



United States Department of the Interior

FISH AND WILDLIFE SERVICE

1875 Century Boulevard

Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/RF/Area II

JAN - 3 2014

Dr. George C. Nield
Associate Administrator for
Commercial Space Transportation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D. C. 20591

Dear Dr. Nield:

The purpose of this letter is provide technical assistance to the Federal Aviation Administration (FAA) in advance of its preparation of an Environmental Impact Statement (EIS) evaluating the potential impacts from the construction and operation of the above-referenced project proposed by Space Florida, the State's aerospace development organization. Although the proposed launch complex (Proposed Project) would be under the control of the State of Florida, it would be operated by private entities as a commercial space launch site and constructed within the boundaries of the John F. Kennedy Space Center (KSC), National Aeronautics and Space Administration (NASA) and Merritt Island National Wildlife Refuge (MINWR), U.S. Fish and Wildlife Service (Service) (Project Site). To operate the Proposed Project, however, Space Florida must apply for and receive the required license from the FAA. In accordance with Federal law, as part of its deliberations on whether to issue the license, the FAA is required to analyze the Proposed Project pursuant to the National Environmental Policy Act of 1969 (42 U.S.C. §§ 4321-4370) (NEPA).

This letter is intended to provide information that the Service believes both necessary and critical for a thorough and robust evaluation by the FAA of the potential environmental impacts of the Proposed Project, particularly to the MINWR. The Proposed Project could potentially impact MINWR management; the public's use and enjoyment of MINWR; plants and wildlife, including, but not limited to, federally listed species (endangered, threatened, and candidate), migratory bird species, and species of concern; wetlands; and cultural resources. The Service also outlines and clarifies its statutory and trust responsibilities that are necessarily implicated by the Proposed Project. The Service's statutory and trust responsibilities devolve from the following laws and the Service's associated implementing regulations, where applicable: the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. § 1531 *et seq.*); the Migratory Bird Treaty Act of 1918, as amended (40 Stat. 755; 16 U.S.C. § 703 *et seq.*) (MBTA); the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d) (BGEPA); Section 106 of the National Historic Preservation Act, as amended (16 U.S.C. § 470 *et seq.*) (NHPA); the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. §§ 668dd-668ee) (NWRA); the Fish and Wildlife Coordination Act (16 U.S.C. § 661) (FWCA); Section 4(f) of the Department of Transportation Act, as amended (49 U.S.C. § 303); and the Marine Mammal Protection Act of 1972 (16 U.S.C. §§ 1361-1407) (MMPA).¹

¹ See Enclosure "A" for literature citations.

PROJECT DESCRIPTION

As previously stated, the Proposed Project, which is on the KSC and within the MINWR, is located north of Haulover Canal and adjacent to Canaveral National Seashore (CNS) (Figure 1). The Project Site would be outside the current area managed by NASA for space launch activities, but within KSC's Operational Buffer and Conservation Area 1, which serves to create an operational safety and security buffer for NASA's space launch and landing activities as well as to conserve KSC's natural environment. As presented to date, the Proposed Project would include the construction and operation of vertical launch facilities and associated space vehicle processing, launch, and recovery operations on one contiguous parcel or two separate parcels totaling no more than approximately 200 gross acres within the MINWR. As presented to date, launch operator activities would involve medium-class and heavy-class vehicles with up to 12 orbital or suborbital launches per year for each developed pad on up to two separate launch pads (i.e., up to 24 total launches per year from the Proposed Project). The activities also would include 12 potential reentries (anticipated to include only booster stage returns) and landings per year for each developed pad and static on-pad engine firing (i.e., up to 24 total recoveries per year to the Proposed Project). The launches would be propelled by liquid oxygen and rocket grade kerosene or liquid hydrogen. All launch vehicle elements, propellants, and required equipment would be transported to the pad site from the north by motor vehicles using U.S. 1 and State Road (SR) 3 (Kennedy Parkway). Off-site infrastructure construction would be located in existing or appropriately zoned private site(s), potentially in Oak Hill or unincorporated Volusia or Brevard Counties.

GEOGRAPHIC LOCATION

The MINWR is located on the east coast of Florida approximately 150 miles south of Jacksonville and 40 miles east of Orlando. It is relatively long and narrow, approximately 35 miles in length and varying from five to ten miles in width. Vegetation on the MINWR can generally be categorized as upland and wetland communities. The MINWR consists of ridge and swale topography that includes bands of uplands and wetlands oriented northeast to southwest. Scrub and pine flatwoods are the most common upland communities on MINWR with freshwater marshes between upland bands. These communities are found on well-drained, acidic, sandy soils that experience brief periods of standing water. They also rely on recurring fire for maintenance of habitat structure and vegetation composition. Wetlands on MINWR are characterized as freshwater, saltwater marsh, estuarine, mangrove, wetland scrub, or forested wetlands (National Aeronautics and Space Administration 2013). A number of species rely on the various habitats that occur on the MINWR and in the surrounding area, including the proposed Project Site. These species include 18 federally listed threatened and endangered (not including the American alligator), one federally designated candidate species (gopher tortoise), 14 Florida-listed animal species (State-listed as threatened two and species of special concern 12; not including the gopher tortoise, which is State-listed as threatened, but which is also a federal candidate species and included above), 33 Florida-listed plant species (State-listed as endangered, threatened, and commercially exploited), the federally protected bald eagle, and other migratory bird species.

The MINWR is generally bordered on the west by the Indian River Lagoon and on the east by the Atlantic Ocean. The headwaters of the Indian River Lagoon and Turnbull Creek are located within the boundaries of the MINWR as is the southern portion of Mosquito Lagoon, which is in the northeast section of MINWR. Approximately one-mile wide and averaging four feet deep, the Mosquito Lagoon supports dense growth of submerged aquatic vegetation. Mosquito Lagoon has no natural outlet, but is connected to the ocean by the Ponce de Leon Inlet, which is 20 miles north of MINWR, and is connected on its west side to the Indian River by the Haulover Canal, which is located on MINWR. A 12-foot deep channel is maintained along the northwest side of Mosquito Lagoon for the Intracoastal Waterway, which then extends westward through the Haulover Canal and into the Indian River. The northernmost end of

the Banana River Lagoon, also on MINWR, lies between KSC and Cape Canaveral Air Force Station (CCAFS). The Mosquito and Banana River lagoons are part of the Indian River Lagoon system, with the Mosquito Lagoon being the northernmost body of water in the system. The system is managed as federal submerged lands within the MINWR/KSC boundaries. The Service maintains over 165 miles of levees, impounding more than 20,000 acres of former salt marsh. These impoundments are managed for mosquito control and wetland wildlife. Several of these levees are used as unpaved roads for public access. Fire lines are strategically placed throughout MINWR to divide the acreage into burn units that facilitate prescribed burning and wildfire suppression. Including Mosquito Lagoon and Banana River Lagoon, the Indian River Lagoon system is designated as an Outstanding Florida Water and an Estuary of National Significance. The marine portion of MINWR is part of the National System of Marine Protected Areas.

The bulk of MINWR is an overlay of the lands and waters of KSC. The KSC contains over 150 miles of paved and 50 miles of unpaved roads and approximately 100 miles of railroad. In 1963, the Service and NASA entered into a cooperative inter-agency agreement for management of non-operational KSC lands and waters; today this agreement covers over 140,000 acres. Outside of the KSC boundary, the Service owns ± 925.7 acres and also manages 321 acres under a lease or agreement with the State of Florida. The Service and the National Park Service (NPS) jointly manage 34,345 acres of the KSC as part of CNS and the MINWR. The managed area includes the central/southern portion of the Mosquito Lagoon area south of the Gomez Grant line to State Route (SR) 402, east to Beach Road, and west to SR 3 (Kennedy Parkway). In this area, the MINWR and CNS contain a unique mixture of subtropical and temperate plants. The mixture includes hammocks comprised of overstory vegetation dominated by temperate species and understory vegetation of subtropical plants. Impounded salt marsh waters are managed by MINWR. Aquatic inland habitats include shrub swamps and freshwater marshes. The wetlands and surrounding waters support large wintering populations of waterfowl as well as transient and resident wading bird populations. Generally, CNS manages east of the Beach Road and MINWR manages west of the Beach Road in the 34,345-acre overlapping area.

NATIONAL ENVIRONMENTAL POLICY ACT

Alternatives

The National Environmental Policy Act (NEPA) process is intended to help public officials make decisions in a transparent way that are based on an understanding of environmental consequences; that inform and engage the public and interested entities; and that take actions which protect, restore, and enhance the environment (40 CFR 1500.1(c)). To evaluate the environmental impacts of the Proposed Project, the FAA has chosen to prepare an EIS. The NEPA implementing regulations require that the FAA's EIS "rigorously explore and objectively evaluate all reasonable alternatives" in order to "inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR §§ 1502.14 and 1502.1). Reasonable alternatives are means of achieving the underlying purpose and need to which the federal agency is responding, which, in this case, is Space Florida's application for a license to construct and operate the Proposed Project. These alternatives are often formulated to examine reducing the environmental impacts of an applicant's proposed action. "Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant" (Council on Environmental Quality, Forty most asked questions concerning CEQ's NEPA regulations, Question 2a, 46 Federal Register 18026).

The FAA's EIS must examine the impacts of the Proposed Project, the no action alternative, and reasonable alternatives. Many of the impacts that are anticipated to occur from the Proposed Project are likely unavoidable and would prove difficult to mitigate due to the unusually high value of the Project Site to the public, plants, and wildlife, including, but not limited to, federally listed endangered,

threatened species, and candidate species; migratory bird species; species of concern; wetlands; and cultural resources. The Project Site is also of unusually high value given its proximity to Mosquito Lagoon and other portions of the MINWR. For these and other reasons, the Service strongly advises the FAA to consider and evaluate not only the Project Site, but alternative sites as well. In formulating the alternatives sites, we recommend that the FAA thoroughly assess the requirements and specifications for a commercial launch facility and critically and diligently seek to identify alternative sites that would both accommodate the Proposed Project as well as minimize the anticipated environmental impact footprint were the project to occur as currently planned. The Service is willing to assist the FAA as it engages this process.

NASA has already expressed a need to reduce its fixed-asset footprint at KSC while preserving the capability to perform its mission of supporting a strong space industry in the United States (KSC Future Development Concept 2012-2031, Divesting Without Diminishing, Chapter 4). One alternative that could be considered is the use of one or more of NASA's existing launch sites at KSC by Space Florida for its commercial launches; KSC and Space Florida could negotiate an agreement that would satisfy the needs, requirements, and goals of both parties. Another alternative could be the use of land with CCAFS by Space Florida. Constructing and operating a commercial launch facility on a developed area within either the KSC security area or the adjacently located CCAFS could enhance the utilization of existing launch facilities, preserve the existing buffer zone at NASA, and avoid adverse impacts to MINWR's natural and cultural resources. As the lead agency, the FAA is required to include reasonable alternatives in its EIS that are not within the agency's jurisdiction (40 CFR 1502.14(c)).

Direct, Indirect, and Cumulative Impacts

In addition to considering and evaluating reasonable alternatives in its EIS, the FAA also must address the direct, indirect, and cumulative impacts of the Proposed Project. Among the reasonably foreseeable future actions that should be addressed in the cumulative impacts analysis of the EIS are the actions considered in NASA's Draft Cape Canaveral Master Plan and the proposed low orbital launches from the Titusville Airport.

Concerns and Recommendations:

- The Service is concerned that a reasonable range of alternatives be explored in the FAA EIS, potentially including sites within the KSC security area and/or CCAFS.
- The Service is concerned about the analysis of direct, indirect, and cumulative impacts, including the metrics being utilized to properly analyze impacts to resources of concern to the Service, including wildlife and habitat resources, cultural resources, and visitors to MINWR. For example, the Service is concerned that, while the Proposed Project would significantly elevate noise levels within sensitive areas of the MINWR, the FAA's threshold model for noise analysis would not specifically evaluate the levels emanating from all launch vehicle propulsion system configurations of the Proposed Project. The Service is concerned that averaged noise impacts would not sufficiently analyze the maximum, instantaneous impacts from each event. The failure to engage in such specific evaluations and to accurately assess the significance and elevation of noise levels could result in harm and/or harassment to fish and wildlife species within the MINWR and the surrounding areas in contravention of Section 4(f) of the Department of Transportation Act and the ESA.²

² Note: From Section 3 of the Federal Endangered Species Act: "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct".

THREATENED AND ENDANGERED SPECIES

Potentially impacted by the Proposed Project, the following species are federally listed as either threatened or endangered under the ESA: Florida scrub-jay, eastern indigo snake, piping plover, roseate tern, Southeastern beach mouse, Atlantic salt marsh snake, loggerhead sea turtle, green sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, hawksbill sea turtle, West Indian manatee, wood stork, smalltooth sawfish, shortnose sturgeon, and Atlantic sturgeon.

Threatened Species

Threatened species are those that the Service has determined warrant protection under the Endangered Species Act; a threatened species is one which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Florida Scrub-jay

The Florida scrub-jay (*Aphelocoma coerulescens*), which was listed in 1987, is a cooperative breeding passerine endemic to Florida. The species' listing was in response to range-wide population declines resulting from habitat conversion and fragmentation caused by agricultural and urban development and the degradation of undeveloped habitat as a result of fire suppression and exclusion. It is estimated that Florida scrub-jay populations have declined by more than 90 percent since European settlement (Boughton and Bowman 2011). Even on public conservation lands where habitat has been actively managed for scrub-jays, populations have declined 26 percent between 1993 and 2011 (Boughton and Bowman 2011).

