

## **APPENDIX A**

### **Titusville-Cocoa Airport Authority Statement Regarding Concept Y Reusable Launch Vehicle**



TIX → SPACE COAST REGIONAL AIRPORT  
COI → MERRITT ISLAND AIRPORT  
X21 → ARTHUR DUNN AIRPARK

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355 Golden Knights Blvd. → Titusville, Florida 32780 → 321.267.8780 → fax: 321.383.4284 → email: [admins@flairport.com](mailto:admins@flairport.com)

May 17, 2018

Federal Aviation Administration  
Office of Commercial Space Transportation

REFERENCE:       Launch Site Operators License Application and  
                      Environmental Assessment  
                      Space Coast Regional Airport

Dear Ms. Katherine Branham

Please accept the following letter of record documenting the TCAA position and intent in reference to Concept Y RLV incorporation within the LSOL Application and Environmental Assessment.

The Titusville-Cocoa Airport Authority (TCAA) hereby withdraws the Concept Y RLV from the Launch Site Operators License (LSOL) Application. However, the TCAA has not removed the Concept Y RLV from the Environmental Assessment (EA) and intends to allow the planning and assessment of that Concept to remain incorporated within the EA should a Concept Y RLV become a more viable option for space flight in the future.

Should you have any questions, please contact us at (321) 267-8780.

Sincerely,  
Michael D. Powell, C.M., ACE  
CEO

# **APPENDIX C**

**U.S. Fish and Wildlife Service and  
Florida Natural Areas Inventory  
Lists of Endangered Species for Brevard County**

- [Welcome](#)
- [Our Mission and Vision](#)
- [Area of Responsibility](#)
- [Our Office Location](#)
- [Contact Us](#)
- [Current News Releases](#)
- [News Archives](#)
- [Landowner Tools](#)
- [Programs and Resources](#)
- [Partners for Fish and Wildlife](#)
- [Coastal Program](#)
- [Habitat Conservation Plans](#)
- [Federally-listed Species in Florida](#)
- [Related Sites of Interest](#)
- **Key North Florida Species**
  - [Bald Eagle](#)
  - [Florida Manatee](#)
  - [Eastern Indigo Snake](#)
  - [Florida Scrub-Jay](#)
  - [Sand Skinks](#)
  - [Sea Turtles](#)
  - [Whooping Crane](#)
  - [Wood Stork](#)
- **General Information**
  - [Hunting-Fishing Licenses & Permits](#)
  - [Injured/Nuisance Wildlife](#)
  - [Wildlife Law Violations](#)

## Federally Listed Species in Brevard County, Florida

This information is provided as a guide to project planning, and is not a substitute for site-specific surveys. Such surveys may be needed to assess species' presence or absence, as well as the extent of project effects on listed species and/or designated critical habitat.

The following table lists those federally-listed species known to be present in the county.

Code Key: E = Endangered, T = Threatened, CH = Critical Habitat Designated, C=Candidate <sup>Note 1</sup>

Category	Species Common Name	Species Scientific Name	Code
Mammals	West Indian (Florida) Manatee	<i>Trichechus manatus latirostris</i>	E/CH
	Southeastern Beach Mouse	<i>Peromyscus polionotus nineiventris</i>	T
Birds	Audubon's Crested Caracara	<i>Polyborus plancus audubinii</i>	T
	Florida Scrub-jay	<i>Aphelocoma coerulescens</i>	T
	Piping Plover	<i>Charadrius melodus</i>	T
	Wood Stork	<i>Mycteria americana</i>	E
	Red-cockaded Woodpecker	<i>Picoides borealis</i>	E
Fish	None		
Reptiles	Atlantic Salt Marsh Snake	<i>Nerodia clarkii (=fasciata)taeniata</i>	T
	Eastern Indigo Snake	<i>Dymarchon corais couperi</i>	T
	Green Sea Turtle	<i>Chelonia mydas</i>	E
	Hawksbill Sea Turtle	<i>Eremochelys imbricata</i>	E
	Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	E
	Kemp's ridley Sea Turtle	<i>Lepidochelys kempii</i>	E
	Loggerhead Sea Turtle	<i>Caretta caretta</i>	T
	Gopher Tortoise	<a href="#">Gopherus polyphemus</a>	C
Amphibians	None		
Mollusks	None		
Crustaceans	None		
Plants	Carter's Mustard	<i>Warea carteri</i>	E

► [Home](#) ► [Species: North Florida County](#) ► [Species: South Florida County](#) ► [Species: Panhandle County](#)

- **Other USFWS Resources**
  - [Service Office Finder](#)
  - [Office Directory](#)
  - [Southeast Region Contacts](#)
  - [Federal Register Notices](#)
  - [Regional Five-Year Reviews](#)

For a list of State species by county use the Florida Natural Areas Inventory's Tracking Lists at <http://www.fnai.org/trackinglist.cfm>

For State listed species details, please go to <http://myfwc.com/imperiledspecies/>

Note 1. [Candidate species](#) receive no statutory protection under the ESA. The FWS encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA.

**NOTE:** Bald eagles were removed from the endangered species list in June 2007 because their populations recovered sufficiently. However, the protections under the Bald and Golden Eagle Act (Eagle Act) continue to apply. Please see the eagle information on our [Landowner Tools](#) page or our national website at <http://www.fws.gov/migratorybirds/baldeagle.htm> for information regarding new permit





*Send comments on our web site or general questions to [North Florida office](#).  
If you need special assistance please contact the [Public Affairs Officer](#).*

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Last updated: February 7, 2018

# FNAI Tracking List

BREVARD COUNTY  
101 Total Elements Found  
**Last Updated: January 2019**

## SEARCH RESULTS

NOTE: This is not a comprehensive list of all species and natural communities occurring in the location searched. Only elements documented in the FNAI database are included and occurrences of natural communities are excluded. Please see FNAI Land Cover information or Reference Natural Community map for more information on communities.

### Plants and Lichens

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Calamovilfa curtissii</i>	Curtiss' sandgrass	G3	S3		T
<a href="#">Centrosema arenicola</a>	sand butterfly pea	G2Q	S2		E
<i>Chamaesyce cumulicola</i>	sand-dune spurge	G2	S2		E
<i>Coelorachis tuberculosa</i>	Piedmont jointgrass	G3	S3		T
<i>Conradina grandiflora</i>	large-flowered rosemary	G3	S3		T
<a href="#">Dennstaedtia bipinnata</a>	hay scented fern	G4	S1		E
<i>Dicerandra thinicola</i>	Titusville balm	G1Q	S1		E
<i>Glandularia maritima</i>	coastal vervain	G3	S3		E
<a href="#">Glandularia tampensis</a>	Tampa vervain	G2	S2		E
<a href="#">Halophila johnsonii</a>	Johnson's seagrass	G2Q	S2	T	E
<i>Harrisia simpsonii</i>	Simpson's prickly apple	G2	S2		N
<i>Heliotropium gnaphalodes</i>	sea rosemary	G4	S3		E
<i>Lantana depressa</i> var. <i>floridana</i>	Atlantic Coast Florida lantana	G2T1	S1		E
<i>Lechea cernua</i>	nodding pinweed	G3	S3		T
<a href="#">Lechea divaricata</a>	pine pinweed	G2	S2		E
<a href="#">Lindera subcoriacea</a>	bog spicebush	G3	S1		E
<a href="#">Monotropis reynoldsiae</a>	pygmy pipes	G1	S1		E
<a href="#">Nemastylis floridana</a>	celestial lily	G2	S2		E
<a href="#">Nolina atopocarpa</a>	Florida beargrass	G3	S3		T

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<a href="#">Ophioglossum palmatum</a>	hand fern	G4	S2		E
<i>Pavonia spinifex</i>	yellow hibiscus	G4G5	S2		N
<a href="#">Peperomia humilis</a>	terrestrial peperomia	G5	S2		E
<a href="#">Peperomia obtusifolia</a>	blunt-leaved peperomia	G5	S2		E
<a href="#">Pteroglossaspis ecristata</a>	giant orchid	G2G3	S2		T
<a href="#">Schwalbea americana</a>	chaffseed	G2	S1	E	E
<a href="#">Tephrosia angustissima var. curtissii</a>	coastal hoary-pea	G1T1	S1		E
<a href="#">Warea carteri</a>	Carter's warea	G3	S3	E	E
<i>Zephyranthes simpsonii</i>	redmargin zephyrlily	G2G3	S2S3		T

#### Clams and Mussels

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Elliptio monroensis</i>	St. Johns Elephantear	G1G2	S1S2		N
<i>Villosa amygdala</i>	Florida Rainbow	G3	S3		N

#### Snails and Allies

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Praticolella bakeri</i>	Ridge Scrubsnail	G2G3	S2S3		N

#### Grasshoppers and Allies

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Melanoplus indicifer</i>	East Coast Scrub Grasshopper	G1	S1		N

#### Beetles

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Aethecerinus hornii</i>	Horn's Aethecerinus Long-Horned Beetle	G2	S2		N
<i>Aphodius aegrotus</i>	Small Pocket Gopher Aphodius Beetle	G3G4	S3?		N
<i>Aphodius laevigatus</i>	Large Pocket Gopher Aphodius Beetle	G3G4	S3?		N
<i>Ataenius wenzelii</i>	An Ataenius Beetle	G3G5	S2S3		N

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Diplotaxis rufa</i>	Red Diplotaxis Beetle	G2G3	S2S3		N
<i>Haroldiataenius saramari</i>	Sand Pine Scrub Ataenius Beetle	G3G4	S3S4		N
<i>Hypotrachia spissipes</i>	Florida Hypotrachia Scarab Beetle	G3G4	S3S4		N
<i>Pelotrupes profundus</i>	Florida Deepdigger Scarab Beetle	G3	S3		N
<i>Phyllophaga elizoria</i>	Elizoria June Beetle	G2	S2		N
<i>Phyllophaga elongata</i>	Elongate June Beetle	G3	S3		N
<i>Selonodon floridensis</i>	Florida Cebrionid Beetle	G2G4	S2S4		N
<i>Serica tantula</i>	Little Silky June Beetle	G1?	S1?		N

#### Butterflies and Moths

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Callophrys gryneus sweadneri</i>	Florida Olive Hairstreak	G5T2	S2		N
<i>Euphyes dukesi calhouni</i>	Calhoun's Skipper	G3T1	S1		N
<i>Idia gopheri</i>	Gopher Tortoise Noctuid Moth	G2G3	S2S3		N
<i>Polites origenes</i>	Crossline Skipper	G4G5	S3		N

#### Ants, Bees, and Wasps

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<a href="#">Bombus fraternus</a>	Southern Plains Bumble Bee	G2G4	S1S2		N
<i>Colletes titusensis</i>	A Cellophane bee	G1G2	S1S2		N

#### Fishes

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Acipenser oxyrinchus oxyrinchus</i>	Atlantic Sturgeon	G3T3	S1	E	FE
<i>Bairdiella sanctaeluciae</i>	Striped Croaker	G5	S2	SC	N
<i>Ctenogobius pseudofasciatus</i>	Slashcheek Goby	G3G5	S1		N
<i>Gobiomorus dormitor</i>	Bigmouth Sleeper	G4	S2		N

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Microphis brachyurus</i>	Opossum Pipefish	G4G5	S2	SC	N
<i>Rivulus marmoratus</i>	Mangrove Rivulus	G4G5	S3	SC	N

#### Amphibians

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<a href="#">Lithobates capito</a>	Gopher Frog	G3	S3		N

#### Reptiles

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Alligator mississippiensis</i>	American Alligator	G5	S4	SAT	FT(S/A)
<a href="#">Caretta caretta</a>	Loggerhead Sea Turtle	G3	S3	T	FT
<a href="#">Chelonia mydas</a>	Green Sea Turtle	G3	S2S3	T	FT
<a href="#">Crotalus adamanteus</a>	Eastern Diamondback Rattlesnake	G4	S3		N
<a href="#">Dermochelys coriacea</a>	Leatherback Sea Turtle	G2	S2	E	FE
<a href="#">Drymarchon couperi</a>	Eastern Indigo Snake	G3	S3	T	FT
<a href="#">Gopherus polyphemus</a>	Gopher Tortoise	G3	S3	C	ST
<i>Lampropeltis getula</i>	Common Kingsnake	G5	S2S3		N
<i>Lampropeltis occipitolineata</i>	South Florida Mole Kingsnake	G1G2	S1S2		N
<a href="#">Lepidochelys kempii</a>	Kemp's Ridley Sea Turtle	G1	S1	E	FE
<a href="#">Pituophis melanoleucus</a>	Pine Snake	G4	S3		ST
<a href="#">Sceloporus woodi</a>	Florida Scrub Lizard	G2G3	S2S3		N

#### Birds

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<a href="#">Antigone canadensis pratensis</a>	Florida Sandhill Crane	G5T2	S2		ST
<a href="#">Aphelocoma coerulescens</a>	Florida Scrub-Jay	G2?	S2	T	FT
<a href="#">Aramus guarana</a>	Limpkin	G5	S3		N
<a href="#">Athene cunicularia floridana</a>	Florida Burrowing Owl	G4T3	S3		ST
<a href="#">Caracara cheriway</a>	Crested Caracara	G5	S2	T	FT

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<a href="#">Dryobates borealis</a>	Red-cockaded Woodpecker	G3	S2	E	FE
<a href="#">Egretta caerulea</a>	Little Blue Heron	G5	S4		ST
<a href="#">Egretta rufescens</a>	Reddish Egret	G4	S2		ST
<a href="#">Egretta thula</a>	Snowy Egret	G5	S3		N
<a href="#">Egretta tricolor</a>	Tricolored Heron	G5	S4		ST
<a href="#">Eudocimus albus</a>	White Ibis	G5	S4		N
<a href="#">Haematopus palliatus</a>	American Oystercatcher	G5	S2		ST
<a href="#">Haliaeetus leucocephalus</a>	Bald Eagle	G5	S3		N
<i>Laterallus jamaicensis</i>	Black Rail	G3G4	S2		N
<a href="#">Mycteria americana</a>	Wood Stork	G4	S2	T	FT
<i>Nyctanassa violacea</i>	Yellow-crowned Night-heron	G5	S3		N
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	G5	S3		N
<a href="#">Pandion haliaetus</a>	Osprey	G5	S3S4		N
<i>Peucaea aestivalis</i>	Bachman's Sparrow	G3	S3		N
<a href="#">Platalea ajaja</a>	Roseate Spoonbill	G5	S2		ST
<i>Plegadis falcinellus</i>	Glossy Ibis	G5	S3		N
<a href="#">Rynchops niger</a>	Black Skimmer	G5	S3		ST
<a href="#">Sternula antillarum</a>	Least Tern	G4	S3	N	ST
<a href="#">Thalasseus maximus</a>	Royal Tern	G5	S3		N

#### Mammals

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Eubalaena glacialis</i>	North Atlantic Right Whale	G1	S1	E	FE
<i>Mustela frenata peninsulae</i>	Florida Long-tailed Weasel	G5T3?	S3		N
<a href="#">Peromyscus polionotus niveiventris</a>	Southeastern Beach Mouse	G5T1	S1	T	FT
<a href="#">Podomys floridanus</a>	Florida Mouse	G3	S3		N
<a href="#">Trichechus manatus</a>	West Indian Manatee	G2	S2	T	FT
<a href="#">Ursus americanus floridanus</a>	Florida Black Bear	G5T4	S4		N

Other Elements

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
<i>Bird Rookery</i>		G5	SNR		N
<i>Manatee Aggregation Site</i>		GNR	SNR		N

# **APPENDIX D**

## **Wildlife Hazard Assessment Species List**



## Species Observed at TIX During the 2011 Wildlife Hazard Assessment Surveys

Retrieved from: Exner, Gary. *Space Coast Regional Airport (KTIX) Wildlife Hazard Assessment*. 1st ed. Chuluota, FL: Advantage Consulting LLC, 2012. Digital.

### **BIRDS**

American crow (*Corvus brachyrhynchos*)  
American kestrel (*Falco sparverius*)  
Anhinga (*Anhinga anhinga*)  
Bald eagle (*Haliaeetus leucocephalus*)  
Barn owl (*Tyto alba*)  
Barn swallow (*Hirundo rustica*)  
Belted kingfisher (*Megasceryle alcyon*)  
Black vulture (*Coragyps atratus*)  
Boat-tailed grackle (*Quiscalus major*)  
Brown-headed cowbird (*Molothrus ater*)  
Cattle egret (*Bubulcus ibis*)  
Common grackle (*Quiscalus quiscula*)  
Common ground-dove (*Columbina passerine*)  
Double-crested cormorant (*Phalacrocorax auritus*)  
Great blue heron (*Ardea herodias*)  
Great egret (*Ardea alba*)  
House sparrow (*Passer domesticus*)  
Killdeer (*Charadrius vociferus*)  
Least tern (*Sternula antillarum*)  
Little blue heron (*Egretta caerulea*)  
Mourning dove (*Zenaida macroura*)  
Northern cardinal (*Cardinalis cardinalis*)  
Osprey (*Pandion haliaetus*)  
Palm warbler (*Setophaga palmarum*)  
Pileated woodpecker (*Oryzocopus pileatus*)  
Red-tailed hawk (*Buteo jamaicensis*)  
Red-winged blackbird (*Agelaius phoeniceus*)  
Ring-billed gull (*Larus delawarensis*)  
Royal tern (*Thalasseus maximus*)  
Sandhill crane (*Grus canadensis*)  
Turkey vulture (*Cathartes aura*)  
White Ibis (*Eudocimus albus*)  
Wild turkey (*Meleagris gallopavo*)

### **REPTILES\***

American alligator (*Alligator mississippiensis*)  
American bullfrog (*Rana catesbeiana*)  
Brown water snake (*Nerodia taxispilota*)  
Common box turtle (*Terrapene carolina*)  
Common garter snake (*Thamnophis sirtalis*)  
Gopher tortoise (*Gopherus polyphemus*)  
Green tree frog (*Hyla cinerea*)  
Eastern Indigo Snake (*Dymarchon corais couperi*)  
Eastern diamondback rattlesnake (*Crotalus adamanteus*)  
Southern black racer (*Coluber constrictor priapus*)

\*Report states that some of these species were observed and others are thought to potentially use the Airport based on suitable habitat or evidence observed.

**MAMMALS\*\*<sup>1</sup>**\_\_\_\_\_

Feral hog (*Sus scrofa*)

Coyote (*Canis latrans*)

White-tailed deer (*Odocoileus virginianus*)

Gray fox (*Urocyon cinereoargenteus*)

Raccoon (*Procyon lotor*)

Bobcat (*Lynx rufus*)

Eastern gray squirrel (*Sciurus carolinensis*)

Eastern cottontail (*Sylvilagus floridanus*)

\*\*Report does not contain a list of mammal species observed, but these species were mentioned in various portions of the report and on the example datasheet provided in the report.

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<sup>1</sup> Exner, Gary. *Space Coast Regional Airport (KTIX) Wildlife Hazard Assessment*. 1st ed. Chuluota, FL: Advantage Consulting LLC, 2012. Print.

