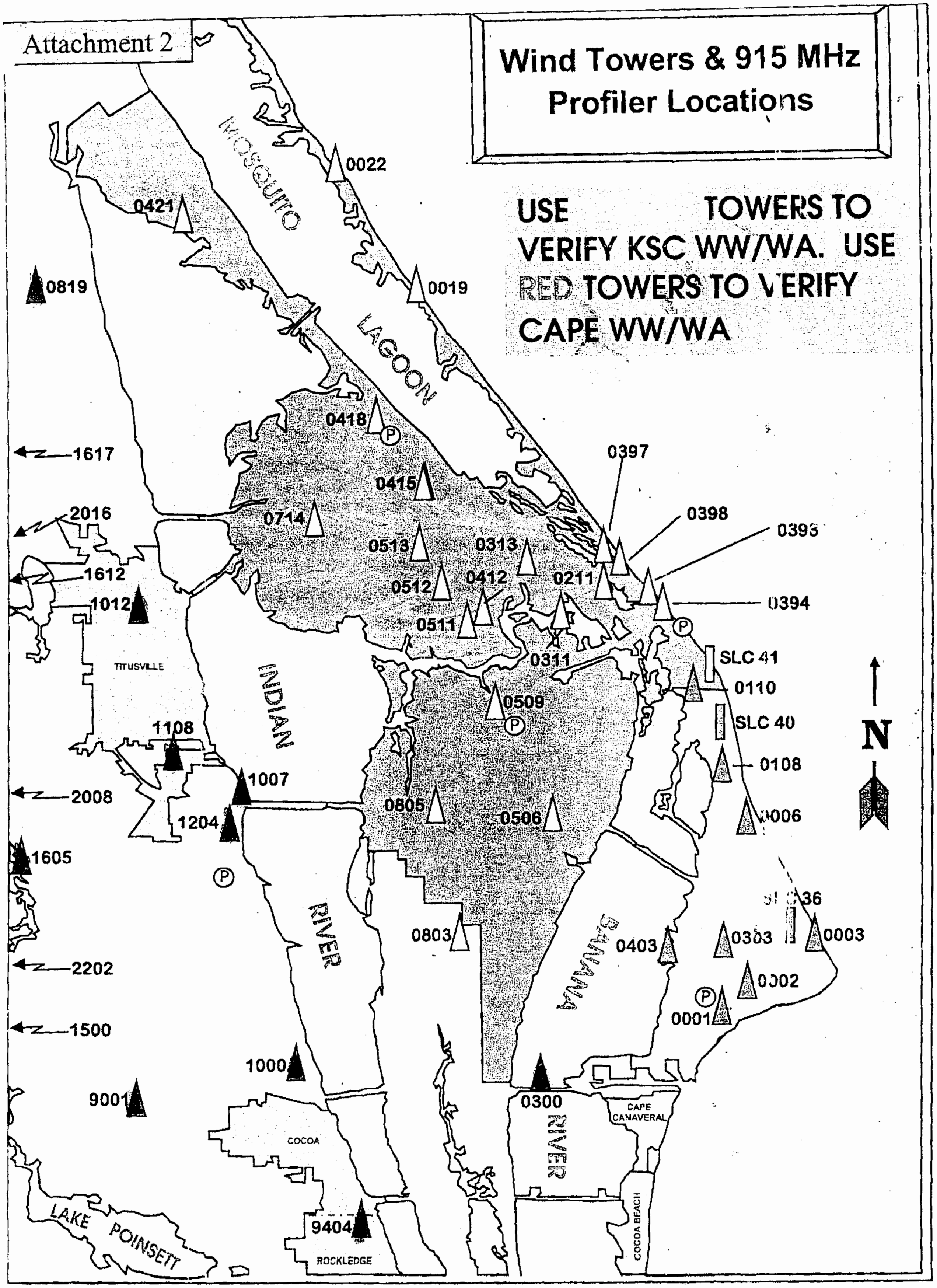
- Leave from South on Runway 33 (SLF) 0 Feet to 1,000
- Departing Coastline 20,000
- At 12 miles out 40,000 Feet
- Transonic Flight at 40,000 Feet
- At 15 miles return 40,000 Feet
- Returning over Coastline 18,000
- Return from North on Runway 15 (SLF) 1,000 to 0 Feet

Appendix 3 Weather Data

Wind Tower location map

Tower Data for all towers 0935 local time – 3 pages

Tower Data for all towers 1330 local time – 3 pages


Attachment 2
Wind Towers & 915 MHz Profiler Locations
USE TOWERS TO VERIFY KSC WW/WA. USE RED TOWERS TO VERIFY CAPE WW/WA
MOSQUITO LAGOON
INDIAN RIVER
BANANA RIVER
LAKE POINSETT
TITUSVILLE
COCOA
ROCKLEDGE
CAPE CANAVERAL
COCOA BEACH
N
0022
0421
0019
0819
0418
1617
0397
0415
2016
0714
0398
0393
0513
0313
1612
0512
0412
0211
0394
1012
0511
0311
SLC 41
0110
0509
SLC 40
1108
0108
1007
2008
0805
0506
0006
1204
1605
0803
0403
0003
2202
0002
0001
1500
1000
9001
0300
9404

0935 Local

Tower (5 min) SYSTEM DATA 1335Z 20070417

see #313 (394:39)

TOWER	HGT FT	AV MIN	05 MIN AVG DIR DEG	05 MIN AVG SPD KTS	05 MIN PEAK DIR DEG	05 MIN PEAK SPD KTS	10 MIN PEAK DIR DEG	10 MIN PEAK SPD KTS	DEV DEG	TMP °F	TMP DIFF °F	DP °F	RH	PRE MB
0001	54	5	311	10	291	19	307	19	15	64.7	-1.7	******	******	******
	12	5	309	5	296	13	296	13	27	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	56.4	******	******	******	******
0002	204	5	312	14	310	20	310	20	10	63.3	******	45.8	53	******
	145	5	312	13	319	18	319	18	10	******	******	******	******	******
	90	5	311	12	311	19	311	19	12	******	******	******	******	******
	54	5	309	10	312	18	312	18	13	64.6	-1.5	46.8	52	******
	12	5	310	7	320	14	320	14	18	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	66.0	******	46.3	49	******
0003	54	5	300	12	292	20	292	20	9	64.5	-2.2	******	******	******
	12	5	297	9	287	16	287	16	12	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	66.7	******	******	******	******
0006	204	5	311	14	317	20	317	20	9	64.1	******	44.2	48	******
	162	5	304	13	309	19	309	19	9	******	******	******	******	******
	54	5	307	9	312	16	312	16	13	65.4	-0.6	46.7	51	******
	12	5	300	6	287	12	287	12	18	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	66.1	******	47.2	50	******
0019	54	5	311	13	323	18	323	18	8	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.1	******	51.2	53	******
0022	54	5	307	16	306	20	306	20	7	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	68.8	******	51.9	55	******
0041	231	******	******	******	******	******	******	******	******	******	******	******	******	******
	230	******	******	******	******	******	******	******	******	******	******	******	******	******
0108	54	5	297	11	307	17	307	17	9	64.8	-1.0	******	******	******
	12	5	306	7	292	12	292	12	12	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	65.8	******	******	******	******
0110	204	5	309	15	314	21	314	21	7	64.2	******	44.1	48	******
	162	5	310	16	319	20	319	20	8	******	******	******	******	******
	54	5	310	14	312	18	322	20	8	64.8	-1.1	44.4	47	******
	12	5	311	10	319	14	324	17	12	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	65.8	******	45.7	48	******
0211	54	5	272	12	270	21	270	21	15	65.3	-0.7	******	******	******
	12	5	297	7	292	14	288	15	18	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	66.0	******	******	******	******
0300	54	5	320	15	320	23	320	23	7	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	68.9	******	52.4	56	******
0303	54	5	303	6	289	14	298	16	20	65.1	-1.8	******	******	******
	12	5	305	2	332	10	301	10	34	******	******	******	******	******

	6	5	******	******	******	******	******	******	******	66.9	******	******	******	******	******
0311	54	5	309	8	299	13	337	14	10	64.7	-1.3	******	******	******	******
	12	5	308	5	324	14	324	14	25	******	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	66.1	******	******	******	******	******
0313	492	5	322	19	326	24	316	25	7	62.6	******	45.[illegible]	53	******	
	394	5	322	18	322	24	326	24	7	******	******	******	******	******	
	[illegible]	5	[illegible]	[illegible]	318	23	318	25	[illegible]	[illegible]	******	******	******	******	
	204	5	[illegible]	18	316	23	316	23	8	64.0	******	42.3	45	******	
	16	[illegible]	323	16	316	23	306	[illegible]	9	******	******	******	******	******	
	54	5	310	11	309	20	309	[illegible]	12	65.0	-1.2	44.0	[illegible]	[illegible]	
	12	5	306	7	301	14	301	14	16	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	66.3	******	45.4	47	1013.0	
0393	60	5	308	14	299	20	299	20	10	64.1	******	43.2	46	******	
0394	60	5	306	10	295	17	281	17	13	64.9	******	41.5	42	******	
	6	5	******	******	******	******	******	******	******	65.8	******	44.3	46	1013.2	
0397	60	5	299	16	298	21	294	22	9	64.3	******	42.3	45	******	
0398	60	5	301	9	340	17	334	19	16	64.8	******	43.8	46	******	
	6	5	******	******	******	******	******	******	******	65.3	******	44.2	46	1012.5	
0403	54	5	319	9	322	14	322	14	11	64.0	-1.3	******	******	******	
	12	5	316	8	325	14	294	15	12	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	65.3	******	******	******	******	
0412	54	5	301	9	317	18	317	18	16	64.9	-1.4	******	******	******	
	12	5	300	4	314	10	314	10	28	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	66.3	******	******	******	******	
0415	54	5	288	8	298	15	298	15	17	64.3	-1.2	******	******	******	
	12	5	311	5	312	14	312	14	22	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	65.5	******	******	******	******	
0418	54	5	279	6	276	12	274	13	19	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	69.2	******	52.0	54	******	
0421	54	5	313	14	314	17	314	17	6	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	67.5	******	51.3	56	******	
0506	54	5	296	6	283	12	294	15	17	65.5	-0.1	******	******	******	
	12	5	282	5	286	11	286	11	19	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	65.6	******	******	******	******	
0509	54	5	297	6	301	11	301	11	18	64.0	-1.8	******	******	******	
	12	5	297	4	324	11	324	11	26	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	65.8	******	******	******	******	
0511	30	5	307	11	313	15	317	16	9	******	******	******	******	******	
0512	30	5	341	9	318	15	318	17	12	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	67.2	******	44.5	44	******	
0513	30	5	316	13	325	18	325	18	8	******	******	******	******	******	
0714	54	5	301	9	307	19	307	19	15	65.4	-0.5	******	******	******	
	12	5	318	8	336	17	336	17	16	******	******	******	******	******	
	6	5	******	******	******	******	******	******	******	65.9	******	******	******	******	
0803	54	5	303	7	331	14	294	16	14	64.1	-1.5	******	******	******	

0 bad

?:2 SLF 398 211 393 398 Cam. 397 Playlinda

Tower (5 min) SYSTEM DATA 1730Z 20070417

TOWER	HGT FT	AV MIN	05 MIN DIR DEG	AVG SPD KTS	05 MIN DIR DEG	PEAK SPD KTS	10 MIN DIR DEG	PEAK SPD KTS	DEV DEG	TMP F	TMP DIFF F	DP F	RH	PRE MB
0001	54	5	320	7	305	13	305	13	19	75.4	-3.1	******	******	******
	12	5	320	3	285	[illegible]	285	11	30	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	78.5	******	******	******	******
0002	204	5	321	9	341	14	308	16	14	73.8	******	38.0	27	******
	145	5	321	9	336	14	321	17	16	******	******	******	******	******
	90	5	322	8	349	13	309	14	18	******	******	******	******	******
	54	5	323	7	338	13	320	15	18	75.8	-2.5	37.9	25	******
	12	5	328	5	336	11	305	12	20	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	78.3	******	37.7	23	******
0003	54	5	356	9	348	12	336	17	22	69.5	-4.6	******	******	******
	12	5	354	7	358	10	326	13	24	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	74.1	******	******	******	******
0006	204	5	17	12	15	18	15	18	28	69.9	******	46.8	44	******
	162	5	13	11	12	18	12	18	28	******	******	******	******	******
	54	5	26	10	24	15	24	15	28	71.2	-2.3	48.7	45	******
	12	5	17	7	22	14	22	14	29	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	73.5	******	49.7	43	******
0019	54	5	4	8	6	10	6	10	9	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	76.5	******	56.3?	50	******
0022	54	5	11	8	12	9	12	9	7	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	76.6	******	55.7	48	******
0041	231	******	******	******	******	******	******	******	******	******	******	******	******	******
	230	******	******	******	******	******	******	******	******	******	******	******	******	******
0108	54	5	4	7	348	12	348	12	28	72.7	-2.3	******	******	******
	12	5	356	7	358	12	358	12	21	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	74.9	******	******	******	******
0110	204	5	358	9	357	12	9	15	15	69.8	******	46.3	43	******
	162	5	358	10	355	14	12	14	14	******	******	******	******	******
	54	5	357	8	347	13	12	14	18	71.7	-1.7	48.3	43	******
	12	5	355	5	326	10	19	11	21	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	73.3	******	50.2	44	******
0211	54	5	22	9	16	12	15	14	27	70.7	-3.2	******	******	******
	12	5	22	7	21	11	21	12	21	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	73.9	******	******	******	******
0300	54	5	333	11	333	16	333	16	15	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	80.8	******	46.2	30	******
0303	54	5	305	6	302	12	283	12	22	75.9	-2.4	******	******	******
	12	5	314	3	318	8	359	9	35	******	******	******	******	******

	12	5	310	6	329	11	342	13	16	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	65.6	******	******	******	******
0805	54	5	302	7	300	14	286	16	18	63.9	-1.5	******	******	******
	12	5	303	4	295	10	302	11	28	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	65.4	******	******	******	******
0819	54	5	312	9	300	16	300	16	14	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.3	******	49.1	49	******
1000	54	5	325	8	329	13	329	13	16	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	68.[illegible]	******	52.9	57	******
1007	54	5	320	12	339	18	339	18	12	[illegible]	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.0	******	51.6	54	******
1012	54	5	327	6	339	11	339	11	20	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	66.2	******	48.7	53	******
1204	54	5	294	7	313	12	313	12	19	******	******	******	******	******
1500	54	5	328	3	300	7	300	7	20	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.3	******	51.9	54	******
1605	54	5	322	13	318	17	318	17	9	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.6	******	52.2	54	******
1612	54	5	309	10	316	17	316	17	14	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.3	******	52.5	55	******
1617	54	5	315	11	319	16	319	16	10	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.2	******	50.6	52	******
2008	54	5	313	9	317	15	317	15	18	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.6	******	50.7	51	******
2016	54	5	324	10	330	14	330	14	9	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.3	******	52.3	55	******
2202	54	5	321	11	325	14	325	14	10	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	68.2	******	47.9	48	******
9001	54	5	333	9	332	14	332	14	15	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	69.0	******	52.7	56	******
9404	54	5	307	11	295	17	295	17	12	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	65.8	******	51.0	59	******

! = Out of Range, ? = Data Questionable, * = Not Tested, "******" = No Data

	6	5	******	******	******	******	******	******	******	78.3	******	******	******	******
(0311)	54	5	7	6	2	10	2	10	18	72.9	-1.7	******	******	******
	12	5	7	4	357	8	357	8	26	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	74.6	******	******	******	******
0313	492	5	340	7	335	11	335	11	15	71.5	******	42.6	35	******
	394	5	351	7	354	11	11	11	13	******	******	******	******	******
	295	5	354	7	4	10	358	11	11	******	******	******	******	******
	204	5	4	7	9	11	4	11	11	70.7	******	44.7	39	******
	162	5	[illegible]	[illegible]	7	10	351	11	[illegible]	[illegible]	******	******	******	******
	54	5	3	[illegible]	352	9	27	11	13	[illegible]	-1.9	45.0	38	******
	12	5	5	5	353	10	353	10	15	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	74.1	******	46.4	37	1011.7
0393	60	5	1	8	11	12	2	14	11	69.5	******	45.9	43	******
0394	60	5	8	9	353	14	355	14	9	69.0	******	42.8	39	******
	6	5	******	******	******	******	******	******	******	71.2	******	46.2	41	1012.0
0397	60	5	5	8	16	12	340	13	14	69.4	******	46.2	43	******
0398	60	5	357	8	348	12	1	12	9	69.5	******	46.2	43	******
	6	5	******	******	******	******	******	******	******	70.3	******	46.4	42	1011.6
0403	54	5	335	7	337	9	343	10	11	74.5	-2.7	******	******	******
	12	5	336	8	340	11	340	11	14	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	77.1	******	******	******	******
0412	54	5	347	4	345	10	345	10	28	73.6	-1.9	******	******	******
	12	5	2	2	25	7	25	7	38	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	75.5	******	******	******	******
0415	54	5	349	8	350	12	350	12	15	72.8	-1.6	******	******	******
	12	5	10	5	10	10	10	10	22	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	74.4	******	******	******	******
0418	54	5	9	6	12	9	19	10	17	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	76.5	******	56.5?	50	******
0421	54	5	43	5	45	8	45	8	39	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	80.8	******	54.0	40	******
0506	54	5	314	5	330	12	345	13	24	76.9	-1.2	******	******	******
	12	5	310	5	339	11	339	11	27	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	78.1	******	******	******	******
0509	54	5	278	5	265	13	265	13	19	74.6	-2.6	******	******	******
	12	5	277	5	268	11	268	11	22	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	77.2	******	******	******	******
0511	30	5	302	8	320	14	327	16	15	******	******	******	******	******
0512	30	5	295	7	288	12	293	16	16	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	77.8	******	41.8	28	******
0513	30	5	313	6	333	14	333	14	21	******	******	******	******	******
0714	54	5	325	5	334	9	340	11	25	76.4	-1.1	******	******	******
	12	5	336	4	349	9	349	9	25	******	******	******	******	******
	6	5	******	******	******	******	******	******	******	77.6	******	******	******	******
0803	54	5	308	6	307	12	327	13	16	75.6	-2.1	******	******	******