The MINWR presently supports one of the largest populations of scrub-jays and is of critical importance to the long term survival of the species. Scrub-jays can be found in areas of suitable habitat throughout the MINWR, but are primarily concentrated in four core areas. These four core areas contain the best scrub-jay habitat and support at least 216 families or nearly 90 percent of the MINWR's known scrub-jay population. One of the four core areas, known as the Shiloh Scrub Reserve Unit (Shiloh SRU), is located north of Haulover Canal and east of SR 3. This core area is within and adjacent to the Project Site and would be affected by the development and construction of the Proposed Project. Based on recent surveys, the Shiloh SRU is currently occupied by 31 scrub-jay families. Due to previous, ongoing, and planned habitat restoration and management, this core area has the potential to support 77 scrub-jay families.

Concerns and Recommendations:

- The MINWR's most important management tool for restoring and maintaining Florida scrub-jay habitat is prescribed fire. The Project Site is adjacent to the Shiloh SRU. Locating launch facilities on the Project Site would adversely impact the MINWR's ability to use prescribed fire within the SRU. This core area is currently undeveloped with limited infrastructure located in the vicinity. The current physical state of this core area has allowed for frequent use of prescribed fire. From 2003 to 2013, forty-five prescribed burns were conducted within the SRU. Since launch facilities and operations could be impacted by smoke and airborne particulates, the construction of the Proposed Project in close proximity to the Shiloh SRU could dramatically reduce opportunities to conduct yearly prescribed burns. If launches were to occur as frequently as proposed (24 launches per year), the use of prescribed fire could be greatly curtailed or eliminated. Reducing the frequency of or eliminating the use of prescribed fire within the Shiloh SRU would make it difficult, if not impossible, to maintain suitable habitat conditions for the scrub-jay and thus result in decreased breeding success, population decline, and possible extirpation.

- Development of the Proposed Project also would require the development of supporting infrastructure (e.g., transportation, energy, water, wastewater, and communications). SR 3, the existing paved road, would likely require improvements, and additional paved roads might be required for the transport of launch facility construction materials, launch vehicles, and payloads. Energy requirements would necessitate the installation of power lines and the construction of associated rights-of-way for communication lines (e.g., fiber optic cables), and water and wastewater lines. Construction of such infrastructure would inevitably lead to greater fragmentation of Florida scrub-jay habitat. Moreover, additional overhead power lines would increase perch sites for predatory species, thereby subjecting the scrub-jay to increased risks of predation.
- The hydrology of the Shiloh SRU and surrounding areas is complex. Past road building, agricultural development, and impoundment construction are believed to have altered the hydrology of freshwater swale wetlands that occupy low areas between scrub ridges. Historically, these swales were dominated by graminoid vegetation. Many of these swales have become overgrown with willows, red maples, and other hardwood species, likely due to these hydrologic changes, as well as due to past exclusion and suppression of fire. These overgrown swales effectively isolate patches of scrub that further fragment scrub-jay habitat. Additional road building and right-of-way construction, as well as the possibility of groundwater withdrawals to provide water to the Proposed Project, could exacerbate the problem.
- Portions of the Proposed Project would occupy a high ridge to the west of SR 3. This area has a long history of disturbance (primarily the legacy of citrus grove operations) and, as a result, contains only fragments of scrub. Restoration of this area would increase the scrub-jay carrying capacity of the Shiloh SRU. The development of this area would preclude the implementation of restoration activities for the species (U.S. Fish and Wildlife Service 2006).

Eastern Indigo Snake

The eastern indigo snake (*Drymarchon corais couperi*), which was listed in 1978, uses diverse habitats such as pine flatwoods, scrubby flatwoods, floodplain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, coastal dunes, and xeric sandhill communities (U.S. Fish and Wildlife Service 1999). The species also uses agricultural lands and various types of wetlands throughout its range. The eastern indigo snake ranges over large areas and uses various habitats throughout the year with most activity occurring in the summer and fall (Smith 1987). Females have been known to use 371 acres, while males use 805 acres (Smith 2003). The species also frequently utilizes gopher tortoise burrows. The MINWR has documented eastern indigo snakes within the Project Site.

Concerns and Recommendations:

- The Proposed Project would require both the clearing of vegetation and the construction of additional roads, which could result in the direct mortality of the species. The Service recommends that Space Florida and FAA review and incorporate the Service's Standard Protection Measures for the Eastern Indigo Snake (U.S. Fish and Wildlife Service 2004) in its plans for the construction and operation of the Proposed Project to minimize potential harm and/or harassment to the species.
- Eastern indigo snakes are particularly vulnerable to mortality from motor vehicles. An increase in motor vehicle traffic in the Shiloh area would have a negative impact on the species, both literally as well as under the parameters of the Endangered Species Act. It is recommended that any road improvement activities associated with the Proposed Project include wildlife under crossings to minimize mortality of eastern indigo snakes and other terrestrial wildlife.

Piping Plover

The piping plover (*Charadrius melodus*) is a small, migratory shorebird that breeds only in three geographic regions of North America: sandy beaches along the Atlantic Ocean, sandy shorelines throughout the Great Lakes, and riverine systems and prairie wetlands of the Northern Great Plains. The species was listed in 1985. Although the species does not breed in Florida, individuals from the three breeding populations do winter in Florida. Piping plover wintering habitat includes beaches, mudflats, and sandflats, as well as barrier island beaches and spoil islands. Piping plovers spend seven to eight months in their wintering areas.

Wintering piping plovers have been extirpated from entire counties in Florida over the past fifty years. This decline may be due to the continued degradation and alteration of the species' wintering habitat. The Service's Piping Plover Recovery Plan identifies habitat protection and enhancement as critical to the species' recovery nationwide. The maintenance of natural coastal formation processes is a habitat protection and enhancement measure. The absence of quality wintering habitat could substantially affect the survival and recovery of the species. In Florida, the focus of piping plover management has been the protection of specific wintering sites.

Migratory birds such as the piping plover are attracted to red warning lights on top of towers (Cochran and Graber 1958). It is believed that warning lights affect the navigation of migrating birds, causing them to collide with the structures to which the light are affixed (Kemper 1964). Mass mortalities of these birds have been reported throughout the United States (Kemper 1964, Able 1973).

Concerns and Recommendations:

- Because migrating piping plovers are negatively affected by artificial lighting, the Service recommends that the FAA engage in a thorough evaluation of the use of such lighting at the Proposed Project and of the impacts that could result to the species from such use.

Roseate Tern

The roseate tern (*Sterna dougallii dougallii*) is a medium-sized, colonial-nesting, marine water bird with a deeply forked tail. This species is distributed worldwide in a variety of coastal habitats. The North American subspecies is divided into two distinct breeding populations, one in the northeastern U.S. and Nova Scotia and the other in the southeastern U.S. and Caribbean. In 1987, the species was listed as endangered in northeastern North America and threatened in the Caribbean and Florida in response to nesting habitat loss, competition from expanding gull populations, and increased predation. The species' wintering areas are concentrated along the north and northeastern coasts of South America; however, it is not known whether or not the two populations winter in proximity to each other. Although both populations have experienced severe population declines, it is believed that the northeastern breeding population is under greater threat.

Strictly a coastal species, the roseate tern is usually observed foraging in nearshore surf. In the winter, the species is pelagic in its habits. The species' optimal nesting habitat is open sandy beaches that are isolated from human activity. A variety of substrates, including pea gravel, open sand, overhanging rocks, and salt marshes, are used by the species. In the northeastern U.S., roseate terns nest on beaches, barrier islands, and offshore islands (U.S. Fish and Wildlife Service 1989).

Concerns and Recommendations:

- Same as those for the piping plover.

Southeastern Beach Mouse

The Southeastern beach mouse (*Peromyscus polionotus niveiventris*), which was listed in 1989, is a subspecies found only on the CCAFS, KSC/MINWR, CNS, and Sebastian Inlet State Park. The species' distribution is highly fragmented due to habitat loss, development, severe storm damage, and successional growth that have occurred over time. The primary habitat type of the beach mouse is coastal dune with coastal scrub, pine flatwoods, and hammock providing marginal habitat for the species. Beach mice prefer sparsely vegetated, open habitat within the sea oat zone of primary dunes (Oddy 2000). Their preferred diet includes sea oats, seeds, and beach grasses (Blair 1951). Beach mice go through seasonal and annual population trends (Ehrhart 1976) with higher numbers observed in the winter (Garten and Smith 1974). While locally abundant, the species' small range makes it vulnerable to extinction (Oddy 2000).

Natural successional changes in dune communities transform open, sparse vegetation into dense, closed canopies. Beach mice do not persist in areas with woody vegetation that exceeds six feet (Stout 1992). Maintaining early successional dune communities is an important priority for management of this species. Prescribed fire, mechanical vegetative management, and chemical control of vegetation are commonly used to manage and maintain dune vegetative communities appropriate for beach mice (Oddy 2000).

The species is adversely affected by artificial lighting, which reduces foraging time, minimizes movement, and increases the risk of predation (Vasquez 1994, Kramer and Birney 2001, Brillhart and Kaufman 1991, Clarke 1983, Falkenberg and Clarke 1998). During natural high moonlit nights, beach mice reduce their activity levels to reduce the risk of predation. With constant artificial lighting conditions, the species must either permanently reduce its foraging time, which results in the reduction of body mass and reproductive success, or risk predation (Beier 2006).

Concerns and Recommendations:

- The MINWR currently implements a prescribed burn regime that creates and maintains open dune habitat suitable for the species. The periodic prescribed burning of habitat in the vicinity of the Proposed Project would be required to manage and maintain suitable beach mouse habitat.
- Because the species is negatively affected by artificial lighting at the Proposed Project, the Service recommends that the FAA engage in a thorough evaluation of the use of such lighting at the Proposed Project and of the impacts that could result to the species from such use.

Atlantic Salt Marsh Snake

The Atlantic salt marsh snake (*Nerodia clarkii taeniata*), which was listed in 1977, is a slender, heavily keeled water snake about two feet in length with a pattern of stripes that are variously broken into blotches. This species feeds on small fish in shallow water and is most active at night during periods of low tide. Extensive drainage and development within the historical range of the species has reduced the availability of suitable habitat. Continued alterations of coastal wetlands will further diminish the range of this already restricted reptile. It is well known that salt marsh snakes occasionally hybridize with closely related freshwater snake species, especially in areas of habitat disturbance (Kochman 1992).

Concerns and Recommendations:

- Alteration of the hydrology of wetlands with the Proposed Project on the Project Site could degrade or destroy suitable habitat for the species. Wetland impact avoidance should be considered to conserve this species.
- Habitat disturbance within the range of the species may have minimized or eliminated natural isolating mechanisms between the species and the adjacent freshwater snake (*Nerodia fasciata*

pictiventris). Reduced isolation is likely responsible for hybridization between these species. The Service recommends limiting habitat disturbance in order to prevent hybridization with the freshwater snake.

Loggerhead Sea Turtle

The loggerhead sea turtle is listed as a threatened species, but is grouped with the other sea turtles for this discussion; see the following section on endangered sea turtles.

Endangered Species

Endangered species are those that the Service has determined warrant protection under the Endangered Species Act; an endangered species is in danger of extinction within the foreseeable future throughout all or a significant portion of its range.

Loggerhead, Green, Leatherback, Kemp's Ridley, and Hawksbill Sea Turtles

The loggerhead sea turtle (*Caretta caretta*, listed in 1978), green sea turtle (*Chelonia mydas*, listed in 1978), and leatherback sea turtle (*Dermochelys coriacea*, listed in 1970) are the most common sea turtles that nest on the Atlantic shores. The Kemp's ridley sea turtle (*Lepidochelys kempii*, listed in 1970) and hawksbill sea turtle (*Eretmochelys imbricate*, listed in 1970) are occasional nesters. Unlike the loggerhead sea turtle (which is federally listed as threatened), the remaining sea turtles are federally listed as endangered under the Endangered Species Act. Sea turtle nesting activity is monitored by the CNS, MINWR, and CCAFS. Nesting activities for the State Nesting Beach Survey (SNBS) and the Index Nesting Beach Survey (INBS) are monitored from November 1 through March 30 and May 15 through August 31.

The 2012 Florida Fish and Wildlife Conservation Commission (FWC) State nesting totals show that Brevard and Volusia Counties, which have the combined highest nesting area for the green and loggerhead sea turtles, are considered the most important nesting beaches in Florida, if not in the world. Sea turtles use the beach and dune system for nesting. The beach and dune areas of KSC/MINWR, CNS, and CCAFS are among the last relatively undeveloped beaches on the east coast of Florida. The large open estuary of the MINWR is a major ecological landscape feature. This aquatic habitat encompasses portions of the Mosquito Lagoon, Indian River Lagoon, and Banana River Lagoon and is considered part of the Indian River Lagoon system. The Mosquito Lagoon Aquatic Preserve includes 4,740 acres of submerged lands and islands (National Park Service 2011) and has been shown to be an important wintering area for juvenile sea turtles. Mosquito Lagoon is considered a developmental habitat primarily for subadult loggerhead and green sea turtles (Mendonca and Ehrhart 1982). However, turtles may remain in the Lagoon system after maturity.

It is well documented that artificial lighting can disorient both nesting sea turtles and hatchlings. Some research suggests that artificial lighting may reduce the overall nesting activity by sea turtles (Mortimer 1982, Proffitt et. al 1986, Worth and Smith 1976). Witherington (1992) documented an increase in non-nesting crawls where artificial lighting conditions were present. Hatching sea turtles emerge from their nests and use cues, one of which is light intensity, to find the ocean. The hatchlings move away from the darker dunes and towards the brighter ocean (Mrosovsky 1967, Mrosovsky and Shettleworth 1968, Van Rhijn and van Gorkom 1983). Hatchlings' orientation is atypical, however, when artificial lighting is present (Verheijen 1985) in that they begin to crawl towards the artificial lighting rather than towards the ocean. The exertion from the disorientation leaves hatchlings dehydrated, exhausted, and subject to increased risk of predation (Witherington and Martin 1996). Both the CCAFS and NASA are presently working with the Service's Ecological Services Office to develop appropriate artificial lighting plans for the conservation of sea turtles on beaches on MINWR lands.