# **APPENDIX E**

## **U.S. Fish and Wildlife Service Correspondence Regarding Scrub Jay Area**



United States Department of the Interior

U. S. FISH AND WILDLIFE SERVICE

7915 BAYMEADOWS WAY, SUITE 200  
JACKSONVILLE, FLORIDA 32256-7517

IN REPLY REFER TO:

FWS Log No. 04EF1000-2012-TA-0270

October 10, 2012

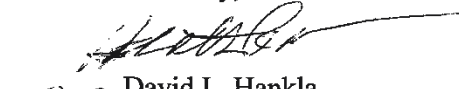
Susan Gosselin  
Brevard County Natural Resources Management Office  
2725 Judge Fran Jamieson Way, Building A-219  
Viera, Florida 32940

Dear Ms. Gosselin:

Thank you for your letter received September 6, 2012 and email received October 8, 2012, providing information regarding the proposed development of the Titusville-Cocoa Airport Authorities's Space Coast Regional Airport property bordered by Perimeter Road to the North and bordered by the Space Coast Regional Airport to the west and east in Brevard County, Melbourne, Florida (Section 3, Township 23 South and Range 35 East. The proposed project occurs within the range of the Florida scrub-jay (*Aphelocoma coerulescens*). Scrub-jay surveys of the site were conducted 2003 and again in June 18-22, 2012, and information in the reports indicated that no scrub-jays were observed on the property or in the surrounding area. Based on aerial maps and information about the sites landscape, the Service has determined that the above-referenced parcel contains overgrown, degraded or otherwise undesirable vegetation and therefore is not suitable habitat for Florida scrub-jays.

The Service concludes that development will not impact scrub-jay habitat, and, therefore, will not result in "take" of scrub-jays as defined under Section 9 of the Endangered Species Act. The Service's determination is valid for a period of no more than two years from the date of this letter. If additional information in the future indicates that the construction of the project is impacting scrub-jays, please notify our office so that we can reassess our determination. If you have any questions, please contact Erin M. Gawera, at 904-731-3121.

Sincerely,

  
David L. Hankla  
Field Supervisor

RECEIVED

OCT 22 2012

BREVARD COUNTY  
NATURAL RESOURCES MGT.



NATURAL RESOURCES MANAGEMENT OFFICE  
2725 Judge Fran Jamieson Way, Building A-219, Viera, FL 32940

FLORIDA'S SPACE COAST



## Introduction

The proposed Project Speed at Titusville-Cocoa Airport Authority's Space Coast Regional Airport is located in Section 3, Township 23, and Range 35 of Brevard County, Florida (Figure 1). The location is bordered to the south by Perimeter Road, to the north, west and east by the larger Space Coast Regional Airport (Figure 2). The Titusville-Space Coast Regional Airport Authority is planning to complete all permitting for the site for an incoming tenant. The total project site is 72 acres, of which, 36 acres occur within a Scrub Jay polygon and contains potential habitat for scrub jays.

## Site Description

A Florida Land Use Cover Forms Classification System (FLUCFCS) map for the project was prepared based on field reconnaissance and is included as Figure 3. The proposed project area is comprised of previously impacted areas (8110-Airports) covering 36 acres and natural areas (4340-Hardwood-Conifer Mixed) covering 36 acres. Site soils are mapped in Figure 4. The soils listed on site are Myakka Sand (36), Candler Fine Sand (4), Tavares Sand (63), and Quartzipsamments, smoothed (52).

The Hardwood-Conifer stand is shown in the photolog included in Site Photographs. The site canopy vegetation is mixed hardwoods and conifers comprised of upland species such as: Eastern red cedar (*Juniperus virginiana*), long leaf pine (*Pinus palustris*), slash pine (*Pinus elliottii*), sand pine (*Pinus clausa*), bluejack oak (*Quercus incana*), scrub oak (*Quercus inopina*), sand live oak (*Quercus geminata*), and live oak (*Quercus virginiana*). The shrub layer was comprised of upland shrubs such as saw palmetto (*Serenoa repens*), hog plum (*Ximenia americana*), and Deerberry (*Vaccinium stamineum*). Ground cover was missing in the interior of the stand due to extensive (>75%) canopy coverage. The remaining land cover type (Airport-8110) is vegetated with Bahia (*Paspalum notatum*) grass with occasional herbaceous groundcover.

The three native soil types present within the natural area of the project site are commonly found in scrub or scrubby flatwoods within Brevard County. They are Myakka Sand, Candler Sand and Tavares Sand. They are well drained to moderately well drained sands found on or around sand ridges within Brevard County. Quartzipsamments are mixed soils that are a result of clearing and filling for development.

## Survey Methodology

Survey methods follow those by U.S. Fish and Wildlife Service, Scrub-Jay Survey Guidelines, Revised 2007 (Appendix A). Transects and play-back stations were based on previous Scrub-Jay Monitoring completed by Storm L. Richards and Associates, Inc. in 2003 (Appendix B).

Fifteen monitoring stations and ten transect lines were utilized to cover the forested property as shown on Figure 5. Florida Scrub jay territorial calls were played for at least five minutes per station in all four cardinal directions. The survey was conducted over a five day period. Data sheets with the results of the survey are located in Appendix C.

## Survey Results

No scrub jay calls were heard in response to the played recordings. No Florida scrub jays were found within or around the proposed Project Speed site. There have been no land management activities in regards to scrub management on the Project Speed Site since the previous survey. The site vegetation is less than optimal for scrub jays with canopy heights well over 20 feet and the only open areas are adjacent to the edges of the site (Appendix B).

Therefore, it is requested that USFWS accept this report and concur on the survey findings of no Florida scrub jay territories within the project boundary.

For questions or comments, please contact Sue Gosselin at (321)633-2016, x52438 or email at [sue.gosselin@brevardcounty.us](mailto:sue.gosselin@brevardcounty.us).

Susan Gosselin  
Environmental Scientist  
Brevard County Natural Resource Management Office

## **FIGURES**





 Survey Area

Figure 1  
Project Location  
Florida Scrub Jay Survey  
Project Speed  
TICO Airport  
Titusville, FL

Disclaimer: Due to the nature of map scale, accuracy, precision, and spatial and non-spatial data integration, this map may not reflect current and/or accurate conditions.



0 3,650 7,300 Feet





Figure 2  
Project Area  
Florida Scrub Jay Survey  
Project Speed  
TICO Airport  
Titusville, FL

 Survey Area

Disclaimer: Due to the nature of map scale, accuracy, precision, and spatial and non-spatial data integration, this map may not reflect current and/or accurate conditions.





0 600 1,200 Feet





Figure 3  
FLUCFCS Map  
Florida Scrub Jay Survey  
Project Speed  
TICO Airport  
Titusville, FL

 Survey Area  
 1350 FLUCFCS Code and Polygon

Disclaimer: Due to the nature of map scale, accuracy, precision, and spatial and non-spatial data integration, this map may not reflect current and/or accurate conditions.

2011 Aerials from Brevard County Property Appraiser  
Map created in ARC/INFO 9.3



1 inch = 322 feet

0 487.5 975 Feet



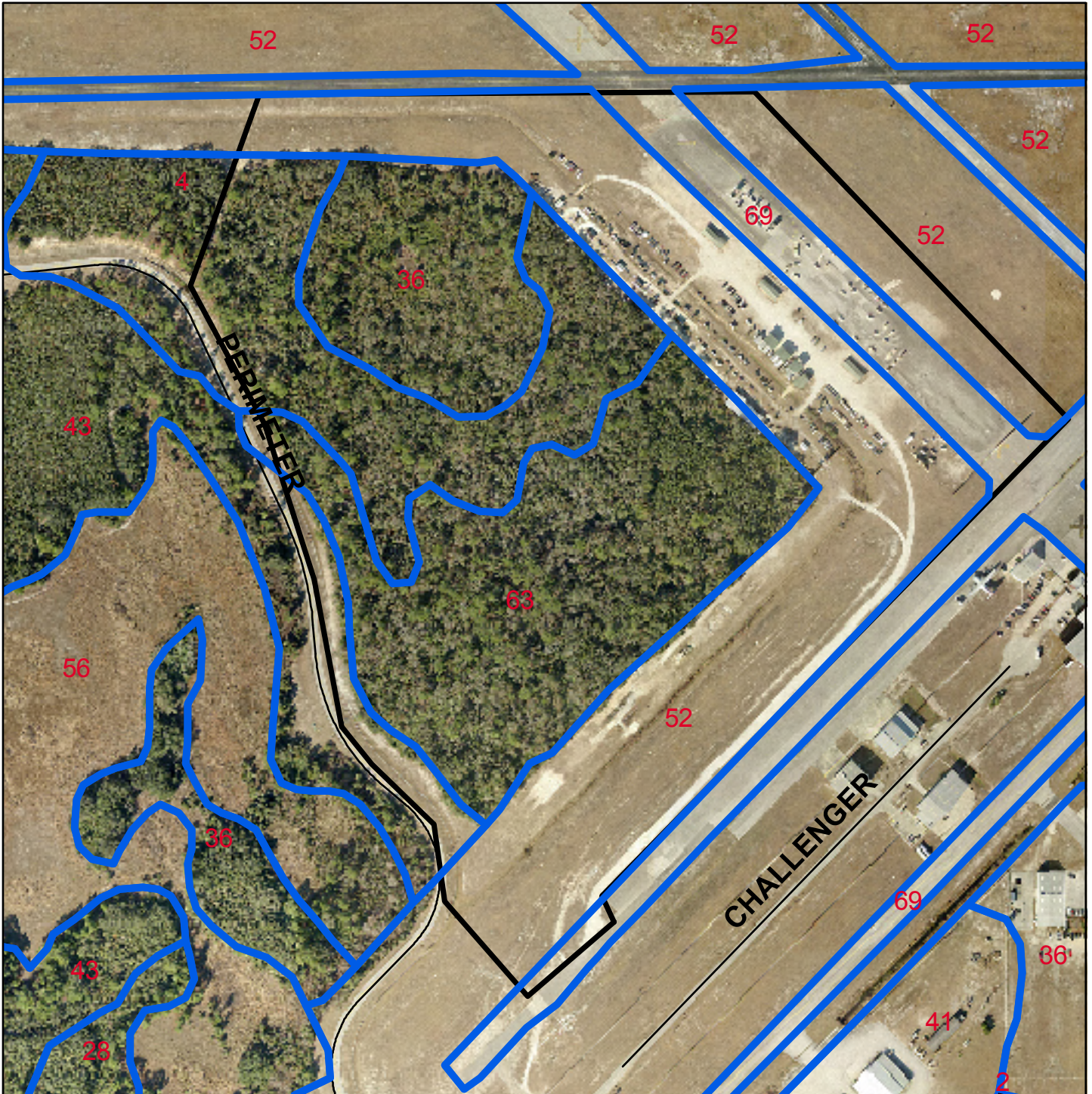
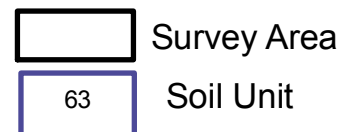


Figure 4  
Soil Map  
Florida Scrub Jay Survey  
Project Speed  
TICO Airport  
Titusville, FL

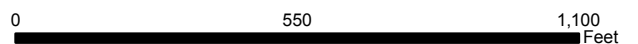


Disclaimer: Due to the nature of map scale, accuracy, precision, and spatial and non-spatial data integration, this map may not reflect current and/or accurate conditions.

2011 Aerials from Brevard County Property Appraiser  
Map created in ARC/INFO 9.3



1 inch = 346 feet





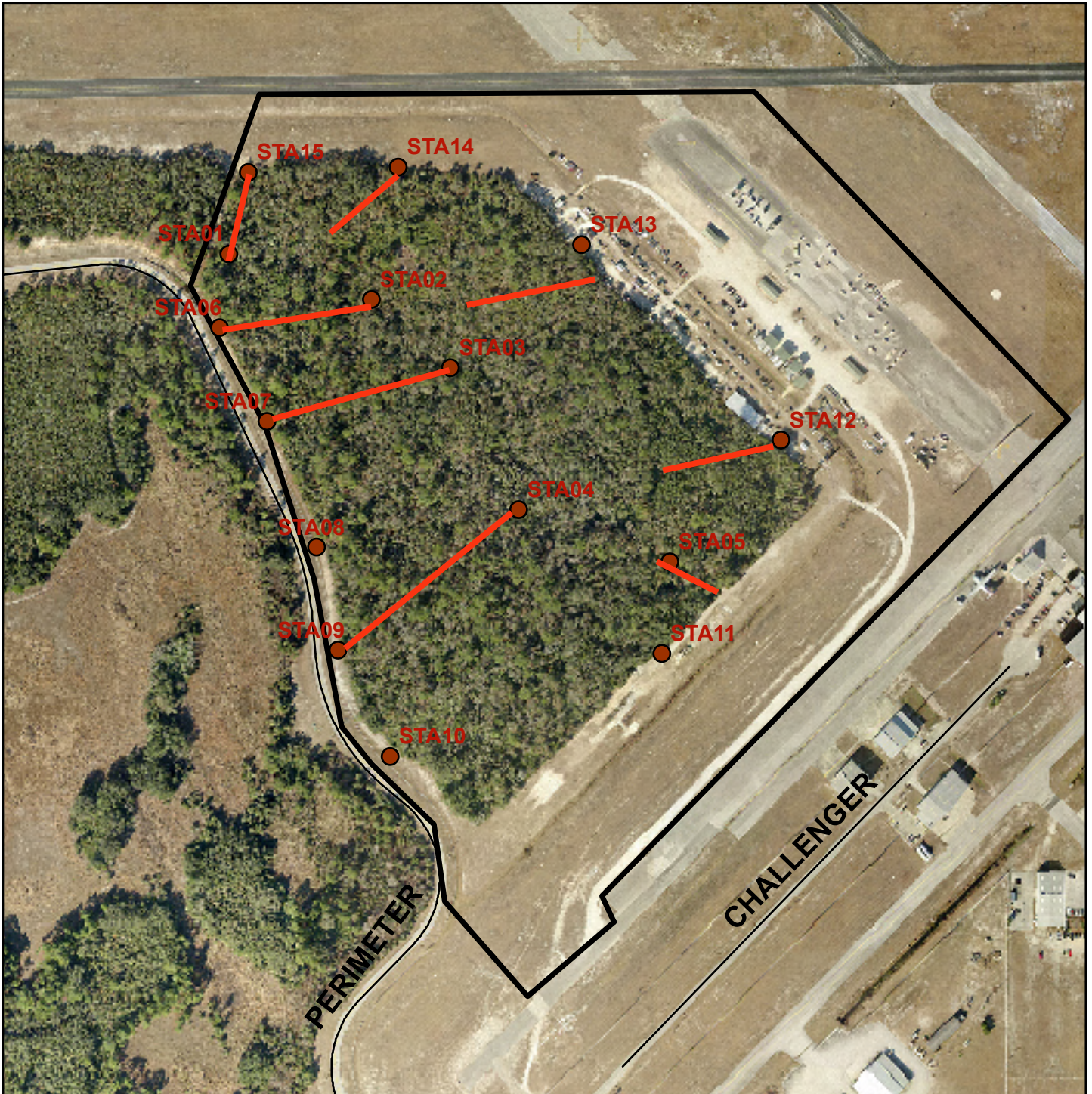


Figure 5  
Survey Map  
Florida Scrub Jay Survey  
Project Speed  
TICO Airport  
Titusville, FL

- Survey Area
- ^ Monitoring Transect
- Survey Stations

Disclaimer: Due to the nature of map scale, accuracy, precision, and spatial and non-spatial data integration, this map may not reflect current and/or accurate conditions.

2011 Aerials from Brevard County Property Appraiser  
Map created in ARC/INFO 9.3



1 inch = 346 feet

0 550 1,100 Feet

## **SITE PHOTOGRAPHS**





Image 1. View to the northeast from the southwest corner of the project site.



Image 2. View to the southwest from the northeast corner of the project site.

## **APPENDIX A**



# Scrub-Jay Survey Guidelines

(Updated 08/24/2007)

Adapted from: J.W. Fitzpatrick, G.E. Woolfenden and M.T. Kopeny. 1991. *Ecology and development-related habitat requirements of the Florida scrub-jay (Aphelocoma coerulescens)*. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report No. 8. Tallahassee, FL. 49pp.

The most effective method for surveying a site for Florida scrub-jays is to traverse the area systematically, using a high quality tape recording of Florida scrub-jay territorial scolding in an attempt to attract the jays. The recording should include clear examples of all typical territorial scolds, including the female "hiccup" call. Vocalizations are available by contacting:

Macaulay Library  
Cornell Lab of Ornithology  
159 Sapsucker Rd.  
Ithaca, NY 14850  
Email: [macaulaylibrary@cornell.edu](mailto:macaulaylibrary@cornell.edu)  
<http://birds.cornell.edu>

Map plant communities either on a 7.5 foot U.S. Geological Survey (USGS) topographic map or an aerial photograph at a scale of no more than 400 feet per inch. The vegetation map must show all forms of existing development. On the vegetation map, establish parallel line transects with playback stations along each transect. Space the transects and playback stations so that all different scrub types will be sampled for jays (i.e., so that the taped calls will be effectively broadcast across areas of concern). These scrub types should include not only the more "classic" xeric oak scrub, scrubby pine flatwoods, scrubby coastal strand, and sand pine scrub, but should also include:

- pine-mesic oak
- xeric oak
- sand live oak
- improved, unimproved, and woodland pastures;
- citrus groves;
- rangeland;
- pine flat woods;
- longleaf pine xeric oak;
- sand pine;
- sand pine plantations;
- forest regeneration areas;
- sand other than beaches;
- disturbed rural land in transition without positive indicators of intended activity; and disturbed burned areas.

The presence of scrub oaks, no matter how sparsely distributed, is the key indicator of "scrub" habitat.

Distances between transects, and between stations along transects, depend on many factors, including power of the speaker used for broadcasting the calls, topography of the site, and the density of the surrounding vegetation. Adequate spacing between transects can be estimated roughly as the distance at which a person listening to the tape directly in front of the speaker perceives the "bird" to be no more than about 100 meters away. A distance of 100 to 200 meters between transects and between stations is generally adequate when using a good-quality, hand-held cassette player broadcasting at full volume.

Surveys should be carried out on calm, clear days about one hour after sunrise, and should terminate before midday heat or wind. Surveys should not be conducted in winds stronger than a moderate breeze (5-8 mph), in mist or fog, or in precipitation exceeding a light, intermittent drizzle. Heat and especially wind lowers the tendency for jays to respond to distant territorial scolds, and wind reduces the distance over which recordings can be heard. Jays are also reluctant to fly on windy days regardless of hour or season. Surveys also should NOT be conducted if accipiters or other scrub-jay predators are present in the area; in the event this is the case, the surveyor should either wait until the predator is gone or come back on another day.

Surveys may be conducted anytime between March 1 through October 31. However, ideal survey periods include: 1) spring (especially March), 2) fall (September and October), when territorial displays are most frequent and vigorous, and 3) midsummer (July) when young of the year are independent but still distinguishable by plumage. The poorest times of the year to survey are late winter, when jays are most likely to fly far for food, and late spring when the young are quiet and the adults are occupied with molt and feeding fledglings.

Transects may be driven or walked. If driven, step out or stand atop the vehicle at each playback station. Broadcast the calls at each station for at least 1 minute in all four directions around the playback station, emphasizing any direction in which low-growing oak scrub is the predominant vegetation. On the vegetation map, plot the locations and indicate group size of all Florida scrub-jays where they are first seen or heard. Distinguish adult-plumaged jays from juvenile-plumaged jays whenever possible.

At localities with car trails, large areas of scrub can be surveyed with a vehicle in one day. On foot, the process is more laborious because of the relatively large size of territories (often 10 to 40 acres). Once a group is located, stop broadcasting at that station. Remaining at this station briefly should result in the assembly of the entire group. This allows one to estimate group size and, if done during the midsummer, to distinguish young of the year from adults.