Appendix 4   Noise Dosimeter Data

Black Point Wildlife Road, Q300 data – excerpt of 4

Playlinda Beach Site, Q400 data – excerpt of 8 pages

Fish and Wildlife Service Headquarters, Q400 data – excerpt of 8

Happy Creek, Q300 data – excerpt of 6

Firing Range off Swartz Rd, Q300 data – excerpt of 4

VAB Area, off Ordnance Rd, Q300 data – excerpt of 4

F104F22.ndat Black Point

Q-300 Noise Logging Dosimeter

ersion:	02.5	Serial Number:	QC292
Name:	F104 Test Flight		
Company:			
WorkArea:			
Description:			
Comments:			

Dosimeter Calibration:

Pre-Survey	114.0 dB	4/12/2007 1:10:00PM

Instrument Range: 40 - 110 dB

Measuring Parameters:

<u>DOSIMETER</u>	<u>1</u>		
Criterion:		85	dB
ExchangeRate:		3	dB
Threshold:		40	dB
UpperLimit:		40	dB
Weighting:		A	
TimeConstant:		Fast	

<u>DOSIMETER</u>	<u>2</u>		
Criterion:		85	dB
ExchangeRate:		3	dB
Threshold:		60	dB
UpperLimit:		50	dB
Weighting:		A	
TimeConstant:		Fast	

<u>DOSIMETER</u>	<u>3</u>		
Criterion:		85	dB
ExchangeRate:		3	dB
Threshold:		80	dB
UpperLimit:		60	dB
Weighting:		A	
TimeConstant:		Fast	

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 9:54:35AM	52	46	0	60	67	98
/2007 9:55:35AM	57	56	0	71	75	102
2007 9:56:35AM	48	0	0	54	60	95
4/17/2007 9:57:35AM	52	47	0	62	67	105
4/17/2007 9:58:35AM	52	45	0	59	65	99
4/17/2007 9:59:35AM	55	51	0	63	68	103
4/17/2007 10:00:35AM	54	50	0	65	70	113
4/17/2007 10:01:35AM	52	44	0	60	65	103
4/17/2007 10:02:35AM	53	45	0	60	64	101
4/17/2007 10:03:35AM	56	51	0	61	65	102
4/17/2007 10:04:35AM	56	53	0	64	70	104
4/17/2007 10:05:35AM	56	54	0	65	69	105
4/17/2007 10:06:35AM	56	53	0	64	70	108
4/17/2007 10:07:35AM	56	52	0	62	67	102
4/17/2007 10:08:35AM	54	50	0	65	70	106
4/17/2007 10:09:35AM	49	31	0	56	61	97
4/17/2007 10:10:35AM	51	36	0	57	62	99
4/17/2007 10:11:35AM	50	44	0	60	67	101
4/17/2007 10:12:35AM	51	42	0	59	63	103
4/17/2007 10:13:35AM	49	34	0	57	61	96
4/17/2007 10:14:35AM	52	44	0	59	63	97
7/2007 10:15:35AM	51	46	0	61	65	101
2007 10:16:35AM	49	27	0	56	60	95
4/17/2007 10:17:35AM	46	0	0	52	57	96
4/17/2007 10:18:35AM	47	37	0	57	62	99
4/17/2007 10:19:35AM	49	32	0	57	60	98
4/17/2007 10:20:35AM	52	42	0	58	63	99
4/17/2007 10:21:35AM	48	39	0	56	63	96
4/17/2007 10:22:35AM	58	57	0	72	76	100
4/17/2007 10:23:35AM	49	39	0	56	62	101
4/17/2007 10:24:35AM	51	41	0	58	64	99
4/17/2007 10:25:35AM	49	35	0	56	62	97
4/17/2007 10:26:35AM	48	40	0	59	63	97
4/17/2007 10:27:35AM	47	0	0	54	60	94
4/17/2007 10:28:35AM	49	38	0	57	62	102
4/17/2007 10:29:35AM	50	0	0	54	58	94

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 12:39:56PM	48	0	0	54	59	98
'/2007 12:40:56PM	45	0	0	50	55	94
:007 12:41:56PM	48	41	0	59	65	93
4/17/2007 12:42:56PM	43	0	0	47	50	91
4/17/2007 12:43:56PM	44	0	0	51	57	101
4/17/2007 12:44:56PM	43	0	0	48	54	92
4/17/2007 12:45:56PM	43	0	0	48	51	90
4/17/2007 12:46:56PM	42	0	0	47	50	90
4/17/2007 12:47:56PM	46	0	0	51	54	95
4/17/2007 12:48:56PM	49	44	0	61	65	92
4/17/2007 12:49:56PM	50	42	0	60	68	88
4/17/2007 12:50:56PM	44	0	0	54	56	97
4/17/2007 12:51:56PM	41	0	0	44	47	89
4/17/2007 12:52:56PM	40	0	0	42	45	85
4/17/2007 12:53:56PM	38	0	0	44	47	88
4/17/2007 12:54:56PM	40	0	0	45	48	89
4/17/2007 12:55:56PM	48	0	0	54	60	88
4/17/2007 12:56:56PM	37	0	0	46	53	86
4/17/2007 12:57:56PM	52	41	0	59	62	92
4/17/2007 12:58:56PM	47	0	0	49	53	91
4/17/2007 12:59:56PM	40	0	0	49	54	87
4/''7/2007 1:00:56PM	46	0	0	55	58	87
:007 1:01:56PM	38	0	0	44	49	89
4/17/2007 1:02:56PM	40	0	0	44	49	88
4/17/2007 1:03:56PM	48	38	0	57	65	89
4/17/2007 1:04:56PM	47	0	0	53	56	90
4/17/2007 1:05:56PM	60	59	0	69	72	94
4/17/2007 1:06:56PM	47	0	0	57	58	94
4/17/2007 1:07:56PM	52	46	0	62	65	91
4/17/2007 1:08:56PM	42	0	0	52	55	92
4/17/2007 1:09:56PM	36	0	0	44	47	90
4/17/2007 1:10:56PM	37	0	0	43	46	88
4/17/2007 1:11:56PM	43	0	0	51	56	91
4/17/2007 1:12:56PM	36	0	0	48	56	89
4/17/2007 1:13:56PM	29	0	0	41	43	83
4/17/2007 1:14:56PM	49	27	0	56	60	89
4/17/2007 1:15:56PM	51	0	0	58	60	90
4/17/2007 1:16:56PM	38	0	0	46	49	90
4/17/2007 1:17:56PM	40	0	0	45	47	84
4/17/2007 1:18:56PM	48	0	0	57	60	88
4/17/2007 1:19:56PM	41	0	0	47	51	92
4/'7/2007 1:20:56PM	46	0	0	51	55	90
:007 1:21:56PM	39	0	0	44	45	84
4/1 /2007 1:22:56PM	38	0	0	44	46	88
4/17/2007 1:23:56PM	35	0	0	44	47	91

F104F13.ndat

PLAYALINDA

Q-400 Noise Logging Dosimeter

ersion: 1.48

Serial Number: QDD080005

Name: F104 Test Flight

Company:

WorkArea:

Description:

Comments:

Dosimeter Calibration:

Pre-Survey	114.0 dB	4/12/2007 1:26:28PM

Level Triggered Events:	OFF			
Instrument Range:	70	-	140	dB

Measuring Parameters:

<u>DOSIMETER</u> <u>1</u>

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	50	dB
Weighting:	A	
TimeConstant:	Fast	
LDN:	OFF	

<u>DOSIMETER</u> <u>2</u>

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	60	dB
Weighting:	C	
TimeConstant:	Fast	

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 9:59:40AM	70	84	71	93	106
'/2007 9:59:50AM	70	85	70	92	107
2007 10:00:00AM	72	90	78	95	110
4/17/2007 10:00:10AM	71	90	76	96	109
4/17/2007 10:00:20AM	70	86	75	95	106
4/17/2007 10:00:30AM	70	84	70	88	102
4/17/2007 10:00:40AM	70	84	71	91	102
4/17/2007 10:00:50AM	70	84	70	94	103
4/17/2007 10:01:00AM	70	85	74	93	104
4/17/2007 10:01:10AM	70	87	72	94	106
4/17/2007 10:01:20AM	70	85	70	91	106
4/17/2007 10:01:30AM	70	86	73	95	110
4/17/2007 10:01:40AM	70	86	72	94	112
4/17/2007 10:01:50AM	70	84	72	91	104
4/17/2007 10:02:00AM	70	85	72	93	105
4/17/2007 10:02:10AM	70	84	71	91	104
4/17/2007 10:02:20AM	70	84	70	89	107
4/17/2007 10:02:30AM	70	87	73	93	106
4/17/2007 10:02:40AM	70	84	70	90	104
4/17/2007 10:02:50AM	70	84	70	93	107
4/17/2007 10:03:00AM	70	85	75	95	110
7/2007 10:03:10AM	70	82	70	87	102
2007 10:03:20AM	70	82	70	90	104
4/17/2007 10:03:30AM	71	86	77	96	107
4/17/2007 10:03:40AM	70	83	74	91	105
4/17/2007 10:03:50AM	70	86	72	93	106
4/17/2007 10:04:00AM	70	83	70	89	102
4/17/2007 10:04:10AM	70	81	70	90	105
4/17/2007 10:04:20AM	70	84	70	93	108
4/17/2007 10:04:30AM	70	81	70	87	103
4/17/2007 10:04:40AM	70	80	70	87	101
4/17/2007 10:04:50AM	70	82	70	89	101
4/17/2007 10:05:00AM	70	82	70	88	102
4/17/2007 10:05:10AM	70	85	70	90	103
4/17/2007 10:05:20AM	70	85	70	90	103
4/17/2007 10:05:30AM	70	83	70	91	102
4/17/2007 10:05:40AM	70	85	70	92	107
4/17/2007 10:05:50AM	70	87	72	93	104
4/17/2007 10:06:00AM	70	83	70	87	102
4/17/2007 10:06:10AM	70	84	70	93	107
4/17/2007 10:06:20AM	70	85	70	91	102
4/17/2007 10:06:30AM	70	83	70	90	103
2007 10:06:40AM	71	90	76	101	112
4/17/2007 10:06:50AM	70	83	70	91	103
4/17/2007 10:07:00AM	70	83	70	88	101

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 10:07:10AM	70	88	73	95	109
'2007 10:07:20AM	70	86	72	92	105
2007 10:07:30AM	70	85	73	90	104
4/17/2007 10:07:40AM	70	85	76	93	106
4/17/2007 10:07:50AM	70	82	71	89	101
4/17/2007 10:08:00AM	70	79	70	85	101
4/17/2007 10:08:10AM	70	81	70	87	101
4/17/2007 10:08:20AM	70	80	70	87	102
4/17/2007 10:08:30AM	70	79	70	85	101
4/17/2007 10:08:40AM	70	81	70	87	102
4/17/2007 10:08:50AM	70	82	70	88	104
4/17/2007 10:09:00AM	70	84	71	89	103
4/17/2007 10:09:10AM	70	83	72	92	104
4/17/2007 10:09:20AM	70	83	70	91	102
4/17/2007 10:09:30AM	70	85	70	90	104
4/17/2007 10:09:40AM	70	84	73	91	103
4/17/2007 10:09:50AM	70	82	72	91	106
4/17/2007 10:10:00AM	70	84	70	89	102
4/17/2007 10:10:10AM	70	81	70	85	102
4/17/2007 10:10:20AM	70	82	71	91	106
4/17/2007 10:10:30AM	70	84	70	90	104
7/2007 10:10:40AM	70	83	70	88	102
2007 10:10:50AM	70	83	70	90	102
4/17/2007 10:11:00AM	70	87	74	92	105
4/17/2007 10:11:10AM	70	84	70	91	106
4/17/2007 10:11:20AM	70	85	70	92	105
4/17/2007 10:11:30AM	70	85	74	93	106
4/17/2007 10:11:40AM	70	83	70	88	101
4/17/2007 10:11:50AM	70	85	70	93	106
4/17/2007 10:12:00AM	70	86	72	94	107
4/17/2007 10:12:10AM	70	86	73	94	108
4/17/2007 10:12:20AM	70	83	73	90	105
4/17/2007 10:12:30AM	70	81	70	89	102
4/17/2007 10:12:40AM	70	89	73	99	110
4/17/2007 10:12:50AM	70	84	71	95	109
4/17/2007 10:13:00AM	70	84	71	90	102
4/17/2007 10:13:10AM	70	85	70	89	104
4/17/2007 10:13:20AM	70	86	72	93	105
4/17/2007 10:13:30AM	70	85	71	94	104
4/17/2007 10:13:40AM	70	84	70	89	102
4/17/2007 10:13:50AM	70	85	70	93	103
4/'7/2007 10:14:00AM	70	83	70	88	102
2007 10:14:10AM	70	85	70	90	103
4/17/2007 10:14:20AM	70	84	70	89	102
4/17/2007 10:14:30AM	70	82	70	87	102

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 10:14:40AM	70	84	70	97	108
'2007 10:14:50AM	70	85	70	91	104
2007 10:15:00AM	70	84	70	89	103
4/17/2007 10:15:10AM	70	87	74	93	107
4/17/2007 10:15:20AM	70	86	71	94	106
4/17/2007 10:15:30AM	70	87	74	93	104
4/17/2007 10:15:40AM	70	86	70	90	102
4/17/2007 10:15:50AM	70	85	70	90	106
4/17/2007 10:16:00AM	70	84	70	89	104
4/17/2007 10:16:10AM	70	85	74	93	105
4/17/2007 10:16:20AM	70	85	70	91	105
4/17/2007 10:16:30AM	70	82	70	86	102
4/17/2007 10:16:40AM	70	86	71	93	105
4/17/2007 10:16:50AM	70	84	70	89	104
4/17/2007 10:17:00AM	70	88	76	95	108
4/17/2007 10:17:10AM	70	87	74	92	107
4/17/2007 10:17:20AM	70	87	74	94	106
4/17/2007 10:17:30AM	70	85	73	93	106
4/17/2007 10:17:40AM	70	86	75	96	109
4/17/2007 10:17:50AM	70	85	70	91	105
4/17/2007 10:18:00AM	70	85	70	88	104
7/2007 10:18:10AM	70	86	76	93	107
2007 10:18:20AM	70	85	73	91	106
4/17/2007 10:18:30AM	70	84	73	93	105
4/17/2007 10:18:40AM	70	83	75	94	109
4/17/2007 10:18:50AM	70	84	70	93	106
4/17/2007 10:19:00AM	70	85	71	92	107
4/17/2007 10:19:10AM	70	86	75	93	106
4/17/2007 10:19:20AM	70	83	70	91	103
4/17/2007 10:19:30AM	70	84	70	90	103
4/17/2007 10:19:40AM	70	86	72	93	108
4/17/2007 10:19:50AM	70	85	72	93	106
4/17/2007 10:20:00AM	70	86	71	92	105
4/17/2007 10:20:10AM	70	86	75	94	108
4/17/2007 10:20:20AM	70	84	70	91	103
4/17/2007 10:20:30AM	70	85	72	91	106
4/17/2007 10:20:40AM	70	87	74	95	111
4/17/2007 10:20:50AM	72	90	79	99	108
4/17/2007 10:21:00AM	73	91	80	98	108
4/17/2007 10:21:10AM	74	91	82	99	110
4/17/2007 10:21:20AM	70	88	72	94	106
4/'7/2007 10:21:30AM	71	86	74	91	104
2007 10:21:40AM	70	87	73	93	105
4/17/2007 10:21:50AM	71	89	74	97	108
4/17/2007 10:22:00AM	71	87	76	91	105