Concerns and Recommendations:

- These species are negatively affected by artificial lighting, therefore, the Service recommends that the FAA engage in a thorough evaluation of the use of such lighting at the Proposed Project and of the impacts that could result to the species from such use.
- Beach access restrictions/closures related to operations of the Proposed Project would result in fewer nesting beach surveys, which may compromise long-term data quality. Beach closure exemptions or special uses should be considered to minimize data loss.
- Access restriction exemptions and coordination with the Service should be considered in instances of cold stunning in the vicinity of the Proposed Project.
- The FAA should seek to develop lines of communication with the Service, NPS, NASA and CCAFS to ensure continued coordination on sea turtle conservation needs including: reducing nearby development and activities on the beach that adversely affect the species, providing data and feedback on artificial lighting and hatchling disorientation issues, and monitoring of coastal erosion rates. In addition, the FAA should evaluate the effects that artificial lighting would have on the sea turtles that nest on beaches located on MINWR and CNS lands and on estuaries and adapt management measures to maintain suitable habitat for sea turtles.

West Indian Manatee

The West Indian manatee (*Trichechus manatus*), which was listed in 1967 and which is also protected by the MMPA, is found throughout peninsular Florida in fresh, brackish, and marine waters. Throughout the year this Florida subspecies, *Trichechus manatus latirostris*, can be found in most of the Lagoon system on MINWR, including the Mosquito Lagoon, Indian River Lagoon, and the Haulover Canal, which connects the two waterways. Turbid waters and other visibility limitations prevent consistent population estimates, but the accepted estimate for the entire population of the species is approximately 4,800 individuals with some 1,100 using the estuaries of the MINWR during the winter (Florida Fish and Wildlife Conservation Commission 2013a). The manatee's primary diet consists of submerged, emergent, and floating vegetation, with seagrass as the most common plant consumed by coastal populations (U.S. Fish and Wildlife Service 2001). There are approximately 50,000 acres of estuarine habitat on the MINWR with 27,000 acres of seagrass (U. S. Fish and Wildlife Service 2006). However, algal blooms in 2011 and 2012 reduced seagrass coverage by 60 percent in the Indian River, including on MINWR (St. Johns River Water Management District 2013a).

The number of watercraft-related deaths in the vicinity of the Proposed Project area is historically among the highest rate for the species. Between 2008 and 2012, 45 watercraft-related deaths were recorded in Brevard County (439 watercraft-related deaths were recorded throughout the species' range for the same period) (Florida Fish and Wildlife Conservation Commission 2013b). Mortalities associated with watercraft are the single-most significant source of deaths caused by humans (U.S. Fish and Wildlife Service 2007). Consequently, the Service and the State of Florida have designated the MINWR's manatee accessible waterways as manatee protection areas where boats are required to either operate at reduced speeds or avoid certain areas all together (U.S. Fish and Wildlife Service 2013a, Florida Fish and Wildlife Conservation Commission 2013c). Other sources of harm to manatee within the Project Site area include entanglements in fishing gear. From 2007 to 2011, there were 16 entanglement-related rescues associated with the blue crab fishery (U.S. Fish and Wildlife Service In press). Measures are in place, however, to minimize the number of entanglements in the future, and a manatee rescue program exists to minimize the effects of entanglement and watercraft-related injuries.

Concerns and Recommendations:

- The seagrass community within the MINWR has experienced dramatic declines in the last several years. This stressed environment is susceptible to the added impacts of additional eutrophication resulting from increased pollutant discharges into the estuary. Manatees' reliance on seagrass beds makes the protection of water quality and clarity paramount to the species' conservation. The proximity of the Proposed Project to wetlands that drain into the Indian River Lagoon also is of grave concern to the Service. Therefore, the Service recommends that the FAA engage in a comprehensive evaluation of the discharge of pollutants from the Proposed Project and of the impacts such emissions would have on the species and the already compromised seagrass community of the Indian River Lagoon.
- Alteration of the hydrology of wetlands could degrade or destroy suitable habitat for the species. The FAA should consider measures to avoid impacts to wetlands for the conservation of the manatee.
- In the event that construction activities occur within waters accessible to manatees, the Service recommends that Space Florida and FAA review and incorporate the Service's Standard Manatee Conditions for In-water Work in plans for the construction and operation of the Proposed Project to minimize the potential for harm and/or harassment to the manatees.
- Should the construction and operation of the Proposed Project require the use of additional watercraft for security purposes, fuel tank and other component recovery and transport purposes, or other reasons, Space Florida should seek to develop lines of communication with the Service, NPS, KSC, and CCAFS to discuss such uses, explore measures that can be undertaken to minimize the effects of additional watercraft operation on the species, and evaluate the need for additional manatee protection areas, as appropriate.

Wood Stork

This species (*Mycteria americana*), which was listed in 1984, uses various wetlands for foraging and mangrove and other woody vegetation for nesting. The Project Site is within the core foraging area (18.6 mile radius) of five known wood stork breeding locations. The MINWR's impoundments, restored salt marshes, interior wetlands, and lagoons provide a wide range of foraging opportunities for this species, as well as ample sites for nesting. Historically, wood stork nesting occurred on several of the MINWR's mangrove islands, but the rookeries were abandoned in the late 1980s due to habitat changes resulting from freezing temperatures. One of the objectives in the MINWR's Comprehensive Conservation Plan is to reestablish wood stork nesting. While the Moore Creek impoundment (579 acres) is one of the former, large nesting colonies for wood storks on the MINWR, the species also has been recorded breeding on Bird Island (Mosquito Lagoon) (Clark and Lee 1982), Blue Bill Creek in the north Banana River, Peacock's Pocket Island, and Mullethead Island (Merritt Island National Wildlife Refuge 1996).

Concerns and Recommendations:

- Alterations or impacts to the watershed of the Shiloh impoundments and surrounding wetlands may impact wood stork foraging and loafing areas. The FAA should consider and evaluate impacts to wetlands beyond the footprint of the Proposed Project, as well as impacts to the wood stork and other wetland bird species.

Smalltooth Sawfish

The smalltooth sawfish (*Pristis pectinata*) is the only sawfish species found in Florida waters. The species' population in the United States experienced range reduction and decline over the last century. Since 1992, the smalltooth sawfish, which was listed in 2003, has been protected from harvest in Florida and from international trade since 2007, when it was listed by the Convention on International Trade in

Endangered Species of Wild Fauna and Flora (CITES). Juveniles of this species most often inhabit brackish water within a mile of land. They can be found in a wide range of habitats, including mud bottoms, sand bottoms, oyster bars, and red mangrove shorelines. The smalltooth sawfish is no longer found throughout its entire historical range (Cape Hatteras to Brazil), but is still a year-round resident of peninsular Florida with most encounters occurring in southwest Florida from Charlotte Harbor to the Florida Keys. (National Oceanic and Atmospheric Administration 2013).

Sighting of this species has been reported in the Indian River Lagoon, north of Port Canaveral and the MINWR.

Concerns and Recommendations:

- Juvenile sawfish use shallow habitats, such as mangrove forests, as important nursery areas. The proximity of the Proposed Project to wetlands that drain into the Indian River Lagoon is a concern. The Service recommends that the FAA engage in a comprehensive evaluation of the discharge of pollution from the Proposed Project and of the impacts such emission would have on the species and the already compromised habitats of the Indian River Lagoon.

Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) was listed in 1967. There are 19 recognized distinct population segments of the species, two of which occur in Florida (St. Mary's and St. Johns rivers). The shortnose sturgeon inhabits the main stems of their natal rivers, migrating between freshwater and mesohaline river reaches. Spawning occurs in upper, freshwater areas, while feeding and overwintering activities may occur in both fresh and saline habitats. Habitat degradation, including pollutant discharges, and mortality (impingement, dredging, and incidental capture) are the principal threats to the species' survival. There is no documentation, however, of the species occurring in the Indian River Lagoon, but the potential for straying into this system is possible as there have been reports of captures in the Atlantic Ocean close to the CNS.

Concerns and Recommendations:

- This species migrates between the Atlantic Ocean and major rivers along the east coast to feed and spawn. The proximity of the Proposed Project to wetlands that drain into the Indian River Lagoon is a concern. The Service recommends that the FAA engage in a comprehensive evaluation of the discharge of pollution from the Proposed Project and of the impacts such emissions would have on the species and the already compromised habitats of the Indian River Lagoon.

Atlantic Sturgeon

The National Marine Fisheries Service issued a final determination to list the South Atlantic distinct population segments of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) in 2012. This species is found in major rivers, estuaries, bays, and coastal waters along the eastern seaboard of the United States, which is the southern part of its range. Atlantic sturgeons migrate into fresh water in advance of the spawning season, generally mid to late February. The species spawns in freshwater and feeds and occupies habitats similar to those of the shortnose sturgeon. There is no documentation of the species occurring in the Indian River Lagoon, but the potential for straying into this system is possible as there have been reports of captures in the Atlantic Ocean close to the CNS.

Concerns and Recommendations:

- This species migrates between the Atlantic Ocean and major rivers along the east coast to feed and spawn. The proximity of the Proposed Project to wetlands that drain into the Indian River Lagoon is a concern. The Service recommends that the FAA engage in a comprehensive evaluation of the discharge of pollution from the Proposed Project and of the impacts such emissions have on the species and the already compromised habitats of the Indian River Lagoon.

CANDIDATE SPECIES

Candidate species are those that the Service has determined warrant listing, but are precluded from listing due to a lack of resources and higher listing priorities. Candidate species must be treated as protected species on Service lands, including the MINWR. One candidate species that would be potentially impacted by the Proposed Project is the gopher tortoise.

Gopher Tortoise

The populations of the gopher tortoise (*Gopherus polyphemus*) located east of the Mobile and Tombigbee Rivers in Alabama, Georgia, Florida, and South Carolina are candidates for listing. Surveys conducted in 2013 estimated the MINWR's gopher tortoise population at 3,000 to 5,000 tortoises (U.S. Fish and Wildlife Service 2013, unpublished data). This species is present in the Proposed Project area.

Protection of gopher tortoises on the MINWR is particularly important due to the species' high ecological value as a keystone species, which means that many other wildlife species benefit from the gopher tortoise's presence and abundance within the ecosystem. More than 300 other species have been known to use gopher tortoise burrows. These include federally and State protected species, such as the eastern indigo snake, pine snake, and gopher frog.

Gopher tortoises have a well-defined activity range limited by the amount of herbaceous ground cover where all feeding and reproduction take place (Auffenberg and Iverson 1979). Gopher tortoises are herbivores, eating mainly grasses, plants, fallen flowers, fruits, and leaves. Gopher tortoises prefer grassy, open-canopy microhabitats (Boglioli et al. 2000), and their population density directly relates to the density of herbaceous biomass (Auffenberg and Iverson 1979, Landers and Speake 1980, Wright 1982, Stewart et al. 1993) and a lack of canopy (Breininger et al. 1994, Boglioli et al. 2000).

The regular application of prescribed burning is critical for the maintenance of habitat conditions preferred by the gopher tortoise. Prescribed burning reduces shrub and hardwood encroachment and stimulates growth of tortoise forage plants, such as grasses, forbs, and legumes. This allows greater sunlight penetration to reach ground level, which promotes establishment of understory foliage used by the species as forage. Fire also promotes conditions necessary for gopher tortoise egg incubation. Any development in gopher tortoise habitat that limits prescribed burning represents a serious threat to gopher tortoise populations and their habitat. Consequently, maintaining habitat conditions preferred by gopher tortoises requires a commitment to plan and initiate vegetation management practices.

Disease can greatly impact the health and population demographics of wildlife. The effects of disease can be increased or confounded when populations are fragmented or stressed by human activity. Gopher tortoises are known to be subject to several diseases that potentially affect their well-being and survival (e.g., mycoplasmal upper respiratory tract disease [URTD], iridovirus, and herpesvirus). Relocation could be one of the mechanisms by which ill tortoises are introduced and trigger an epizootic. Some studies also have indicated that previously exposed captive tortoises became ill more quickly when re-exposed (McLaughlin 1997).

Concerns and Recommendations:

- Gopher tortoise habitat must be managed, primarily through prescribed burning. Consequently, any development in the Shiloh area must allow for continued management of the habitat in order for the species to persist.
- All gopher tortoises displaced from a development site must be relocated in accordance with federal and State permitting guidelines. Details on Florida State guidelines can be found in FWC's Gopher Tortoise Management Plan at: <http://myfwc.com/media/2286685/GT-Management-Plan.pdf>.
- Gopher tortoise burrows are critical habitat for many commensal species. Relocation of these associated species needs to be part of any plan to relocate gopher tortoises whose burrows are impacted by development.
- Invasive plant species also must be controlled in order for the gopher tortoises to persist on the landscape. This is particularly important in areas where the soil has been disturbed due to site development activities.
- Due to the risk of disease transmission, any permitted person engaging in research or relocation activities should follow approved disinfection and sanitation protocols when conducting such activities. In the case infected gopher tortoises are encountered, an approved protocol for accommodating clinically ill tortoises must be followed.

BALD EAGLES

While no longer listed under the Endangered Species Act, bald eagles (*Haliaeetus leucocephalus*) continue to be protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). Bald eagles are known to utilize a variety of habitats on both the MINWR and the CNS for breeding, foraging, roosting, and migrating. Bald eagles are known to occupy the MINWR and CNS year round, but are most abundant during the winter months when breeding pairs, non-breeding adults, and sub-adults are known to be present.