Sometimes two or more groups will be attracted to one station, usually from different directions. Observers should be careful, therefore, to plot each group where it was first spotted or heard, not at the site to which the jays were attracted. In rare circumstances, especially at sites where numerous groups congregate at artificial food or water sources, it may be difficult to differentiate groups. This is especially true where jays have become habituated and tame to human approach. Again, in such cases careful observation is extremely important. Studies of such congregations using color-marked jays have confirmed that almost always they consist of members of different family groups. Often they may have crossed several territory boundaries to reach the neutral feeding or drinking areas. The result gives a false impression of extremely high jay density.

It is essential that the subject area be surveyed as often as necessary (for a minimum of 5 days) to establish an accurate count of jay groups and territorial boundaries. If more than 8 to 10 jays are encountered at a single playback station during a fall or spring survey period, the jays at this site should be monitored carefully over several visits and different times of day. Numbers will shift as groups arrive and depart. Often it is possible to watch where the jays come from or return to as a means of determining how many groups are represented. For determining territorial boundaries, it is essential that the surveyor be familiar with different types of behavior exhibited by scrub-jays. Territorial boundaries may be most accurately predicted through a combination of observing scrub-jays and listening for territorial behavior (in the case where several families of scrub-jays exist in contiguous habitat) or by including habitat suitable for occupation by scrub-jays within a territorial boundary (in the case where a family of scrub-jays is somewhat isolated from other groups). If a question exists as to how many groups of scrub-jays are onsite, or where to draw territorial boundaries, it is strongly recommended that the U.S. Fish and Wildlife Service receive permission from the land owner to conduct an independent survey onsite.

The key end products of this procedure are: (1) a complete count of all jay groups onsite and (2) an approximate territory map or home range center for each group. Provide the U.S. Fish and Wildlife Service with a final report that includes the following, as applicable:

- A. An information sheet including:
  - Dates and starting and ending times of all surveys conducted.
  - Weather conditions during all surveys, including average temperature, wind speed and direction, visibility, and precipitation.
  - Total number of jay groups found, number of jays in each group and number of juvenile-plumaged jays in each of these groups.
- B. An aerial photograph or vegetation map depicting:
  - The entire area of interest.
  - Transect lines and playback stations.  
Locations of all jays seen or heard while conducting the survey or at any other time, including flight direction.
  - Approximate suspected territory boundaries between jay groups or suspected home range centers for each group.

Mail Scrub-jay survey reports to:

#### **North Florida Counties**

Scrub-Jay Survey  
U.S. Fish and Wildlife Service  
6620 Southpoint Dr. South, Suite 310  
Jacksonville, FL 32216-0958

#### **South Florida Counties**

Scrub-Jay Survey  
U.S. Fish and Wildlife Service  
1339 20<sup>th</sup> St.  
Vero Beach, FL 32960-3559

## **APPENDIX B**

**STORM L. RICHARDS & ASSOCIATES, INC.**  
ENVIRONMENTAL ASSESSMENTS, FEASIBILITY STUDIES, & PERMITTING  
1804 MAPLE AVENUE  
SANFORD, FLORIDA 32771-3358  
(407) 323-9021 FAX: (407) 366-0538

DR. JEANNE FILLMAN-RICHARDS, President  
DR. STORM L. RICHARDS

July 31, 2003

Mr. Scott C. Carr, C.M.  
Director of Facilities, Operations,  
& Planning  
**Space Coast Regional Airport**  
**Titusville-Cocoa Airport Authority**  
355 Golden Knights Boulevard  
Titusville, Florida 32780

Re: Review by U.S. Fish and Wildlife Service of the proposed northwest development area site, located on the east side of Perimeter Road west of Taxiways "D" and "F" at the Space Coast Regional Airport, in Sections 2 & 3, Township 23 South, Range 38 East, Titusville, Brevard County, Florida 32780

Dear Mr. Carr:

In conjunction with the Letter Report of Official Endangered and Protected Fauna and Flora in Florida regarding the above-referenced site, **Storm L. Richards & Associates, Inc.**, has completed a Florida scrub jay (*Aphelocoma coerulescens coerulescens*) report for the subject site located on the east side of Perimeter Road west of Taxiways "D" and "F" at the Space Coast Regional Airport. The guidelines for this report are included for your convenience in Attachment #3—U.S. Fish and Wildlife Service Scrub-jay Survey Guidelines.

In July 2003 **Storm L. Richards & Associates, Inc.**, completed a detailed survey of the above-referenced project including 15 stations for review by using the Florida scrub jay bird vocalizations, observations throughout the area (see Attachment 1—Maps of Site for maps showing stations and transect lines for the subject site) and 10 transects throughout the site. All stations and transect lines were inventoried for 5 consecutive days from early morning on through afternoon. The area was also photoinventoried (included in Attachment 4—Threatened/Endangered Species Inventory of the Site by **Storm L. Richards & Associates, Inc.**, Dated July 31, 2003). Additional surveying was conducted after the 5-day reporting period both at the perimeter of the site and the internal areas of the site. Monitoring sheets were also kept for the 5-day reporting period (see Attachment 2—Florida Scrub Jay

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THE ASSOCIATION OF AMERICAN GEOGRAPHERS • FLORIDA SOCIETY OF GEOGRAPHERS  
THE GALILEO CIRCLE OF THE AMERICAN GEOGRAPHICAL SOCIETY  
REGISTER OF PROFESSIONAL ARCHAEOLOGISTS • FLORIDA ARCHAEOLOGICAL COUNCIL

Mr. Scott C. Carr, C.M.  
Director of Facilities, Operations,  
& Planning  
**Space Coast Regional Airport**  
**Titusville-Cocoa Airport Authority**  
July 31, 2003

Page 2

Monitoring Data Sheets). Additionally, Ms. Annie Dziergowski of the **U.S. Fish and Wildlife Service** reviewed portions of the site perimeter and interior prior to the monitoring. No Florida scrub jays were observed on the subject proposed development site when observations by Ms. Dziergowski took place or during the period of review by Dr. Storm L. Richards, Ph.D., and Dr. Jeanne Fillman-Richards, Ph.D. or other staff of **Storm L. Richards & Associates, Inc.** There is habitat near and adjacent to the subject site that provides more opportunity for xeric habitat, less development and activity, and greater opportunity for nesting and overall habitat.

The monitoring reports, transects, testing stations, and bird call playback stations are included in this report for your transmittal to the **U.S. Fish and Wildlife Service**. This information and methodology for review was derived from the **U.S. Fish and Wildlife Service Scrub-Jay Survey Guidelines** developed by Ms. Annie Dziergowski (copy included in Attachment 2).

In conclusion, the proposed northwest development area site does not appear to have a resident Florida scrub jay population or Florida scrub jays that routinely occupy the specific area. No Florida scrub jays were observed on the site and a formal request should be made to the **U.S. Fish and Wildlife Service** via Ms. Dziergowski for immediate habitat modification of the site based on Florida scrub jays not occurring on the site and the need for development plans which need to be completed at the earliest date. Please do not hesitate to call if you have any questions.

Respectfully submitted,



Storm L. Richards, Ph.D.  
**Certified Environmental Professional**  
Florida Association of Environmental  
Professionals, Member



Attachments:

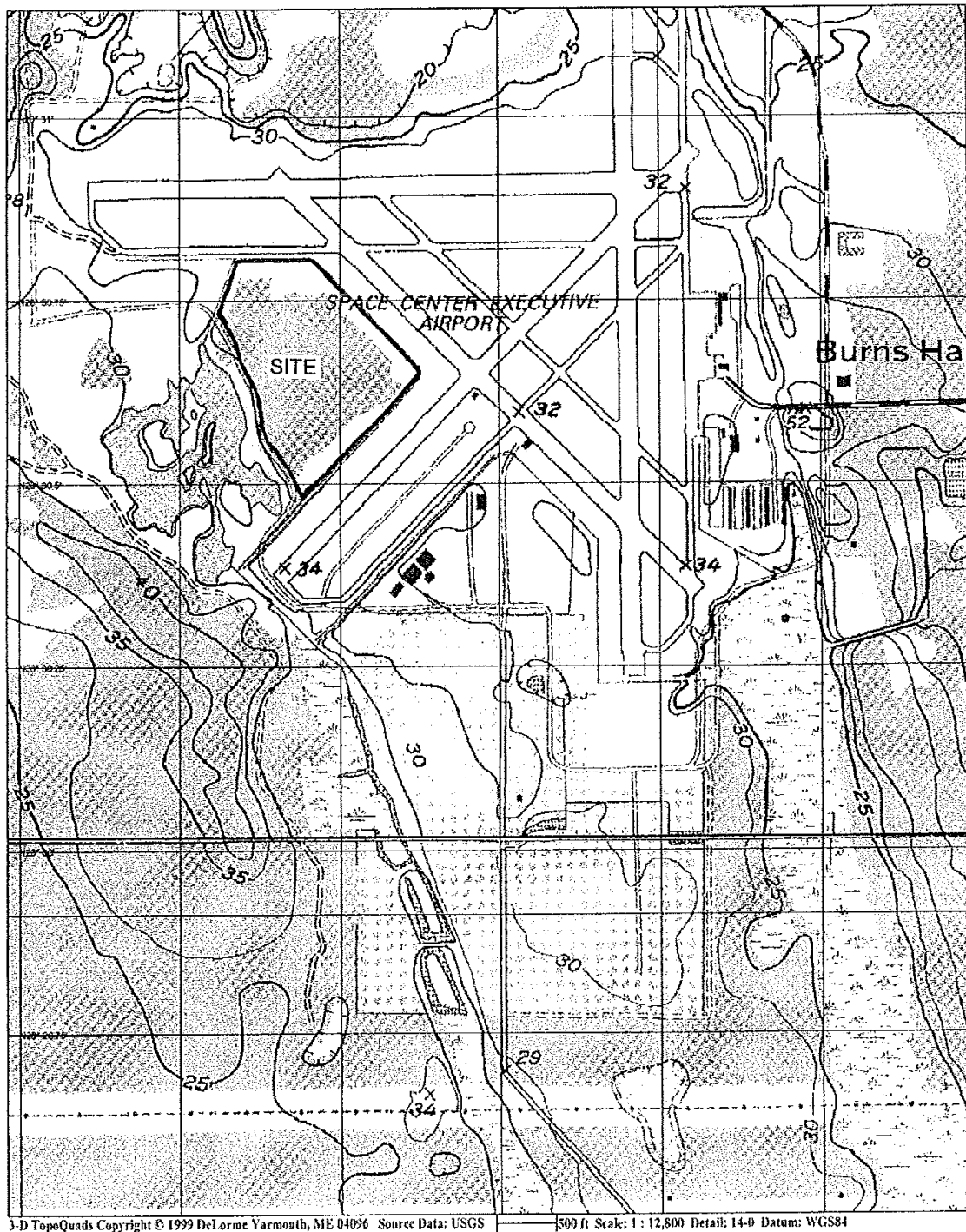
- 1: Maps of Site
- 2: Florida Scrub Jay Monitoring Data Sheets
- 3: **U.S. Fish and Wildlife Service Scrub-Jay Survey Guidelines**
- 4: **Threatened/Endangered Species Inventory of the Site by Storm L. Richards & Associates, Inc., Dated July 31, 2003**

**ATTACHMENT 1**

**MAPS OF SITE**

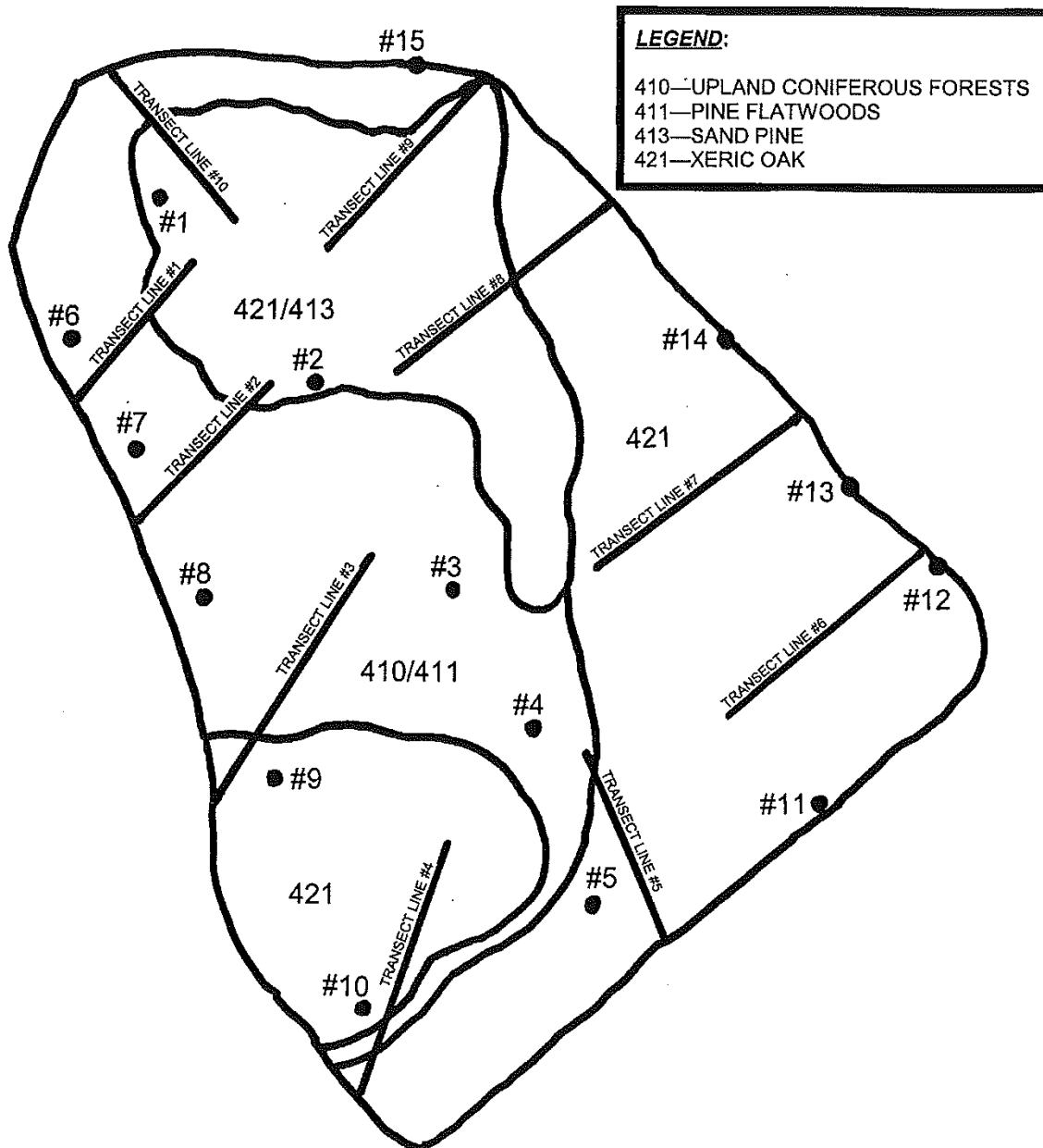
- USGS Map of Proposed Northwest Development Area
- Outline Map of Proposed Northwest Development Area Showing FLUCFCS  
Communities, Bird Call Playback Stations, and Transect Locations for  
Florida Scrub Jay Occurrence by Bird Call Playback Station and  
Observation
- Aerial Photo of Northwest Development Area Showing FLUCFCS  
Communities on the Site
- Aerial Photo of Northwest Development Area Showing Bird Call Playback  
Stations on the Site
- Aerial Photo of Northwest Development Area Showing Transect Locations for  
Florida Scrub Jay Occurrence by Bird Call Playback Station and  
Observation on the Site

## USGS MAP OF PROPOSED NORTHWEST DEVELOPMENT AREA

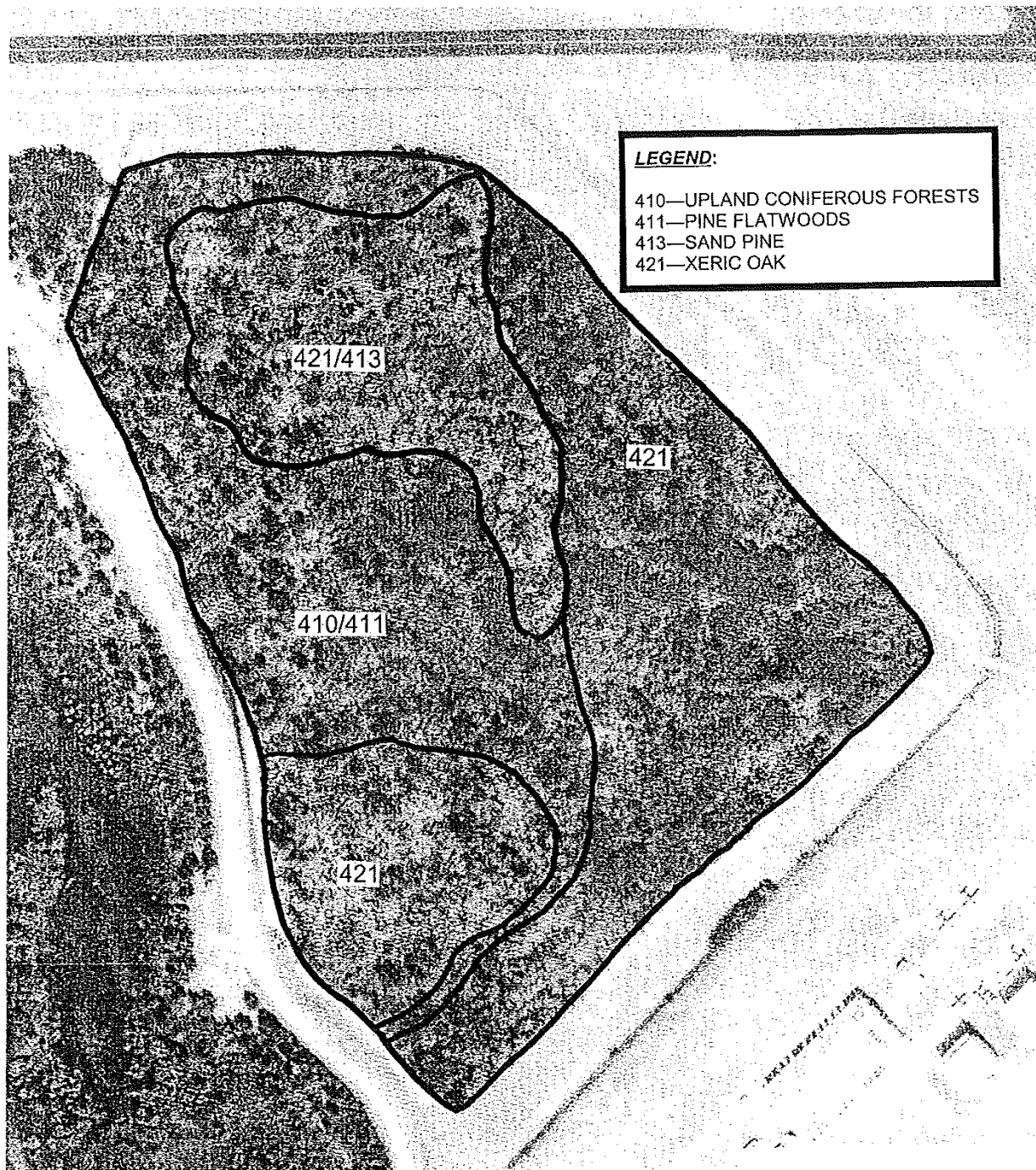




**OUTLINE MAP OF PROPOSED NORTHWEST DEVELOPMENT AREA  
SHOWING FLUCFCS COMMUNITIES, BIRD CALL PLAYBACK STATIONS, AND  
TRANSECT LOCATIONS FOR FLORIDA SCRUB JAY OCCURRENCE BY BIRD  
CALL PLAYBACK STATION AND OBSERVATION**