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 10:22:10AM	72	90	79	95	107
'2007 10:22:20AM	70	88	74	96	109
2007 10:22:30AM	71	90	75	98	112
4/17/2007 10:22:40AM	70	88	73	96	108
4/17/2007 10:22:50AM	71	87	76	94	104
4/17/2007 10:23:00AM	70	86	72	92	104
4/17/2007 10:23:10AM	70	85	70	93	105
4/17/2007 10:23:20AM	70	84	70	91	106
4/17/2007 10:23:30AM	70	87	72	93	105
4/17/2007 10:23:40AM	70	84	71	90	103
4/17/2007 10:23:50AM	70	88	74	95	106
4/17/2007 10:24:00AM	70	85	71	93	102
4/17/2007 10:24:10AM	70	84	70	89	102
4/17/2007 10:24:20AM	71	87	75	94	106
4/17/2007 10:24:30AM	70	85	73	92	104
4/17/2007 10:24:40AM	70	88	73	97	109
4/17/2007 10:24:50AM	70	86	70	94	106
4/17/2007 10:25:00AM	70	87	72	94	106
4/17/2007 10:25:10AM	70	87	75	98	110
4/17/2007 10:25:20AM	70	86	71	92	104
4/17/2007 10:25:30AM	70	85	70	90	102
7/2007 10:25:40AM	70	87	70	93	106
2007 10:25:50AM	70	87	74	96	107
4/17/2007 10:26:00AM	71	89	75	93	105
4/17/2007 10:26:10AM	71	87	75	92	105
4/17/2007 10:26:20AM	70	87	71	92	104
4/17/2007 10:26:30AM	70	86	71	92	102
4/17/2007 10:26:40AM	70	87	71	91	104
4/17/2007 10:26:50AM	70	85	71	91	104
4/17/2007 10:27:00AM	70	85	73	90	104
4/17/2007 10:27:10AM	70	85	74	90	105
4/17/2007 10:27:20AM	70	86	72	92	107
4/17/2007 10:27:30AM	73	89	80	96	111
4/17/2007 10:27:40AM	71	88	76	95	105
4/17/2007 10:27:50AM	70	91	75	96	106
4/17/2007 10:28:00AM	70	89	73	95	108
4/17/2007 10:28:10AM	70	87	73	93	104
4/17/2007 10:28:20AM	70	87	73	93	104
4/17/2007 10:28:30AM	70	87	70	94	107
4/17/2007 10:28:40AM	71	87	76	92	106
4/17/2007 10:28:50AM	70	85	71	93	105
4/17/2007 10:29:00AM	70	87	75	93	105
2007 10:29:10AM	70	88	72	95	106
4/17/2007 10:29:20AM	70	86	70	93	107
4/17/2007 10:29:30AM	70	87	70	92	106

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 12:59:40PM	70	79	70	87	101
/2007 12:59:50PM	70	78	70	85	102
2007 1:00:00PM	70	79	70	88	102
4/17/2007 1:00:10PM	70	81	70	86	102
4/17/2007 1:00:20PM	70	80	70	86	101
4/17/2007 1:00:30PM	70	77	70	84	95
4/17/2007 1:00:40PM	70	78	70	85	98
4/17/2007 1:00:50PM	70	77	70	83	101
4/17/2007 1:01:00PM	70	80	70	88	102
4/17/2007 1:01:10PM	70	79	70	87	102
4/17/2007 1:01:20PM	70	79	70	85	101
4/17/2007 1:01:30PM	70	78	70	85	101
4/17/2007 1:01:40PM	70	79	70	87	102
4/17/2007 1:01:50PM	70	81	70	89	102
4/17/2007 1:02:00PM	70	81	70	88	101
4/17/2007 1:02:10PM	70	76	70	84	97
4/17/2007 1:02:20PM	70	81	70	89	104
4/17/2007 1:02:30PM	70	82	70	90	102
4/17/2007 1:02:40PM	70	82	70	88	101
4/17/2007 1:02:50PM	70	80	70	88	101
4/17/2007 1:03:00PM	70	81	70	88	102
7/2007 1:03:10PM	70	80	70	91	105
2007 1:03:20PM	70	80	70	88	102
4/17/2007 1:03:30PM	70	82	70	87	102
4/17/2007 1:03:40PM	70	84	70	93	102
4/17/2007 1:03:50PM	70	81	70	90	102
4/17/2007 1:04:00PM	70	82	70	90	102
4/17/2007 1:04:10PM	70	83	70	88	102
4/17/2007 1:04:20PM	70	81	70	88	102
4/17/2007 1:04:30PM	70	79	70	83	97
4/17/2007 1:04:40PM	70	80	70	85	101
4/17/2007 1:04:50PM	70	75	70	82	98
4/17/2007 1:05:00PM	70	79	70	88	101
4/17/2007 1:05:10PM	70	77	70	86	97
4/17/2007 1:05:20PM	70	78	70	87	101
4/17/2007 1:05:30PM	70	79	70	83	101
4/17/2007 1:05:40PM	70	79	70	84	96
4/17/2007 1:05:50PM	70	79	70	85	98
4/17/2007 1:06:00PM	70	78	70	87	101
4/17/2007 1:06:10PM	70	76	70	85	102
4/17/2007 1:06:20PM	70	78	70	85	102
4/17/2007 1:06:30PM	70	80	70	86	101
2007 1:06:40PM	70	78	70	82	101
4/17/2007 1:06:50PM	70	79	70	88	102
4/17/2007 1:07:00PM	70	80	70	89	101

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 1:07:10PM	70	82	70	86	101
'/2007 1:07:20PM	70	80	70	87	102
2007 1:07:30PM	70	83	70	91	106
4/17/2007 1:07:40PM	70	85	71	90	102
4/17/2007 1:07:50PM	70	83	71	89	102
4/17/2007 1:08:00PM	70	81	70	87	102
4/17/2007 1:08:10PM	70	81	70	88	101
4/17/2007 1:08:20PM	70	78	70	86	101
4/17/2007 1:08:30PM	70	75	70	82	97
4/17/2007 1:08:40PM	70	73	70	79	95
4/17/2007 1:08:50PM	70	74	70	81	96
4/17/2007 1:09:00PM	70	72	70	78	93
4/17/2007 1:09:10PM	70	76	70	86	101
4/17/2007 1:09:20PM	70	82	70	89	102
4/17/2007 1:09:30PM	70	81	70	87	101
4/17/2007 1:09:40PM	70	82	70	87	101
4/17/2007 1:09:50PM	70	84	70	90	102
4/17/2007 1:10:00PM	70	84	70	89	102
4/17/2007 1:10:10PM	70	79	70	84	101
4/17/2007 1:10:20PM	70	75	70	84	101
4/17/2007 1:10:30PM	70	78	70	84	97
7/2007 1:10:40PM	70	79	70	88	102
2007 1:10:50PM	70	77	70	83	95
4/17/2007 1:11:00PM	70	81	70	86	102
4/17/2007 1:11:10PM	70	78	70	84	101
4/17/2007 1:11:20PM	70	79	70	86	102
4/17/2007 1:11:30PM	70	77	70	85	101
4/17/2007 1:11:40PM	70	78	70	86	101
4/17/2007 1:11:50PM	70	80	70	85	102
4/17/2007 1:12:00PM	70	77	70	83	97
4/17/2007 1:12:10PM	70	78	70	85	97
4/17/2007 1:12:20PM	70	78	70	85	98
4/17/2007 1:12:30PM	70	77	70	85	101
4/17/2007 1:12:40PM	70	77	70	86	101
4/17/2007 1:12:50PM	70	80	70	87	101
4/17/2007 1:13:00PM	70	79	70	83	96
4/17/2007 1:13:10PM	70	75	70	83	97
4/17/2007 1:13:20PM	70	78	70	84	98
4/17/2007 1:13:30PM	70	77	70	84	101
4/17/2007 1:13:40PM	70	76	70	82	96
4/17/2007 1:13:50PM	70	75	70	83	96
4/17/2007 1:14:00PM	70	76	70	82	95
2007 1:14:10PM	70	78	70	86	98
4/17/2007 1:14:20PM	70	80	70	85	101
4/17/2007 1:14:30PM	70	81	70	86	101

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 1:14:40PM	70	77	70	84	97
'/2007 1:14:50PM	70	75	70	83	95
2007 1:15:00PM	70	77	70	85	96
4/17/2007 1:15:10PM	70	78	70	87	98
4/17/2007 1:15:20PM	70	73	70	80	93
4/17/2007 1:15:30PM	70	76	70	84	101
4/17/2007 1:15:40PM	70	81	70	87	102
4/17/2007 1:15:50PM	70	85	70	94	107
4/17/2007 1:16:00PM	70	81	70	88	101
4/17/2007 1:16:10PM	70	79	70	84	101
4/17/2007 1:16:20PM	70	80	70	86	102
4/17/2007 1:16:30PM	70	80	70	87	101
4/17/2007 1:16:40PM	70	78	70	83	98
4/17/2007 1:16:50PM	70	79	70	84	101
4/17/2007 1:17:00PM	70	78	70	84	101
4/17/2007 1:17:10PM	70	76	70	82	97
4/17/2007 1:17:20PM	70	75	70	83	96
4/17/2007 1:17:30PM	70	76	70	85	102
4/17/2007 1:17:40PM	70	79	70	84	99
4/17/2007 1:17:50PM	70	81	70	86	97
4/17/2007 1:18:00PM	70	79	70	84	101
7/2007 1:18:10PM	70	77	70	83	101
2007 1:18:20PM	70	79	70	87	101
4/17/2007 1:18:30PM	70	79	70	85	101
4/17/2007 1:18:40PM	70	79	70	85	101
4/17/2007 1:18:50PM	70	83	70	88	103
4/17/2007 1:19:00PM	70	78	70	82	96
4/17/2007 1:19:10PM	70	80	70	87	102
4/17/2007 1:19:20PM	70	81	70	87	102
4/17/2007 1:19:30PM	70	78	70	84	101
4/17/2007 1:19:40PM	70	76	70	82	98
4/17/2007 1:19:50PM	70	77	70	84	102
4/17/2007 1:20:00PM	70	77	70	83	97
4/17/2007 1:20:10PM	70	78	70	83	97
4/17/2007 1:20:20PM	70	78	70	83	98
4/17/2007 1:20:30PM	70	81	70	88	101
4/17/2007 1:20:40PM	70	79	70	86	102
4/17/2007 1:20:50PM	70	77	70	83	96
4/17/2007 1:21:00PM	70	76	70	82	96
4/17/2007 1:21:10PM	70	76	70	79	95
4/17/2007 1:21:20PM	70	75	70	83	96
4/17/2007 1:21:30PM	70	78	70	84	98
2007 1:21:40PM	70	78	70	84	102
4/17/2007 1:21:50PM	70	76	70	82	96
4/17/2007 1:22:00PM	70	80	70	87	101

F104F24.ndat FWS

Q-400 Noise Logging Dosimeter

ersion:	1.48	Serial Number:	QDD080008
Name:	F104 Test Flight		
Company:			
WorkArea:			
Description:			
Comments:			

Dosimeter Calibration:

Pre-Survey	114.0 dB	4/12/2007	1:24:41PM

Level Triggered Events:	OFF			
Instrument Range:	70	-	140	dB

Measuring Parameters:

DOSIMETER 1

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	50	dB
Weighting:	A	
TimeConstant:	Fast	
LDN:	OFF	

DOSIMETER 2

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	60	dB
Weighting:	C	
TimeConstant:	Fast	

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 10:01:37AM	70	81	70	88	101
/2007 10:01:47AM	70	76	70	82	100
2007 10:01:57AM	70	77	70	84	101
4/17/2007 10:02:07AM	70	78	70	83	100
4/17/2007 10:02:17AM	70	72	70	79	94
4/17/2007 10:02:27AM	70	71	70	77	93
4/17/2007 10:02:37AM	70	77	70	85	101
4/17/2007 10:02:47AM	70	77	70	85	100
4/17/2007 10:02:57AM	70	72	70	78	91
4/17/2007 10:03:07AM	71	81	77	86	101
4/17/2007 10:03:17AM	73	85	78	89	103
4/17/2007 10:03:27AM	73	85	79	89	103
4/17/2007 10:03:37AM	70	80	71	86	101
4/17/2007 10:03:47AM	70	77	70	83	101
4/17/2007 10:03:57AM	70	78	70	84	101
4/17/2007 10:04:07AM	70	73	70	79	93
4/17/2007 10:04:17AM	70	72	70	79	92
4/17/2007 10:04:27AM	70	78	70	84	100
4/17/2007 10:04:37AM	70	72	70	82	101
4/17/2007 10:04:47AM	70	74	70	84	100
4/17/2007 10:04:57AM	70	75	70	81	96
7/2007 10:05:07AM	70	75	70	82	94
2007 10:05:17AM	70	70	70	74	91
4/17/2007 10:05:27AM	70	71	70	77	91
4/17/2007 10:05:37AM	70	74	70	80	100
4/17/2007 10:05:47AM	70	74	70	82	101
4/17/2007 10:05:57AM	70	72	70	78	92
4/17/2007 10:06:07AM	70	74	70	82	100
4/17/2007 10:06:17AM	70	74	70	80	95
4/17/2007 10:06:27AM	70	78	70	85	101
4/17/2007 10:06:37AM	70	79	70	89	105
4/17/2007 10:06:47AM	70	83	70	92	105
4/17/2007 10:06:57AM	70	78	70	89	103
4/17/2007 10:07:07AM	70	70	70	77	91
4/17/2007 10:07:17AM	70	76	70	85	100
4/17/2007 10:07:27AM	70	74	70	84	101
4/17/2007 10:07:37AM	70	74	70	82	100
4/17/2007 10:07:47AM	70	83	70	93	103
4/17/2007 10:07:57AM	70	80	70	87	105
4/17/2007 10:08:07AM	70	79	70	89	103
4/17/2007 10:08:17AM	70	81	70	88	101
4/17/2007 10:08:27AM	70	77	70	88	101
2007 10:08:37AM	70	76	70	82	94
4/17/2007 10:08:47AM	70	70	70	71	87
4/17/2007 10:08:57AM	70	71	70	76	93

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 10:09:07AM	70	70	70	73	90
'/2007 10:09:17AM	70	70	70	74	90
2007 10:09:27AM	70	71	70	76	90
4/17/2007 10:09:37AM	70	74	70	82	93
4/17/2007 10:09:47AM	70	73	70	81	100
4/17/2007 10:09:57AM	70	73	70	83	95
4/17/2007 10:10:07AM	70	70	70	73	90
4/17/2007 10:10:17AM	70	71	70	78	95
4/17/2007 10:10:27AM	70	77	70	87	101
4/17/2007 10:10:37AM	70	73	70	80	100
4/17/2007 10:10:47AM	70	77	70	87	100
4/17/2007 10:10:57AM	70	70	70	70	87
4/17/2007 10:11:07AM	70	71	70	76	91
4/17/2007 10:11:17AM	70	71	70	76	93
4/17/2007 10:11:27AM	70	71	70	78	93
4/17/2007 10:11:37AM	70	72	70	80	94
4/17/2007 10:11:47AM	70	74	70	82	101
4/17/2007 10:11:57AM	70	74	70	83	96
4/17/2007 10:12:07AM	70	73	70	81	101
4/17/2007 10:12:17AM	70	71	70	77	91
4/17/2007 10:12:27AM	70	72	70	81	100
4/17/2007 10:12:37AM	70	71	70	77	91
2007 10:12:47AM	71	73	78	80	91
4/17/2007 10:12:57AM	72	75	79	82	93
4/17/2007 10:13:07AM	70	70	70	71	87
4/17/2007 10:13:17AM	70	70	70	71	87
4/17/2007 10:13:27AM	70	73	70	82	101
4/17/2007 10:13:37AM	70	72	70	77	91
4/17/2007 10:13:47AM	70	71	70	75	90
4/17/2007 10:13:57AM	70	70	70	71	87
4/17/2007 10:14:07AM	70	71	70	76	90
4/17/2007 10:14:17AM	70	71	70	77	92
4/17/2007 10:14:27AM	70	70	70	71	89
4/17/2007 10:14:37AM	70	70	70	74	89
4/17/2007 10:14:47AM	70	75	70	85	102
4/17/2007 10:14:57AM	70	71	70	76	91
4/17/2007 10:15:07AM	70	71	70	77	91
4/17/2007 10:15:17AM	70	74	70	83	100
4/17/2007 10:15:27AM	70	74	70	83	100
4/17/2007 10:15:37AM	70	74	70	80	94
4/17/2007 10:15:47AM	70	71	70	74	90
4/17/2007 10:15:57AM	70	70	70	73	87
2007 10:16:07AM	70	72	70	82	98
4/17/2007 10:16:17AM	70	77	70	83	100
4/17/2007 10:16:27AM	70	81	70	86	100