There are 25 known bald eagle nesting territories on the MINWR and CNS. These territories are monitored annually by InoMedic Health Applications (IHA) researchers during the breeding season. Only a portion of these territories are typically active in any given breeding season. During the past ten seasons, the number of active territories has averaged ten (maximum 13, minimum 8). While annual nesting success can vary widely, an estimated 10 to 15 eagles are successfully fledged each year (Bolt 2013).

Concerns and Recommendations:

- The Proposed Project is in close proximity (i.e., less than two miles) to nine bald eagle nesting territories. One nesting territory includes a nest (active in the 2012-2013 nesting season) that is less than 100 feet from the edge of the Proposed Project. The Service is concerned that disturbance from the construction of space launch facilities and supporting infrastructure and operation of the launch facilities may cause the species to abandon their nests and/or nesting territories.
- The construction, presence and operation of the Proposed Project may cause a reduction in the number of resident and migratory waterbirds and waterfowl that utilize adjacent impoundments (Shiloh 5, Shiloh 3 and Shiloh 1N). This would cause a reduction in foraging opportunities for bald eagles, especially during winter months when migratory waterfowl are normally abundant in these impoundments. Reduced foraging opportunities may lead to reduced nesting success for bald eagle pairs that utilize these resources.

MIGRATORY BIRDS

The Service is the principal Federal agency with oversight for the 1,026 avian species identified and protected under the MBTA (50 CFR 10.13). These include individuals that are resident, breeding, overwintering, migrating, staging, roosting, feeding, resting, and otherwise transit through Proposed Project areas on a daily, seasonal, annual, or other periodic basis. Florida lies within the Atlantic Flyway, an administrative unit that helps frame management and conservation activities that sustain the millions of migratory birds that seasonally move along Atlantic coastal corridors. Millions of individuals of many dozens of migratory species are funneled to, move through, rest in, and refuel throughout Florida as they move to and from temperate breeding areas in the United States and Canada and neotropical wintering areas in Caribbean and Latin America. Of these migratory species, many are also designated as conservation priorities due to declining, threatened, or otherwise vulnerable populations. These priorities are articulated in several lists that are generated by conservation entities, including state wildlife agencies; federal natural resource agencies; and international bird conservation initiatives, such as Partners in Flight.

The Birds of Conservation Concern (BCC) is a set of lists generated by the Service that justify and present migratory birds of high conservation priority at a variety of spatial scales (e.g., national, regional, and ecoregional). The Service periodically updates and publishes its BCC lists. The most recent BCC lists were revised in 2008, and can be found at the website: (http://library.fws.gov/bird_publications/bcc2008.pdf).

The BCC includes a list of bird species of conservation concern for Bird Conservation Region 31, Peninsular Florida, as well as for the entire Southeast Region of the Service and nationwide. The species identified on these lists are considered vulnerable and are among the highest bird conservation priorities for the Service and its partners. Many of these species are experiencing widespread declines and could potentially become candidates for federal listing under the Endangered Species Act in the future. The Service is responsible on an annual basis for demonstrating explicit progress in advancing the conservation of these species as a component of the Service's overall fiscal accountability and performance metrics. Therefore, it is particularly important to the Service that the FAA fully consider and evaluate impacts to BCC species when assessing short-term and cumulative effects of the Proposed Project that can reasonably be expected to influence habitats, behaviors, and demographics of these species. The BCC list specifically for Bird Conservation Region 31, Peninsular Florida, includes 49 species. However, more data are needed to determine which bird species specifically utilize the Proposed Project area, how and when they use the area, the specific threats, and the manner in which the populations of the most vulnerable species might be impacted. These data will assist in determining the effects of the Proposed Project on all federally protected migratory birds, particularly those where concern exists regarding their long term viability.

Concerns and Recommendations:

- The Service recommends that FAA comprehensively assess the potential risks to all bird species, particularly those identified on relevant BCC lists, which are documented or suspected to occur on the Project Site or be impacted by the Proposed Project.
- The collection and interpretation of migratory bird and waterfowl point count data should be consistent with the manner in which data for the wood stork are collected and analyzed.

AT-RISK SPECIES

In 2011, the Southeast Region of the Service began implementing a conservation strategy with public and private partners to evaluate more than 400 fish, wildlife, and plant species for potential listing under the

Endangered Species Act, which is referred to as the "Southeast At-Risk Species Conservation Strategy." Through this strategy, the Service is working with public and private partners to proactively conserve as many species as possible and, hopefully, preclude the need to list species under the Endangered Species Act. For the purposes of the Southeast At-Risk Species Conservation Strategy, those species that are of interest have either been proposed for listing under the Endangered Species Act, are candidates for listing, or have been petitioned for listing. All of these scenarios have significant overlap with the State Species of Greatest Conservation Need, which are outlined in the State's Wildlife Action Plan (Florida Fish and Wildlife Conservation Commission 2012). The at-risk species potentially impacted by the Proposed Project include: Florida sandhill crane, black rail, Duke's skipper, and eastern diamondback rattlesnake.

Florida Sandhill Crane

Florida sandhill cranes (*Grus canadensis pratensis*) (FSCs) occur from southern Georgia, primarily in the Okefenokee Swamp, to the Everglades (Stys 1997). However, most of the population is in peninsular Florida from Alachua County in the north to the northern edge of the Everglades in the south.

FSCs are non-migratory and exhibit year-round home-range fidelity. Territorial adult home ranges are influenced by several factors including habitat quality, status, and season (Nesbitt and Williams 1990). The average home range of a pair of FSCs is about 1,100 acres. Although home ranges overlap, core nesting areas are defended from other cranes and vary from 300 to 635 acres.

FSCs rely on shallow marshes for roosting and nesting and open upland habitats for foraging (Wood and Nesbitt 2001). Preferred crane habitat occurs where most vegetation is less than 20 inches high (Stys 1997). The crane avoids forests and deep marshes and may preferentially use open upland habitats, such as pastures and transitional pastures (Nesbitt and Williams 1990). Cranes in north Florida spent 86 percent of their time in four habitat types: pasture, freshwater marsh, pasture-marsh transition, and pasture-forest transition (Nesbitt and Williams 1990).

Wading birds (including FSCs) at the MINWR use a broad range of wetland habitat types for foraging, roosting, and nesting. The habitats most frequented by wading birds include both natural and manmade features, including the open estuary, natural freshwater wetlands, impoundments, and roadside ditches. In addition, many wading birds use vegetated dredge spoil islands in the Indian River Lagoon and Banana River Lagoon as roosting and nesting sites.

The FSC is listed as State Threatened by the Florida Fish and Wildlife Conservation Commission. The species also is protected under the MBTA, but is not currently listed under the Endangered Species Act. The Center for Biological Diversity recently petitioned the Service, however, to list the FSC (U.S. Fish and Wildlife Service 2011). The Service made a substantial 90-day finding for the petition and is currently soliciting information for use in the 12-month finding.

Concerns and Recommendations:

- Alterations or impacts to the watershed of the Shiloh impoundments and surrounding wetlands may impact the FSC foraging and loafing areas. The FAA should consider impacts to wetlands impacts beyond the footprint of the Proposed Project, as well as impacts to the FSC and other wetland bird species.
- FSCs avoid overgrown habitats and dense forest canopies that result from ecological succession unchecked by disturbances, such as fire. The loss of natural fire regimes in both upland and wetland plant communities across the Florida landscape hamper the species' success. As habitat conditions degrade, FSCs will leave their home ranges and travel up to 9.3 miles to find resources thus making them more vulnerable to mortality. Consequently, the proximity of wetlands for the species' roosting and nesting to upland foraging areas is critical to the species' conservation.

Black Rail

The black rail (*Laterallus jamaicensis*) is a secretive marsh bird and the smallest rail in the State. It inhabits densely vegetated marshes where it would pass largely unnoticed if not for its distinctive vocalizations. It breeds in coastal California and Kansas; on the Atlantic and Gulf coasts from New York through Florida to east Texas; and in Belize, Peru, Chile, and Argentina.

Black rails are usually found with one or more species of cordgrass (*Spartina*) (Florida Fish and Wildlife Conservation Commission 2003). In central Florida, large areas are dominated by cordgrass, producing extensive savannas with scattered cabbage palm islands. At these sites, the wetter marshes are characterized by sawgrass, which frequently grows taller than six feet. An exception to the association of black rails and tufted cordgrass occurs at MINWR as well as in Brevard County, where the species is most frequently seen in areas dominated by spike grass.

The black rail builds its nest of green or dead grasses on moist ground or just above the ground or water attached to weed or grass stalks. The species is a permanent resident in upper tidal marshes along the Gulf coast from Texas to Florida and is also found in inland marshes of the Florida peninsula. Within Florida, the species is found in the higher zones of tidal marshes, which are rarely inundated. The inland population is centered in the St. Johns River Valley from Lake Woodruff in Volusia County southward to Brevard County. It is also known from Paynes Prairie in Alachua County and in portions of the Everglades. The black rail certainly occurs elsewhere in the State, but its secretive nature has precluded discovery and documentation.

Black rails are listed as a Species of Management Concern by the Service. As noted above, St. Johns NWR furnishes what may be the most important wintering and breeding habitat for the species in the eastern United States. In the 1990s, black rails were relatively abundant on the MINWR. However, monitoring in the 2000s using a different methodology failed to detect the species. It is not known whether this failure was due to the different methodology or an actual decline in the species' numbers.

Concerns and Recommendations:

- Fire is required to maintain black rail habitat. If the Proposed Project were constructed on the Project Site, the MINWR's ability to use prescribed fire in a timely manner to properly maintain adjacent marsh habitat would be diminished. If it is determined that the species occupies these adjacent habitats, it is likely that black rail populations would decline or that the species could be extirpated locally due to failure to properly maintain its habitat.

Duke's Skipper

There are three populations of this species (*Euphyes dukesi*) in eastern North America. The subspecies *E. dukesi calhouni* inhabits the southern United States coastal plain and is endemic to Florida. The endemic nature of *E. dukesi calhouni* was recognized in the mid-1990s. Shuey (1996) speculates that its isolation from populations on the North American mainland may be attributed to Pleistocene glacial events.

This species prefers shaded wetlands dominated by the larval food plant *Carex lacustris*, including coastal swamps and ditches. In Florida, *E. dukesi calhouni* is limited to swamp habitats that support large stands of the sedge host plants and various *Rhynchospora* and *Carex* species (Shuey 1996).

Duke's skipper is not listed by the FWC or the Service. The Center for Biological Diversity recently petitioned the Service, however, to list the species (U.S. Fish and Wildlife Service 2011). The Service made a substantial 90-day finding for the petition and is currently soliciting information for use in the 12-month finding.

Concerns and Recommendations:

- Dukes' skippers are primarily threatened by conversion of their wetland habitat to development and other uses. The FAA should consider impacts to wetlands beyond the footprint of the Proposed Project, as well as impacts to this species.

Eastern Diamondback Rattlesnake

The eastern diamondback rattlesnake (*Crotalus adamanteus*) occupies relatively large, unfragmented blocks of fire-maintained, open canopy, xeric habitats, including sandhill, old fields, pastures, sand pine scrub, and scrubby flatwoods. In addition to the habitat itself, stump holes, active and inactive gopher tortoise burrows, and pocket gopher mounds and burrows are necessary to ensure adequate underground refugia (areas for protection or feeding) for the species.

The Center for Biological Diversity, Coastal Plains Institute, Protecting All Living Species, and One More Generation recently petitioned the Service to list the species (U.S. Fish and Wildlife Service 2011). The Service made a substantial 90-day finding for the petition and is currently soliciting information for use in the 12-month finding.

Concerns and Recommendations:

- Direct mortality of the species could occur from vegetation clearing and additional road construction.
- Eastern diamondbacks are particularly vulnerable to mortality from motor vehicles. Any increase in motor vehicle traffic in the Shiloh area could have a negative impact on species.
- Fire is required to maintain rattlesnake habitat. If the Proposed Project were constructed on the Project Site, the MINWR's ability to use prescribed fire in a timely manner to properly maintain adjacent habitat would be diminished.

OTHER SPECIES OF CONCERN

The Service recognizes Florida's State list of species of special concern in its MINWR management activities. The following species are of special management concern to the MINWR: Florida mouse, gopher frog, Florida pine snake, painted bunting, swallow-tailed kite, and mangrove rivulus.

Florida Mouse

Listed as a State Species of Special Concern, the Florida mouse (*Podomys floridanus*) is endemic to peninsular Florida and occupies fire maintained xeric uplands with well drained soils and has been documented on the MINWR (as part of other small mammal surveys). The species shares similar habitats with the Florida scrub-jay and at times occurs commensally with gopher tortoises. No systematic surveys have been conducted for the species on the MINWR. Consequently, its abundance and distribution are unknown. Nonetheless, the species should be considered when the FAA develops its risk assessments for the Proposed Project.

Concerns and Recommendations:

- Fire is required to maintain Florida mouse habitat. If the Proposed Project is constructed on the Project Site, the MINWR's ability to use prescribed fire in a timely manner to properly maintain adjacent scrub habitat would be diminished. If it is determined that the species occupies these adjacent habitats, it is likely that the Florida mouse populations would decline or that the species could extirpated locally due to failure to properly maintain its habitat.

- If the Proposed Project is constructed, as part of any gopher tortoise relocation activities, all Florida mice found occurring commensally with a tortoise should also be recovered and relocated.

Gopher Frog

Listed as a State Species of Special Concern, the presence of the gopher frog (*Rana capito*) is closely linked to the presence of gopher tortoises. This species relies extensively on gopher tortoise burrows for shelter and, to some degree, food (Godley 1992). Moreover, the survival of newly metamorphosed gopher frogs is dependent on their ability to locate and use gopher tortoise burrows and other underground refugia (Roznik and Johnson 2009).

Concerns and Recommendations:

- Same as those for the Florida mouse.