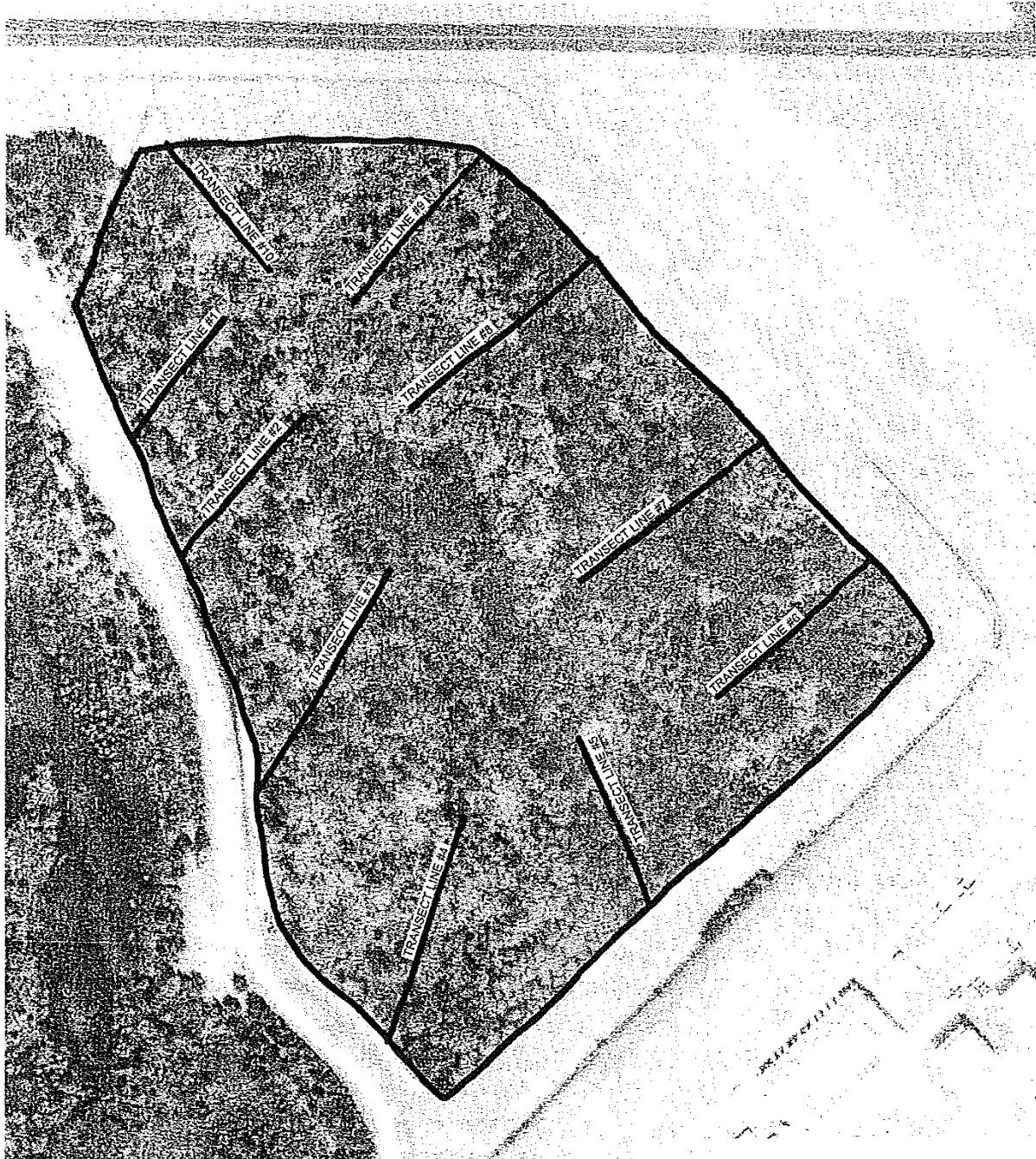
**AERIAL PHOTO OF NORTHWEST DEVELOPMENT AREA  
SHOWING FLUCFCS COMMUNITIES ON THE SITE**



**AERIAL PHOTO OF NORTHWEST DEVELOPMENT AREA  
SHOWING BIRD CALL PLAYBACK STATIONS ON THE SITE**



**AERIAL PHOTO OF NORTHWEST DEVELOPMENT AREA SHOWING  
TRANSECT LOCATIONS FOR FLORIDA SCRUB JAY OCCURRENCE BY  
BIRD CALL PLAYBACK STATION AND OBSERVATION ON THE SITE**



**ATTACHMENT 2**

**FLORIDA SCRUB JAY MONITORING DATA SHEETS**









# FLORIDA SCRUB JAY MONITORING DATA SHEET

Project: NORTHWEST DEPARTMENT AREA AT SPACE COAST REGIONAL AIRPORT  
Date: 07/03/2003 Start Time: 6:00 AM End Time: 6:00 PM

Date: 07/03/2003

Start Time: 6:00 AM

End Time: 6:00 PM

[illegible]

[illegible]

**ATTACHMENT 3**

**U.S. FISH AND WILDLIFE SERVICE  
SCRUB-JAY SURVEY GUIDELINES**

### Scrub-Jay Survey Guidelines

Adapted from: J.W. Fitzpatrick, G.E. Woolfenden and M.T. Kopeny. 1991. Ecology and development-related habitat requirements of the Florida scrub-jay (*Aphelocoma coerulescens*). Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report No. 8. Tallahassee, FL. 49pp.

The most effective method for surveying a site for Florida scrub-jays is to traverse the area systematically, using a high quality tape recording of Florida scrub-jay territorial scolding in an attempt to attract the jays. The recording should include clear examples of all typical territorial scolds, including the female "hiccup" call. Vocalizations are available by contacting:

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Ithaca, NY 14850  
Email: libnatsounds@cornell.edu

<http://birds.cornell.edu>

Map plant communities either on a 7.5 foot U.S. Geological Survey (USGS) topographic map or an aerial photograph at a scale of no more than 400 feet per inch. The vegetation map must show all forms of existing development. On the vegetation map, establish parallel line transects with playback stations along each transect. Space the transects and playback stations so that all different scrub types will be sampled for jays (i.e., so that the taped calls will be effectively broadcast across areas of concern). These scrub types should include not only the more "classic" xeric oak scrub, scrubby pine flatwoods, scrubby coastal strand, and sand pine scrub, but should also include:

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- rangeland;
- pine flat woods;
- longleaf pine xeric oak;
- sand pine;
- sand pine plantations;
- forest regeneration areas;
- sand other than beaches;



- disturbed rural land in transition without positive indicators of intended activity; and
- disturbed burned areas.

The presence of scrub oaks, no matter how sparsely distributed, is the key indicator of "scrub" habitat.

Distances between transects, and between stations along transects, depend on many factors, including power of the speaker used for broadcasting the calls, topography of the site, and the density of the surrounding vegetation. Adequate spacing between transects can be estimated roughly as the distance at which a person listening to the tape directly in front of the speaker perceives the "bird" to be no more than about 100 meters away. A distance of 100 to 200 meters between transects and between stations is generally adequate when using a good-quality, hand-held cassette player broadcasting at full volume.

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Surveys should be conducted during 1) spring (especially March), 2) fall (September and October), when territorial displays are most frequent and vigorous, and 3) midsummer (July) when young of the year are independent but still distinguishable by plumage. The poorest times of the year to survey are late winter, when jays are most likely to fly far for food, and late spring when the young are quiet and the adults are occupied with molt and feeding fledglings.

Transects may be driven or walked. If driven, step out or stand atop the vehicle at each playback station. Broadcast the calls at each station for at least 1 minute in all four directions around the playback station, emphasizing any direction in which low-growing oak scrub is the predominant vegetation. On the vegetation map, plot the locations and indicate group size of all Florida scrub-jays where they are first seen or heard. Distinguish adult-plumaged jays from juvenile-plumaged jays whenever possible.

At localities with car trails, large areas of scrub can be surveyed with a vehicle in one day. On foot, the process is more laborious because of the relatively large size of territories (often 10 to 40 acres). Once a group is located, stop broadcasting at that station. Remaining at this station briefly should result in the assembly of the entire group. This allows one to estimate group size and, if done during the midsummer, to distinguish young of the year from adults.

Sometimes two or more groups will be attracted to one station, usually from different directions. Observers should be careful, therefore, to plot each group where it was first spotted or heard, not at the site to which the jays were attracted. In rare circumstances, especially at sites where

numerous groups congregate at artificial food or water sources, it may be difficult to differentiate groups. This is especially true where jays have become habituated and tame to human approach. Again, in such cases careful observation is extremely important. Studies of such congregations using color-marked jays have confirmed that almost always they consist of members of different family groups. Often they may have crossed several territory boundaries to reach the neutral feeding or drinking areas. The result gives a false impression of extremely high jay density.

It is essential that the subject area be surveyed as often as necessary (for a minimum of 5 days) to establish an accurate count of jay groups and territorial boundaries. If more than 8 to 10 jays are encountered at a single playback station during a fall or spring survey period, the jays at this site should be monitored carefully over several visits and different times of day. Numbers will shift as groups arrive and depart. Often it is possible to watch where the jays come from or return to as a means of determining how many groups are represented. For determining territorial boundaries, it is essential that the surveyor be familiar with different types of behavior exhibited by scrub-jays. Territorial boundaries may be most accurately predicted through a combination of observing scrub-jays and listening for territorial behavior (in the case where several families of scrub-jays exist in contiguous habitat) or by including habitat suitable for occupation by scrub-jays within a territorial boundary (in the case where a family of scrub-jays is somewhat isolated from other groups). If a question exists as to how many groups of scrub-jays are onsite, or where to draw territorial boundaries, it is strongly recommended that the U.S. Fish and Wildlife Service receive permission from the land owner to conduct an independent survey onsite.

The key end products of this procedure are: 1) a complete count of all jay groups onsite; and 2) an approximate territory map or home range center for each group.

Provide the U.S. Fish and Wildlife Service with a final report that includes the following, as applicable:

A. An information sheet including:

- Dates and starting and ending times of all surveys conducted.
- Weather conditions during all surveys, including average temperature, wind speed and direction, visibility, and precipitation.
- Total number of jay groups found, number of jays in each group and number of juvenile-plumaged jays in each of these groups.

B. An aerial photograph or vegetation map depicting:

- The entire area of interest.
- Transect lines and playback stations.
- Locations of all jays seen or heard while conducting the survey or at any other time, including flight direction.
- Approximate suspected territory boundaries between jay groups or suspected home range centers for each group.

Mail final reports to:  
Scrub-Jay Survey  
U.S. Fish and Wildlife Service  
6620 Southpoint Dr. South, Suite 310  
Jacksonville, FL 32216-0958

Call us at 904-232-2580, extension 116, or email us at [Annie\\_Dziergowski@fws.gov](mailto:Annie_Dziergowski@fws.gov)

**APPENDIX 4**

**THREATENED/ENDANGERED SPECIES INVENTORY OF THE SITE  
BY STORM L. RICHARDS & ASSOCIATES, INC.,  
DATED JULY 31, 2003**

**STORM L. RICHARDS & ASSOCIATES, INC.**  
ENVIRONMENTAL ASSESSMENTS, FEASIBILITY STUDIES, & PERMITTING  
1804 MAPLE AVENUE  
SANFORD, FLORIDA 32771-3358  
(407) 323-9021 FAX: (407) 366-0538

DR. JEANNE FILLMAN-RICHARDS, President  
DR. STORM L. RICHARDS

July 31, 2003

Mr. Scott C. Carr, C.M.  
Director of Facilities, Operations,  
& Planning  
**Space Coast Regional Airport**  
**Titusville-Cocoa Airport Authority**  
355 Golden Knights Boulevard  
Titusville, Florida 32780

Re: Letter Report on *Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida* (FGFWFC, 1 June 1994) on the proposed northwest development area site, located on the east side of Perimeter Road west of Taxiways "D" and "F" at the Space Coast Regional Airport, in Sections 2 & 3, Township 23 South, Range 38 East, Titusville, Brevard County, Florida 32780

Dear Mr. Carr:

The subject proposed northwest development area property is an approximately 30-acre site located in a rural area in Titusville in Brevard County, Florida, in Sections 2 & 3, Township 23 South, Range 38 East. The subject site is located on the east side of Perimeter Road west of Taxiways "D" and "F" at the Space Coast Regional Airport (see Appendix "A"—Maps of Site). This letter report represents the enumeration of the *Official List of Endangered and Potentially Endangered Fauna and Flora in Florida* (Wood, 1994). The list was derived by field investigation conducted in July 2003. The intent of this report will be to inventory identified and possibly occurring threatened and endangered species on the site.

Specific Information

1. Developer:

Mr. Scott C. Carr  
Senior Manager of Airports  
Project Manager  
**Space Coast Regional Airport**  
**Titusville-Cocoa Airport Authority**  
355 Golden Knights Boulevard  
Titusville, Florida 32780

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THE ASSOCIATION OF AMERICAN GEOGRAPHERS • FLORIDA SOCIETY OF GEOGRAPHERS  
THE GALILEO CIRCLE OF THE AMERICAN GEOGRAPHICAL SOCIETY  
REGISTER OF PROFESSIONAL ARCHAEOLOGISTS • FLORIDA ARCHAEOLOGICAL COUNCIL



Mr. Scott C. Carr, C.M.  
 Director of Facilities, Operations,  
 & Planning  
**Space Coast Regional Airport**  
**Titusville-Cocoa Airport Authority**  
 July 31, 2003

Page 2

2. Description of Activity:

This approximately 30-acre parcel will be developed in Titusville, Brevard County, Florida, by the Space Coast Regional Airport/Titusville-Cocoa Airport Authority

3. Location:

- A. Sections 2 & 3, Township 23 South, Range 38 East
- B. County: Brevard
- C. City: Titusville

4. Location Maps: See Appendix "A"

Site Description

The subject property is upland and consists predominantly of pine flatwoods and xeric oak habitat. The overall area appears to be a mixture of several Florida Land Use, Cover, and Forms Classification System (FLUCFCS) classes with xeric oak being dominant in some areas and pine flatwood in other areas. The mixture is probably due to the lack of burning along with longleaf and slash pine (*Pinus palustris* and *P. elliottii*) growth on the site (see Appendix "C"—Photoinventory of Site). FLUCFCS classifications were used to differentiate the vegetative types on the site. The Level III designations were used for habitat evaluation and are as follows:

<u>Type #</u>	<u>Description</u>
#410	Upland Coniferous Forests
#411	Pine Flatwoods
#413	Sand Pine
#421	Xeric Oak

These habitats including uplands and wetlands are suitable to a number of federal and state protected species. A revised methodology based on the *Wildlife Methodology Guidelines for Section 18.D of the Application for Development Approval* published by the Florida Game and Fresh Water Fish Commission's Office of Environmental Services (15 January 1988) was used to inventory protected species as identified in the *Official Lists of Endangered & Potentially Endangered Fauna and Flora in Florida* compiled by Mr. Don A. Wood,

Mr. Scott C. Carr, C.M.  
 Director of Facilities, Operations,  
 & Planning  
**Space Coast Regional Airport**  
**Titusville-Cocoa Airport Authority**  
 July 31, 2003

Page 3

Endangered Species Coordinator and published by the Florida Game and Fresh Water Fish Commission (1 June 1994).

The *Wildlife Methodology Guidelines* were used in a modified manner for upland surveys, small mammal sampling, and herpetofaunal surveys as follows (pp. 7-10):

Upland Surveys:

Sherman's fox squirrel (*Sciurus niger shermani*)  
 Florida scrub jay (*Aphelocoma coerulescens coerulescens*)  
 Burrowing owl (*Speotyto cunicularia*)  
 Osprey (*Pandion haliaetus*)  
 Florida grasshopper sparrow (*Ammodramus savannarum floridanus*)  
 Southeastern American kestrel (*Falco sparverius paulus*)  
 Red-cockaded woodpecker (*Picoides borealis*)

Detection of individuals within this group can be difficult since these species tend to exhibit either inherently low populations or solitary behavior, or both. For this reason, survey efforts which fail to detect any of the species listed above should not necessarily be construed to imply species absence. An appropriate survey methodology should consist of morning and evening pedestrian surveys (1500 feet of transect per 100 acres) across the site for a minimum of five days. Transects should be meandered through areas of suitable habitat and changed after each survey to maximize site coverage. Transect locations should be mapped accordingly. Map all observations of listed species as well as physical features which may indicate species presence such as tree markings, tracks, nests, and cavity trees.

Small Mammal Sampling:

Florida mouse (*Peromyscus floridanus*)

The location and number of small mammal transects should be based on the distribution of available habitat across the site. Each transect should consist of a minimum of 25 stations (two live traps placed within a 10-foot radius of the station) per 50 acres of suitable habitat. Each transect should be sampled for four consecutive 24-hour periods to obtain the necessary 200 trap-nights per transect. Traps should be shaded and checked twice each day to prevent dehydration of captured animals. Captured animals should be identified to species and released. Final survey reports should include all habitat/transect data. To maximize Florida mouse captures, sampling stations should be located

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Space Coast Regional Airport  
Titusville-Cocoa Airport Authority  
July 31, 2003

Page 4

in the immediate vicinity of stumps, fallen logs, pathways, and gopher tortoise burrows. In some cases, it may be more appropriate to rely on gopher tortoise survey results to assist with the location of live trap transects.

Herpetofaunal Surveys:

Indigo snake (*Drymarchon corais couperi*)  
Florida pine snake (*Pituophis melanoleucus mugitus*)  
Gopher tortoise (*Gopherus polyphemus*)  
Gopher frog (*Rana capito* [=areolata] *aesopus*)  
Blue-tailed mole skink (*Eumeces egregius lividus*)  
Sand skink (*Neoseps reynoldsi*)

Species in this group are extremely difficult to census due to their highly cryptic nature and seasonal activity patterns. Investigators should be aware of how seasonal and local conditions may influence individual species sampling success.

Gopher frog, indigo snake, and Florida pine snake populations should be censused using a combination of pedestrian surveys and funnel trapping. On portions of the site that support moderate to high densities of gopher tortoises (*Gopherus polyphemus*) (0.4 individuals per acre or greater), one-way funnel traps (minimum three-foot length) should be placed at the burrow entrance of at least 25% of the active, inactive, and abandoned gopher tortoise burrows on a site. Greater sampling effort for gopher frog populations should be expended on burrows within one-half mile of intermittent wetlands. Traps should be shaded and left in place for at least four consecutive days and checked twice each day.

Upland pedestrian surveys for these species are best conducted during the spring, summer, and fall months. When conducting winter month surveys, investigators should closely observe gopher tortoise burrows for the presence of basking indigo and Florida pine snakes in the vicinity of the burrow, and gopher frogs just inside the burrow entrance. Snake observations can be increased if surveys are conducted during warm sunny days between early and mid-afternoon hours. During the months of February through October following heavy rains, nighttime monitoring of frog vocalizations from intermittent wetlands can be conducted to determine the presence of gopher frog breeding habitat within a site.

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 July 31, 2003

Page 5

### Site Review

Staff of **Storm L. Richards & Associates, Inc.**, transected the site in July 2003. Special attention to the xeric area was given for potential habitat of protected species. The site was reviewed in the early morning and late afternoon hours on several occasions. Transects were made throughout the property. The specifics of this inventory are attached to this basic report.