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 10:16:37AM	70	78	70	84	101
7/2007 10:16:47AM	70	74	70	81	95
2007 10:16:57AM	70	73	70	78	94
4/17/2007 10:17:07AM	70	75	70	86	100
4/17/2007 10:17:17AM	70	76	70	84	100
4/17/2007 10:17:27AM	70	72	70	79	93
4/17/2007 10:17:37AM	70	71	70	76	92
4/17/2007 10:17:47AM	70	76	70	86	100
4/17/2007 10:17:57AM	70	79	70	87	101
4/17/2007 10:18:07AM	70	80	70	87	101
4/17/2007 10:18:17AM	70	75	70	82	100
4/17/2007 10:18:27AM	70	72	70	77	91
4/17/2007 10:18:37AM	70	78	70	87	101
4/17/2007 10:18:47AM	70	80	70	87	101
4/17/2007 10:18:57AM	75	78	86	87	101
4/17/2007 10:19:07AM	75	82	82	89	103
4/17/2007 10:19:17AM	71	81	77	86	101
4/17/2007 10:19:27AM	70	80	70	93	104
4/17/2007 10:19:37AM	70	82	70	89	101
4/17/2007 10:19:47AM	70	75	70	80	94
4/17/2007 10:19:57AM	70	72	70	78	92
7/2007 10:20:07AM	70	73	70	79	94
2007 10:20:17AM	70	76	70	82	100
4/17/2007 10:20:27AM	70	76	70	82	96
4/17/2007 10:20:37AM	70	71	70	76	91
4/17/2007 10:20:47AM	70	71	70	77	92
4/17/2007 10:20:57AM	70	72	70	80	95
4/17/2007 10:21:07AM	70	71	70	76	90
4/17/2007 10:21:17AM	70	73	70	83	101
4/17/2007 10:21:27AM	70	74	70	81	100
4/17/2007 10:21:37AM	70	70	70	74	90
4/17/2007 10:21:47AM	70	73	70	79	94
4/17/2007 10:21:57AM	70	73	70	78	93
4/17/2007 10:22:07AM	70	72	70	79	92
4/17/2007 10:22:17AM	70	76	70	83	101
4/17/2007 10:22:27AM	70	73	70	80	94
4/17/2007 10:22:37AM	70	70	70	75	90
4/17/2007 10:22:47AM	70	70	70	72	86
4/17/2007 10:22:57AM	70	71	70	75	90
4/17/2007 10:23:07AM	70	71	70	75	91
4/17/2007 10:23:17AM	70	72	70	80	95
4/17/2007 10:23:27AM	70	78	70	83	100
2007 10:23:37AM	70	71	70	76	91
4/17/2007 10:23:47AM	70	71	70	78	91
4/17/2007 10:23:57AM	70	76	70	87	101

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
/2007 10:24:17AM	70	72	70	76	92
4/17/2007 10:24:07AM	70	71	70	77	91
2007 10:24:27AM	70	72	70	77	92
4/17/2007 10:24:37AM	70	73	70	82	100
4/17/2007 10:24:47AM	70	74	70	81	94
4/17/2007 10:24:57AM	70	71	70	75	90
4/17/2007 10:25:07AM	70	71	70	80	94
4/17/2007 10:25:17AM	70	74	70	81	93
4/17/2007 10:25:27AM	70	76	70	82	95
4/17/2007 10:25:37AM	70	76	70	85	101
4/17/2007 10:25:47AM	70	76	70	81	94
4/17/2007 10:25:57AM	70	76	70	84	100
4/17/2007 10:26:07AM	70	75	70	81	100
4/17/2007 10:26:17AM	70	74	70	83	100
4/17/2007 10:26:27AM	70	81	70	90	103
4/17/2007 10:26:37AM	70	72	70	80	94
4/17/2007 10:26:47AM	70	79	70	88	101
4/17/2007 10:26:57AM	70	78	70	84	100
4/17/2007 10:27:07AM	70	73	70	78	95
4/17/2007 10:27:17AM	70	72	70	78	95
4/17/2007 10:27:27AM	70	71	70	76	91
4/17/2007 10:27:37AM	70	70	70	76	93
2007 10:27:47AM	70	71	70	76	92
4/17/2007 10:27:57AM	70	71	70	79	92
4/17/2007 10:28:07AM	70	70	70	75	87
4/17/2007 10:28:17AM	70	74	70	81	101
4/17/2007 10:28:27AM	70	79	70	87	101
4/17/2007 10:28:37AM	70	77	70	86	101
4/17/2007 10:28:47AM	70	78	70	86	101
4/17/2007 10:28:57AM	70	74	70	85	101
4/17/2007 10:29:07AM	70	70	70	70	86
4/17/2007 10:29:17AM	70	70	70	76	91
4/17/2007 10:29:27AM	70	72	70	79	94
4/17/2007 10:29:37AM	70	73	70	80	94
4/17/2007 10:29:47AM	70	75	70	82	96
4/17/2007 10:29:57AM	70	78	70	87	100
4/17/2007 10:30:07AM	70	76	70	84	101
4/17/2007 10:30:17AM	70	73	70	82	94
4/17/2007 10:30:27AM	70	71	70	81	91
4/17/2007 10:30:37AM	70	70	70	71	89
4/17/2007 10:30:47AM	70	71	70	76	91
4/17/2007 10:30:57AM	70	71	70	76	90
2007 10:31:07AM	70	71	70	75	89
4/17/2007 10:31:17AM	70	81	70	91	101
4/17/2007 10:31:27AM	70	82	70	89	102

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
7/2007 1:01:47PM	70	70	70	70	86
2007 1:01:57PM	70	70	70	70	85
4/17/2007 1:02:07PM	70	70	70	70	85
4/17/2007 1:02:17PM	70	70	70	71	89
4/17/2007 1:02:27PM	70	70	70	72	89
4/17/2007 1:02:37PM	70	70	70	71	87
4/17/2007 1:02:47PM	70	70	70	70	85
4/17/2007 1:02:57PM	70	70	70	70	86
4/17/2007 1:03:07PM	70	70	70	70	85
4/17/2007 1:03:17PM	70	70	70	70	86
4/17/2007 1:03:27PM	70	71	70	76	92
4/17/2007 1:03:37PM	70	70	70	75	91
4/17/2007 1:03:47PM	70	70	70	75	88
4/17/2007 1:03:57PM	70	70	70	70	86
4/17/2007 1:04:07PM	70	70	70	74	90
4/17/2007 1:04:17PM	70	75	70	87	101
4/17/2007 1:04:27PM	70	76	70	84	100
4/17/2007 1:04:37PM	70	70	70	72	87
4/17/2007 1:04:47PM	70	70	70	71	86
4/17/2007 1:04:57PM	70	73	70	80	93
4/17/2007 1:05:07PM	70	72	70	77	93
2007 1:05:17PM	70	71	70	76	91
4/17/2007 1:05:27PM	70	74	70	82	94
4/17/2007 1:05:37PM	73	77	80	84	101
4/17/2007 1:05:47PM	78	85	83	90	104
4/17/2007 1:05:57PM	77	87	84	92	104
4/17/2007 1:06:07PM	71	79	76	86	101
4/17/2007 1:06:17PM	70	74	70	79	92
4/17/2007 1:06:27PM	70	71	70	76	90
4/17/2007 1:06:37PM	70	71	70	75	92
4/17/2007 1:06:47PM	70	70	70	70	85
4/17/2007 1:06:57PM	70	70	70	70	85
4/17/2007 1:07:07PM	70	70	70	70	85
4/17/2007 1:07:17PM	70	70	70	72	88
4/17/2007 1:07:27PM	70	70	70	70	86
4/17/2007 1:07:37PM	70	70	70	74	89
4/17/2007 1:07:47PM	70	70	70	71	89
4/17/2007 1:07:57PM	70	70	70	76	92
4/17/2007 1:08:07PM	70	70	70	70	85
4/17/2007 1:08:17PM	70	70	70	70	85
4/17/2007 1:08:27PM	70	70	70	70	85
2007 1:08:37PM	70	70	70	72	86
4/17/2007 1:08:47PM	70	70	70	72	87
4/17/2007 1:08:57PM	70	70	70	75	90

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 1:09:07PM	70	70	70	70	85
7/2007 1:09:17PM	70	70	70	70	85
2007 1:09:27PM	70	70	70	70	85
4/17/2007 1:09:37PM	70	70	70	70	85
4/17/2007 1:09:47PM	70	70	70	70	85
4/17/2007 1:09:57PM	70	70	70	70	85
4/17/2007 1:10:07PM	70	70	70	70	85
4/17/2007 1:10:17PM	70	70	70	70	85
4/17/2007 1:10:27PM	70	70	70	70	86
4/17/2007 1:10:37PM	70	70	70	70	85
4/17/2007 1:10:47PM	70	70	70	70	86
4/17/2007 1:10:57PM	70	70	70	70	85
4/17/2007 1:11:07PM	70	70	70	70	85
4/17/2007 1:11:17PM	70	70	70	70	85
4/17/2007 1:11:27PM	70	70	70	71	86
4/17/2007 1:11:37PM	70	71	70	79	93
4/17/2007 1:11:47PM	70	70	70	71	85
4/17/2007 1:11:57PM	70	70	70	71	86
4/17/2007 1:12:07PM	70	70	70	70	86
4/17/2007 1:12:17PM	70	70	70	70	87
4/17/2007 1:12:27PM	70	70	70	70	86
17/2007 1:12:37PM	70	70	70	71	87
2007 1:12:47PM	70	70	70	70	85
4/17/2007 1:12:57PM	70	70	70	74	90
4/17/2007 1:13:07PM	70	71	70	75	90
4/17/2007 1:13:17PM	70	72	70	79	94
4/17/2007 1:13:27PM	70	70	70	74	90
4/17/2007 1:13:37PM	70	70	70	74	91
4/17/2007 1:13:47PM	70	70	70	72	87
4/17/2007 1:13:57PM	70	70	70	70	87
4/17/2007 1:14:07PM	70	70	70	70	86
4/17/2007 1:14:17PM	70	70	70	70	85
4/17/2007 1:14:27PM	70	70	70	70	85
4/17/2007 1:14:37PM	70	70	70	70	85
4/17/2007 1:14:47PM	70	70	70	70	86
4/17/2007 1:14:57PM	70	70	70	70	86
4/17/2007 1:15:07PM	72	73	81	83	95
4/17/2007 1:15:17PM	70	70	70	72	86
4/17/2007 1:15:27PM	70	72	70	79	94
4/17/2007 1:15:37PM	70	70	70	71	89
4/17/2007 1:15:47PM	70	70	70	73	89
4/17/2007 1:15:57PM	70	70	70	74	88
007 1:16:07PM	70	72	70	80	93
4/17/2007 1:16:17PM	70	73	70	81	95
4/17/2007 1:16:27PM	70	70	70	72	88

Date and Time	LEQ #1	LEQ #2	LMAX #1	LMAX #2	LPEAK
4/17/2007 1:16:37PM	70	70	70	70	85
7/2007 1:16:47PM	70	70	70	74	90
2007 1:16:57PM	70	70	70	72	87
4/17/2007 1:17:07PM	70	70	70	73	87
4/17/2007 1:17:17PM	70	73	70	80	91
4/17/2007 1:17:27PM	70	70	70	73	89
4/17/2007 1:17:37PM	70	72	70	79	96
4/17/2007 1:17:47PM	70	70	70	75	91
4/17/2007 1:17:57PM	70	70	70	72	87
4/17/2007 1:18:07PM	70	70	70	75	93
4/17/2007 1:18:17PM	70	71	70	75	94
4/17/2007 1:18:27PM	70	70	70	74	89
4/17/2007 1:18:37PM	70	70	70	70	85
4/17/2007 1:18:47PM	70	70	70	70	85
4/17/2007 1:18:57PM	70	70	70	72	89
4/17/2007 1:19:07PM	70	70	70	70	85
4/17/2007 1:19:17PM	70	70	70	71	86
4/17/2007 1:19:27PM	70	70	70	70	85
4/17/2007 1:19:37PM	70	72	70	80	96
4/17/2007 1:19:47PM	70	71	70	77	92
4/17/2007 1:19:57PM	70	70	70	70	85
17/2007 1:20:07PM	70	70	70	70	85
2007 1:20:17PM	70	70	70	70	85
4/17/2007 1:20:27PM	70	70	70	70	85
4/17/2007 1:20:37PM	70	70	70	74	89
4/17/2007 1:20:47PM	70	70	70	70	86
4/17/2007 1:20:57PM	70	70	70	70	85
4/17/2007 1:21:07PM	70	70	70	70	85
4/17/2007 1:21:17PM	70	70	70	70	86
4/17/2007 1:21:27PM	70	70	70	70	86
4/17/2007 1:21:37PM	70	70	70	70	86
4/17/2007 1:21:47PM	70	70	70	70	86
4/17/2007 1:21:57PM	70	70	70	70	86
4/17/2007 1:22:07PM	70	70	70	70	86
4/17/2007 1:22:17PM	70	70	70	70	86
4/17/2007 1:22:27PM	70	70	70	71	86
4/17/2007 1:22:37PM	70	70	70	70	85
4/17/2007 1:22:47PM	70	70	70	70	85
4/17/2007 1:22:57PM	70	70	70	70	85
4/17/2007 1:23:07PM	70	70	70	70	85
4/17/2007 1:23:17PM	70	70	70	70	87
4/17/2007 1:23:27PM	70	70	70	70	85
007 1:23:37PM	70	70	70	70	85
4/ /2007 1:23:47PM	70	70	70	72	88
4/17/2007 1:23:57PM	70	70	70	76	90

F104F25.ndat Happy Creek

Q-300 Noise Logging Dosimeter

ersion: 02.2 Serial Number: QC7020020

Name: F104 Test Flight

Company:

WorkArea:

Description:

Comments:

Dosimeter Calibration:

Pre-Survey 114.0 dB 4/12/2007 1:07:22PM

Instrument Range: 40 - 110 dB

Measuring Parameters:

DOSIMETER 1

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	40	dB
Weighting:	A	
TimeConstant:	Fast	

DOSIMETER 2

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	60	dB
UpperLimit:	50	dB
Weighting:	A	
TimeConstant:	Fast	

DOSIMETER 3

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	80	dB
UpperLimit:	60	dB
Weighting:	A	
TimeConstant:	Fast	

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 9:28:34AM	62	62	0	73	77	106
' '/2007 9:29:34AM	60	59	0	67	69	103
2007 9:30:34AM	53	46	0	61	65	96
4/17/2007 9:31:34AM	49	42	0	60	63	95
4/17/2007 9:32:34AM	57	54	0	63	66	100
4/17/2007 9:33:34AM	56	51	0	63	67	99
4/17/2007 9:34:34AM	59	57	0	67	72	103
4/17/2007 9:35:34AM	63	63	0	70	75	107
4/17/2007 9:36:34AM	57	53	0	64	68	99
4/17/2007 9:37:34AM	57	54	0	63	66	98
4/17/2007 9:38:34AM	61	61	0	68	70	102
4/17/2007 9:39:34AM	64	64	0	71	76	108
4/17/2007 9:40:34AM	58	56	0	65	69	102
4/17/2007 9:41:34AM	57	53	0	63	66	97
4/17/2007 9:42:34AM	59	58	0	66	71	104
4/17/2007 9:43:34AM	63	62	0	70	74	107
4/17/2007 9:44:34AM	63	62	0	70	73	105
4/17/2007 9:45:34AM	61	60	0	70	75	106
4/17/2007 9:46:34AM	55	53	0	68	72	100
4/17/2007 9:47:34AM	60	59	0	67	71	104
4/17/2007 9:48:34AM	59	57	0	67	69	100
4''7/2007 9:49:34AM	57	55	0	65	72	103
2007 9:50:34AM	55	51	0	62	65	95
4/17/2007 9:51:34AM	51	46	0	62	66	97
4/17/2007 9:52:34AM	44	0	0	53	56	89
4/17/2007 9:53:34AM	51	0	0	57	59	95
4/17/2007 9:54:34AM	51	38	0	58	62	95
4/17/2007 9:55:34AM	54	49	0	61	66	100
4/17/2007 9:56:34AM	56	53	0	66	69	102
4/17/2007 9:57:34AM	55	48	0	61	65	98
4/17/2007 9:58:34AM	57	55	0	67	71	102
4/17/2007 9:59:34AM	57	54	0	63	66	97
4/17/2007 10:00:34AM	57	55	0	66	70	102
4/17/2007 10:01:34AM	56	51	0	61	67	107
4/17/2007 10:02:34AM	65	64	0	74	76	96
4/17/2007 10:03:34AM	61	60	0	72	76	107
4/17/2007 10:04:34AM	62	61	0	68	72	105
4/17/2007 10:05:34AM	53	41	0	60	64	100
4/17/2007 10:06:34AM	55	51	0	61	64	105
4/17/2007 10:07:34AM	59	57	0	65	70	102
4/17/2007 10:08:34AM	62	62	0	70	75	111
4/'7/2007 10:09:34AM	61	60	0	68	71	105
'007 10:10:34AM	61	60	0	66	69	101
4/1 /2007 10:11:34AM	60	59	0	66	70	103
4/17/2007 10:12:34AM	58	55	0	65	67	102