Florida Pine Snake

Listed as a State Species of Special Concern, the Florida pine snake (*Pituophis melanoleucus mugitus*) occupies relatively large, unfragmented blocks of fire-maintained, open canopy, xeric habitats, including sandhill, old fields, pastures, sand pine scrub, and scrubby flatwoods (Franz 1992, Hipes et al. 2001). In addition to the habitat itself, stump holes, active and inactive gopher tortoise burrows, and pocket gopher mounds and burrows are necessary to ensure adequate underground refugia (areas for protection or feeding) for the species. Florida pine snakes have relatively large home ranges with an average home range of 173 acres for males and 93 acres for females (Miller 2008).

Concerns and Recommendations:

- The Proposed Project would require both the clearing of vegetation and construction of additional roads, which would result in the direct mortality of the species.
- Florida pine snakes are particularly vulnerable to mortality from motor vehicles. An increase in motor vehicle traffic in the Shiloh area would have a negative impact on the species.
- Fire is required to maintain Florida pine snake habitat. If the Proposed Project is constructed on the Project Site, the MINWR's ability to use prescribed fire in a timely manner to properly maintain adjacent habitat would be diminished.

Painted Bunting

The painted bunting (*Passerina ciris*) is a small finch typically 4.7 to 5.1 inches long weighing 0.46 to 0.67 ounces (Lowther et al. 1999). Both Breeding Bird Surveys (BBSs) and Christmas Bird Counts show steep population declines in the species since the early 1970s (J. Cox, pers. comm.; Cox 1996). BBS data point to three percent declines per year, while Christmas counts show a significant decrease in twelve of the twenty-five counts (Sauer et al. 1997).

The species' range extends north into coastal North Carolina and south into northeastern coastal Florida. The vast majority of wintering eastern painted buntings is concentrated in south Florida, Cuba, and the Bahamas (Lowther et al. 1999). The species prefers open freshwater wetlands to salt marsh. The eastern painted bunting has been identified as one of the highest priority species in need of conservation in the southeast.

Concerns and Recommendations:

- The Proposed Project is located at the southern end of the species' breeding range and is well within the species' wintering range. Painted buntings occupy the shrub and shrubby grasslands of the MINWR year round with a documented breeding in abandoned citrus groves north of Haulover Canal. The application of prescribed fire is necessary to maintain the presence of early successional habitats used by the species.

Swallow-Tailed Kite

In addition to being a State Species of Special Concern, the swallow-tailed kite (*Elanoides forficatus*) is also designated as a "species-at-risk" by the U.S. Geological Survey's Biological Resources Division. Moreover, the species is listed on the National Audubon Society's Watch List as a "species of critical concern" and classified as "imperiled" on NatureServe's rating of degree of endangerment in Florida. The Service's Partners in Flight program also ranks the swallow-tailed kite on its list of highest priority species for immediate management and conservation action.

Swallow-tailed kites prefer tall pine or cypress trees for nesting and a surrounding mosaic of open and forested habitats for foraging. Habitat alteration and loss continue to be the primary threats affecting the status of the species.

Concerns and Recommendations:

- Breeding pairs of swallow-tailed kites are known to use the area around the Proposed Project. Due to the species' imperiled status, the Service recommends the implementation of protocols similar to those in place for bald eagles.

Mangrove Rivulus

The mangrove rivulus (*Kryptolebias marmoratus*) inhabits mangrove forests from southeastern Brazil through the Antilles and Central America to Florida (Taylor 1999). It is the only member of the rivulus family that occurs in North America. In Florida, this species is found on the Atlantic coast from the Keys to Volusia County and on the Gulf Coast from the Keys to Tampa Bay (Taylor 1999). The species, which is considered a self-fertilizing hermaphrodite, attains a total length of approximately 50 mm. The mangrove rivulus' diet consists primarily of worms, copepods, and mosquito larvae (Smithsonian Marine Station at Fort Pierce 2013).

Concerns and Recommendations:

- The main threat to this species is the destruction and fragmentation of mangrove habitat caused by development, encroachment, and implementation of mosquito control measures. Pollution to the Indian River Lagoon from the Proposed Project is an additional threat to the species.

REFUGE MANAGEMENT

A wide array of habitats exists on the MINWR, including the beach and dune system; estuarine waters; forested and non-forested wetlands; impounded wetlands; and upland shrub lands and forests. These diverse habitats support more than 1,000 species of plants and more than 500 species of fish and wildlife, including a variety of waterfowl, shorebirds, and neotropical migratory birds, of which 66 are federally- or State-listed. The MINWR's primary habitat management activities involve applying prescribed fire, using mechanical treatments in upland scrub, employing chemical control of exotic plants, protecting cultural resources, managing water levels in impounded wetlands, and managing visitor services.

Fire Management

Since the mid-1980s, the Service has conducted fire operations on the MINWR, including wildfire suppression and prescribed fire. Pursuant to the Service's agreement with NASA for MINWR management at KSC, the Service is responsible for the protection of KSC resources, personnel, and visitors from wildland fire. The MINWR staff is also responsible for utilizing fire to maintain high quality wildlife habitat. With high numbers of lightning strikes, the MINWR experiences frequent wildfires. In 1981, during a severe wildfire season, almost 17,000 acres were burned. During one of these wildfires, two MINWR employees were killed. These fatalities led to significant changes in manner in which the MINWR conducted its fire program, including a significant increase in the frequency of prescribed burns and in the amount of acreage burned annually.

Currently, the MINWR provides wildfire suppression on the KSC and CNS, as well as in adjacent communities. It also conducts prescribed burns on 15,000 to 20,000 acres annually at various times of the year to mimic natural burn cycles. There are five major fuel (vegetation) groups: scrub, palmetto with pine overstory, hammock, short grass, and tall marsh grass. The average burn frequency to mitigate fuel loads is every three to four years for each fire management unit with annual burns occurring as needed to maintain Florida scrub-jay habitat.

Concerns and Recommendations:

- The Service conducts prescribed burns on the MINWR to reduce hazardous fuels and manage fire-dependent wildlife habitat. The burning program is frequently restricted and is prohibited from occurring within three to six miles of a launch or payload storage facility due to NASA and Air Force launch operations, payload processing, or payload movement by civil, military, or commercial operators. During the past 10 years, a total of 57 prescribed burns were conducted on the MINWR north of Haulover Canal with 70 percent (39) completed in the last four years. The addition of the Proposed Project in the Shiloh area, where infrastructure and burn restrictions do not currently exist, would constrain prescribed burning operations, creating an added liability during wildfire suppression activities and impacting the ability of the Service to meet habitat goals for a variety of management concern and federally listed species.

Invasive Species Management

The Service is the only federal agency whose primary responsibility is the conservation of the nation's fish, wildlife, and plant resources. Given this mandate, the Service is gravely concerned about the destructive and harmful impacts of invasive species on fish and wildlife resources throughout the nation. These species degrade and often change native habitats and compete with indigenous plants and wildlife.

Ultimately, invasive plants destroy natural habitats and entire landscapes and reduce biodiversity. In addition to the incalculable costs to the environment from the impact of these species, significant costs are incurred to eradicate these species. For example, the United States spends over \$100 million a year just to control invasive plants in wetlands. Moreover, approximately \$200,000 of the MINWR's annual budget is expended in efforts to control invasive plants.

Feral hogs are an invasive species, and thousands of them occur on the MINWR. These hogs cause extensive damage to habitat, destroy sea turtle nests, and prey on sea turtle eggs. Feral hogs also are the cause of numerous motor vehicle accidents on the KSC each year. In many instances, the vehicle occupants sustain serious injury. The MINWR utilizes trappers and staff to remove 2,000 to 2,500 feral hogs each year. This effort is critical to protecting the natural resources of MINWR.

Concerns and Recommendations:

- Invasive species pose a serious threat to the natural resources on the MINWR. Disturbance is a major contributor to the establishment of invasive plants (Hobbs and Humphries 1995). Invasive plant species currently occur on a small area of the Proposed Project (Cardno Tec 2013). The Service recommends that the FAA conduct a comprehensive assessment of the risk of invasive plant establishment as part of its NEPA analysis of the impacts of the Proposed Project.
- The FAA should require implementation of Hazard Analysis and Critical Control Point planning to prevent or minimize the spread of all invasive species.
- The Service is concerned that the MINWR's feral hog trapping efforts could be thwarted by operational closures of areas near the Proposed Project that would negatively impact MINWR's ability to adequately manage the feral hog population north of Haulover Canal. Any such hindrances would result in an increase in both the species' population and destructive impacts to habitat and wildlife on the MINWR, as well as in the surrounding area.

Wetland Issues

The construction and operation of the Proposed Project may adversely and cumulatively affect the hydrology, habitat, and organisms within MINWR and surrounding areas, including portions of the Indian River Lagoon and Mosquito Lagoon. These habitats provide storage and serve as a buffer to filter, absorb, and assimilate nutrients, toxins, and sediments that enter the system, thereby preserving water quality and functions. Many species of fish and wildlife depend on this unique resource for foraging and spawning habitat. In 1990, the U.S. Environmental Protection Agency (EPA) designated the Indian River Lagoon as an estuary of national significance. This designation served as the catalyst for the implementation of efforts, locally and nationally, to better protect the biodiversity of this rich ecosystem.

The lagoon areas may also be considered an Aquatic Resource of National Importance (ARNI). An ARNI is a resource-based threshold used in determining whether disputes between the EPA and the U.S. Army Corps of Engineers (Corps) over individual permit cases are eligible for elevation under the 1992 Memorandum of Agreement (MOA) cited in Section 404(q) of the Clean Water Act. The following factors are used to identify an ARNI: economic importance of the aquatic resource; rarity or uniqueness; and/or importance of the aquatic resource to the protection, maintenance, or enhancement of the quality of the Nation's waters. According to the St. Johns River Water Management District, the total estimated annual economic value of the Lagoon is \$3.7 billion, supporting 15,000 full and part-time jobs, and providing recreational opportunities for 11 million people per year (St. Johns River Water Management District 2013b). Also according to the St. Johns River Water Management District, the Lagoon supports 685 fish species, 370 bird species, 2,100 plant species, and 2,200 animal species (St. Johns River Water Management District 2013c, Gilmore 1977).

Concerns and Recommendations:

- The FAA should consider alternatives to the Project Site. If the Project Site is selected, however, impacts to wetlands should be avoided and, if not avoided, minimized during the construction and operation of the Proposed Project. Consequently, Space Florida should submit a proposed plan, in accordance with the EPA's Section 404(b)(1) guidelines and the 1990 EPA/Corps MOA concerning the Determination of Mitigation, setting forth the actions it would take: first, to avoid damage to the aquatic ecosystem; secondly, to minimize any damage to the aquatic ecosystem; and finally, to mitigate for unavoidable adverse impacts to "obtain no overall net loss to wetlands."

Water Quality

The Indian River Lagoon area has been plagued for years with declining water quality. The Lagoon's condition improved, however, beginning in the early 1990s in conjunction with numerous restoration and water quality improvement projects and programs. Seagrass coverage in the estuary - used by scientists as an indicator to determine relative water quality - climbed steadily from 1993 through 2011. The St. Johns River and South Florida water management districts sponsor the Indian River Lagoon National Estuary Program (IRLNEP), in which they work with a network of partners on efforts to improve water quality in the Lagoon. To date, the IRLNEP has implemented more than \$80 million in improvement projects. This investment has been leveraged with federal, State and local funding, resulting in \$200 million in capital improvements and preservation dollars for the Indian River Lagoon.

In the spring of 2011, following previous progress and improvements, an algal superbloom appeared in the portion of the system known as Banana River Lagoon, destroying approximately 47,000 acres of seagrasses, representing an approximately 60 percent reduction of the Lagoon's total seagrass coverage. In August 2012, a brown tide bloom began in the Mosquito Lagoon and moved into the northern Indian River Lagoon near Titusville. The bloom reappeared in 2013, compounded with concerns regarding the losses of manatees and pelicans since July 2012 and bottlenose dolphins since January 2013.

Concerns and Recommendations:

- The Proposed Project would result in increased vehicular traffic, exhaust, and drift from emissions and propellants that could negatively affect water quality.

Fisheries Resources

The Indian River Lagoon is a diverse, shallow-water estuary stretching across 40 percent of Florida's east coast. Spanning 156 miles from Ponce de Leon Inlet in Volusia County to Jupiter Inlet in Palm Beach County, the Lagoon is an important commercial and recreational fishery and economic resource. Due primarily to its unique location, which overlaps the boundary between temperate and subtropical climatic zones, east central Florida's Indian River Lagoon is one of the most biologically diverse estuarine systems in the continental United States. The Lagoon's habitats support more than 3,500 documented species of animals, plants, fungi and protists (planktons).

Redfish and spotted sea trout are the most popularly sought recreational species. Due to declining habitat and water quality, goliath grouper are no longer found in the system. Sightings of the smalltooth sawfish have been reported in the Indian River Lagoon, north of Port Canaveral and the MINWR.

Concerns and Recommendations:

- The Service is concerned that increased vehicular traffic on paved and unpaved roads may require additional infrastructure construction that could further fragment habitats critical to species, reduce water availability and flow regimes, and adversely affect fish passage.

Visitor Services

The National Wildlife Refuge System (NWRS) emphasizes connecting people with nature, making visitors feel welcome and safe, and providing visitors with a variety of accessible opportunities to enjoy and appreciate natural resources. The NWRS Improvement Act cites hunting, fishing, wildlife viewing, wildlife photography, and environmental education and interpretation as the priority public uses of the Refuge System. These wildlife-dependent uses are to be accommodated when and where compatible with the purpose(s) of the refuge (National Wildlife Refuge System Improvement Act of 1997).