### Species Inventory

Xeric oak, upland coniferous forest and pine flatwood community types comprise the dominant vegetative community types for the site in which protected species might occur. The xeric habitat requires more evaluation and reconnaissance. This habitat is conducive to Florida scrub jays (*Aphelocoma coerulescens coerulescens*), but none were sighted nor were their distinctive twig- and sawpalmetto-lined nests sighted. Numerous gopher tortoise (*Gopherus polyphemus*) burrows were inventoried during field review of the site.

Mature slash pines (*Pinus elliottii*) did not have nests of protected species such as eagles or owls. No cavity trees were observed on the site. A listing of species potentially occurring on the site includes the following:

The upland area includes animals such as armadillo (*Dasypus novemcinctus*), Florida mouse (*Peromyscus floridanus*), hispid cotton rat (*Sigmodon hispidus*), eastern cottontail rabbit (*Sylvilagus floridanus*), white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*) as mammals observed or potentially occurring within on-site. Birds typically may include, but are not limited to, Bachman's sparrow (*Aimophila aestivalis*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), killdeer (*Charadrius vociferus*), nighthawk (*Chordeiles minor*), common bobwhite (*Colinus virginianus*), American kestrel (*Falco sparverius*), loggerhead shrike (*Lanius ludovicianus*), turkey (*Meleagris gallopavo*), screech owl (*Otus asio*), and starling (*Sturnus vulgaris*). Reptiles may typically include the yellow rat snake (*Elaphe obsoleta*), eastern indigo snake (*Drymarchon corais couperi*), pygmy rattlesnake (*Sistrurus miliarius*) pine snake (*Pituophis melanoleucus mugitus*), box turtle (*Terrapene carolina*), gopher tortoise (*Gopherus polyphemus*), and the Florida ribbon snake (*Thamnophis sauritus*). Red-cockaded woodpeckers (*Picoides borealis*) are not anticipated to use this site due to the lack of mature pine trees in the area.

Xeric habitat on the site includes animals which are limited to those which are tolerant of dry conditions and high temperatures. Deer which may utilize these areas feed on the fruits of the oaks. Armadillos (*Dasypus novemcinctus*) and gopher tortoises

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Space Coast Regional Airport  
Titusville-Cocoa Airport Authority  
July 31, 2003

Page 6

(*Gopherus polyphemus*) along with blue-tailed mole skinks (*Eumeces egregius lividus*) may inhabit the xeric oak scrub. Bachman's sparrow, rufous-sided towhee (*Pipilo erythrophthalmus*), great-crested flycatcher (*Myarchus crinitus*), and Florida scrub jays (*Aphelocoma coerulescens coerulescens*) could occur in this habitat, but there was no evidence of past or current occurrence of species.

#### Threatened and Endangered Species

Species which occur or could potentially occur on the proposed northwest development area site and have legal status according to the Florida Fish and Wildlife Conservation Commission (FFWCC) and the U.S. Fish and Wildlife Service (USFWS) are listed in Appendix "B"—List of Protected Animals with Potential for Occurrence on the Proposed Northwest Development Area Site, Sections 2 & 3, Township 23 South, Range 38 East, Titusville, Brevard County, Florida. Numerous gopher tortoise (*Gopherus polyphemus*) burrows were observed on the site. Other vertebrates which may occur in association with the gopher tortoise population include the Florida gopher frog (*Rana capito* [= *areolata*] *aesopus*), the Florida short-tailed mouse (*Podomys floridanus*), and the eastern indigo snake (*Drymarchon corais couperi*), which were not observed. Please do not hesitate to call if you have any questions.

Respectfully submitted,



Storm L. Richards, Ph.D.  
Certified Environmental Professional  
Florida Association of Environmental  
Professionals, Member



#### Appendices:

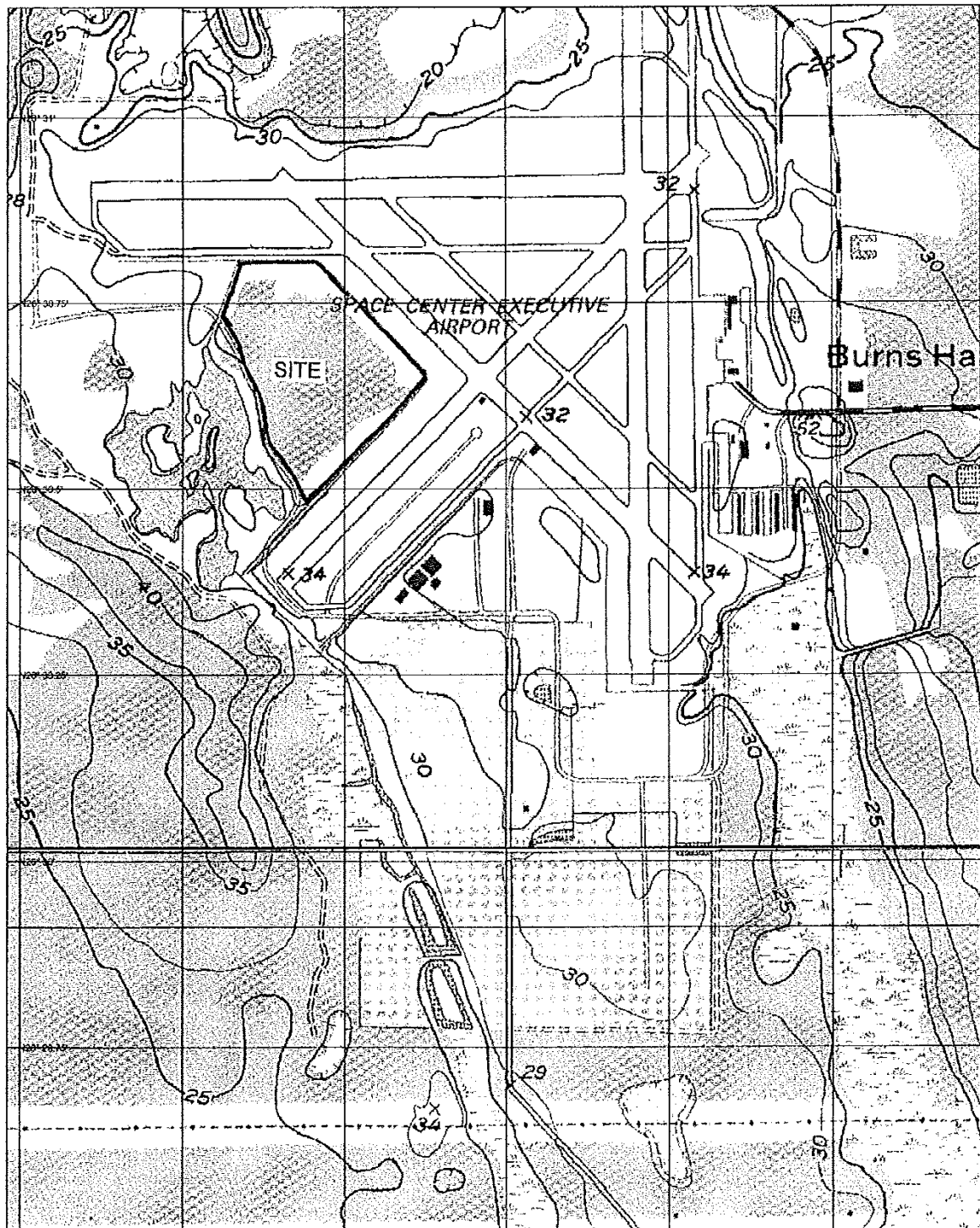
- "A": Maps of Site
- "B": List of Protected Animals with Potential for Occurrence on the Proposed Northwest Development Area Site, Sections 2 & 3, Township 23 South, Range 38 East, Titusville, Brevard County, Florida
- "C": Photoinventory of Site



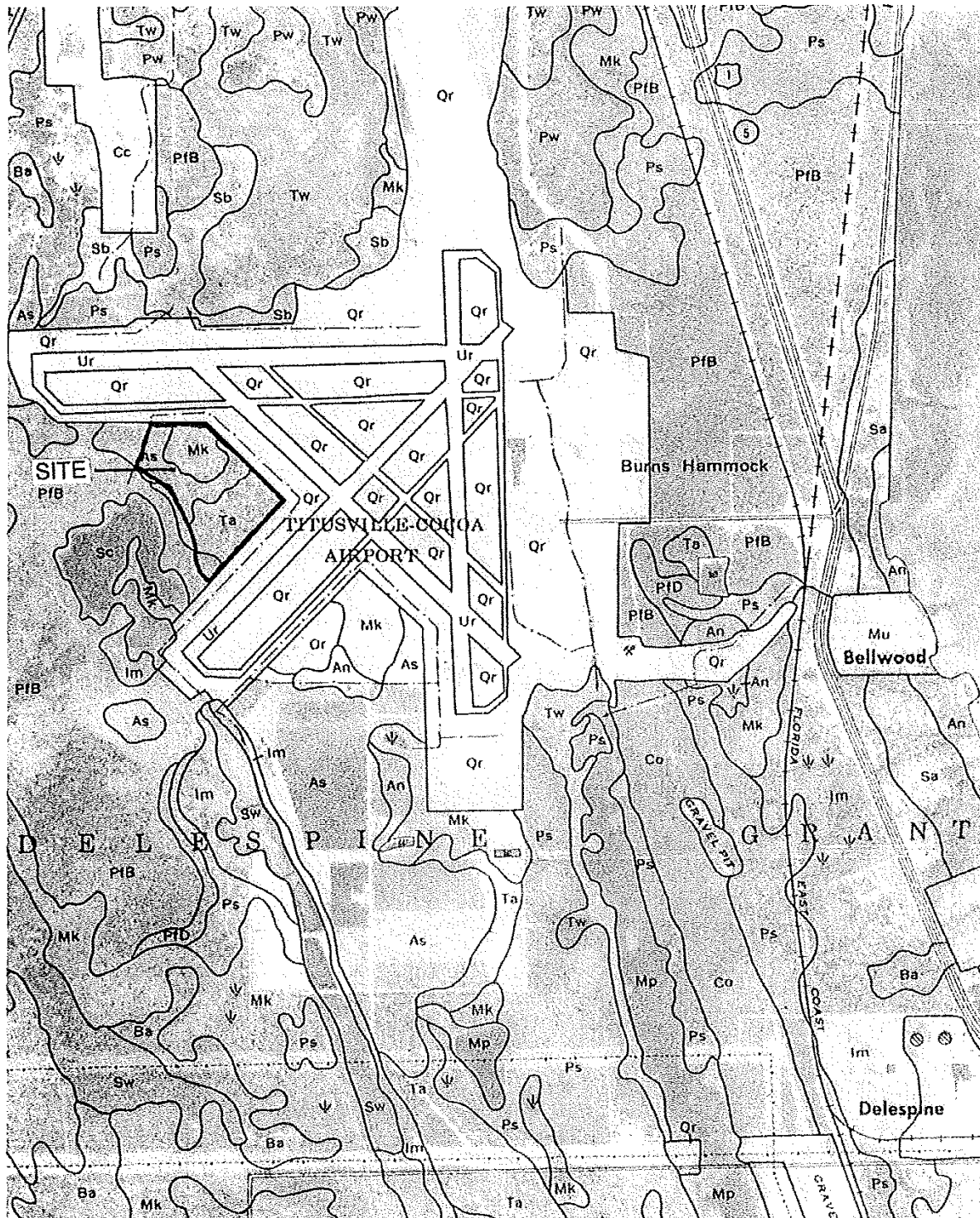
**APPENDIX "A"**

**MAPS OF SITE**

USGS MAP OF PROPOSED NORTHWEST DEVELOPMENT AREA



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS 500 ft Scale: 1:12,800 Detail: 14-0 Datum: WGS84



**APPENDIX "B"**

LIST OF PROTECTED ANIMALS WITH POTENTIAL FOR OCCURRENCE  
ON THE PROPOSED NORTHWEST DEVELOPMENT AREA SITE,  
SECTIONS 2 & 3, TOWNSHIP 23 SOUTH, RANGE 38 EAST,  
TITUSVILLE, BREVARD COUNTY, FLORIDA

LIST OF PROTECTED ANIMALS WITH POTENTIAL FOR OCCURRENCE ON  
THE PROPOSED NORTHWEST DEVELOPMENT AREA SITE, SECTIONS 2 & 3,  
TOWNSHIP 23 SOUTH, RANGE 38 EAST, TITUSVILLE, BREVARD COUNTY,  
FLORIDA

Species	Habitat	Designated Status <sup>1</sup>	
		USFWS <sup>2</sup>	FFWCC <sup>3</sup>
Birds:			
<i>Aphelocoma coerulescens</i> <i>coerulescens</i> Florida scrub jay	Oak habitat; habitat available; no scrub jays sighted	T	T
<i>Haliaeetus l. leucocephalus</i> Southern bald eagle	Near rivers and marshes; none sighted; no nests; preferred habitat not available	T	T
<i>Pandion haliaetus</i> Osprey	Near rivers, lakes; none sighted		SSC
<i>Picoides borealis</i> Red-cockaded woodpecker	Mature pine trees; no cavity trees; none sighted	E	T
<i>Picoides villosus audoboni</i> Hairy woodpecker	Variety of habitat; none sighted	4	4
Reptiles and Amphibians:			
<i>Drymarchon corais couperi</i> Eastern indigo snake	Dry, sandy areas; possible occurrence; none sighted	T	T
<i>Gopherus polyphemus</i> Gopher tortoise	Live oak, pine, turkey oak; numerous burrows sighted	C2	SSC



Species	Habitat	Designated Status <sup>1</sup>	
		USFWS <sup>2</sup>	FFWCC <sup>3</sup>
Reptiles and Amphibians-- <i>Continued</i>			
<i>Pituophis melanoleucus</i> Florida pine snake	Dry, sandy areas; possible occurrence; none sighted	C2	SSC
<i>Rana aereolata aesopus</i> (= <i>Rana capitu</i> ) Florida gopher frog	Dry, sandy areas; some possibility of occurrence; none sighted	C2	SSC
Mammals:			
<i>Peromyscus floridanus</i> Florida short-tailed mouse	Sand pine scrub, early successional stage; possible occurrence; none sighted	C2	SSC

<sup>1</sup>E = Endangered; T = Threatened; SSC = Species of Special Concern; C2 = Candidate for listing, with some evidence of vulnerability although with insufficient information at present to support listing, but which is encouraged for consideration in environmental planning.

<sup>2</sup>U.S. Fish and Wildlife Service

<sup>3</sup>Florida Fish and Wildlife Conservation Commission (former Florida Game and Freshwater Fish Commission)

<sup>4</sup>Listed under other species reviews.

**APPENDIX "C"**

**PHOTOINVENTORY OF SITE**

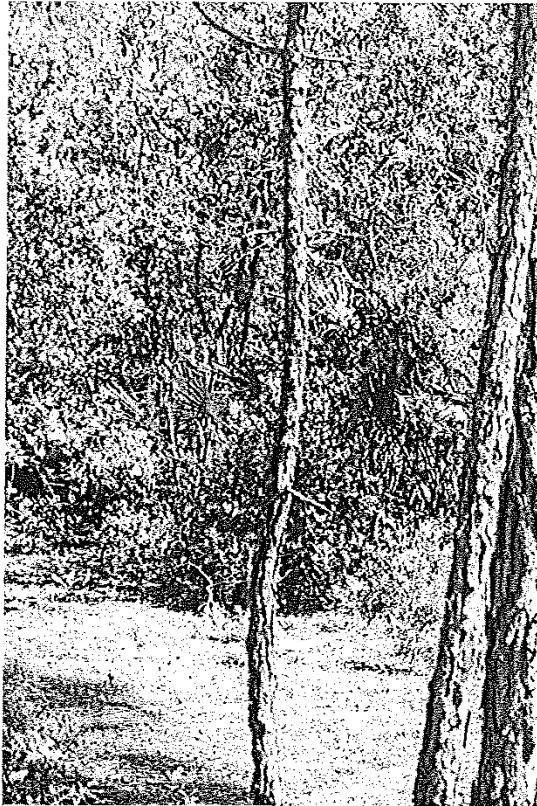
**Photo 1:** Representative vegetation near Station #1, xeric oak. No Florida scrub jays (*Aphelocoma coerulescens coerulescens*) sighted during 5-day monitoring inventory.

**Photo 2:** Representative vegetation near Station #3, pine flatwood, sawpalmetto understory. No Florida scrub jays sighted during 5-day inventory.



**Photo 3:** View of area in central portion of site, xeric oak and pine flatwood emerging.

**Photo 4:** Representative view of eastern side of site near Station #14, pine flatwood and xeric oak; no Florida scrub jays sighted.



**Photo 5:** Representative view near Station #15, pine flatwood and xeric oak mixture; no Florida scrub jays sighted.

**Photo 6:** View of xeric oak habitat located on east side of northwest development area; no Florida scrub jays sighted.



## **APPENDIX C**



# **APPENDIX F**

## **Cultural Resources Assessment Report Executive Summary**

**A copy of the complete “PHASE I CULTURAL RESOURCE ASSESSMENT SURVEY OF  
THE SPACE COAST REGIONAL AIRPORT, BREVARD COUNTY, FLORIDA” is  
available upon request from:**

**Stacy Zee  
Environmental Specialist  
FAA Commercial Space Transportation  
800 Independence Ave SW, Suite 325  
Washington, DC 20546**

# **APPENDIX G**

## **Noise Methodology Approval**



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Office of Environment and Energy

800 Independence Ave., S.W.  
Washington, D.C. 20591

September 22, 2014

Daniel Murray  
Office of Commercial Space Transport  
Federal Aviation Administration  
800 Independence Ave. SW  
Washington, DC 20591

Dear Mr. Murray,

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling method for the launch noise associated with the proposed Concept Y Reusable Launch Vehicle (RLV) from Titusville Spaceport based at Space Coast Regional Airport (TIX). This is in support of the noise impact analysis for the National Environmental Policy Act (NEPA) Environmental Assessment. In accordance with FAA Order 1050.1e, all non-standard noise analysis must be approved by AEE. This letter serves as AEE's response to the proposed noise method for the NEPA document.

The methodology is a quantitative analysis based on the latest available methods for launch noise. The FAA does not currently have an approved model for launch vehicles and the document includes a proposed noise modeling methodology for the launch vehicle. The proposed noise modeling method is based on the best available research and understanding.

Given the proposed launch noise method is based on the best available research on vehicle launches, this approach is appropriate for the NEPA document for the Titusville Spaceport based at Space Coast Regional Airport for the Concept Y RLV. AEE concurs with the launch noise methodology used for this project. Please understand that this approval is limited to this particular project and vehicles. Any additional projects using this or other launch noise methodologies or variations of launch vehicles not mentioned here will require separate approval.

Sincerely,

A handwritten signature in cursive script that reads "Rebecca Cointin".