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 10:13:34AM	60	58	0	69	71	100
7/2007 10:14:34AM	59	58	0	65	70	104
2007 10:15:34AM	60	59	0	69	74	110
4/17/2007 10:16:34AM	61	60	0	68	73	104
4/17/2007 10:17:34AM	63	63	0	71	74	105
4/17/2007 10:18:34AM	60	59	0	66	68	103
4/17/2007 10:19:34AM	62	62	0	69	72	106
4/17/2007 10:20:34AM	59	58	0	65	71	104
4/17/2007 10:21:34AM	58	55	0	67	69	103
4/17/2007 10:22:34AM	62	62	0	69	73	104
4/17/2007 10:23:34AM	60	59	0	67	70	102
4/17/2007 10:24:34AM	59	57	0	65	69	101
4/17/2007 10:25:34AM	53	47	0	61	63	99
4/17/2007 10:26:34AM	58	56	0	66	69	101
4/17/2007 10:27:34AM	61	61	0	68	72	102
4/17/2007 10:28:34AM	61	59	0	68	71	105
4/17/2007 10:29:34AM	56	52	0	62	65	99
4/17/2007 10:30:34AM	61	60	0	67	71	104
4/17/2007 10:31:34AM	58	56	0	65	69	102
4/17/2007 10:32:34AM	58	56	0	66	70	102
4/17/2007 10:33:34AM	62	62	0	68	72	105
7/2007 10:34:34AM	60	58	0	67	70	103
2007 10:35:34AM	57	53	0	63	68	100
4/17/2007 10:36:34AM	56	53	0	64	68	102
4/17/2007 10:37:34AM	58	55	0	64	68	101
4/17/2007 10:38:34AM	53	40	0	58	62	95
4/17/2007 10:39:34AM	54	46	0	60	62	97
4/17/2007 10:40:34AM	56	50	0	63	66	98
4/17/2007 10:41:34AM	55	49	0	61	64	106
4/17/2007 10:42:34AM	53	44	0	60	65	99
4/17/2007 10:43:34AM	57	54	0	63	66	97
4/17/2007 10:44:34AM	49	0	0	59	58	95
4/17/2007 10:45:34AM	52	43	0	59	63	97
4/17/2007 10:46:34AM	56	53	0	63	67	103
4/17/2007 10:47:34AM	56	53	0	64	66	98
4/17/2007 10:48:34AM	49	32	0	56	61	93
4/17/2007 10:49:34AM	53	43	0	59	63	97
4/17/2007 10:50:34AM	56	52	0	63	66	101
4/17/2007 10:51:34AM	54	50	0	62	65	97
4/17/2007 10:52:34AM	54	46	0	62	63	95
4/17/2007 10:53:34AM	49	0	0	57	60	95
4/17/2007 10:54:34AM	56	52	0	65	68	100
2007 10:55:34AM	57	52	0	63	67	99
4/17/2007 10:56:34AM	55	44	0	60	63	97
4/17/2007 10:57:34AM	59	58	0	66	68	102

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 12:28:34PM	52	46	0	60	65	98
/2007 12:29:34PM	52	48	0	61	64	98
2007 12:30:34PM	58	55	0	65	67	95
4/17/2007 12:31:34PM	55	48	0	60	62	96
4/17/2007 12:32:34PM	56	53	0	62	64	96
4/17/2007 12:33:34PM	54	50	0	62	64	94
4/17/2007 12:34:34PM	37	0	0	45	47	84
4/17/2007 12:35:34PM	48	35	0	57	61	95
4/17/2007 12:36:34PM	52	48	0	61	64	97
4/17/2007 12:37:34PM	48	0	0	57	57	92
4/17/2007 12:38:34PM	55	51	0	62	65	98
4/17/2007 12:39:34PM	53	47	0	60	64	97
4/17/2007 12:40:34PM	52	44	0	60	64	96
4/17/2007 12:41:34PM	46	0	0	54	57	91
4/17/2007 12:42:34PM	50	40	0	57	62	96
4/17/2007 12:43:34PM	50	42	0	59	63	95
4/17/2007 12:44:34PM	45	0	0	53	58	92
4/17/2007 12:45:34PM	47	0	0	56	60	94
4/17/2007 12:46:34PM	53	47	0	63	67	103
4/17/2007 12:47:34PM	53	50	0	64	69	105
4/17/2007 12:48:34PM	47	0	0	54	58	94
4/17/2007 12:49:34PM	48	44	0	59	65	98
2007 12:50:34PM	49	40	0	58	62	96
4/17/2007 12:51:34PM	50	46	0	63	67	98
4/17/2007 12:52:34PM	52	48	0	63	67	98
4/17/2007 12:53:34PM	52	44	0	59	64	95
4/17/2007 12:54:34PM	43	0	0	52	56	91
4/17/2007 12:55:34PM	53	46	0	60	64	96
4/17/2007 12:56:34PM	53	46	0	60	64	98
4/17/2007 12:57:34PM	52	45	0	60	64	100
4/17/2007 12:58:34PM	50	42	0	60	65	96
4/17/2007 12:59:34PM	49	0	0	54	57	92
4/17/2007 1:00:34PM	46	0	0	53	58	93
4/17/2007 1:01:34PM	49	38	0	59	62	101
4/17/2007 1:02:34PM	47	33	0	57	61	95
4/17/2007 1:03:34PM	47	0	0	56	60	97
4/17/2007 1:04:34PM	66	66	0	76	77	96
4/17/2007 1:05:34PM	66	66	0	77	79	99
4/17/2007 1:06:34PM	46	0	0	56	59	94
4/17/2007 1:07:34PM	50	38	0	58	62	96
4/17/2007 1:08:34PM	47	0	0	55	58	92
4/17/2007 1:09:34PM	46	0	0	53	56	92
2007 1:10:34PM	43	0	0	52	57	91
4/17/2007 1:11:34PM	49	0	0	55	59	95
4/17/2007 1:12:34PM	52	45	0	60	65	98

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 1:13:34PM	50	42	0	60	65	97
'/2007 1:14:34PM	52	41	0	59	62	94
2007 1:15:34PM	52	47	0	61	65	98
4/17/2007 1:16:34PM	53	45	0	60	64	98
4/17/2007 1:17:34PM	48	31	0	57	60	97
4/17/2007 1:18:34PM	51	34	0	57	60	94
4/17/2007 1:19:34PM	50	42	0	59	63	98
4/17/2007 1:20:34PM	50	44	0	60	64	96
4/17/2007 1:21:34PM	53	50	0	64	65	97
4/17/2007 1:22:34PM	49	31	0	57	61	97
4/17/2007 1:23:34PM	50	43	0	59	63	97
4/17/2007 1:24:34PM	49	39	0	59	62	96
4/17/2007 1:25:34PM	46	0	0	54	57	93
4/17/2007 1:26:34PM	46	0	0	56	60	94
4/17/2007 1:27:34PM	47	30	0	56	60	96
4/17/2007 1:28:34PM	47	42	0	60	63	95
4/17/2007 1:29:34PM	54	51	0	65	67	99
4/17/2007 1:30:34PM	48	34	0	56	61	95
4/17/2007 1:31:34PM	48	34	0	57	61	93
4/17/2007 1:32:34PM	51	40	0	58	62	98
4/17/2007 1:33:34PM	42	0	0	53	57	95
4/17/2007 1:34:34PM	48	0	0	57	60	92
2007 1:35:34PM	48	0	0	57	60	95
4/17/2007 1:36:34PM	49	39	0	58	61	94
4/17/2007 1:37:34PM	47	0	0	52	56	92
4/17/2007 1:38:34PM	41	0	0	50	54	87
4/17/2007 1:39:34PM	32	0	0	43	47	85
4/17/2007 1:40:34PM	46	0	0	56	58	93
4/17/2007 1:41:34PM	50	42	0	60	61	92
4/17/2007 1:42:34PM	28	0	0	43	49	80
4/17/2007 1:43:34PM	48	0	0	53	56	93
4/17/2007 1:44:34PM	46	0	0	54	56	88
4/17/2007 1:45:34PM	42	0	0	52	56	91
4/17/2007 1:46:34PM	38	0	0	46	50	87
4/17/2007 1:47:34PM	46	0	0	55	59	91
4/17/2007 1:48:34PM	45	32	0	57	60	93
4/17/2007 1:49:34PM	48	27	0	58	60	92
4/17/2007 1:50:34PM	47	39	0	58	61	93
4/17/2007 1:51:34PM	38	0	0	47	51	89
4/17/2007 1:52:34PM	43	0	0	55	60	94
4/17/2007 1:53:34PM	44	0	0	51	55	89
4/17/2007 1:54:34PM	44	0	0	52	55	93
2007 1:55:34PM	45	0	0	55	60	95
4/17/2007 1:56:34PM	48	41	0	60	65	97
4/17/2007 1:57:34PM	44	0	0	52	56	92

F104F27.ndat

FIRING RANGE
SWARTZ RD

Q-300 Noise Logging Dosimeter

ersion:	02.2	Serial Number:	QC7020018
Name:	F104 Test Flight		
Company:			
WorkArea:			
Description:			
Comments:			

Dosimeter Calibration:

Pre-Survey	114.0 dB	4/12/2007 1:02:44PM

Instrument Range: 40 - 110 dB

Measuring Parameters:

DOSIMETER	1	
Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	40	dB
Weighting:	A	
TimeConstant:	Fast	

DOSIMETER	2	
Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	60	dB
UpperLimit:	50	dB
Weighting:	A	
TimeConstant:	Fast	

DOSIMETER	3	
Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	80	dB
UpperLimit:	60	dB
Weighting:	A	
TimeConstant:	Fast	

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 9:56:07AM	52	47	0	63	69	104
/2007 9:57:07AM	49	31	0	56	61	103
2007 9:58:07AM	59	57	0	67	72	106
4/17/2007 9:59:07AM	60	59	0	72	77	115
4/17/2007 10:00:07AM	55	50	0	64	70	106
4/17/2007 10:01:07AM	61	60	0	67	68	103
4/17/2007 10:02:07AM	60	60	0	65	68	104
4/17/2007 10:03:07AM	49	27	0	55	60	98
4/17/2007 10:04:07AM	54	49	0	63	67	105
4/17/2007 10:05:07AM	53	50	0	65	70	104
4/17/2007 10:06:07AM	48	33	0	63	61	100
4/17/2007 10:07:07AM	57	55	0	67	71	108
4/17/2007 10:08:07AM	57	54	0	64	69	106
4/17/2007 10:09:07AM	55	53	0	64	69	110
4/17/2007 10:10:07AM	55	50	0	64	72	107
4/17/2007 10:11:07AM	54	49	0	65	71	102
4/17/2007 10:12:07AM	57	56	0	66	70	105
4/17/2007 10:13:07AM	82	82	82	95	99	110
4/17/2007 10:14:07AM	73	73	71	85	89	103
4/17/2007 10:15:07AM	78	78	77	86	90	105
4/17/2007 10:16:07AM	69	69	59	78	82	102
4/17/2007 10:17:07AM	66	66	0	76	80	101
2007 10:18:07AM	57	53	0	65	72	105
4/17/2007 10:19:07AM	73	73	70	83	86	103
4/17/2007 10:20:07AM	77	77	76	87	91	105
4/17/2007 10:21:07AM	49	33	0	57	61	98
4/17/2007 10:22:07AM	54	49	0	65	71	109
4/17/2007 10:23:07AM	53	48	0	61	65	100
4/17/2007 10:24:07AM	55	50	0	63	69	103
4/17/2007 10:25:07AM	55	49	0	62	66	102
4/17/2007 10:26:07AM	56	52	0	63	68	102
4/17/2007 10:27:07AM	52	43	0	59	65	100
4/17/2007 10:28:07AM	58	57	0	67	71	105
4/17/2007 10:29:07AM	56	53	0	67	73	105
4/17/2007 10:30:07AM	56	52	0	62	66	103
4/17/2007 10:31:07AM	42	0	0	46	51	92
4/17/2007 10:32:07AM	51	47	0	61	69	107
4/17/2007 10:33:07AM	51	45	0	60	65	104
4/17/2007 10:34:07AM	55	50	0	62	66	103
4/17/2007 10:35:07AM	55	53	0	65	67	103
4/17/2007 10:36:07AM	48	36	0	57	63	100
4/17/2007 10:37:07AM	50	39	0	57	62	96
007 10:38:07AM	54	50	0	63	64	97
4/1/2007 10:39:07AM	50	41	0	60	64	101
4/17/2007 10:40:07AM	51	40	0	57	63	105

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 12:56:07PM	47	30	0	55	60	98
7/2007 12:57:07PM	43	0	0	50	54	92
2007 12:58:07PM	49	43	0	60	63	99
4/17/2007 12:59:07PM	47	33	0	57	60	99
4/17/2007 1:00:07PM	54	49	0	61	65	105
4/17/2007 1:01:07PM	46	0	0	54	57	96
4/17/2007 1:02:07PM	47	0	0	54	58	96
4/17/2007 1:03:07PM	48	46	0	61	64	93
4/17/2007 1:04:07PM	60	59	0	67	68	100
4/17/2007 1:05:07PM	52	43	0	59	65	103
4/17/2007 1:06:07PM	54	50	0	63	68	110
4/17/2007 1:07:07PM	52	43	0	59	62	98
4/17/2007 1:08:07PM	47	36	0	56	62	105
4/17/2007 1:09:07PM	43	0	0	50	53	95
4/17/2007 1:10:07PM	45	0	0	51	55	94
4/17/2007 1:11:07PM	54	52	0	65	65	100
4/17/2007 1:12:07PM	48	31	0	55	61	97
4/17/2007 1:13:07PM	52	48	0	62	65	104
4/17/2007 1:14:07PM	55	53	0	66	72	106
4/17/2007 1:15:07PM	83	83	83	94	97	111
4/17/2007 1:16:07PM	51	38	0	58	62	104
7/2007 1:17:07PM	84	84	84	95	97	115
2007 1:18:07PM	77	77	77	89	93	110
4/17/2007 1:19:07PM	48	42	0	60	65	97
4/17/2007 1:20:07PM	49	42	0	59	65	101
4/17/2007 1:21:07PM	53	44	0	59	63	98
4/17/2007 1:22:07PM	47	0	0	54	56	99
4/17/2007 1:23:07PM	44	0	0	52	55	91
4/17/2007 1:24:07PM	59	59	0	69	76	99
4/17/2007 1:25:07PM	50	46	0	63	67	102
4/17/2007 1:26:07PM	62	62	0	70	78	102
4/17/2007 1:27:07PM	63	63	0	71	79	103
4/17/2007 1:28:07PM	61	61	51	73	80	104
4/17/2007 1:29:07PM	38	0	0	46	48	85
4/17/2007 1:30:07PM	53	51	0	64	71	104
4/17/2007 1:31:07PM	56	55	0	68	76	99
4/17/2007 1:32:07PM	66	65	54	74	82	106
4/17/2007 1:33:07PM	55	54	0	67	75	102
4/17/2007 1:34:07PM	62	62	0	70	76	101
4/17/2007 1:35:07PM	64	64	51	74	81	104
4/17/2007 1:36:07PM	63	63	47	72	80	105
4/17/2007 1:37:07PM	52	45	0	59	64	100
2007 1:38:07PM	50	0	0	56	59	95
4/17/2007 1:39:07PM	45	0	0	50	55	94
4/17/2007 1:40:07PM	48	41	0	59	65	98

F104F26.ndat

VAB Area (OCD.20)

Q-300 Noise Logging Dosimeter

ersion:	02.5	Serial Number:	QC9050052
Name:	F104 Test Flight		
Company:			
WorkArea:			
Description:			
Comments:			

Dosimeter Calibration:

Pre-Survey 114.0 dB 4/12/2007 1:06:32PM

Instrument Range: 40 - 110 dB

Measuring Parameters:

DOSIMETER 1

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	40	dB
UpperLimit:	40	dB
Weighting:	A	
TimeConstant:	Fast	

DOSIMETER 2

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	60	dB
UpperLimit:	50	dB
Weighting:	A	
TimeConstant:	Fast	

DOSIMETER 3

Criterion:	85	dB
ExchangeRate:	3	dB
Threshold:	80	dB
UpperLimit:	60	dB
Weighting:	A	
TimeConstant:	Fast	