In 2012, the MINWR hosted 1.2 million visitors. A visitor use study conducted in 2010/2011 (Sexton et al. 2012) indicated that most visitors came to the MINWR multiple times per year. The study further found that 37 percent of the visitors were from the local area (within 50 miles of MINWR), whereas 63 percent were nonlocal. For most local visitors (81 percent), the MINWR was the primary purpose or sole destination of their trip. Nonlocal visitors stayed in the area, on average, for six days and spent an average of \$91/person/day in the local area. Local visitors, on the other hand, spent an average of \$52/person/day in the local area. According to the Service's 2013 Banking on Nature report, MINWR generated more than \$60.4 million in economic benefit for the counties of Brevard, Orange, and Volusia in Fiscal Year 2011 (U.S. Fish and Wildlife Service 2013b). The economic stimulus came from recreation spending by MINWR visitors. Areas designated for public use on MINWR north of Haulover Canal include waterfowl hunt areas, two boat ramps, the Manatee Observation Deck, Pine Flatwoods hiking trail, Shiloh Marsh Trail, and approximately 20,000 acres of federally-controlled navigable estuarine waters; approximately 200,000 to 300,000 visitors utilize these areas each year.

The diversity of the Indian River Lagoon system draws millions of boaters, fishermen, kayakers, and birdwatchers annually. The Mosquito Lagoon supports multi-million dollar recreational and commercial fisheries with over 135 different species. Southern Mosquito Lagoon is co-managed by the Service and NPS and supports one of the most popular fishing areas in Central Florida. Visitors are allowed to fish, crab, clam, oyster, and shrimp the Indian River Lagoon and Mosquito Lagoon.

The MINWR operates four boat ramps that provide direct access to Mosquito Lagoon (i.e., Biolab, Bair's Cove, Beacon 42, and WSEG). Bair's Cove and Beacon 42 allow launching 24 hours a day. Three other boat ramps on the MINWR and CNS (i.e., WSEG, Biolab, and Eddy Creek) allow for easy access into Mosquito Lagoon during daylight hours. WSEG and Beacon 42 are located north of Haulover Canal. The estimated number of fishermen in the Lagoon on the MINWR is 215,000 annually. In 2002, 100 aerial flight surveys were conducted over Mosquito Lagoon finding an average of eighty-two (82) boats per survey with the highest concentration north of Haulover Canal. These aerial surveys were instantaneous counts and underestimate the actual number of boaters. The average number of anglers per boat was 2.2, and the average fishing trip was 5 hours and 18 minutes. These surveys were only conducted during daylight hours and for one hour per survey, likely missing a large contingent of the use. This survey further showed that the highest concentration of use occurred in the shallow flats on the east and west side of the Lagoon with the majority of the fishing pressure north of Haulover Canal. An analysis of survey data from the boat ramps indicated that the largest segment of fishermen (52 percent) travel from 51-100 miles to fish on the MINWR. The Hunt for Reds fishing tournament, which occurs each October and is headquartered out of Titusville, draws over 1,300 fishermen. Many other tournaments occur in the local area mostly on Mosquito Lagoon. On average each year, fifty (50) commercial guides and eighty (80) commercial harvesters are issued Special Use Permit by the Service and NPS to operate in waters of MINWR and CNS. These local businesses have an economic interest in the management of the northern Indian River Lagoon system, including Mosquito Lagoon.

Waterfowl hunting on the MINWR has a long tradition, which existed before the establishment of MINWR and which began under MINWR authority in 1964. The waterfowl hunting program occurs on approximately 36,000 acres. Half-day hunts are allowed on Wednesdays, Saturdays, Sundays, and designated Federal holidays during the State Waterfowl Season. There were 5,520 hunt visits in 2012. Quota permits are required in the months of November and December for many hunt areas, including Shiloh 3 and Shiloh 5, which are regarded as some of the best waterfowl hunting in Central Florida. Shiloh 3 and 5, as well as Area 3 in Mosquito Lagoon, which is not a quota area, are within the Project Site.

The Service has proposed to open approximately 6,000 acres of the MINWR, north of Haulover Canal, to upland hunting for deer and feral hog beginning in 2015. This hunt, which was proposed in the

MINWR's 2007 Comprehensive Conservation Plan (CCP), is currently undergoing NEPA analysis. On July 8, 2013, the Refuge held a public scoping meeting on the proposed hunt and solicited public comments on its draft Environmental Assessment (EA). Much of the hunting would occur in areas included in the Proposed Project.

Wildlife observation and photography are the most popular activities on the MINWR. In 2012, there were approximately 1.2 million visits in these activities. Providing opportunities to observe the widest variety of local wildlife and habitat, a system of trails, viewing towers, and roads have been established, including several popular destinations north of Haulover Canal (e.g., Pine Flatwoods Trail, Shiloh Marsh Road, and the Manatee Observation Deck). Pine Flatwoods Trail is a one-mile loop that is located adjacent to the Proposed Project. This trail takes visitors through the pine flatwoods ecosystem. The MINWR uses this facility as part of its environmental education program, educating junior high/middle and high school students each year about the pine flatwoods community, prescribed fire, and the wildlife species that occur on and rely on this habitat. The Manatee Observation Deck is one of the most visited areas on the MINWR. Few locations exist in Florida where the non-boating public can observe these endangered mammals. This site is ideal for conducting public interpretive programs on manatees. The Manatee Observation Deck has nearly 70,000 visitors annually.

Concerns and Recommendations:

- **Fishing/Boating:** The FAA should engage in a thorough analysis of any proposed closures to the Mosquito Lagoon, Indian River Lagoon, Haulover Canal, and/or Intracoastal Waterway for launches, wet dresses, or any other activity. As well as require comprehensive plans/proposals that include, among other things, the manner in which the closures would be effectuated and the entity/entities who would be responsible for clearing the areas for closure. The area north of Haulover Canal, including the Intracoastal Waterway, has never been closed by the KSC for any NASA launch. The closure of these areas would significantly impact access to recreational activities, commercial users, and the local economy, as well as require coordination with multiple agencies and organizations and extensive public notification. The Service also is concerned about the extent to which the visiting public's safety could be compromised were there catastrophic failures in the operation of the Proposed Project (e.g., on launch pads or after launches). As previously stated, one of the foremost responsibilities of the NWRS is to ensure visitor safety. The Service recommends that the FAA thoroughly and robustly evaluate and consider these matters.
- **Hunting:** The FAA should analyze the manner in which waterfowl hunters and upland hunts on the MINWR would be impacted by the Proposed Project. The hunts are operated under a Quota System that is managed by FWC. Moreover, in order to participate in a hunt, an individual is required to apply for and obtain a FWC issued permit at cost. The Service is concerned that there would be occasions when it would be required to close areas during scheduled hunts due to launch activities. Such instances would pose a number of challenges to MINWR and FWC. First, there would need to be some means by which those permitted to participate in the hunts were notified of the closure, preferably beforehand. Secondly, the MINWR would bear the burden and costs to ensure that hunters would not enter the areas, whether willfully or mistakenly, for their own safety. Moreover, MINWR would have to use its resources to ensure that trespassers would not enter the areas. Thirdly, those with the required permit would be denied the opportunity to engage lawfully in the very activity for which they obtained and purchased permits. Fourthly, both the Service and the FWC would bear the brunt of the permittees' discontent and the invariable ramifications of the closures. Currently, neither reimbursement of hunt fees, nor the transfer of permits to others is authorized. Lastly, non-quota areas of MINWR also would be subject to closure, impacting many hunters who, similar to those with quota

permits, might have traveled from outside the area to hunt and upon arriving at MINWR could be advised that the areas are closed.

- **Wildlife Observation and Photography:** The Service strongly urges the FAA to analyze, evaluate, and fully consider the impacts the Proposed Project would have on visits and visitors to the MINWR for recreation, including wildlife observation and photography, in the development of the EIS. Such analysis should encompass impacts associated with the closures of trails, roads, and observation areas. In addition, the EIS should address the impact on species, such as scrub-jays, bald eagles, songbirds, waterfowl, and gopher tortoises that MINWR's visitors most frequently seek to observe. The launch activities at the Proposed Project likely would reduce the presence of wildlife within public areas, thus decreasing observation opportunities for visitors.

CULTURAL RESOURCE MANAGEMENT

The Service is responsible for compliance with Section 106 of the National Historic Preservation Act (NHPA) within National Wildlife Refuges. The Proposed Project would likely have direct and indirect adverse effects on cultural resources, including historic properties and associated cultural landscapes. These properties and landscapes are located in the Ross Hammock and Shiloh areas and include the 2,585-acre Elliott Plantation Complex, the Ross Hammock Complex (8VO130/VO131), the Griffis Place Burial Mound (8VO148), the "Confederate" Salt Works (8VO213), homesteads associated with Spanish land grants from the Second Spanish period (1784 A.D. -1820 A.D.), and four early 20th century historic cemetery plots (Archeological Consultants, Inc. 1992, Deming 1992, Griffin and Miller 1978, Long, 1967, Hellmann 2008, Parker 2008). Several cultural landscapes are tied to the late 18th century sugar agricultural plantation system and the late 18th – 19th century African and African American experience associated with the Elliott Plantation. Features identified with these landscapes include, but are not limited to, slave-built canals and irrigation ditches, old fields, gardens, roads, paths, slave villages and activity areas, indigo and sugar production areas, the sugar works (8VO160), and the Stobbs Farm (Ross Hammock). Using terrestrial laser scanning and aerial LiDAR, Collins and Doering (2010) documented the extensive Elliott Plantation's Sugar Works (8VO160), which is the southernmost and earliest intact sugar plantation in North America. They also identified a potential pre-Columbian mound located south of the mill complex. Follow-up archaeological testing is required, however, to verify the mound. The Elliott Plantation Complex and its associated landscapes are eligible for the National Register of Historic Places and for designation as a National Historic Landmark.

Additional archaeological and historical investigations are required to complete the initial evaluation of John Ross' Complex and Slave Village, the Sugar Factory Complex, the Overseer's House Complex and Slave Village, and the "Confederate" Salt Works. These investigations are needed to accurately determine the east and west boundaries of the plantation complex; map features of the historic landscapes, such as the slave-built canals, using 3D LiDAR and Gigapan technology; analyze the recovered archaeological assemblage; and prepare a final report and complete National Register and/or National Historic Landmark nomination (Schwadron 2013).

Several Spanish land grants were awarded during the Second Spanish Period (1783-1821), including the area comprising the Elliott Plantation. Land grants also were awarded to Nicolasa Gomez, Lucas Crayon, and Antelm Gay (Griffin and Miller 1978, Parker 2008). Archaeological evidence of the Second Spanish Period occupation has not yet been uncovered due primarily to a lack of archaeological surveys in these areas. However, given the relatively undisturbed nature of the area, there is a high potential that these resources would be uncovered. Later cultural landscapes, which are not as well-defined, include 19th – early 20th century citrus agricultural landscape, the 18th – 20th century transportation systems, and the conservation landscape associated with the MINWR and CNS (Parker 2008, Schwadron 2013).

The pre-Columbian past has yet to be fully evaluated for the MINWR and CNS as they are located along the fringe of other areas that receive more scrutiny from archaeologists (Parker 2008). The National Register-listed Ross Hammock Complex (8VO130/131), the Griffis Place Burial Mound (8VO148), and the Little Creek Site (8VO4073) are located within the footprint of the Proposed Project. These archaeological sites date to the Orange and St. Johns Periods [ca. 2000 B.C. to 1565 A.D.]. A number of National Register-listed or eligible pre-Columbian shell mounds and earthen burial mounds are present in the vicinity of the Project Site, including Seminole Rest, Turtle Mound, Castle Windy, Max Hoeck Burial Mound, and Bill's Hill Burial Mound. Based upon archaeological and historical evidence, the Ross Hammock Complex and Turtle Mound are associated with the Surruque, a 16th-17th century chiefdom on Mosquito Lagoon that was encountered by the Spanish and later European explorers and colonists. At this time, Ross Hammock (8VO131) is thought to have been the residence of the Surruque chief or cacique. Today, many of these archaeological sites possess unique botanical communities (Bullen et al. 1967, Deming 1992, Griffin and Miller 1978, Long 1967, Parker 2008).

Additional archaeological investigations are required for the Ross Hammock and Shiloh areas, specifically Phase I reconnaissance and Phase II follow-up testing of previously recorded archaeological sites, such as the Little Creek Site (8VO4073) and archaeological sites identified during the Phase I reconnaissance. These recorded historic properties have cultural and religious significance to the Seminole Tribe of Florida, the Seminole Nation of Oklahoma, the Miccosukee Tribe of Indians, the Muscogee (Creek) Nation, and the Poarch Band of Creeks. The FAA will need to consult with these Tribes as part of its compliance with the NEPA, NHPA, and the federal government's obligations to consult with Tribes pursuant to *Executive Order 13175: Consultation and Coordination with Indian Tribal Governments*; *Secretarial Order 3206: American Indian Tribal Rights, and Federal-Tribal Trust Responsibilities and the Endangered Species Act*; and tribal consultation policy.

One of the unique features of the Shiloh and Ross Hammock areas is the lack of development. Significant cultural resources, such as the Elliott Plantation Complex, the Ross Hammock Complex, and other sites, would have been substantially damaged and/or destroyed by later habitation and development. NASA, the Service, and NPS are preserving these significant historic properties and associated landscapes.

Concerns and Recommendations:

- The Service recommends that the FAA conduct systematic and intensive archaeological and historic investigations. With the use of 3-D LiDAR or other similar technology, the investigations should include the documentation and mapping of the historic landscape associated with the Elliott Plantation, such as the network of slave-built ditches and the Overseer's House Complex and Slave Village.
- At its earliest convenience, the FAA should initiate direct consultation with the previously mentioned Tribes and their respective Historical Preservation Offices.
- The Service recommends that the FAA and Space Florida negotiate and execute a programmatic agreement with all of the necessary federal and State agencies, the previously mentioned Tribes, and other relevant interested parties that clearly delineates each entity's specific responsibilities and actions, as well as the historic preservation protocols that will be undertaken to ensure compliance with Section 106 of the NHPA. The necessary federal and State agencies should include NASA, the Service, National Park Service (NPS), Advisory Council on Historic Preservation, and Florida Division of Historical Resources.