Rebecca Cointin, Manager  
AEE/Noise Division

# **APPENDIX H**

## **Noise Methodology**

# Blue Ridge Research and Consulting, LLC

## *Final Report*

# Noise Study for the Titusville Spaceport Environmental Assessment

*March 2016 – DRAFT*

**Prepared for:**

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**Contract Number:**

201 3067 000

**BRRC Report Number:**

BRRC 14-32



## Table of Contents

Table of Figures .....	3
Table of Tables .....	3
Acronyms and Abbreviations .....	4
1 Introduction .....	5
2 Noise Metrics and Criteria .....	6
2.1 Noise Metrics .....	6
2.2 Noise Criteria .....	7
2.2.1 Human Annoyance.....	7
2.2.2 Hearing Conservation.....	7
2.2.3 Structural Damage .....	7
3 Acoustic Modeling Methodology .....	9
3.1 Far-Field Launch Noise Modeling.....	9
3.1.1 Acoustic Source Power.....	9
3.1.2 Forward Flight Effect.....	9
3.1.3 Directivity .....	10
3.1.4 Doppler Effect .....	10
3.1.5 Atmospheric Absorption .....	11
3.1.6 Ground Interference .....	11
3.1.7 Geo-referenced Coordinate System .....	12
3.1.8 Received Noise .....	12
3.2 Sonic Boom Modeling .....	13
4 Space Coast Regional Airport.....	16
4.1 Airfield Description .....	16
4.2 Concept Y RLV Proposed Action Input Parameters .....	18
5 Results.....	20
5.1 Launch Noise Analysis .....	20
5.2 Sonic Boom Noise Analysis .....	23
6 Summary .....	24
7 References .....	25



## Table of Figures

Figure 1. Effect of expanding wavefronts (decrease in frequency) that an observer would notice for higher relative speeds of the rocket relative to the observer for: a) stationary source b) source velocity < speed of sound c) source velocity = speed of sound d) source velocity > speed of sound .....	11
Figure 2. Sound propagation near the ground is modeled as the combination of a direct wave (blue) and a reflected wave (red) from the source to the receiver. ....	12
Figure 3. Sonic boom generation and evolution to N-wave (Carlson, 1967).....	13
Figure 4. Sonic boom carpet in steady flight (Plotkin, et al., 1990) .....	14
Figure 5. Sonic boom propagation for rocket launch .....	15
Figure 6. Sonic boom ground intercepts for reentry of a sounding rocket .....	15
Figure 7. Space Coast Regional Airport with Runways 18/36 and 9/27 .....	16
Figure 8. Atmospheric temperature, relative humidity, and pressure profiles (Note, above 30 km, the relative humidity and pressure are assumed to asymptote to zero) .....	17
Figure 9. Concept Y RLV launch trajectory from Runway 17 .....	19
Figure 10. Comparison of the 2018 No Action Alternative (solid) and 2018 Proposed Action (dashed) DNL contours .....	21
Figure 11. Comparison of the 2023 No Action Alternative (solid) and 2023 Proposed Action (dashed) DNL contours .....	22
Figure 12. Concept Y RLV sonic boom psf contour resulting from nominal flight profile re-entry .....	23

## Table of Tables

Table 1. Possible damage to Structures from sonic booms (Haber, et al., April 1989) .....	8
Table 2. TIX runway start and end point locations .....	16
Table 3. Source of data provided by RS&H .....	17
Table 4. Vehicle parameters utilized in acoustic modeling .....	18
Table 5. Concept Y RLV flight operations .....	18
Table 6. Concept Y RLV pre-flight run-up operations .....	18

## Acronyms and Abbreviations

The following acronyms and abbreviations are used in the report:

AFCEE	Air Force Center for Engineering and Environment
AST	Office of Commercial Space Transportation
BRRC	Blue Ridge Research and Consulting, LLC
CFR	Code of Federal Regulations
dB	decibel
dBA	A-weighted decibel level
DNL	Day-Night Average Sound Level
DSM-1	Distributed Source Method 1
EA	Environmental Assessment
FAA	Federal Aviation Administration
ft	foot/feet
kg	kilogram
km	kilometer
lbf	pound force
lbm	pound mass
L <sub>max</sub>	maximum unweighted OASPL
LOX	Liquid Oxygen
m	meters
N	newton
NEPA	National Environmental Policy Act
NIHL	noise-induced hearing loss
NIOSH	National Institute for Occupational Safety and Health
OASPL	overall sound pressure level
OSHA	Occupational Safety and Health Administration
psf	pounds per square foot
RLV	reusable launch vehicle
RUMBLE	The Launch Vehicle Acoustic Simulation Model
RS&H	RS&H, Inc.
RSRM	reusable solid rocket motor
S.L.	sea level
sec	second
SEL	Sound Exposure Level
TICO	Titusville-Cocoa Airport Authority
TIX	Space Coast Regional Airport
μPa	micropascal

## 1 Introduction

The Titusville-Cocoa Airport Authority (TICO) is proposing to operate a commercial space launch site at the Space Coast Regional Airport (TIX), in Titusville, Florida, also referred to as the Titusville Spaceport, for the operations of horizontal take-off and horizontal landing reusable launch vehicles (RLV). To operate a commercial space launch site, the TICO must obtain a commercial launch site operator license from the Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST). The launch site operator license would remain in effect for five years from the date of issuance (14 CFR Part 420.43). Therefore, a five-year study period from 2018 through 2023 is used in the analysis since RLV launch operations are forecasted to begin in 2018. The following report documents the noise study performed as part of the TICO's efforts in obtaining a commercial space launch site operator's license at TIX.

The issuance of a launch site operator license is considered a Federal action subject to environmental review under the National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [U.S.C.] §4321, et seq.). The noise impact of the proposed future actions is evaluated based on the FAA Order 1050.1F, Environmental Impacts: Policies and Procedures. A significant noise impact is one in which "the action would increase noise by DNL 1.5 dB[A] or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB[A] noise exposure level, or that will be exposed at or above this level due to the increase, when compared to the no action alternative for the same timeframe." Where DNL is defined as the Day-Night Average Sound Level (see Section 2.1).

TIX is a corporate and commercial charter facility owned by the TICO, currently conducting an average of 272 daily itinerant and local operations consisting of general aviation and military activities. An environmental noise analysis was prepared by Michael Baker International to determine the No Action Alternative DNL noise contours from the aircraft operations at TIX. The aircraft operations were projected to 2018 and 2023 for the community noise exposure comparison encompassing the length of the study period.

The Titusville Spaceport (the Proposed Action) would include 50 departures and arrivals per year of each of the Concept X, Y, and Z RLVs in addition to the projected aircraft operations at TIX. Michael Baker International has prepared the environmental noise analysis corresponding to the projected aircraft operations at TIX (No Action Alternative) and the proposed operations of the Concept X and Concept Z RLVs. The following report documents the noise analysis for operations of a Concept Y RLV and the community noise exposure of the Proposed Action (Concept X, Y, and Z RLVs in addition to the projected aircraft operations). The community noise exposure of the Proposed Action on a DNL basis was then compared to the No Action Alternative to determine if a significant noise impact would occur as a result of the Proposed Action.

This noise study describes the environmental noise associated with the Proposed Action. Section 2 summarizes the noise metrics discussed throughout this report; Section 3 describes the general methodology of the Concept Y RLV launch noise and sonic boom noise models; Section 4 describes the acoustical modeling input parameters for TIX; and Section 5 presents the noise modeling results. A summary is provided in Section 6 to document the notable findings of this noise study.

## 2 Noise Metrics and Criteria

### 2.1 Noise Metrics

Any unwanted sound that interferes with normal activities or the natural environment can be defined as noise. Noise sources can be continuous (constant) or transient (short-duration) and contain a wide range of frequency (pitch) content. Determining the character and level of sound aids in predicting the way it is perceived. Both launch noise and sonic booms are classified as transient noise events.

The decibel (dB) is a ratio that compares the sound pressure of the sound source of interest (e.g. the rocket launch) to a reference pressure (the quietest sound we can hear, 20  $\mu$ Pa (micropascal)). Standard weighting filters help to shape the levels in reference to how they are perceived. An “A-weighting” filter approximates the frequency response of human hearing, adjusting low and high frequencies to match the sensitivity of human hearing. For this reason, the A-weighted decibel level (dBA) is commonly used to assess community noise. However, if the structural response is of importance to the analysis, a “Flat-weighted” (unweighted) level is more appropriate.

The impact of noise can be described with the use of noise metrics, which depend on the nature of the event and who or what is affected by the sound. Individual time-varying noise events have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. The overall sound pressure level (OASPL) provides a measure of the sound level at any given time, while the maximum OASPL ( $L_{\max}$ ) indicates the maximum OASPL achieved over the duration of the event. Sound Exposure Level (SEL) represents both the magnitude of a sound and its duration. SEL provides a measure of the cumulative noise exposure of the entire acoustic event, but it does not directly represent the sound level heard at any given time. Mathematically, it represents the sound level of a constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For sound generated by rocket launches, which last more than one second, the SEL is greater than the  $L_{\max}$  because an individual launch can last for minutes and the  $L_{\max}$  occurs instantaneously. Sonic boom noise levels are described in units of peak overpressure in pounds per square foot (psf).

The DNL is a cumulative noise metric that accounts for the SEL of all noise events in a 24-hour period. Typically, DNL values are expressed as the level over a 24-hour annual average day. In order to account for increased human sensitivity to noise at night, a 10 dB penalty is applied to nighttime events (occurring between the hours of 10:00 p.m. and 7:00 a.m.). Noise contour maps of these metrics are comprised of lines of equal noise level or exposure, and they serve as visual aids for assessing the impact of noise on a community.

## 2.2 Noise Criteria

Noise criteria have been developed to protect the public health and welfare of the surrounding communities. The impacts of launch noise and sonic booms are evaluated on a cumulative basis in terms of human annoyance per FAA Order 1050.1F. In addition, sonic booms impacts are evaluated on a single-event basis in regards to hearing conservation and structural damage criteria.

### 2.2.1 Human Annoyance

FAA Order 1050.1F, states that a significant noise impact would occur if the “action would increase noise by DNL 1.5 dB[A] or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB[A] noise exposure level, or that will be exposed at or above this level due to the increase, when compared to the No Action Alternative for the same timeframe”. DNL is based on long-term cumulative noise exposure and has been found to correlate well with adverse community impacts for regularly occurring events including aircraft, rail, and road noise (Schultz, 1978; Finegold, et al., 1994). Noise studies used in the development of the DNL metric did not include rocket noise, which are historically irregularly occurring events. Thus, it is acknowledged that the suitability of DNL for infrequent rocket noise and sonic boom events is uncertain. DNL contours are provided in compliance with FAA requirements as the FAA considers DNL the best available metric to estimate the potential long-term annoyance.

### 2.2.2 Hearing Conservation

A sonic boom is the sound associated with the shock waves created by a vehicle traveling through the air faster than the speed of sound. Multiple federal government agencies have provided guidelines on permissible noise exposure limits on impulsive noise such as a sonic boom. These documented guidelines are in place to protect one’s hearing from exposures to high noise levels and aid in the prevention of noise-induced hearing loss (NIHL). In terms of upper limits on impulsive or impact noise levels, the National Institute for Occupational Safety and Health (NIOSH) (NIOSH, 1998) and Occupational Safety and Health Administration (OSHA) (OSHA, 2008) has stated that levels should not exceed 140 dB peak sound pressure level, which equates to a level of ~4 psf.

### 2.2.3 Structural Damage

Sonic booms are also commonly associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table 1 summarizes the threshold of damage that may be expected at various overpressures (Haber, et al., April 1989). A large degree of variability exists in damage experience, and much damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. The probability of a window breaking at 1 psf ranges from one in a billion (Sutherland, 1990) to one in a million (Hershey, et al., 1976). These damage rates are associated with a combination of boom load and glass condition. At 10 psf, the probability of breakage is between one in 100 and one in 1,000. Laboratory tests involving glass (White, 1972) have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms; however in the real world glass is not always in pristine condition.

Damage to plaster occurs at similar ranges to glass damage. Plaster has a compounding issue in that it will often crack due to shrinkage while curing or from stresses as a structure settles, even in the absence of outside loads. Sonic boom damage to plaster often occurs when internal stresses are high from these

factors. In general, for well-maintained structures, the threshold for damage from sonic booms is 2 psf, below which damage is unlikely.

**Table 1. Possible damage to Structures from sonic booms (Haber, et al., April 1989)**

Sonic Boom Overpressure Nominal (psf)	Type of Damage	Item Affected
0.5 - 2	Plaster	Fine cracks; extension of existing cracks; more in ceilings; over doorframes; between some plasterboards.
	Glass	Rarely shattered; either partial or extension of existing.
	Roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Inside ("party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plasterboards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

### 3 Acoustic Modeling Methodology

The majority of the noise generated by a rocket launch is created by the rocket plume, or jet exhaust, interacting with the atmosphere along the entire plume, and combustion noise of the propellants. Rocket noise occurs in the region surrounding the launch ignition point and radiates in all directions. However, it is highly directive, meaning that a significant portion of the source's acoustic power is concentrated in a specific direction. Additionally, the level of noise received depends on the distance from the source. Noise decreases as the distance from the source increases, for example, there is a 6 dB decrease in OASPL per doubling of distance when described by spherical spreading.

In addition to the launch noise, a launch vehicle can create sonic booms as a result of the shock waves created from supersonic flight. The perception of a sonic boom depends on the distance from the vehicle to the observer as well as the physical characteristics of the vehicle and the atmospheric conditions. The noise is perceived as a deep double boom, with most of its energy concentrated in the low frequency range. Although sonic booms generally last less than one second, their potential for impact may be considerable.

#### 3.1 Far-Field Launch Noise Modeling

As the FAA does not currently have an approved model for launch vehicles, the FAA Office of Environment and Energy (AEE), in accordance with FAA Order 1050.1F, must approve all non-standard noise analysis. The Launch Vehicle Acoustic Simulation Model (RUMBLE), developed by Blue Ridge Research and Consulting, LLC (BRRC), is the noise model used to predict the Concept Y RLV noise associated with the proposed operations at Titusville Spaceport. AEE has reviewed and accepted the RUMBLE noise modeling method for this project as documented in the letter of approval (FAA, 2014). The core components of the model are described in the following sub sections.

##### 3.1.1 Acoustic Source Power

Eldred's Distributed Source Method 1 (DSM-1) (Eldred, 1971) is utilized for the source characterization. The DSM-1 model determines the launch vehicle's total sound power based on its total thrust, exhaust-velocity and the engine/motor's acoustic efficiency. A recent validation of the DSM-1 model showed very good agreement between full-scale rocket noise measurements and the empirical source curves (James, et al., 2014). The acoustic efficiency of the rocket engine/motor was modeled using Guest's variable acoustic efficiency (Guest, 1964). For launch vehicles with multiple tightly clustered equivalent engines, the engines can be modeled as a single engine with an effective exit diameter and total thrust (Eldred, 1971). Therefore, in the far-field, the set of distributed sources are modeled as a compact source located at the nozzle exit with an equivalent total sound power and range of frequencies.

##### 3.1.2 Forward Flight Effect

A jet in forward flight radiates less noise than the same jet in a static environment. A standard method to quantify this effect reduces overall sound levels as a function of the relative velocity between the jet and the outside airflow (Viswanathan, et al., 2011; Saxena, et al., 2012; Buckley, et al., 1984; Buckley, et al., 1983). In the case of a rocket launch, ambient air flows by the rocket body at the velocity of forward flight. This ambient airflow travels in the same direction as the rocket exhaust; at the launch, the rocket exhaust travels at far greater speeds than the ambient airflow. As the differential between the forward flight



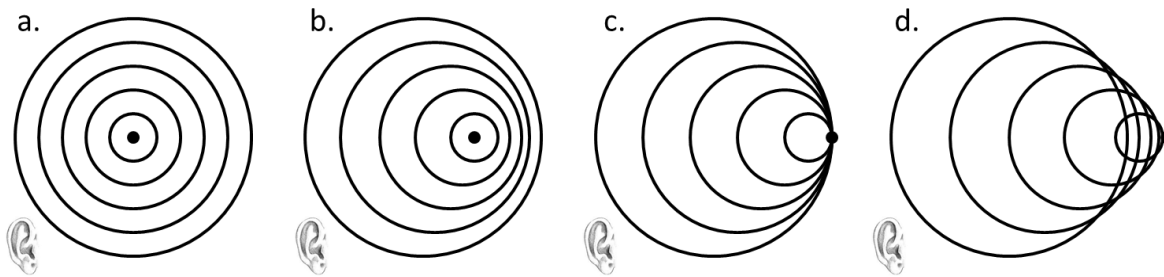
velocity and exhaust velocity decreases, jet mixing is reduced, which in turn reduces the corresponding noise emission. Notably, the maximum overall sound pressure levels are generally generated before the vehicle reaches a sonic velocity. Thus, the modeled noise reduction is capped at a forward flight velocity of Mach 1.

### 3.1.3 Directivity

Rocket noise is highly directive, meaning the acoustic power is concentrated in specific directions and the sound pressure observed will depend on the angle from the source to the receiver. NASA's Project Constellation Program has made significant improvements in determining launch vehicle directivity of the reusable solid rocket motor (RSRM) (Haynes, et al., 2009). The RSRM directivity indices (DI) incorporate a larger range of frequencies and angles than previously available data. Improvements to the formulation of the RSRM DI accounting for the spatial extent and downstream origin of the rocket noise source (James, et al., 2014) have recently been published (coauthored by BRRC and the National Aeronautics and Space Administration (NASA)). These updated DI are used for this analysis.

### 3.1.4 Doppler Effect

Doppler effect is defined as the change in frequency of a wave for an observer moving relative to its source. During a rocket launch, an observer on the ground will hear a downward shift in the frequency of the sound as the distance from the source to receiver increases. The perceived frequency is related to the actual frequency by the speed of the source and receiver and the speed of the waves in the medium. The received frequency is higher (compared to the emitted frequency) during the approach, it is identical at the instant of passing by, and it is lower during the recession. The relative changes in frequency can be explained as follows. When the source of the waves is moving toward the observer, each successive wave crest is emitted from a position closer to the observer than the previous wave. Therefore, each wave takes slightly less time to reach the observer than the previous wave. Therefore, the time between the arrivals of successive wave crests at the observer is reduced, causing an increase in the frequency. While they are travelling, the distance between successive wave fronts is reduced; so the waves "bunch together". Conversely, if the source of waves is moving away from the observer each wave is emitted from a position farther from the observer than the previous wave, so the arrival time between successive waves is increased, reducing the frequency. The distance between successive wave fronts is increased, so the waves "spread out". This spreading effect is illustrated in Figure 1 for an observer in a series of images, where a) the source is stationary, b) the source is moving less than the speed of sound, c) the source is moving at the speed of sound, and d) the source is moving faster than the speed of sound. As the frequency is shifted lower, the A-Weighting filtering on the spectrum results in a decreased A-weighted sound level. For unweighted overall sound levels, Doppler has no effect on the levels since all frequencies are accounted for equally.



**Figure 1. Effect of expanding wavefronts (decrease in frequency) that an observer would notice for higher relative speeds of the rocket relative to the observer for: a) stationary source b) source velocity < speed of sound c) source velocity = speed of sound d) source velocity > speed of sound**

### 3.1.5 Atmospheric Absorption

Atmospheric absorption is a measure of the sound attenuation from the excitation of vibration modes of air molecules. Atmospheric absorption is a function of temperature, pressure and relative humidity of the air. The atmospheric absorption is calculated using formulas found in ANSI standard S1.26-1995 (R2004) (ANSI/ASA S1.26, 2004). The result is a sound-attenuation coefficient, which is a function of frequency, atmospheric conditions, and distance from the source. The amount of absorption depends on the parameters of the atmospheric layer and the distance that the sound travels through the layer. The total sound attenuation is the sum of the absorption experienced from each atmospheric layer.

Nonlinear propagation effects can result in distortions of high-amplitude sound waves (McInerny, et al., 2007) as they travel through the medium. These nonlinear effects are counter to the effect of atmospheric absorption (McInerny, et al., 2005; Pernet, et al., 1971). However, recent research shows that nonlinear propagation effects change the perception of the received sound (Gee, et al., 2007; Ffowcs, et al., 1975), but the standard acoustical metrics do not reflect this perception change (Gee, et al., 2008; Gee, et al., 2006). The overall effects of nonlinear propagation on high-amplitude sound signatures and their perception is an on-going area of research.