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 9:51:51AM	60	59	0	69	73	105
2007 9:52:51AM	60	59	0	69	72	102
2007 9:53:51AM	61	60	0	71	74	108
4/17/2007 9:54:51AM	64	63	0	76	80	108
4/17/2007 9:55:51AM	55	54	0	68	74	102
4/17/2007 9:56:51AM	62	61	0	71	77	110
4/17/2007 9:57:51AM	66	66	0	75	79	107
4/17/2007 9:58:51AM	65	65	47	74	80	109
4/17/2007 9:59:51AM	62	62	0	75	79	111
4/17/2007 10:00:51AM	63	63	0	74	79	109
4/17/2007 10:01:51AM	66	66	0	75	80	107
4/17/2007 10:02:51AM	65	65	53	77	81	111
4/17/2007 10:03:51AM	58	56	0	65	69	105
4/17/2007 10:04:51AM	58	57	0	66	72	104
4/17/2007 10:05:51AM	58	57	0	70	74	107
4/17/2007 10:06:51AM	53	48	0	62	67	103
4/17/2007 10:07:51AM	66	66	56	78	82	112
4/17/2007 10:08:51AM	68	68	0	74	78	110
4/17/2007 10:09:51AM	65	65	0	73	77	107
4/17/2007 10:10:51AM	64	64	0	72	75	106
4/17/2007 10:11:51AM	60	59	0	70	77	106
7/2007 10:12:51AM	63	62	0	74	78	108
2007 10:13:51AM	68	68	57	77	82	112
4/17/2007 10:14:51AM	58	57	0	68	70	103
4/17/2007 10:15:51AM	65	65	0	75	78	107
4/17/2007 10:16:51AM	62	61	0	71	76	107
4/17/2007 10:17:51AM	60	58	0	67	69	103
4/17/2007 10:18:51AM	58	54	0	63	67	103
4/17/2007 10:19:51AM	56	53	0	64	67	103
4/17/2007 10:20:51AM	55	45	0	60	64	100
4/17/2007 10:21:51AM	61	60	0	71	75	107
4/17/2007 10:22:51AM	64	63	0	74	77	109
4/17/2007 10:23:51AM	61	61	0	72	75	103
4/17/2007 10:24:51AM	58	57	0	71	78	106
4/17/2007 10:25:51AM	63	62	0	72	76	104
4/17/2007 10:26:51AM	61	60	0	70	74	106
4/17/2007 10:27:51AM	59	57	0	69	74	104
4/17/2007 10:28:51AM	63	63	0	70	77	110
4/17/2007 10:29:51AM	60	60	0	73	77	108
4/17/2007 10:30:51AM	59	57	0	66	72	103
4/17/2007 10:31:51AM	60	59	0	67	71	102
4/17/2007 10:32:51AM	58	56	0	66	72	103
2007 10:33:51AM	60	60	0	68	72	104
4/1 /2007 10:34:51AM	62	62	0	72	78	107
4/17/2007 10:35:51AM	63	62	0	72	77	106

Date and Time	LEQ #1	LEQ #2	LEQ #3	Slow MAX	Fast MAX	LPEAK
4/17/2007 12:51:51PM	61	60	0	69	75	104
2007 12:52:51PM	59	58	0	71	75	106
2007 12:53:51PM	62	61	0	69	74	105
4/17/2007 12:54:51PM	58	57	0	69	75	105
4/17/2007 12:55:51PM	50	43	0	60	62	96
4/17/2007 12:56:51PM	51	45	0	61	64	99
4/17/2007 12:57:51PM	49	41	0	59	64	98
4/17/2007 12:58:51PM	53	48	0	61	65	100
4/17/2007 12:59:51PM	50	40	0	59	62	96
4/17/2007 1:00:51PM	57	55	0	67	73	105
4/17/2007 1:01:51PM	58	57	0	69	73	105
4/17/2007 1:02:51PM	58	57	0	67	72	105
4/17/2007 1:03:51PM	54	51	0	65	68	103
4/17/2007 1:04:51PM	60	58	0	65	68	101
4/17/2007 1:05:51PM	56	53	0	64	67	101
4/17/2007 1:06:51PM	55	52	0	64	70	102
4/17/2007 1:07:51PM	54	51	0	63	67	97
4/17/2007 1:08:51PM	45	0	0	54	52	87
4/17/2007 1:09:51PM	44	0	0	49	52	88
4/17/2007 1:10:51PM	54	49	0	61	65	99
4/17/2007 1:11:51PM	50	42	0	59	63	97
7/2007 1:12:51PM	49	40	0	58	63	96
2007 1:13:51PM	51	0	0	57	58	96
4/17/2007 1:14:51PM	51	37	0	58	61	96
4/17/2007 1:15:51PM	53	37	0	58	61	96
4/17/2007 1:16:51PM	51	44	0	60	63	98
4/17/2007 1:17:51PM	56	53	0	64	67	96
4/17/2007 1:18:51PM	54	48	0	62	65	93
4/17/2007 1:19:51PM	57	54	0	64	68	101
4/17/2007 1:20:51PM	54	48	0	62	66	100
4/17/2007 1:21:51PM	54	51	0	64	67	98
4/17/2007 1:22:51PM	51	31	0	57	61	97
4/17/2007 1:23:51PM	49	31	0	55	61	93
4/17/2007 1:24:51PM	58	57	0	68	73	103
4/17/2007 1:25:51PM	52	42	0	60	63	97
4/17/2007 1:26:51PM	49	0	0	52	56	93
4/17/2007 1:27:51PM	48	0	0	54	58	86
4/17/2007 1:28:51PM	55	53	0	63	66	98
4/17/2007 1:29:51PM	52	31	0	58	61	96
4/17/2007 1:30:51PM	50	39	0	57	64	94
4/17/2007 1:31:51PM	51	0	0	55	59	94
4/17/2007 1:32:51PM	51	39	0	58	62	98
2007 1:33:51PM	50	0	0	54	59	93
4/1 /2007 1:34:51PM	48	0	0	54	55	90
4/17/2007 1:35:51PM	48	0	0	53	58	93

Appendix 6. Environmental Noise Assessment, Andretti-Green Racecar Test at Kennedy Space Center, Florida.

CHS
Comprehensive
Health Services
INCORPORATED

June 25, 2007 T200706-3206

Becky Bolt, DYN-5
Dynamac Corp
Kennedy Space Center, Florida

NOISE ASSESSMENT: ANDRETTI RACECAR NOISE MONITORING AT SLF MIDFIELD AND SIX OTHER LOCATIONS J6-2313/ LANDING AIDS CONTROL BUILDING

The SGS/CHS Industrial Hygiene Office provided noise monitoring at six locations at your request. The objective was to log sound level data to assist in the impact assessment of racecar noise produced at the shuttle landing facility.

Six specified monitoring stations were instrumented with logging noise dosimeters for two days of racecar test runs at the SLF. An additional monitoring location was established at the SLF midfield to assist in identifying racecar runs and comparing conditions near the source to the remote locations. A summary of this monitoring is provided in the attached Noise Hazard Assessment Report. Additionally, all logged data are provided in hardcopy form within two notebooks. A disk located within a holder on the inside cover of each notebook contains files of all these data. Those files are in Excel (.xls) format.

Please contact me at 867-9018 if you have any questions.

Gary I. Bergstrom

Gary I. Bergstrom
Industrial Hygiene Office, CHS-022

GIB:glm

Attachment:
- Noise Assessment Report
- Figures & Tables Addendum
- Notebook 1 (with 3 ½ in disk) – hardcopy only, for addressee
- Notebook 2 (with 3 ½ in disk) – hardcopy only, for addressee

cc: Mike Cardinale, CIH, TA-C2
Mario Busacca, TA-C3

NOISE ASSESSMENT REPORT

JBOSC Environmental Health and Service

ADMINISTRATIVE DATA

Facility Number	Facility Name	Room Number/ Area Designation	Task Tracking Number
J6-2313	Landing Aids Control Building	SLF	T200706-3206

Organization	Requestor/ Addressee Name	Mail Code	POC	Phone
Dynamac	M. R. (Becky) Bolt	DYN-5	Becky Bolt	867-7330

Purpose:
Requested to provide sound level data for racecar test runs at the SLF during two days of testing at six specified locatations.

PROCESS DATA

Shop or **Dept**:	---	**Supervisor:**	---	**MC:**	---	**Phone:**	----

Process/Tasks: (include description, frequency, duration, location description, engineering and admin. controls)

- Two days of the Andretti AG racecar test runs were conducted using the length of the SLF. Staging was near J6-2313 with 4 runs per test and several tests each day.
- A run consisted of a start near the runway end, an increase to speed/objective which ended near midfield and "coasting" to the other end of the runway. Typically, The test set continued by repeating the run 4 times from alternating ends with each starting at the end, reducing speed at approximately mid-field, and slowing to terminate at the opposite end.

Noise Source(s):

AG racecar

☐ includes impact/impulse

EMPLOYEE DATA

Job Title/ Shop Title(s):

Exposure Group(s):

ROOM/ AREA DATA

Description: (relevant to acoustics; surfaces, size, source position, etc.)

- 6 monitoring locations were specified in the request:
  Blackpoint Rd – RC1, Playlinda Rd – RC2, Fish & Wildlife Service – RC3, Happy Creed Rd – RC4, VAB Area – RC5, and the Firing Range – RC6 (A map of location is provided in Notebooks 1 and 2)
- A 7th location a Midfield was established to provide a signature for each set of test runs.
- Sources had varying levels of interfering potential noise sources including traffic, and work activity, as well as natural sources. Some stations external to KSC gates were manned for instrumentation security purposes. Sound related events were observed for application to data integrity.

CALIBRATOR DATA / SOUND LEVEL METER DATA / OCTAVE BAND FILTER

CALIBRATOR DATA		SOUND LEVEL METER DATA			OCTAVE BAND FILTER	
Manufacturer/ Model	See Table 1 for calibrators used	**Manufacturer/ Model**	See Table 2 for summary of instruments used.		**Model**	---
ID Number		**ID # and Cal Due**	ID #:	Due:	**ID #**	
Calibration Due		**SPL: Pre- & Post Survey**	Pre-:	Post-:	**Cal Due**	
Calibration SPL (dB)		**Microphone** Tripod & Windscreen	Tri/Hand:	On/Off	**Note:**	

SOUND PRESSURE LEVEL DATA

☐ **Figures or Tables Addendum Attached**

Measurement Date: 5/3 & 4/07

Sample Location	Coordinates	Data Location	Sound Level *(dBA)*	Comment
Blackpoint Rd – RC1	N28.65659/ W080.77707	Notebook 1 & Disk 1		Manned
Playalinda Rd – RC2	N28.64356/ W080.68581	Notebook 1 & Disk 1		Manned
Fish & Wildlife Service – RC3 (FWS Helipad)	N28.64038/ W080.73045	Notebook 1 & Disk 1		
Happy Creed Rd – RC4	N28.63378/ W080.66348	Notebook 1, Notebook 2, Disk 1 & Disk 2	Fig 4, 5 & 6 examples	
VAB Area – RC5	N28.58937/ W080.64349	Notebook 2 & Disk 2		
Firing Range – RC6	N28.56492/ W080.68072	Notebook 2 & Disk 2		
SLF Midfield	N28.61506/ W080.69267	Notebook 2 & Disk 2	75 – 88 (10-sec Leq) 85 – 95 Lmax.	Manned

Footnote:

SPL DATA CONTINUED - OCTAVE BAND ANALYSIS AND RESULTS

# from above	Sound Pressure Level *(dB)* at Iso-Band Centers *Frequency (Hz)*										Sound Analysis Results *(dB)*			
	16	31.5	63	125	250	500	1K	2K	4K	8K	16K	RC	SIL		

Footnotes:

NOISE CONTROL PRACTICES

Current Status: (Engineering, Administrative, and Postings)

- ---

HEARING PROTECTION AVAILABLE/PRACTICES

Type	Manufacture/Model	NRR

Worn by all? ☐ **Yes;** ☐ **No;** ☐

REPORTS REFERENCED

Ref #	Rept Number	Date	Subject/Fac/Comment

MAJOR STANDARDS APPLIED DURING THIS ASSESSMENT

☐ 29 CFR 1910.95 Occupational Noise Exposure
☐ KNPR 1820.3 Hearing Loss Prevention Program
☐ AFOSH Standard 48-19 Hazardous Noise Program
☐ ACGIH TLVs and BEIs Acoustic: Noise
☐ ANSI 12.19 Measurement of Occupational Noise Exposure
☐ ANSI S12.2 Criteria for Evaluating Room Noise
☐ ANSI S3.14 Rating Noise with Respect to Speech Interference
☐

OBSERVATIONS, COMMENTS, & CONCLUSIONS

- Tripods were used to mount each noise dosimeter (Fig 1). Logging noise dosimeters were positioned on tripods with the angle of incidence toward the SLF (Fig 2).
- Two notebooks (No. 1 & 2) contain electronic spreadsheet files (disk 1 & 2) and printouts of logged data from each noise dosimeter as well as a location map of monitoring locations accompany this report. For Q400 dosimeters the increment is 10-seconds while the Q300 data is presented as 1-minute data. This was based on the capabilities and limitations of the instrumentation.
- Blackpoint Rd. (RC1): Airboat activity occurred. Racecar could be heard at Blackpoint Rd but background remained low (eg. 38 – 43 dBA). Nearby automobile traffic produced 41 to 52 dBA at this location. Although racecar could be heard, broadband measurements did not reflect any difference from background noise. Traffic from nearby automobiles and airboat was reflected in increased broadband sound pressure levels.
- Playalinda Rd (RC2): Manned. Moved slightly to fenced area with permission from FWS for day 2. Instantaneous measurements of background, traffic sounds and racecar action all ranged from 34 to 51 dBA. Broadband isolation of the racecar was not apparent. Racecar could be detected person manning the location. A mowing operation produced sound levels greater than 85 dBA at the location. A nearby warbler produced 74 dBA.
- Fish & Wildlife Service (FWS Helipad) – RC3: Not manned. There were no logged 10-second sound level data that reflected increases coincidental to racecar action.
- Happy Creed Rd – RC4 (Fig 1) : Not manned. Three examples of data paired with SLF Midfield is provided in Fig. 4, 5 and 6. Data reflected variable sound pressure data for the Happy Creek location; but there was not a good correlation with the racecar activity.
- VAB Area – RC5: Not manned. Logged data did not suggest increased broadband sound levels during racecar runs.
- Firing Range – RC6: Logged data did not suggest increased broadband sound levels during racecar runs. This location was not manned.
- SLF Midfield (RC9) (Fig 3): This location was added to document racecar runs and provide a measure of the noise source for comparison to other locations. Not all runs were equally loud; however, runs within a test set were fairly similar in terms of loudness. Local activity of buses, fire truck, and other vehicles affected the background but did not affect the actual measurements of the racecar.
- Examples of test runs are displayed in Figures 4, 5 and 6. Each of these examples represent morning runs, high noise runs and compare the Midfield noise to the nearby Happy Creek location.
    - Figure 4 demonstrates the sound (10-second averages) for a series of 4 runs. No value above the lower limits of these meters were recorded throughout that test although examples of elevated sound levels can be seen both before and after the racecar activity.
    - Figures 5 and 6 show examples of other tests where there is noise at Happy Creek during the runs; however, correlation with the racecar is not evident. Other sources of noise were present.

CONTACT INFORMATION

IH Program Manager:	Phone:	EH Mail Code:	EH Specialist:	Phone:	Task Tracking #:
Gary I. Bergstrom	867-9018	CHS-022	Amanda Beatty, Cindy Pfeil, Dan Sciarini, Lisa Whittaker, Marian Yeager	867-2400	T200706-3206

NOISE ASSESSMENT

FIGURES & TABLES ADDENDUM

JBOSC Environmental Health and Services

FIGURES/TABLES

Fig. 1. **Sampling Station Example**. All noise dosimeters were positioned on similar tripods and height. This photo is at Happy Creek Rd (RC4)

Fig. 2. **Noise Dosimeter mounted to a tripod**. Noise dosimeters were mounted on the tripod with the angle of incidence to the noise source location (SLF).

Fig. 3. **An SLF midfield station provided signatures of each run**. Noise levels did reach approximately 88 dBA (10-sec average) with some approximately 75 dBA (10-sec avg.). Instantaneous maximum values commonly reached 85 to 95 dBA.

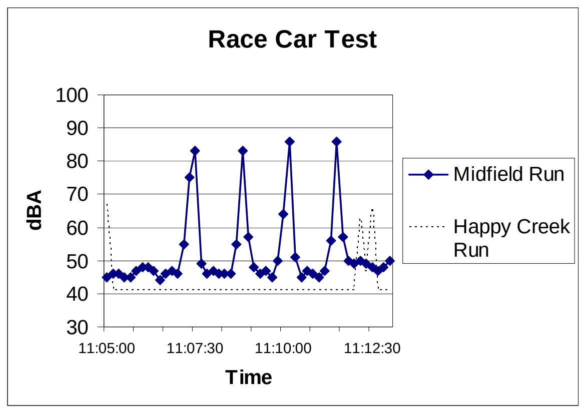


Fig. 4. **Racecar signature compared to Happy Creek sound level.** Racecar run is well defined at Midfield. Happy Creek remains at the lowest detection level throughout the 4 runs in a test series.