SECTION 4(f) OF THE DEPARTMENT OF TRANSPORTATION ACT

Section 4(f) requires the FAA to minimize impacts of transportation projects to National Wildlife Refuges and all historic sites that are listed or eligible for inclusion in the National Register of Historic Places. The section also requires that the FAA avoid or minimize use of properties meeting the requirements of the statute. The Proposed Project is located within 200 acres of the MINWR and adjacent to the CNS. The 2,585-acre Elliott Plantation Complex, with its historically important Native American burial mounds and middens and 18th century British agricultural operation ruins, is located on lands within and adjacent to the Project Site. Moreover, as previously stated, the complex is eligible for inclusion on the National Register of Historic Places. As part of its Section 4(f) analysis, the FAA must determine that no feasible and prudent avoidance alternative exists before approving Space Florida's application to construct and operate the Proposed Project on the Project Site.

Concerns and Recommendations:

- Construction and operation of the Proposed Project could significantly and adversely impact a large portion of the MINWR, including but not limited to, the Elliott Plantation. The critical importance of the MINWR's natural and cultural resources and visitor use cannot be understated or questioned. Consequently, among the matters the FAA must evaluate in the development of avoidance measures and alternatives to the Proposed Project are: minimization and/or avoidance of noise and vibration impacts to historical ruins, federal and State listed species, migratory birds, and other trust species on the MINWR; restrictions on the Service's operations on the MINWR, such as prescribed burning, public use, visitor safety, and closures; and, the immeasurable damage that could occur to the MINWR's resources and the visiting public in the event of catastrophic failures, including but not limited to, hazardous material spills and launch-related mishaps.

FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) mandates the Service's involvement in the evaluation of impacts to fish and wildlife from proposed water resource development projects and requires that fish and wildlife resources receive consideration equal to other project features. In accordance with the Act, federal agencies that construct, license or permit water resource development projects must consult with the Service and the applicable State fish and wildlife agency on the impacts of the proposed development on fish and wildlife resources prior to engaging in or authoring such actions. Moreover, the consulting agency is required to propose measures to mitigate impacts of the development.

The Proposed Project is within and adjacent to the Indian River Lagoon, which is North America's most diverse estuary with over 685 species of fish, 370 species of birds, 2,100 species of plants, and 2,200 species of animals (St. Johns River Water Management District 2013c). In 1990, this estuary was added to the National Estuary Program (NEP) that was created by an amendment to the Clean Water Act to identify, restore, and protect nationally significant estuaries of the United States. Given the national importance of the Lagoon, it is essential that the FAA analyze and address any adverse and cumulative impacts the Proposed Project might have on the hydrology and water quality of the Indian River Lagoon and Mosquito Lagoon. The FAA also must analyze the corresponding effects any such impacts might have on the wide diversity of estuarine-dependent animal and plants found on the MINWR and in the surrounding areas. The potential additive adverse impacts of the Proposed Project are of particular concern given that the Indian River Lagoon and Mosquito Lagoon are currently under stress from several years of algal blooms. In the spring of 2011, algal blooms began in portions of the Banana River Lagoon and spread into the northern Indian River Lagoon and farther north into the Mosquito Lagoon. Concurrently, a lesser bloom extended south from north of Melbourne, Florida to the Vero Beach-Fort

Pierce area. Approximately 47,000 acres (60 percent) of the Lagoon system's total sea grass coverage were destroyed. Subsequently, in August 2012, a brown tide algal bloom began in the Mosquito Lagoon and moved into the northern Indian River Lagoon near Titusville. The bloom reappeared in 2013. Compounding existing concerns was the number of losses of manatees and pelicans since July 2012 and bottlenose dolphins since January 2013. The full ecological impact of these events has not yet been determined.

The Service anticipates working in close coordination with the U.S. Army Corps of Engineers on the review of any Clean Water Act permit application related to the Proposed Project and the impacts the project might have on the existing significant wetlands and fish and wildlife resources.

Concerns and Recommendations:

- Construction and operation of the Proposed Project could add significant stressors to an already impaired estuarine environment. The FAA must robustly evaluate and assess impacts on the Lagoon system's ability to filter, absorb, and assimilate nutrients, toxins, and sediments, as well as on migratory birds, inter-jurisdictional fish, federally-listed and trust species, and other estuarine-dependent plants and animals.
- The Service recommends that the FAA require implementation of the most stringent measures to avoid, minimize, and, if necessary, mitigate for impacts to wetlands and the currently existing hydrology.

CATASTROPHIC EVENTS

Throughout this letter, the Service has outlined species-specific concerns related to the potential effects of runoff and pollutants from the Proposed Project. There is also an overarching concern regarding the occurrence of catastrophic failures that would result in the release of large volumes of fluids and gases during the recurring launch activities that would occur as part of the operation of the Proposed Project. While possibly unlikely to occur, the FAA must consider these events in its analysis and develop clear contingencies to ameliorate environmental impacts from such incidents.

CONCLUDING COMMENTS

The Service has identified a substantial number of concerns regarding the impacts of the Proposed Project on federally listed, candidate species, and species at risk; State-listed species; migratory birds; wetlands; fisheries resources; cultural resources; and operations at the MINWR, including, but not limited to, recreational use. We have identified a number of species of MINWR management concern that occur on the MINWR, in the surrounding area, within the footprint of the Proposed Project, and in areas that are likely to be directly or indirectly affected by the project; these species include 16 federally listed threatened and endangered species, 1 federally designated candidate species, 4 federally designated at-risk species, 6 Florida-listed animal species (State-listed as threatened and species of special concern), the federally protected bald eagle, and other migratory bird species. Anticipated habitat impacts include habitat loss, habitat degradation, and creation of barriers or conditions that result in loss of habitat value for fish, animal, and plant species.

As previously stated, the Project Site is adjacent to the already ecologically compromised Indian River Lagoon, which supports an array of plants and animals. Maintaining or enhancing water quality is paramount to restoring this important wetland system, and the Proposed Project should include all necessary measures to fully avoid, minimize and, if necessary, mitigate anticipated impacts. There also are a number of significant cultural resources and archaeological sites on or near the Project Site that could be impacted. The Service urges the FAA to seriously consider alternatives to the Project Site so as

to avoid the deleterious impacts of the Proposed Project. The Service further requests that the FAA remain mindful of the negative impacts the Proposed Project would have on the public's access and recreational use of the MINWR, as well as on the operations within MINWR.

NEPA requires that federal agencies integrate environmental values into their decision making processes by analyzing the environmental impacts of their proposed actions and considering reasonable alternatives to those actions. Given the many and diverse direct and indirect impacts that are anticipated to result from the Proposed Project, the Service encourages the FAA to rigorously analyze Space Florida's application and to consider a wide range of reasonable alternatives to the project as proposed and sited that would minimize, if not preclude, environmental impacts.

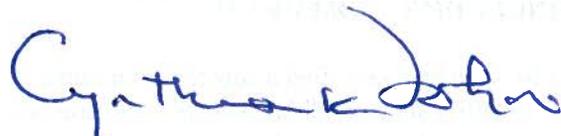
This letter serves as technical assistance on the FAA's NEPA analysis of the Proposed Project and should not be considered as meeting the requirements of consultation under the ESA or of the MBTA, MMPA, BGEPA, or NEPA.

We look forward to responses to the issues outlined above. In addition to the concerns and recommendations set forth throughout this letter, the Service suggests that the FAA undertake the following:

- Meet with the Service to discuss and refine data being collected;
- Coordinate with species' experts and seek other authorities to obtain the best scientific and commercially available data; and
- Meet with the Service to discuss the scope of the proposed reasonable alternatives and direct, indirect, and cumulative impacts of the Proposed Project, including but not limited to, future build-out and cumulative impacts.

Thank you for the opportunity to provide input and to express our concerns and recommendations regarding this matter. If you have any questions, please contact me at (404) 679-4000 or Layne Hamilton, Refuge Manager, MINWR, at (321) 861-2278.

Sincerely yours,



Cynthia K. Dohner
Regional Director

Enclosures: Enclosure A: Literature Citation
Figure 1: Location of the Proposed Space Florida Shiloh Launch Facility on Merritt Island National Wildlife Refuge

cc:

Stacey Zee, Environmental Specialist, Federal Aviation Administration, Stacey.Zee@faa.gov (electronic only)

Irene Sadowski, U.S. Army Corps of Engineers, 400 High Point Dr. # 600, Cocoa, FL 32926-6662

Stanley Austin, Regional Director, National Park Service, 100 Alabama Street, SW, 1924 Building, Atlanta, GA 30303

Nick Wiley, Florida Fish and Wildlife Conservation Commission, Farris Bryant Building, 620 S. Meridian St., Tallahassee, FL 32399-1600

Robert Cabana, Director, National Aeronautics and Space Administration, Mail Stop: AA000, John F. Kennedy Space Center, Kennedy Space Center, FL 32899

Sylvia Pelizza, Refuge Supervisor Area 2, U.S. Fish and Wildlife Service, Arthur R. Marshall Loxahatchee NWR, 10216 Lee Rd., Boynton Beach, FL 33473

David Viker, Chief of Refuges, U.S. Fish and Wildlife Service, 1875 Century Blvd. Ste. 400, Atlanta, GA 30345

Layne Hamilton, Refuge Manager, U.S. Fish and Wildlife Service, Merritt Island NWR, P.O. Box 2683, Titusville, FL 32781

Dawn Jennings, Deputy Field Supervisor, U.S. Fish and Wildlife Service, 7915 Baymeadows Way, Suite 200, Jacksonville, FL 32256

Cindy Fury, Leader/Wildlife Biologist FL/Caribbean Migratory Bird Field Office, US Fish and Wildlife Service, P.O. Box 739, Midway, FL 32343

Cheri Ehrhardt, Natural Resource Planner, U.S. Fish and Wildlife Service, Merritt Island NWR, P.O. Box 2683, Titusville, FL 32781

Leopoldo Miranda, Assistant Regional Director, Ecological Services, 1875 Century Blvd., Ste. 200 Atlanta, GA 30345

Enclosure A - Literature Cited

Able, K.P. 1973. The changing seasons. *American Birds* 27(1):19-23.

Archeological Consultants, Inc. 1992. Archeological Survey to Establish Zones of Archeological Potential (ZAPs) in the KSC North Area (East of State Road 3) (Basic Contract Area) of the Kennedy Space Center. Sarasota, FL.

Auffenberg, W., and J.B. Iverson. 1979. Demography of terrestrial turtles. Pages 541–569 in M. Harless and H. Morlock, editors. *Turtles: Perspectives and Research*. Wiley-International, New York, USA.

Beier P. 2006. Effects of artificial night lighting on terrestrial mammals. *Ecological Consequences of Artificial Night Lighting* (ed. By C. Rich & T. Longcore). Island Press, Washington, DC, USA.

Blair, W.F. 1951. Population Structure, social behavior, and environmental relations of the beach mouse (*Peromyscus polionotus leucocephalus*). *Contributions Laboratory Vertebrate Biology University of Michigan*. 48:1-47.

Boglioli, M.D., W.K. Michener, and C. Guyer. 2000. Habitat selection and modification of the gopher tortoise (*Gopher polyphemus*) in Georgia longleaf pine forest. *Chelonian Conservation and Biology* 3(4):699-703.

Bolt, B. 2013. KSC/MINWR Bald eagle reproduction surveys. Unpublished report. InoMedic Health Applications.

Boughton, R. and R. Bowman. 2011. State wide assessment of Florida scrub-jays on managed areas: A comparison of current populations to the results of the 1992-93 survey. A report submitted to the U.S. Fish and Wildlife Service.

Breining, D.R., P.A. Schmalzer, and C. R. Hinkle. 1994. Gopher tortoise (*Gopherus polyphemus*) densities in coastal scrub and slash pine flatwoods in Florida. *Journal of Herpetology* 28:60–65.

Brillhart, D.B., and D.W. Kaufman. 1991. Influence of illumination and surface structure on space use by prairie deer mice (*Peromyscus maniculatus bairdii*). *Journal of Mammalogy* 72:764–768.

Bullen, Ripley P., Adelaide K. Bullen, and William J. Bryant. 1967. Archaeological Investigations at the Ross Hammock Site, Florida. The William L. Bryant Foundation Report No. 7.

Cardno Tec. 2013. Final Environmental Site Review for the Approximate 1,140 Acres Combined Study Area for the Shiloh Site. Jacksonville, FL. 44 pp.

Clark, E.S., and R.C. Lee, Jr. 1982. History and status of wood stork nesting on Merritt Island National Wildlife Refuge, Florida, 1972-1981. U.S. Department of Interior Fish and Wildlife Service.

Clarke, J.A. 1983. Moonlight's influence on predator/prey interactions between short-eared owls (*Asio flammeus*) and deer mice (*Peromyscus maniculatus*). *Behavioral Ecology and Sociobiology* 13:205–209.

Cochran, W.W. and R.R. Graber. 1958. Attraction of nocturnal migrants by lights on a television tower. *Wilson Bulletin* 70(4):378-380.

Collins, Lori D., and Travis F. Doering. 2010. Terrestrial and Airborne LiDAR for the Three-Dimensional Documentation of the Elliott Sugar Mill Complex (8VO160) and Environs (CESU), Florida. University of South Florida, Alliance for Integrated Spatial Technologies, Tampa Bay.

Cox, J. 1996. Painted Bunting. Pp. 644–661, In J.A. Rodgers, Jr., H.W. Kale II, and H.T. Smith (Eds.). Rare and Endangered Biota of Florida. Vol. 5: Birds. University Press of Florida, Gainesville, FL. 688 pp.