### 3.1.6 Ground Interference

The calculated results of the sound propagation using DSM-1 provide a free-field sound level at the receiver. However, sound propagation near the ground is most accurately modeled as the combination of a direct wave (source to receiver) and a reflected wave (source to ground to receiver) shown in Figure 2. The ground will reflect sound energy back toward the receiver. Depending on the frequency of the wave and the geometry, this reflected wave may interfere with the direct wave causing constructive or destructive interference. Additionally, the ground may absorb a portion of the sound energy causing the reflected wave to propagate a smaller portion of energy to the receiver. The acoustic model accounts for the attenuation of sound by the ground (Chessel, 1977; Embleton, et al., 1983) when estimating the received noise. To account for the random fluctuations of wind and temperature on the direct and reflected wave, the effect of atmospheric turbulence is also included (Chessel, 1977; Daigle, 1979).

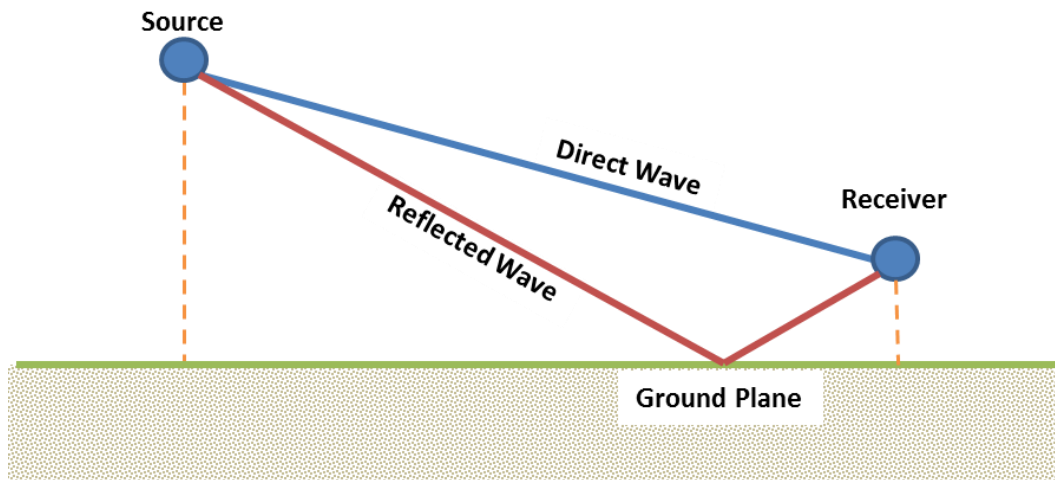


Figure 2. Sound propagation near the ground is modeled as the combination of a direct wave (blue) and a reflected wave (red) from the source to the receiver.

### 3.1.7 Geo-referenced Coordinate System

Many of the launch noise model components described above are calculated based on the specific source (launch vehicle trajectory point) to receiver geometry (grid point). The position of the launch vehicle, described by the trajectory, is often provided in the angular geodetic coordinates of latitude and longitude, defined relative to a reference system (such as WGS84) that approximates the Earth's surface by an ellipsoid. The receiver grid is described in geodetic latitude and longitude, referenced to the same reference system as the trajectory data. Maintaining the same reference system ensures greater accuracy in source to receiver geometry calculations as well as achieving a more physical model, which includes the curvature of the earth.

### 3.1.8 Received Noise

Combining these separate components, the impact of noise is estimated for the region of the Concept Y RLV proposed operations and described with the use of the cumulative acoustic metrics, A-weighted Day-Night Average Sound Level (DNL).

### 3.2 Sonic Boom Modeling

When an aircraft moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the aircraft is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at ground level, a sonic boom consists of two shock waves (one associated with the forward part of the aircraft, the other with the rear part) of approximately equal strength and (for fighter aircraft) separated by 100 to 200 milliseconds. For rockets, the separation can be extended because of the volume of the plume. Thus, their waveform durations can be as large as one second. When plotted, this pair of shock waves and the expanding flow between them has the appearance of a capital letter “N,” so a sonic boom pressure wave is usually called an “N-wave.” An N-wave has a characteristic “bang-bang” sound that can be startling. Figure 3 shows the generation and evolution of a sonic boom N-wave under the aircraft. Figure 4 shows the sonic boom pattern for an aircraft in steady, level supersonic flight. The boom forms a cone that is said to sweep out a “carpet” under the flight track. The boom levels vary along the lateral extent of the “carpet” with the highest levels directly underneath the flight track and decreasing as the lateral distance increases to the cut-off edge of the “carpet.” When the vehicle is maneuvering, the sonic boom energy can be focused in highly localized areas on the ground. This focusing will cause the N-wave boom to be amplified and transformed into a U-wave.

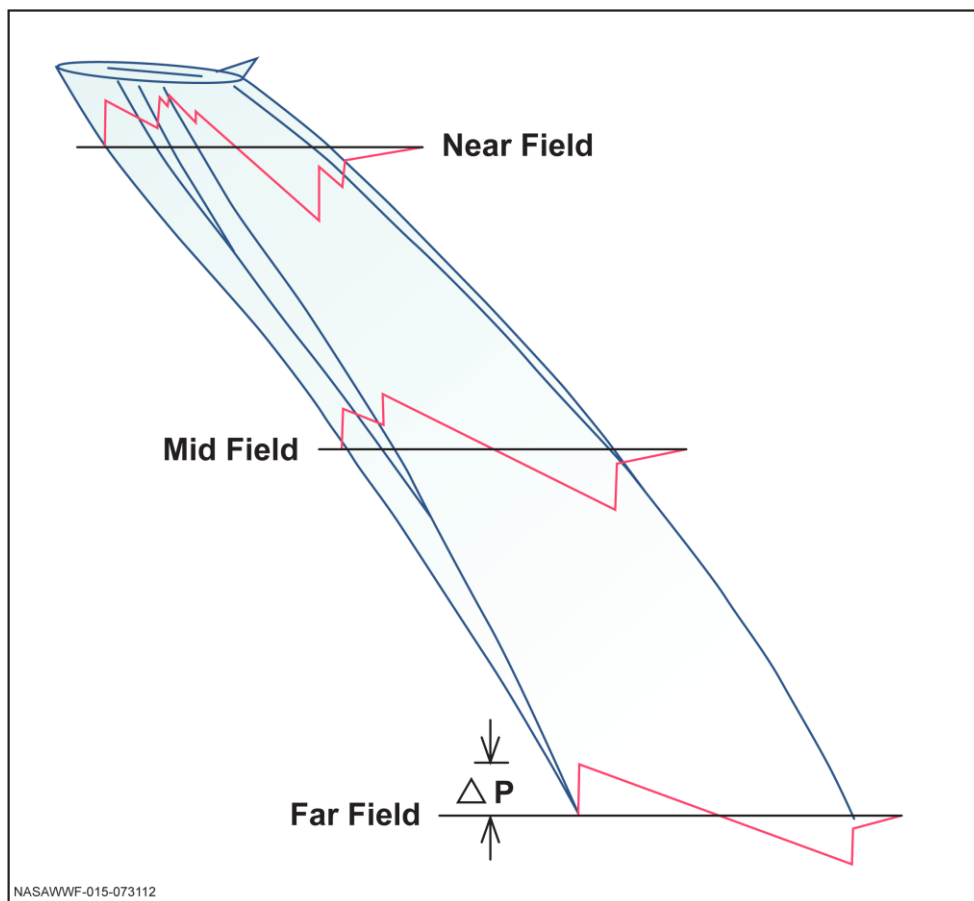


Figure 3. Sonic boom generation and evolution to N-wave (Carlson, 1967)

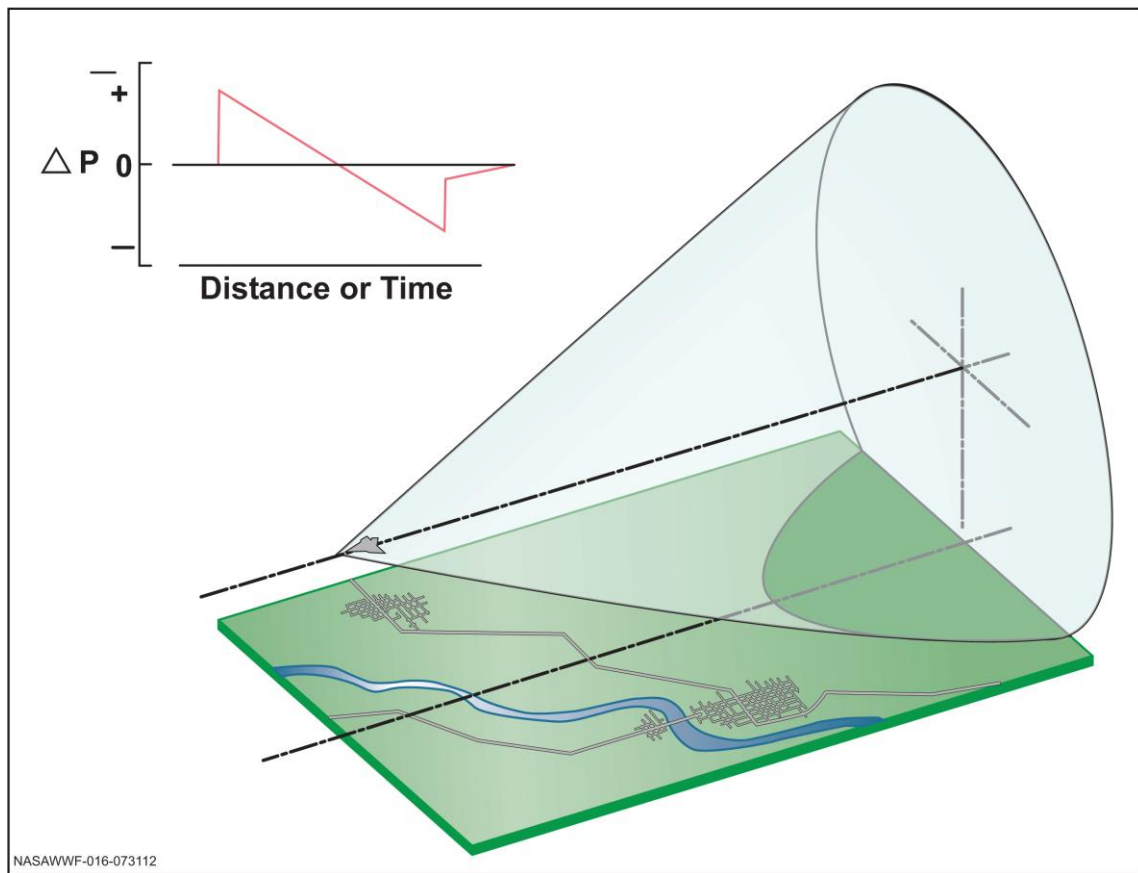


Figure 4. Sonic boom carpet in steady flight (Plotkin, et al., 1990)

The complete ground pattern of a sonic boom depends on the size, weight, shape, speed, and trajectory of the vehicle. Since aircraft fly supersonically with relative low horizontal angles, the boom is directed toward the ground. However, for rocket trajectories, the boom is directed laterally until the rocket rotates significantly away from vertical as shown in Figure 5. This difference causes a sonic boom from a rocket to propagate much further downrange compared to aircraft sonic booms. This extended propagation usually results in relatively lower sonic boom levels from rocket launches. For aircraft, the front and rear shock are generally the same magnitude. However, for a rocket the plume provides a smooth decrease in the vehicle volume, which diminishes the strength of the rear shock. During reentry of a rocket body, the vehicle can also generate sonic boom on the ground as the body descends back toward the airport. The sonic booms are somewhat reduced as the vehicle is decelerating. For this case, the propagation is direct toward the ground, so the boom is concentrated around the impact site as shown in Figure 6, which is for a sounding rocket.

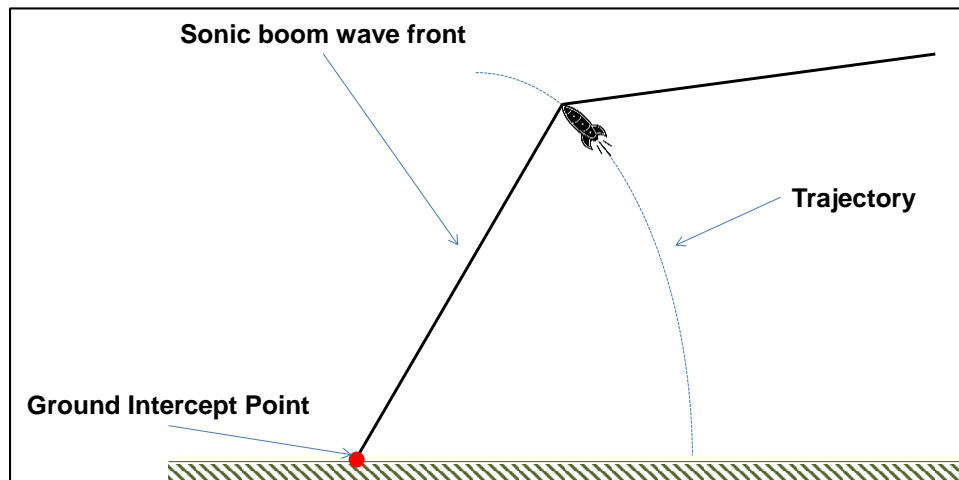


Figure 5. Sonic boom propagation for rocket launch

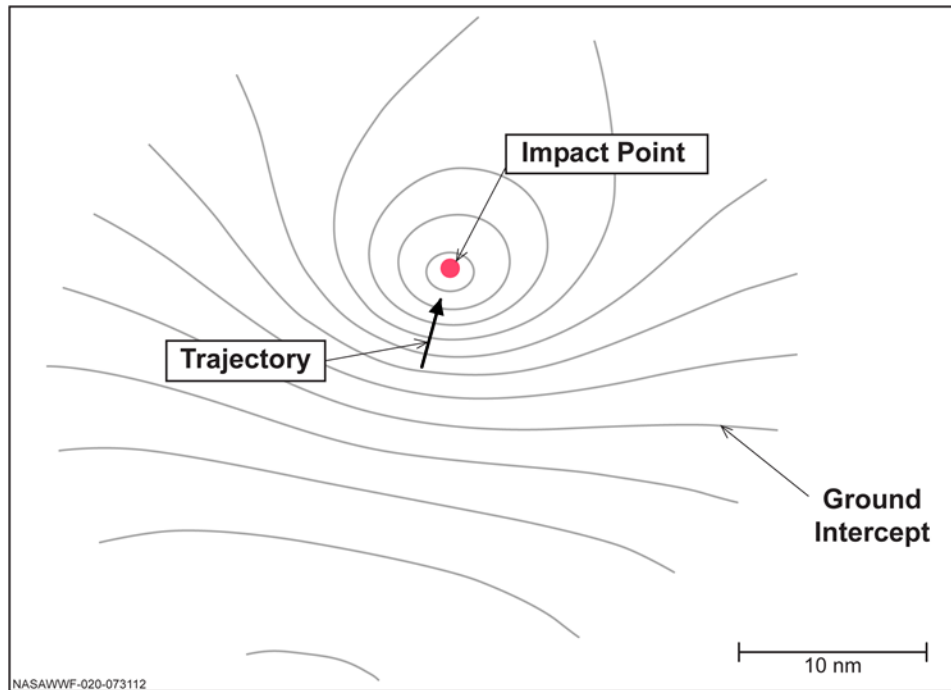


Figure 6. Sonic boom ground intercepts for reentry of a sounding rocket

The single-event prediction model, PCBoom4 (Plotkin, 1996; Plotkin, 1989; Plotkin, et al., 2002), provided by the Air Force Center for Engineering and Environment (AFCEE) is used to predict the sonic boom footprint. PCBoom4 calculates the magnitude and location of sonic boom overpressures on the ground from supersonic flight. Several inputs are required to calculate the sonic boom impact, including the aircraft model, the trajectory path, the atmospheric conditions and the ground surface height. Predicted sonic boom footprints are in the form of constant pressure contours.



## 4 Space Coast Regional Airport

### 4.1 Airfield Description

TIX is a corporate and commercial charter facility owned by the TICO, currently conducting an average of 272 daily itinerant and local operations consisting of general aviation and military activities. TIX contains two operating runways, shown in Figure 7. The longitude and latitude start and end-points of the TIX runways are included in Table 2.



Figure 7. Space Coast Regional Airport with Runways 18/36 and 9/27

Table 2. TIX runway start and end point locations

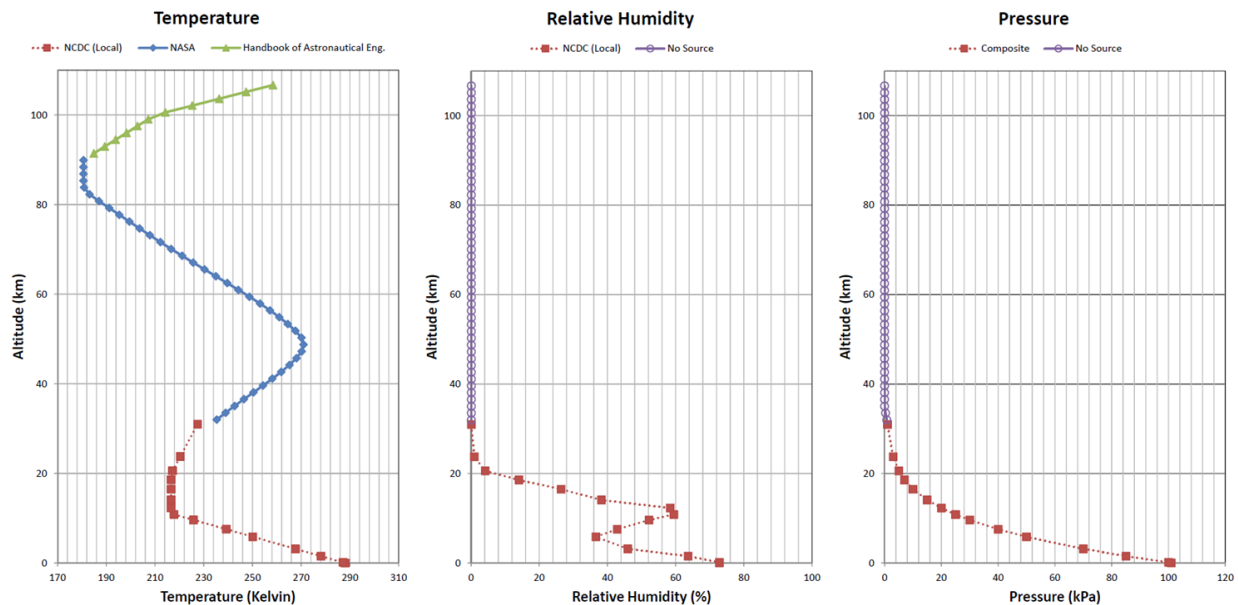
Runway	Start		End		Active (Y/N)
	Latitude	Longitude	Latitude	Longitude	
18/36	28°31.476933N	80°47.814057W	28°30.269347N	80°47.793217W	Y
9/27	28°30.903113N	80°48.640247W	28°30.915633N	80°47.706300W	Y



The launch noise and sonic boom models utilize an atmospheric profile, which describes the variation of temperature, pressure and relative humidity with respect to the altitude. A number of site-specific and standard atmospheric data sources were provided by RS&H. These sources, described in Table 3, were used to create a composite atmospheric profile for altitudes up to 350,000 feet (106.7 km). The composite atmospheric profile temperature, relative humidity, and pressure profile are shown in Figure 8.