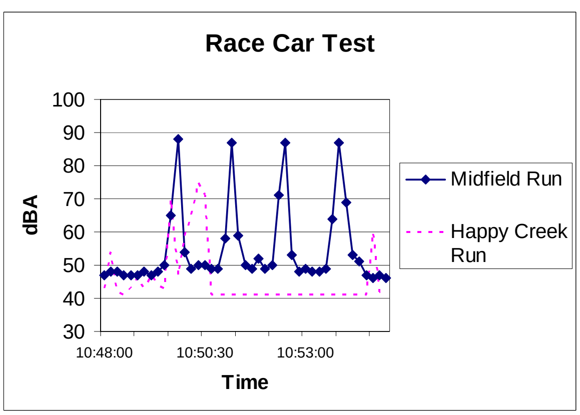


Fig. 5. **Racecar signature and Non-Racecar influences**. The racecar runs are clearly seen at Midfield. The Happy Creek location has Non-Racecar influences that reach approximately 75 dBA.

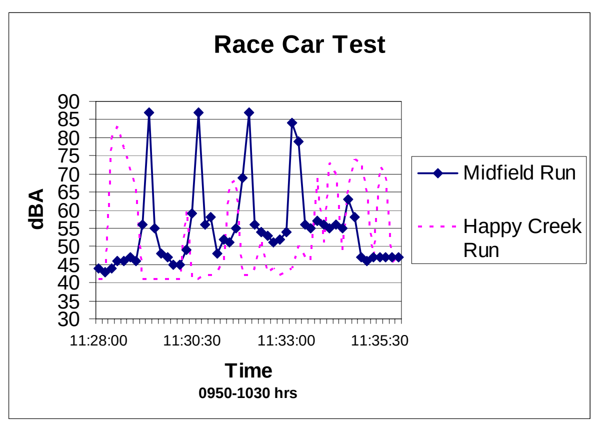


Fig. 6. **Racecar signature and Non-Racecar influences at SLF and Happy Creek.** Short-term actions from traffic, wildlife, and other activities can influence data (10-second data averages, in this case). Although this example shows several peaks at Happy Creek, times, time intervals (time between peaks), and non-racecar run data together demonstrate the racecar noise was not measured at this Happy Creek station.

T200706-3206

NOISE ASSESSMENT

FIGURES & TABLES ADDENDUM

JBOSC Environmental Health and Services

FIGURES/TABLES

Model	ID	Cal Due
QC-10	M71875	8/1/07
QC-10	M65262	6/12/07
QC-10	M84255	5/8/07

Table . 1. **Calibrators Used**.

Model	ID	Cal Due	Pre/Post
2200	1661616	6/20/07	114/114
2200	1661617	6/20/07	114/114
Q300	M75432	5/28/07	114/114
Q400	M85425	5/16/07	114/114
Q300	M75436	10/5/07	114/114
Q400	M85424	5/28/07	114/114
Q400	M85421	5/16/07	114/114
Q300	M75730	8/12/07	114/114
Q300	M75731	8/20/07	114/114
Q300	M75434	10/5/07	114/114
Q300	M75433	9/22/07	114/114

Table. 2. **Sound Level Meters and Noise Dosimeters Used**.

Fig.

T200706-3206

Appendix 7. Public Review Letters of Comment

United States Department of the Interior

NATIONAL PARK SERVICE
Canaveral National Seashore
212 South Washington Ave.
Titusville, Florida 32796

L76 (CANA)

August 14, 2007

Mario Busacca
Lead, Planning and Special Projects
Environmental Program Office
Mail Code TA-C3
Kennedy Space Center, FL 32899

Dear Mario Busacca:

Thank you for the opportunity to address the Public Review Draft of the Environmental Assessment for Expanded Use of the Shuttle Landing Facility, John F. Kennedy Space Center, Florida, July 2007.

Since the northern end of the shuttle landing facility is located only about a mile east of Canaveral National Seashore (CANA), noise generated by the proposed activities could affect both park wildlife and visitors. CANA consulted the National Park Service Natural Sounds Program for input on potential impacts of the proposed action. The comments are included below, by section, with a list of referenced materials.

1. Section 3.7

The Environmental Assessment (EA) states "*Noise generated above ambient levels by these sources has the potential to adversely affect both wildlife and humans*." However the ambient sound levels at CANA have not been provided in the EA. This level should be determined in order to assess impacts from proposed activities affecting the park. Section 8.3.2 of the NPS Management Policies (2006) relating to the use of motorized equipment and vehicles states *"The natural ambient sound level – that is, the environment of sound that exists in the absence of human caused noise – is the baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated."*

NPS has standard protocols and methodologies for determining natural and existing ambient conditions that can be completed without significant cost or time delays. Procedures for analyzing acoustic data and generating appropriate metrics have also been developed. CANA managers and NPS staff are available to meet with NASA to develop appropriate standards for assessing impacts to park resources.

2. Section 3.7

The EA states "*Research on the effects of noise on wildlife at KSC during the launch of spacecraft has shown that besides an initial startle response, birds and other wildlife quickly return to their normal activities and show no immediate adverse effects. Other studies conducted on wading bird colonies subjected to military overflights … documented no productivity limiting responses and only a short-term interruption of the birds' normal routine.*" Research has indicated that impacts to wildlife can vary depending on the species being studied, time of year (e.g. breeding season), the characteristics of the noise source, and other contextual variables. Some studies have detected major impacts to wildlife from noise. In addition, habituation, when it is observed is typically not 100% (Conomy, et.al 1998).

Several studies support the conclusion that birds are adversely affected by noise (Stone, 2000; Rodgers and Schwikert, 2002; Brumm, 2004) including Geese (Ward et.al 1999), Bald Eagles (Stalmaster and Kaiser, 1997) and Peregrine Falcons (Palmer, et.al, 2003). In the EA should qualify its conclusions and indicate that there is scientific uncertainty relating to the effects of noise on wildlife species and the ability of animals to fully habituate to noise intrusions.

In addition, much of the research examines wildlife responses to acute, short-term noise stimuli. However, aviation activity at KSC is projected to include more than 3700 overflights by 2015. This level would expose wildlife (and visitors) to more than 10 overflights per day (if evenly spaced throughout the year). This represents a long-term, chronic exposure to noise which has only been addressed in the literature on a limited basis.

3. Section 3.7

The EA states that *"Permissible noise exposure limits for humans are established by the Occupational Safety and Health Administration (OSHA). The 8-hour time weighted average noise level on KSC is appreciably lower than the OSHA recommended level of 85 decibels, A-weighted (dBA) (OSHA 2006)."* The OSHA 8-hour time weighted average noise level was not designed for application to impacts on visitor experience or natural resources at a national park area. Visitors expect the NPS to provide, an acoustic experience is far below levels established to protect human health and safety. Standards for assessing impacts from noise should be based on the resources being protected.

Section 4.2.7

With regard to construction, the EA states that *"ambient noise levels would likely increase during construction of the Proposed Action and Alternative 1 facilities, but are expected to be below the EPA's recommended upper level noise threshold of 70 dBA, for a 24-hour timeframe."* As described above with the OSHA limits, EPA's noise thresholds are not applicable to protecting CANA resources and visitor experience. Thresholds for noise impacts to CANA should consider park resources, purposes and values. Analysis should also include amount of time per day that construction would occur and duration of construction activities for each alternative.

4. Section 4.2.7

The EA states "*Sound levels between 60 and 90 decibels would be perceptible along the flight path, but these are well below dangerous thresholds and the impacts would be considered* *minor*." A noise level of 60 – 90 decibels would represent more than a minor impact. Noise at levels between 60 and 90 dB could have major impacts to park resources and visitor experience. For example, speech between visitors talking in a normal voice 1 meter apart is disrupted at levels above 65 dB (EPA 1974). Park staff typically conducts interpretive programs about 10 meters from the most distant member of the group. Speaking in a raised voice, the interpreter becomes difficult to understand at noise levels above 52 dB. The noise from the proposed action could make normal speech between visitors and park staff difficult or impossible during overflights. This issue is of particular concern because the flight path appears to go directly above or very close to the Playalinda Beach, one of the most heavily visited areas of CANA.

In addition, natural ambient sound levels at other National Park units have ranged from less than 20 dB to 35 dB. As a result, 60- 90 dB could be up to 70 dB above natural ambient levels. This could have major impacts on the ability of wildlife to hear predators, find prey, and communicate.

It is difficult to see CANA resources in relation to the noise contour maps provided in Appendix 4. It would be helpful to overlay the contours on a better map that included CANA resources and features.

The use of Leq and Lmax is not sufficient to assess impacts to CANA resources. Additional noise metrics and information would be extremely helpful to assess impacts from proposed overflight activities at SLF, including:

- Natural ambient sound levels at CANA
- The amount (or percentage) of time that SLF activities would be audible at CANA – audibility can be calculated using INM 6.2 This should be presented as contours over a map of CANA resources
- The % of time that noise from SLF activities would be above ambient levels and above speech interference thresholds (65dB and 52dB) presented as contours over a map of CANA resources
- The number of overflights expected per day

7. Section 4.2.7

The EA states that *"none of the noise levels recorded from the racecar testing at any of the locations exceeded background noise levels"* However, it should be noted in the EA that at both of the manned measurement sites (Blackpoint Wildlife Drive and Playalinda Beach Road, the race car was audible. It is likely that the racecar would be audible within much of the southern portion of CANA. The southern portion of CANA receives high levels of visitation, and introduction of an audible noise source in this area would be of concern. The audibility of the racecar at the unmanned sites was not determined.

8. Section 4.3

The EA does not include an analysis of cumulative impacts from noise. A cumulative noise analysis should include a disclosure of:

- natural ambient conditions,
- existing ambient conditions without the proposed action (the acoustic conditions when all existing natural and human-caused sounds are included),
- anticipated acoustic conditions when the proposed action is included (existing ambient condition plus impacts from the proposed action)

With this information an analysis of the effects of the proposed action can be assessed in relation to other past, present, and reasonably foreseeable future actions

Conclusion

Generally, the EA needs to be updated to include natural ambient conditions, additional metrics that adequately describe the changes to acoustic conditions due to proposed activities, and appropriate standards for assessing impacts. NPS has standard protocols and methodologies to accomplish these tasks without significant cost or time delays. With this additional information, noise impacts to CANA resources and visitor experience can be adequately assessed.

References

Brumm, Henrik, 2004, The impact of environmental **noise** on song amplitude in a territorial bird. **Journal of Animal Ecology**, 73(3): 434-440;

Conomy, John T., James A. Dubovsky, Jaime A. Collazo, W. James Fleming, 1998, **“**Do Black Ducks and Wood Ducks Habituate to Aircraft Disturbance?” **The Journal of Wildlife Management**, Vol. 62, No. 3 pp. 1135-1142

EPA, *Information on Levels of Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety*, March 1974

Palmer, Angela G., Nordmeyer, Dana L., Roby, Daniel D., 2003, “Effects of jet aircraft overflights on parental care of peregrine falcons” **Wildlife Society Bulletin**. 31(2).. 499-509

Rodgers, JA; Schwikert, ST, 2002, “Buffer-Zone Distances to Protect Foraging and Loafing Waterbirds from Disturbance by Personal Watercraft and Outboard-Powered Boats” **Conservation Biology** Vol. 16, no. 1, pp. 216-224.

Stalmaster, Mark V. and Kaiser, James L., 1997, “Flushing responses of wintering bald eagles to military activity” **Journal of Wildlife Management**. 61(4) 1307-1313.

Stone, Eric, 2000, Separating the **noise** from the **noise**: a finding in support of the "Niche Hypothesis," that birds are influenced by human-induced **noise** in natural habitats. **Anthrozoos**, 13(4): 225-231

Ward, DH; Stehn, RA; Erickson, WP; Derksen, DV , 1999, “Response of fall-staging brant and Canada geese to aircraft overflights in southwestern Alaska” **Journal of Wildlife Management** Vol. 63, no. 1, pp. 373-381.

Sincerely

/S/ Vidal Martinez
for Carol A. Clark
Superintendent

Response to comments submitted by Canaveral National Seashore regarding the Public Review Draft of the Environmental Assessment for Expanded Use of the Shuttle Landing Facility, John F. Kennedy Space Center, Florida, July 2007

The Canaveral National Seashore (CNS) submitted formal comments on the Draft Environmental Assessment (EA) for the Expanded Use of the Shuttle Landing Facility on Kennedy Space Center (KSC). The comments submitted by CNS were primarily concerned with potential impacts of the noise levels produced by the proposed operations at the Shuttle Landing Facility (SLF) on wildlife and the CNS visitors' experience. CNS recommended that these noise levels be compared to "natural ambient" noise levels (i.e., those sound levels existing in the absence of human-caused noise) in order to get a true picture of impacts at CNS.

Comparing SLF operations' noise levels to levels produced in the absence of human activities may not be realistic or appropriate. The CNS was originally created almost two decades after KSC was established and placed into operation. It has never been in operation under the condition of the "absence of human-caused noise". Therefore, it is more appropriate to make comparisons to the sound levels actually existing at CNS, as was done in the EA. CNS attracts over 1 million visitors per year, and elevated (above natural ambient) noise levels are produced by the people themselves, their vehicles, park vehicles associated with mowing and other maintenance operations, four-wheeled motorcycles driven by park rangers and wildlife researchers, habitat management such as controlled burning, licensed hunting, and a myriad of other day-to-day park activities. In addition, conditions at CNS are influenced by its neighbors: KSC, Cape Canaveral Air Force Station, and the Merritt Island National Wildlife Refuge (MINWR). Even under existing conditions, natural ambient noise levels do not commonly occur at CNS, if ever, and particularly not during the hours the park is available for tourists.

The comments submitted contend that increasing noise levels at CNS could adversely impact wildlife resources at the park, and several studies were cited as evidence. Examination of the literature cited did not support the claim. Several of the papers did find noise impacts to birds, but the conditions or noise sources were not applicable to the circumstances proposed for the SLF. For example, Conomy et al. (1998) did find that black ducks and wood ducks reacted to aircraft, but the animals used in the study were held captive in pens at the center of the runway. Rodgers and Schwikert (2000) examined the flush responses of waterbirds to fast-approaching personal watercraft and outboard-powered boats, neither of which was evaluated as a potential noise source at the SLF. Brumm (2004) found that songbirds increased their singing amplitude in response to increased levels of environmental (i.e., natural) noise, but had no data to suggest that the birds were "adversely affected". The flushing responses of bald eagles to a variety of military activities were studied (Stalmaster and Kaiser 1997); sources included weapon and ordnance firings, low-altitude helicopter flights, and non-powered boats (rafts, canoes, and kayaks). Results showed that the boats were actually more disruptive to the eagles than either the firings or helicopters. The helicopters did cause a high rate of flushing responses (47%). However, the authors acknowledged that the disturbance was not enough to preclude heavy use of the area by eagles, and that habituation to the helicopters and good quality of the habitat may have influenced use. Each year, hundreds of low-altitude helicopter operations are flown at KSC and the surrounding area for security, wildlife research, and habitat management purposes by NASA, the Life Science Services Contract, and MINWR. There has not been a documented long-term impact to wildlife from any of these activities.

An applicable noise study cited in CNS's comments to the EA was Palmer et al. 2007, which addressed the effects of jet aircraft overflights on the parental care of peregrine falcons. They compared behavior of nesting peregrines in territories exposed to jet aircraft flights to behavior in territories not exposed to jets. They said, "Our results provide very little support for the hypothesis that low-altitude jet aircraft overflights affect parental behavior of peregrine falcons." There were differences in some behaviors between the two types of territories, but these differences did not translate into reduced productivity. Palmer's paper also cited eight other published scientific studies that found minimal effects of jet aircraft overflights on wildlife.

In 2006, a technical report was prepared for the U.S. Navy entitled Review of Studies Related to Aircraft Disturbance of Waterfowl (Plumpton 2006). In it, 42 peer-reviewed scientific articles were evaluated and summarized. The conclusions were: 1) the quality and validity of these papers varied greatly; 2) results from one study should not be extrapolated to other situations; and 3) a potentially infinite number of variables (e.g., species, habitat, location, prior experience of the birds, and season, to name a few) can affect waterfowl responses to noise. A common problem with almost every study was the failure to determine whether or not observed behavioral responses translated into demographic responses that might impact a population. Review of the literature indicates that data do not exist that would allow for a generalized evaluation of noise impacts to all CNS wildlife. I n addition, the collection of such data would take an extended period of time (years) and significant resources.

Concerns regarding the visitors' experience being impacted by the proposed uses of the SLF are difficult to demonstrate. If the maximum number of potential flight operations (take-offs and landings) was realized by 2015, approximately 7,369 would occur, as well as 45 days/year of high-performance car testing. This is half of the number of operations that were taking place at the SLF between 1998 and 2001 (prior to September 11, 2001). The table below shows the number of flight operations which occurred at the SLF and the number of visitors to CNS from 1998 through 2006. There is no apparent correlation between these two groups of numbers, and there is no indication that increased operations (and the associated noise levels) would be a deterrent to visitors.