Deming, Joan. 1992. Archeological survey to establish zones of archeological potential (ZAPs) in the KSC North Area (Option 3) of the Kennedy Space Center. Archeological Consultants, Inc., Sarasota, FL.

Ehrhart, L.M. 1976. A study of diverse coastal ecosystem on the Atlantic coast of Florida: Mammal studies. Final Report to NASA/KSC. Grant No. NGR10-019-004. Kennedy Space Center, Florida. 182 pp.

Falkenberg, J.C., and J.A. Clarke. 1998. Microhabitat use of deer mice: effects of interspecific interaction risks. *Journal of Mammalogy* 79:558–565.

Florida Fish and Wildlife Conservation Commission. 2013a. Manatee Synoptic Surveys. Fish and Wildlife Research Institute. St. Petersburg, FL, USA. Accessed October 18, 2013. Available at: <http://myfwc.com/research/manatee/projects/population-monitoring/synoptic-surveys/>

Florida Fish and Wildlife Conservation Commission. 2013b. Manatee Mortality Statistics. Fish and Wildlife Research Institute. St. Petersburg, FL, USA. Available at: <http://myfwc.com/research/manatee/rescue-mortality-response/mortality-statistics/>

Florida Fish and Wildlife Conservation Commission. 2013c. Manatee Protection Zones. Fish and Wildlife Research Institute. St. Petersburg, FL, USA. Accessed October 18, 2013. Available at: <http://myfwc.com/wildlifehabitats/managed/manatee/protection-zones/>

Florida Fish and Wildlife Conservation Commission. 2012. Florida's Wildlife Legacy Initiative: Florida's State Wildlife Action Plan. Tallahassee, Florida, USA.

Franz, R. 1992. Florida pine snake, *Pituophis melanoleucus mugitus* Barbour. Pages 254–258 in P. E. Moler, editor. Rare and endangered biota of Florida.

Garten, C.T. and M.H. Smith. 1974. Movement by old field mice and population regulation. *Acta Theriologica*. 19:513-514.

Gilmore, R.G. 1977. Fishes of the Indian River Lagoon and adjacent waters, Florida. *Bulletin of the Florida State Museum* 22(3):101-147.

Godley, J.S. 1992. Gopher frog, *Rana capito* Le Conte. Pages 15–19 in P. E. Moler, editor. Rare and endangered biota of Florida. Volume III. Amphibians and reptiles. University Press of Florida, Gainesville, Florida, USA.

Griffin, John W. and James J. Miller. 1978. Cultural Resource Reconnaissance of Merritt Island National Wildlife Refuge. Cultural Resource Management, Inc. Tallahassee, FL.

Hellmann, Robert. 2008. Archeological Overview and Assessment of Canaveral National Seashore, Volusia and Brevard County, FL. Southeast Archeological Center, National Park Service, Tallahassee, FL.

Hipes, D., D.R. Jackson, K. NeSmith, D. Printiss, and K. Brandt. 2001. Florida pine snake *Pituophis melanoleucus mugitus*. Florida Natural Areas Inventory: Field Guide to the Rare Animals of Florida. Walsworth Publishing Company, Brookfield, Missouri, USA.

Hobbs, R.J. and S.E. Humphries. 1995. An Integrated Approach to the Ecology and Management of Plant Invasions. Conservation Biology. Volume 9. 4:761-770.

Kemper, C.A. 1964. A tower for TV: 30,000 dead birds. Audubon Magazine 66(1):86-90.

Kochman, H.I. 1992. Atlantic Salt Marsh Snake. Pages 111-116 in Paul E. Mohler, ed., Rare and Endangered Biota of Florida, Volume III. Amphibians and Reptiles. University Press of Florida, Gainesville. Page 291.

Kramer, K.M., and E.C. Birney. 2001. Effect of light intensity on activity patterns of Patagonian leaf-eared mice, *Phyllotis xanthopygus*. Journal of Mammalogy 82:535-544.

Landers, J.L., and D.W. Speake. 1980. Management needs of sandhill reptiles in southern Georgia. Proceedings of the Annual Conference of Southeastern Fish and Wildlife Agencies 34:515-529.

Long, George A. 1967. Indian and Historic Sites Report, John F. Kennedy Space Center, NASA. Prepared for the KSC Public Affairs Office, Kennedy Space Center, FL.

Lowther, P.E., S.M. Lanyon and C.W. Thompson. 1999. Painted bunting (*Passerina ciris*). In: The Birds of North America, No. 398, A. Poole and F. Gill, eds.

McLaughlin, G.S. 1997. Upper respiratory tract disease in gopher tortoises (*Gopherus polyphemus*): Pathology, secondary immune responses, transmission, and implications for conservation and management. Ph.D. Dissertation, University of Florida.

Mendonca, M.T. and L.M. Ehrhart. 1982. Activity, Population Size and Structure of Immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia, Vol 1982, No 1, pp161-167.

Merritt Island National Wildlife Refuge. 1996. Annual Narrative, print copy available at Refuge office.

Miller, G.J. 2008. Home range size, habitat associations and refuge use of the Florida pine snake *Pituophis melanoleucus mugitus*, in southwest Georgia, USA. Thesis, University of Florida, Gainesville, USA.

Mortimer, J.A. 1982. Factors effecting beach selection by nesting sea turtles. Biology and Conservation of Sea Turtles. 45-51.

Mrosovsky, N. 1967. How turtles find the sea. Science Journal. Vol 3. 52-57.

Mrosovsky, N. and S.J. Shettleworth. 1968. Wavelength preferences and brightness cues in the water finding behaviour of sea turtles. Behaviour. Vol 32. 211-257.

National Aeronautics and Space Administration. 2013. Environmental Assessment for Central Campus Complex Modifications. Available at:

<http://environmental.ksc.nasa.gov/projects/documents/centralCampusEA.pdf>

National Oceanic and Atmospheric Administration. 2013. Smalltooth Sawfish (*Pristis pectinata*). NOAA Fisheries, Office of Protected Resources. Accessed October 30, 2013. Available at: <http://www.nmfs.noaa.gov/pr/species/fish/smalltoothsawfish.htm>

National Park Service. 2011. Canaveral National Seashore, Draft General Management Plan, Environmental Impact Statement. Titusville, FL 385pp.

National Wildlife Refuge System Improvement Act of 1997. Available at: http://www.fws.gov/refuges/policiesandbudget/HR1420_index.html

Nesbitt, S.A. and K.S. Williams. 1990. Home range and habitat use of Florida sandhill cranes. J. Wildl. Management. 54(1):92-96.

Oddy, D.M. 2000. Population estimate and demography of the southeastern beach mouse (*Peromyscus polionotus niveiventris*) on Cape Canaveral Air Force Station, Florida. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science. University of Central Florida.

Parker, Susan. 2008. Canaveral National Seashore Historic Resource Study, Cultural Resources Division, Southeast Regional Office, National Park Service, Atlanta, GA.

Proffitt, C.E., R.E. Martin, R.G. Ernest, B.J. Graunke, S.E. LeCroy, K.A. Muldoon, B.D. Peery, J.R. Wilcox, and N. Williams-Walls. 1986. Effects of power plant construction on the nesting of the loggerhead sea turtle (*Caretta caretta*). Copeia. 813-816. U.S Fish and Wildlife Service. 1999. South Florida Multi-Species Recovery Plan. Southeast Region; Atlanta, GA.

Roznik, E.A. and S.A. Johnson. 2009. Canopy closure and emigration by juvenile gopher frogs. Journal of Wildlife Management 73:260-268.

Sauer J.R., J.E. Hines, G. Gough, I. Thomas and B. G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis. Version 96.4 Patuxent Wildlife Research Center. Laurel, Maryland.

Schwadron, Margo. 2013. Elliott Plantation. Florida Master Site File Form, Tallahassee, Florida.

Sexton, N.R., Dietsch, A.M., Don Carlos, A.W., Koontz, L.M., Solomon, A.N. and Miller, H.M. 2012. National wildlife refuge visitor survey 2010/2011—Individual refuge results: U.S. Geological Survey Data Series 643.

Shuey, J. 1996. Another new <<Euphyes>> from the southern United States coastal plain (Hesperiidae). Journal of the Lepidopterists' Society, 50(1): 46-53.

Smith, C.R. 1987. Ecology of juvenile and gravid eastern indigo snakes in north

Florida. Unpublished M.S. thesis, Auburn University; Auburn, Alabama.

Smith, R. 2003. Personal communication. Biologist. Presentation to the U.S. Fish and Wildlife Service on February 24, 2003. Dynamac Corporation; Kennedy Space Center, Florida.

Smithsonian Marine Station at Fort Pierce. 2013. Accessed October 30, 2013. Available at: http://www.sms.si.edu/irlspec/rivulu_marmor.htm

Stewart, M.C., D.F. Austin, and G.R. Bourne. 1993. Habitat structure and the dispersion of gopher tortoise on a nature preserve. *Florida Scientist* 56(2):70-81.

St. Johns River Water Management District. Updated 2013a. The Indian River Lagoon: An estuary in distress. Accessed July 25, 2013. Available at: <http://www.sjrwmd.com/itsyourlagoon/index.html>

St. Johns River Water Management District. 2013b. The Indian River Lagoon: An estuary of national significance. Accessed December 10, 2013. Available at: <http://floridaswater.com/itsyourlagoon/>

St. Johns River Water Management District. 2013c. Fast Facts about the Indian River Lagoon. Accessed December 10, 2013. Available at: <http://floridaswater.com/itsyourlagoon/fastfacts.html>

Stys, B. 1997. Ecology of the Florida sandhill crane. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report No. 15. Tallahassee, FL. 20 pp.

Stout, I.J. 1992. Southeastern beach mouse. Pages 242-249 in S.R. Humphrey, ed. Rare and endangered biota of Florida. vol. I: Mammals. University Presses of Florida; Gainesville, Florida.

Taylor, D.S. 1999. *Rivulus marmoratus* status review: consideration for listing under the Endangered Species Act. National Marine Fisheries Service. Final Report. 46 p.

U.S. Fish and Wildlife Service. In press. Revised Stock Assessment Report for the West Indian Manatee (*Trichechus manatus*), Florida Stock, (Florida subspecies *Trichechus manatus latirostris*). U.S. Fish and Wildlife Service, Jacksonville Field Office. Jacksonville, FL. 14 pp.

U.S. Fish and Wildlife Service. 2013a. Federal Manatee Protection Areas. Jacksonville, FL, USA. Accessed October 18, 2013. Available at: <http://www.fws.gov/northflorida/Manatee/federal-manatee-protection-areas.htm>

U.S. Fish and Wildlife Service. 2013b. Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation. Washington, D.C. 365pp. Available at: <http://www.fws.gov/refuges/about/RefugeReports/>

U.S. Fish and Wildlife Service. 2011. Partial 90-Day finding on a petition to list 404 species in the Southeastern United States as endangered or threatened with critical habitat. *Federal Register* 76: 59836-59862.

U.S. Fish and Wildlife Service. 2007. 5-Year Review: Summary and Evaluation for the West Indian Manatee. Unpublished report. U.S. Fish and Wildlife Service, Jacksonville Field Office. Jacksonville, FL. 79 pp.

U. S. Fish and Wildlife Service. 2006. Habitat Management Plan for Merritt Island National Wildlife Refuge. U. S. Fish and Wildlife Service. Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2004. Standard Protection Measures for the Eastern Indigo Snake. U.S. Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida. Available at: http://www.fws.gov/northflorida/IndigoSnakes/20040212_gd_EIS_Standard_Protection_Measures.pdf

U. S. Fish and Wildlife Service. 2001. Florida Manatee Recovery Plan, (*Trichechus manatus latirostris*), Third Revision. U. S. Fish and Wildlife Service. Atlanta, Georgia.

U. S. Fish and Wildlife Service. 1999. South Florida Multi-species Recovery Plan. 23pp.

U. S. Fish and Wildlife Service. 1989. Roseate tern recovery plan-northeast population. U.S. Fish and Wildlife Service; Newton Corner, Massachusetts.

Van Rhijn, F.A. and J.C. van Gorkom. 1983. Optic orientation in hatchlings of the sea turtle *Chelonia mydas*. III. Sea-finding behaviour: the role of photic and visual orientation in animals walking on the spot under laboratory conditions. *Marine Behaviour and Physiology*, Vol 9. 211–228.

Vasquez, R.A. 1994. Assessment of predation risk via illumination level: facultative central place foraging in the cricetid rodent *Phyllotis darwini*. *Behavioral Ecology and Sociobiology* 34:375–381.

Verheijen, F.J. 1985. Photopollution: artificial light optic spatial control systems fail to cope with. Incidents, causation, remedies. *Experimental Biology*. Vol 44. 1–18.

Witherington, B.E., Martin, R.E. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. Florida Marine Research Institute Technical Report TR-2.

Witherington, B.E. 1992. Behavioral Responses of Nesting Sea Turtles to Artificial Lighting. *Herpetologica*. Vol. 48. 1: 33-39.

Wright, J.S. 1982. Distribution and population biology of the gopher tortoise, *Gopherus polyphemus*, in South Carolina. Clemson University. Master Thesis. 74pp.

Wood, D.A. and S.A. Nesbitt. 2001. Sandhill crane. Pages 108-123 in D. A. Wood, editor. Florida's fragile wildlife; conservation and management. University Press of Florida, Gainesville, USA.

Worth, D.F. and J.B. Smith. 1976. Marine turtle nesting on Hutchinson Island, Florida in 1973. Florida Mar. Res. Publication. Vol 18. 1-17.

Figure 1. Location of the Proposed Space Florida Shiloh Launch Facility on Merritt Island National Wildlife Refuge