Year	# of Flight Operations	# of CNS Visitors
1998	14,645	703,301
1999	16,602	846,512
2000	18,743	1,115,345
2001	14,283	1,062,963
2002	6,535	1,075,747
2003	3,572	1,045,898
2004	3,264	1,050,212
2005	3,529	1,007,446
2006	3,533	1,005,401

The possibility of disruption of interpretive programs by noise was mentioned in the CNS comments. According to the CNS website (http://www.nps.gov/CANA/), the vast majority of such programs are conducted from the north district visitor's center at Apollo Beach, approximately 35 km (22 mi.) north of KSC. This visitor center is located less than 5 km (3 mi.) east of the New Smyrna Beach Municipal Airport, which supports jet, fixed-wing, and helicopter traffic, as well as a flight school. Additional operations based at the SLF are not likely to impact programs in the north end of the CNS, nor are they likely to dissuade visitors from attending or enjoying CNS programs.

In conclusion, NASA greatly appreciates the CNS's interest in the proposed program to expand the uses of the SLF. The CNS raised several issues concerning the potential impacts of noise from these operations on the CNS and its visitors. Additional review of the literature and the existing data related to SLF operations and CNS visitation lead NASA to the conclusion that there is not sufficient evidence to justify further analysis of noise impacts to CNS at this time. Potential increases in noise levels from proposed future operations at the SLF are expected to be minor or minimal, based on existing data and "worst case scenario" predictions (i.e., maximum number of operations, loudest vehicles, etc.). Although the number of annual flight operations may increase from current levels, it is significantly less than what was experienced by wildlife and visitors in the late 1990s through 2001. No adverse effects related to noise levels during those years have been reported to NASA or otherwise documented. NASA welcomes continued input from the CNS as the program matures and will support the collection of additional data as is deemed appropriate by both parties.

Literature Cited

Brumm, H. 2004. The impact of environmental noise on song amplitude in a territorial bird. Journal of Animal Ecology 73: 434-440.

Conomy, J., J. Dubovsky, J. Collazo, and J. Fleming. 1998. Do black ducks and wood ducks habituate to aircraft disturbance? Journal of Wildlife Management 62: 1135-1142.

Palmer, A., D. Nordmeyer, and D. Roby. 2003. Effects of jet aircraft overflights on parental care of peregrine falcons. Wildlife Society Bulletin 31: 499-509.

Plumpton, D. 2006. Review of studies related to aircraft noise disturbance of waterfowl. A Technical Report in Support of the Supplemental Environmental Impact Statement (SEIS) for Introduction of F/A-18 E/F (Super Hornet) Aircraft to the East Coast of the United States. Prepared for the U.S. Department of Navy, Norfolk, Virginia. 93 pp.

Rodgers, J., and S. Schwikert. 2002. Buffer-zone distances to protect foraging and loafing waterbirds from disturbance by personal watercraft and outboard-powered boats. Conservation Biology 16: 216-224.

Stalmaster, M., and J. Kaiser. 1997. Flushing responses of wintering bald eagles to military activity. Journal of Wildlife Management 61: 1307-1313.

SPACE FLORIDA

13 Aug 2007

Mr. Mario Busacca
Lead, Planning and Special Projects
Environmental Program Office
Mail Stop: TA-C3
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

SUBJECT: Space Florida Support of Expanded Use of the Shuttle Landing Facility

Reference: Draft Environmental Assessment (EA) for the Expanded Use of the Shuttle Landing Facility, July 2007

Space Florida supports the Kennedy Space Center (KSC) effort to expand use of the Shuttle Landing Facility (SLF). We see expansion of the SLF—to include private sector initiatives—as an excellent way to broaden space-related economic development in Florida.

The proposed actions described in the referenced EA would add significant capabilities to the SLF. They would serve as an excellent enticement to new commercial customers considering bringing jobs to the state. Space Florida welcomes the increased opportunities such expansion would offer the space workforce in the state. We foresee new educational opportunities for Florida students growing out of the aeronautical research, training, and testing entities that may locate to an expanded-use SLF.

Space Florida looks forward to working with the Kennedy Space Center in expanding uses of the Shuttle Landing Facility to the mutual benefit of NASA and the State of Florida.

Steve Kohler
President

Sf07-195-sk-pm

Mail Stop: SPFL
State Road 405
Building M6-306, Room 9030
Kennedy Space Center, FL 32899
PH: 321-730-5301 FAX: 321-730-5307
www.spaceflorida.gov

Florida Department of
Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

September 13, 2007

Mr. Mario Busacca
NASA Environmental Program Office
Mail Code: TA-C3
John F. Kennedy Space Center
Kennedy Space Center, FL 32899

RE: National Aeronautics and Space Administration - Draft Environmental Assessment (DEA) for the Expanded Use of the Shuttle Landing Facility - John F. Kennedy Space Center, Brevard County, Florida.
SAI # FL200707203633C

Dear Mr. Busacca:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16, U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4231, 4331-4335, 4341-4347, as amended, has coordinated a review of the subject DEA.

The St. Johns River Water Management District (SJRWMD) notes that the proposed action alternative involves construction of new facilities at the south field and mid field sites to enable access for commercial use and other non-NASA uses. Several acres of direct wetland impacts are anticipated from construction of facilities under the proposed use. Secondary impacts from construction and utilization of the facilities should also be assessed and addressed. Because the project will exceed permitting thresholds, an Environmental Resource Permit (ERP) from the SJRWMD will be required. During the ERP application review process, the applicant will be required to demonstrate that any direct and secondary impacts to wetlands and wildlife have been avoided or minimized. Unavoidable impacts would require mitigation in accordance with the Unified Mitigation Assessment Method found in Chapter 62-345, *Florida Administrative Code*. In addition, the applicant will need to demonstrate compliance with the environmental review criteria in Chapter 12 of the SJRWMD Applicant's Handbook: Management and Storage of Surface Waters. Please contact Ms. Susan Moor, Senior Regulatory Scientist, in the Palm Bay Service Center at (321) 676-6626 or smoor@sjrwmd.com for further information.

Based on the information contained in the DEA and the enclosed state agency comments, the state has determined that, at this stage, the proposed activities are consistent with the

Florida Coastal Management Program (FCMP). The concerns identified by our reviewing agencies must be addressed prior to project implementation. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews. The state's final review of the project's consistency with the FCMP will be conducted during the environmental permitting stage.

Thank you for the opportunity to review the proposed project. Should you have any questions regarding this letter, please contact Ms. Suzanne E. Ray at (850) 245-2172.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

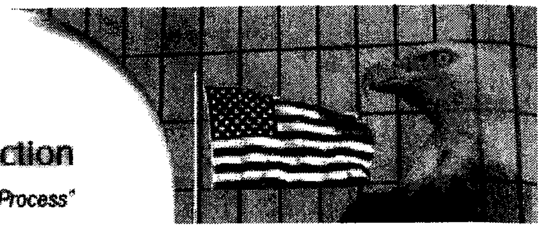
SBM/ser
Enclosures

cc: Geoffrey Sample, SJRWMD

MyFlorida.com

Florida
Department of Environmental Protection

"More Protection, Less Process"



Categories

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Project Information	
Project:	FL200707203633C
Comments Due:	08/24/2007
Letter Due:	09/16/2007
Description:	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION - DRAFT ENVIRONMENTAL ASSESSMENT FOR THE EXPANDED USE OF THE SHUTTLE LANDING FACILITY - JOHN F. KENNEDY SPACE CENTER, BREVARD COUNTY, FLORIDA.
Keywords:	NASA - EXPANDED USE OF THE SHUTTLE LANDING FACILITY - CAPE CANAVERAL, BREVARD CO
CFDA #:	43.000

Agency Comments:
COMMUNITY AFFAIRS - FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS
DCA has no comments.
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
No comments.
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
No Final Comments Received
STATE - FLORIDA DEPARTMENT OF STATE
No Comment/Consistent
TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION
No Comment
ST. JOHNS RIVER WMD - ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
This plan examines the potential uses of the shuttle landing facility after the space shuttle program ends at 2010. The proposed use involves construction of new facilities at the south field and mid field sites to enable access for commercial use and other non-NASA uses. Several acres of direct wetland impacts are anticipated from construction of facilities under the proposed use. Secondary impacts from construction and use of the facilities should also be assessed and addressed. This project will exceed permit thresholds and will require an Environmental Resource Permit (ERP) from the District. During the permit application review process, the applicant will be required to demonstrate that any direct and secondary impacts to wetlands and wildlife have been avoided or minimized. Unavoidable impacts would require mitigation in accordance with the Unified Mitigation Assessment Method found in Chapter 62-345, F.A.C. In addition, the applicant would need to demonstrate compliance with the environmental review criteria in Chapter 12 of the District Applicantÿs Handbook: Management and Storage of Surface Waters. Please contact Susan Moor, Senior Regulatory Scientist, in the Palm Bay Service Center at (321) 676-6626 or smoor@sjrwmd.com if there are any questions.
E. CENTRAL FL RPC - EAST CENTRAL FLORIDA REGIONAL PLANNING COUNCIL
The East Central Florida Regional Planning Council has no comments.
BREVARD -
Brevard County has no comments.

For more information or to submit comments, please contact the Clearinghouse Office at:

3900 COMMONWEALTH BOULEVARD, M.S. 47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

COUNTY: BREVARD
SCH- NASA - DEA

DATE: 7/18/2007
COMMENTS DUE DATE: 8/24/2007
CLEARANCE DUE DATE: 9/16/2007
SAI#: FL200707203633C

MESSAGE: 2007-06210

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
COMMUNITY AFFAIRS	ST. JOHNS RIVER WMD		
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
X STATE			
TRANSPORTATION			

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

_ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

X Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

_ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

_ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION - DRAFT ENVIRONMENTAL ASSESSMENT FOR THE EXPANDED USE OF THE SHUTTLE LANDING FACILITY - JOHN F. KENNEDY SPACE CENTER, BREVARD COUNTY, FLORIDA.

To: Florida State Clearinghouse

AGENCY CONTACT AND COORDINATOR (SCH)
3900 COMMONWEALTH BOULEVARD MS-47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

EO. 12372/NEPA

- [x] No Comment
- [ ] Comment Attached
- [ ] Not Applicable

Federal Consistency

- [x] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:

Division/Bureau: Division of Historical Resources
Bureau of Historic Preservation

Reviewer: S. Edwards Laura A. Kammerer, Deputy SHPO

Date: 9-7-07 9.10.2007

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BREVARD County
BOARD OF COUNTY COMMISSIONERS

FLORIDA'S SPACE COAST

NATURAL RESOURCES MANAGEMENT OFFICE
2725 Judge Fran Jamieson Way, Viera, FL 32940

Telephone: (321) 633-2016
FAX: (321) 633-2029

August 14, 2007

Mario Busacca
Mail Stop: TA-C3
Lead, Planning and Special Projects
Environmental Program Office
NASA
John F. Kennedy Space Center, FL 32899
Mario.busacca-1@nasa.gov
Ph: 321-867-8456
Fax: 321-867-8040

RE: Environmental Assessment of Shuttle Landing Facility

Dear Mario:

This Office has reviewed the proposed action and associated alternatives to expand the Shuttle Landing Facility. The habitat loss associated with the proposed action project is minimal relative to the amount of existing managed lands. Please coordinate review and installation of the fuel farm with Chris Ulrich, Contracted DEP Fuel System Inspector with this Office. He can be reached at 633-2016, ext. 52427.

Kindest Regards,

Debbie Coles
Special Projects Coordinator IV

SPACE COAST
ECONOMIC DEVELOPMENT COMMISSION

2000 South Washington Avenue, Suite 2
Titusville, Florida 32780-4752
Phone: 321-269-3221
800-749-3224
Fax: 321-267-8971
E-mail: sedc@titusville.com
Website: www.NspacecoastEDC.org

Karen Steil
Interim Director

August 13, 2007

Mario Busacca
Mail Stop: TA-C3
Lead, Planning and Special Projects
NASA Environmental Program Office
Kennedy Space Center, FL 32899

RE: Expanded Use of the Shuttle Landing Facility (SLF)

Dear Mr. Busacca:

The Space Coast Economic Development Commission would like to go on record in its whole-hearted support of expanding the SLF to provide commercial and other non-NASA entities the opportunity to use the SLF for broad and diverse economic development activities.

The time has come for NASA to share its space program with entrepreneurs that will continue to invest in the future of this county and provide long-term economic health to the citizenry; especially in light of the tax reform initiatives that are looming before us. Private industry has never been more needed than it is today for the economic future of our county.

Finally, it would be a great loss to our community if the SLF were left idle with so many superb projects on the drawing board just waiting to be birthed through NASA's commitment to sharing the wealth. We are a united community when it comes to the dreams that space travel has produced within us.

Sincerely,

Karen Steil

August 14, 2007

Mario Busacca
Mail Stop: TA-C3
Lead, Planning and Special Projects
NASA
Kennedy Space Center, Fl 32899

Dear Mario,

The Space Coast Office of Tourism supports your action to provide commercial and other non-NASA entities the opportunity to use the Shuttle landing Facility at the Kennedy Space Center for a number of diverse activities.

Horizontal spaceflight development; commercial spaceflight programs; aviation test operations; airborne research and technology development; and ground-based research and training are all part of space tourism. As the space tourism industry grows, travel will become better, more efficient and more affordable to all customers. Space tourism will expand an already thriving industry into a new and potentially very lucrative arena.

By diversifying the use of this landing facility, the Space Coast could be the ultimate gateway for space tourism. The space tourism market exists and the time has come to exploit it. We need to take the lead in expanding the frontiers of human possibility and play the role as the incubator of innovative technologies. Let's take that giant leap and start with the expanded use of the shuttle landing facility.

Regards,

Rob Varley, Director
SPACE COAST OFFICE OF TOURISM

ECONOMIC DEVELOPMENT COMMISSION
OF FLORIDA'S SPACE COAST

August 15, 2007

Mr. Mario Busacca
Lead, Planning and Special Projects
Mail Stop: TA-C3,
Environmental Program Office
NASA, Kennedy Space Center, FL 32899

Re: Environmental Assessment for the Expanded Use of the Shuttle Landing Facility

Dear Mr. Busacca:

On behalf of the Economic Development Commission of Florida's Space Coast, I would like to express support of the Proposed Action alternative addressed in the Environmental Assessment (EA) for the Expanded Use of the Shuttle Landing Facility (SLF) at the John F. Kennedy Space Center.

The Proposed Action alternative is a vital component of a strategy to increase commercial and non-traditional government aerospace activities in Brevard County and the State of Florida. The unique infrastructure of the SLF and planned improvements will allow Florida to remain competitive with other states in new commercial space, R & D and sub-orbital markets. In addition, the SLF as described in the Proposed Action alternative is an important part of the strategy to create high tech employment opportunities to help offset a workforce reduction during the Space Shuttle program transition in 2010.

The Proposed Action alternative for the SLF will enable Brevard County and the State of Florida to continue an aggressive pursuit of emerging opportunities in the aerospace industry.

Sincerely,

Lynda L. Weatherman
President/CEO

597 Haverty Court, Suite 100
Rockledge, Florida 32955
Phone: (321) 638.2000
Toll-Free: (800) 535.0203
Fax: (321) 633.4200
www.SpaceCoastEDC.org

TIX ✈ SPACE COAST REGIONAL AIRPORT
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355 Golden Knights Blvd. ✈ Titusville, Florida 32780 ✈ 321.267.8780 ✈ fax: 321.383.4284 ✈ e-mail: admins@flairport.com

August 20, 2007

Mr. Mario Busacca
Mail Stop: TA-C3
Lead, Planning and Special Projects
Environmental Program Office – NASA
John F. Kennedy Space Center, FL 32899

REFERENCE: Expanded Use of the Shuttle Landing Facility John F. Kennedy Space Center, Florida

Dear Mr. Busacca:

It is with sincere enthusiasm the Titusville - Cocoa Airport Authority is afforded the opportunity to extend our support regarding the expanded use of the Shuttle Landing Facility at the John F. Kennedy Space Center. Airport Authority Staff has worked diligently along side Kennedy Space Center Staff to help ensure the new commercial uses of the Shuttle Landing Facility would be a positive contribution to the surrounding communities and would also work to complement the area's aviation system as opposed to competing with these valuable community assets.

The Titusville - Cocoa Airport Authority stands ready to assist in any aspect of the oversight of development and support that NASA and the Kennedy Space Center sees fit. Prudent and coordinated development with the surrounding aviation community will help ensure the emerging commercial space flight endeavors will be well received and supported. The Titusville - Cocoa Airport Authority is committed to working tirelessly on assisting to develop and in keeping the emerging commercial activities outlined in the NASA Environmental Assessment in Brevard County.

If you have any questions, please feel free to contact me at (321) 267-8780, Ext. 203.

Sincerely,

Michael D. Powell

Michael D. Powell, C.M., ACE
Executive Director

cc: Titusville - Cocoa Airport Authority Board of Directors
Mr. James Ball, Spaceport Development Manager