**Table 3. Source of data provided by RS&H**

Altitude Range	Source	Parameters
0 – 95,000 ft. (~0 – 30 km)	NCDC, Station 74794, Cape Canaveral, FL	Humidity and Pressure
100,000 – 295,000 ft. (~30 – 90 km)	NASA Technical Memo 4511	Temperature and Pressure
300,000 – 350,000 ft. (~91 – 107 km)	“Handbook of Astronautical Engineering” (McGraw-Hill 1961)	Temperature and Pressure



**Figure 8. Atmospheric temperature, relative humidity, and pressure profiles (Note, above 30 km, the relative humidity and pressure are assumed to asymptote to zero)**

## 4.2 Concept Y RLV Proposed Action Input Parameters

The Proposed Action involves the operation of a commercial space launch site at TIX, offering a site to operate horizontal take-off and horizontal landing RLVs. The noise modeling described in Section 3 and its input defined herein is limited to the Concept Y RLV. The RUMBLE and PCBoom4 models require specific vehicle/engine input parameters to determine the noise exposure resulting from the proposed operations of a Concept Y RLV. Table 4 presents the representative parameters of a Concept Y RLV utilized in the acoustic modeling. These parameters are assumed to remain constant over the powered duration of the flight event.

**Table 4. Vehicle parameters utilized in acoustic modeling**

Vehicle/Engine Parameters	
Vehicle Length	335 inches (8.51 m, 27.9 ft)
Gross Vehicle Weight	5000 kg (11,023 lbm)
Number of Engines	4
Nozzle Exit Diameter	16.4 cm (6.45 in)
Propellant	Liquid Oxygen (LOX)/ Kerosene
Exhaust Velocity	2,900 m/s (9,514 ft/s)
Single Engine Thrust (S.L.)	3,335 lbf (14,835 N)

The Proposed Action regarding the Concept Y RLV includes 50 operations per year. Proposed launch operations would begin in 2018 and the frequency of Concept Y launch operations would remain constant over the five-year study period. Table 5 and Table 6 summarize the Concept Y RLV flight and pre-flight run-up operational data, respectively. Static operations will be limited to pre-flight run-ups located at the start of the flight track. Pre-flight run-up operations include a single engine running for two seconds at full thrust, repeating for all four engines.

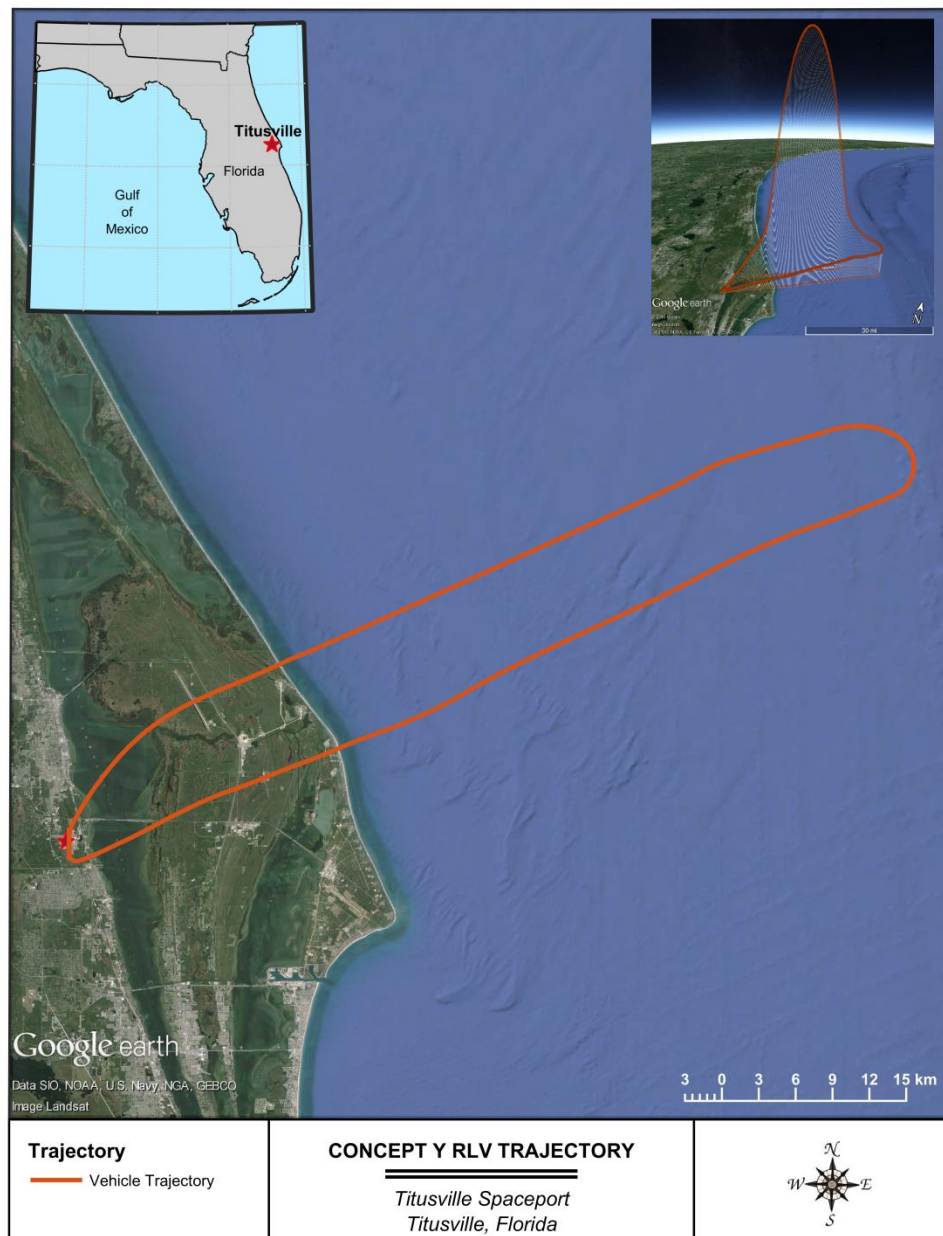
**Table 5. Concept Y RLV flight operations**

Flight Operations	
<b>Number of Operations:</b>	<b>50 total flight operations per year</b>
<b>Day/Night Split:</b>	Acoustic Day (07:00 – 21:59): 95%, Acoustic Night (22:00 – 06:59): 5%
<b>Runway Usage:</b>	Airport Operation Runway Utilization
	Departure on 18: 0%      Departure on 9: 0%
	Departure on 36: 100%      Departure on 27: 0%

**Table 6. Concept Y RLV pre-flight run-up operations**

Pre-Flight Run-up Operations	
<b>Number of Operations:</b>	<b>50 total pre-flight run-up operations per year</b>
<b>Day/Night Split:</b>	Acoustic Day (07:00 – 21:59): 95%, Acoustic Night (22:00 – 06:59): 5%
<b>Static Pad Usage Split:</b>	Runway 36 Run-up: 100%      Runway 18,9,27 Run-up: 0%
<b>Static Profiles:</b>	Full thrust for 2 sec., repeat for all 4 engines (Each engine run separately due to brakes)

The Concept Y RLV operations will be modeled using a single representative flight track departing from TIX's Runway 36, shown in Figure 9. Site-specific vehicle trajectory parameters are described at one-second intervals and include: latitude, longitude, altitude, flight velocity vector, acceleration, thrust, weight, fuel burn, and times (and thrust) when the engine fires. The launch noise is modeled assuming constant engine thrust from take-off until the engines are shut-off. This "shut-off" time is identified in the velocity profile as the peak ascent velocity. Although the vehicle is still gaining altitude, it will begin to decelerate until it reaches its apogee. The sonic boom analysis only considers the re-entry portion of the launch event in which the vehicle is supersonic. The propagation is calculated assuming a receiver height of five feet along with a homogeneous soft ground surface.



**Figure 9. Concept Y RLV launch trajectory from Runway 17**

## 5 Results

The following sections present the results of the noise analysis. The launch noise impact is represented by DNL, presented in the form of contour maps in Section 5.1. The results of the Concept Y RLV sonic boom analysis are presented in Section 5.2.

### 5.1 Launch Noise Analysis

The DNL is a cumulative noise metric that includes noise from all flight operations over a 24-hour annual average day. The No Action Alternative environmental noise analysis was prepared by Michael Baker International to determine the DNL noise contours from the aircraft operations at TIX, projected to 2018 and 2023, encompassing the five-year license duration. As a result of decreases in the projected annual operations, the 2023 DNL contours are slightly smaller than the 2018 DNL contours. Thus, as the Proposed Action operations are constant over the study period the most significant impacts would occur in 2023 when the No Action Alternative DNL contours are the smallest.

The community noise exposure of the Proposed Action, on a DNL basis, is compared to the No Action Alternative to determine if a significant noise impact would occur as a result of the Proposed Action. DNL contours corresponding to the forecasted 2018 and 2023 operations are presented in Figure 10 and Figure 11, respectively. The results of the No Action Alternative analysis are displayed with solid contour lines. The noise analysis pertaining to the Concept X and Z RLVs in addition to the projected aircraft operations, was also prepared by Michael Baker International. The analysis provided by Michael Baker International was combined with the Concept Y RLV noise analysis performed by BRRC, resulting in the DNL noise contours of the Proposed Action (Concept X, Y, and Z RLVs in addition to the projected aircraft operations), displayed with dashed contour lines.

A significant noise impact is one in which the “action would increase noise by DNL 1.5 dB[A] or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB[A] noise exposure level, or that will be exposed at or above this level due to the increase, when compared to the No Action Alternative for the same timeframe” (FAA, 2014). The future 2018 No Action Alternative DNL 65 dBA contour extends off-airport property. This is a result of the increase in airport operations forecast to occur in 2018. Approximately 13.38 acres of off-airport property would be impacted in the 2018 No Action Alternative. The 2018 Proposed Action DNL 65 dBA contour extends further off-airport property. This results in an additional 4.54 acres of area impacted. Similarly, approximately 12.62 acres of off-airport property would be impacted in the 2023 No Action Alternative and the 2023 Proposed Action results in an additional 4.24 acres of area impacted. When comparing the 2018 or 2023 No Action Alternative with the 2018 or 2023 Proposed Action, off-airport areas would not receive a 1.5 dBA DNL or greater increase. Therefore, significant noise impacts would not occur as a result of the 2018 or 2023 Proposed Action.



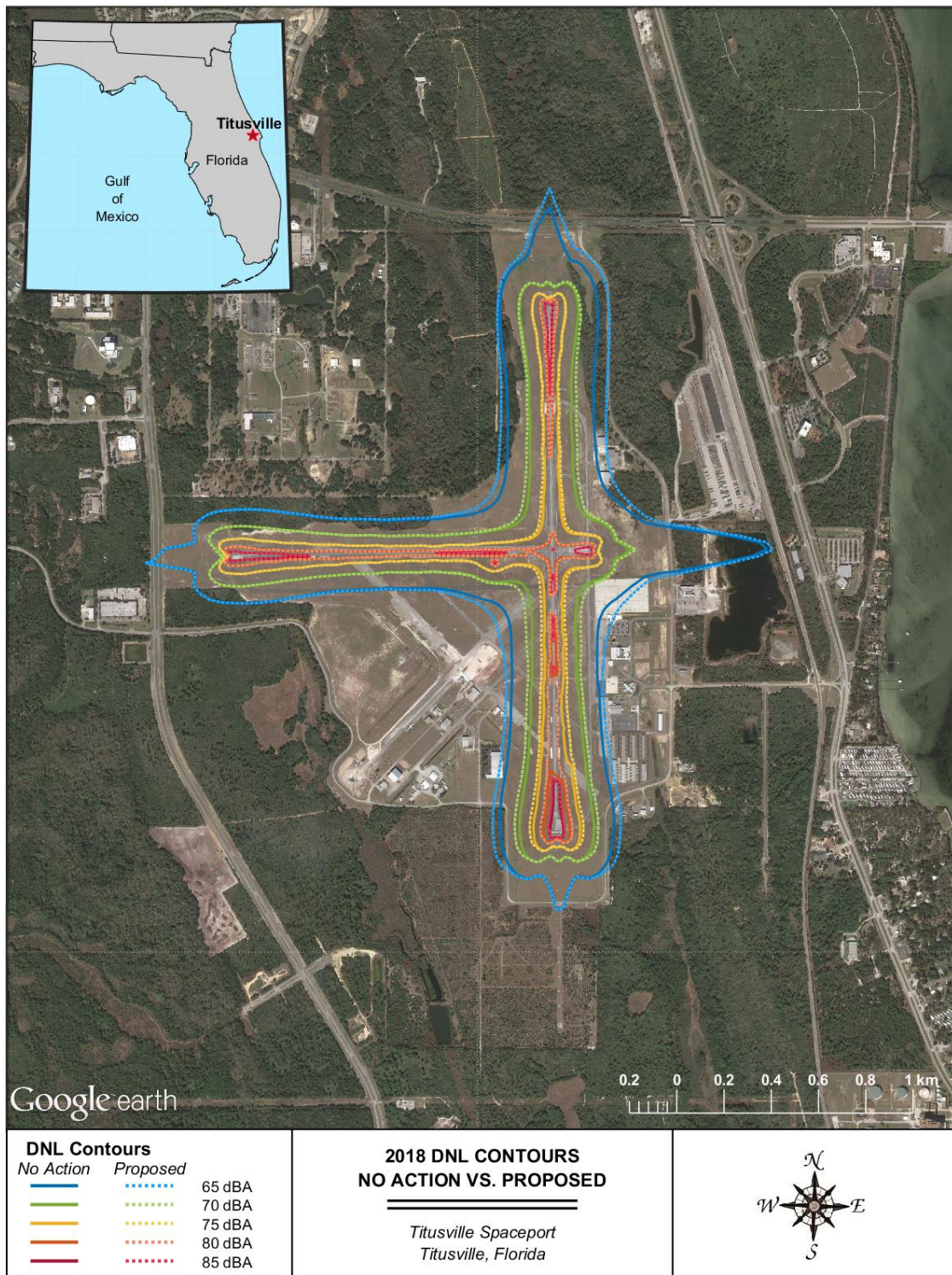


Figure 10. Comparison of the 2018 No Action Alternative (solid) and 2018 Proposed Action (dashed) DNL contours



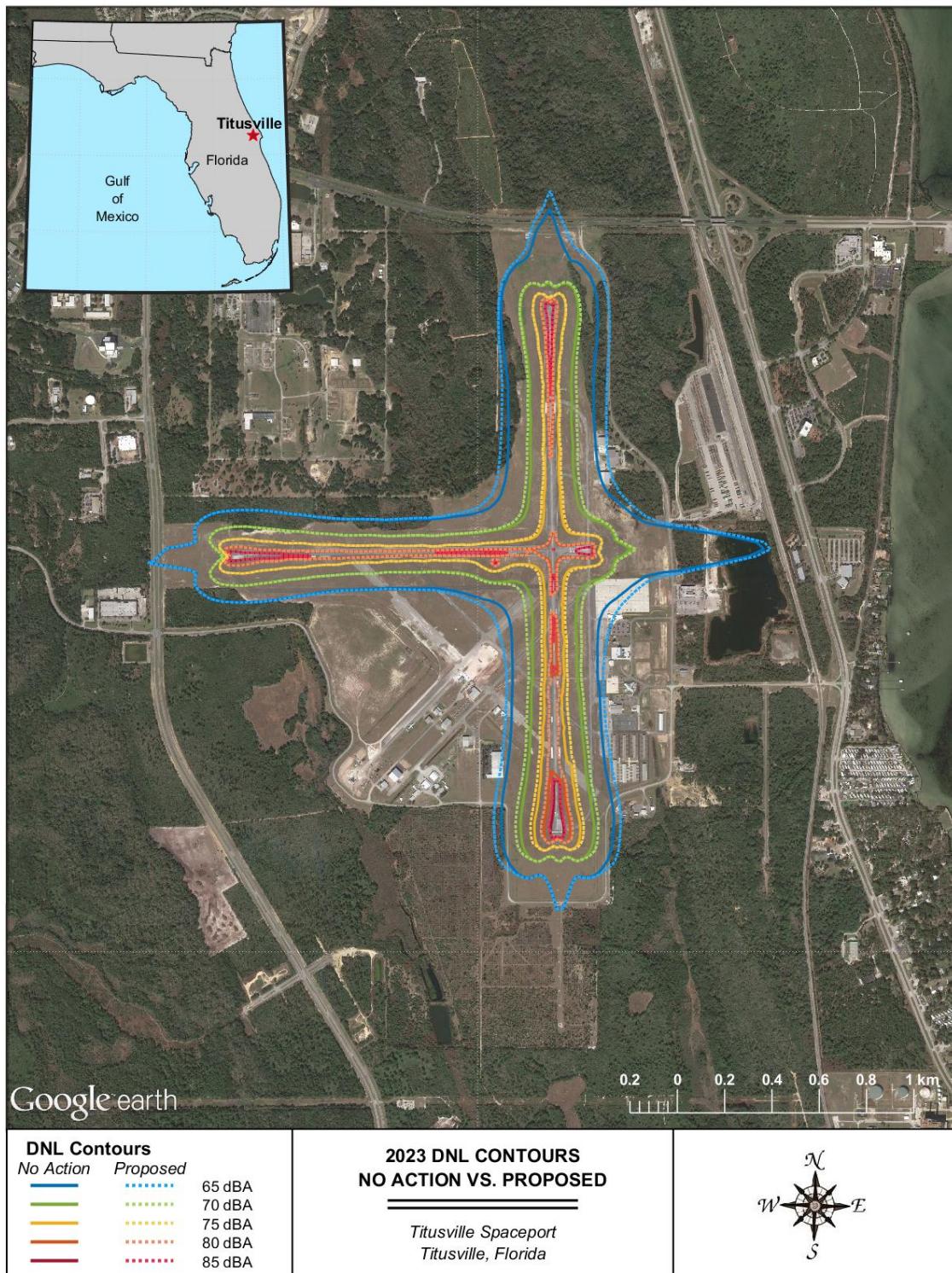


Figure 11. Comparison of the 2023 No Action Alternative (solid) and 2023 Proposed Action (dashed) DNL contours

## 5.2 Sonic Boom Noise Analysis

The sonic boom resulting from the supersonic portion of the departure will not reach the ground due to the steep ascending flight path angle, as the boom propagates along an angle that is unlikely to intercept the ground. Sonic boom analysis was completed for the supersonic re-entry of the nominal Concept Y RLV operation arriving to Runway 36, highlighted in red in Figure 9. The maximum noise exposure of the proposed operational tempo, along with the maximum of 0.9 psf sonic boom is predicted to be a C-weighted DNL of 44 dBC, which translates to an equivalent A-weighted DNL of 52 dBA, according to ANSI 12.9 Part 4 Annex B (ANSI S12.9, 2005). The noise impacts from potential sonic booms would not be significant since the maximum predicted levels are much less than the 65 dBA DNL noise exposure criteria.

Figure 12 displays the 0.25 and 0.50 psf contours resulting from the nominal flight track. The 0.5 psf contour is generated by a turn focus boom during reentry. This focus region occurs over 35 miles from the Florida coastline. Smaller 0.25 psf contour outliers also result from minor focusing of the sonic boom. Note that the presence and/or location of focus boom regions will be highly dependent on the actual trajectory and atmospheric conditions at the time of flight. The predicted sonic boom overpressure levels over land are less than 0.5 psf; therefore, the potential for structural damage is negligible (Haber, et al., 1989). The potential for hearing damage is also negligible, as the predicted sonic boom overpressure levels are substantially lower than the ~4 psf impulsive hearing conservation noise criteria.

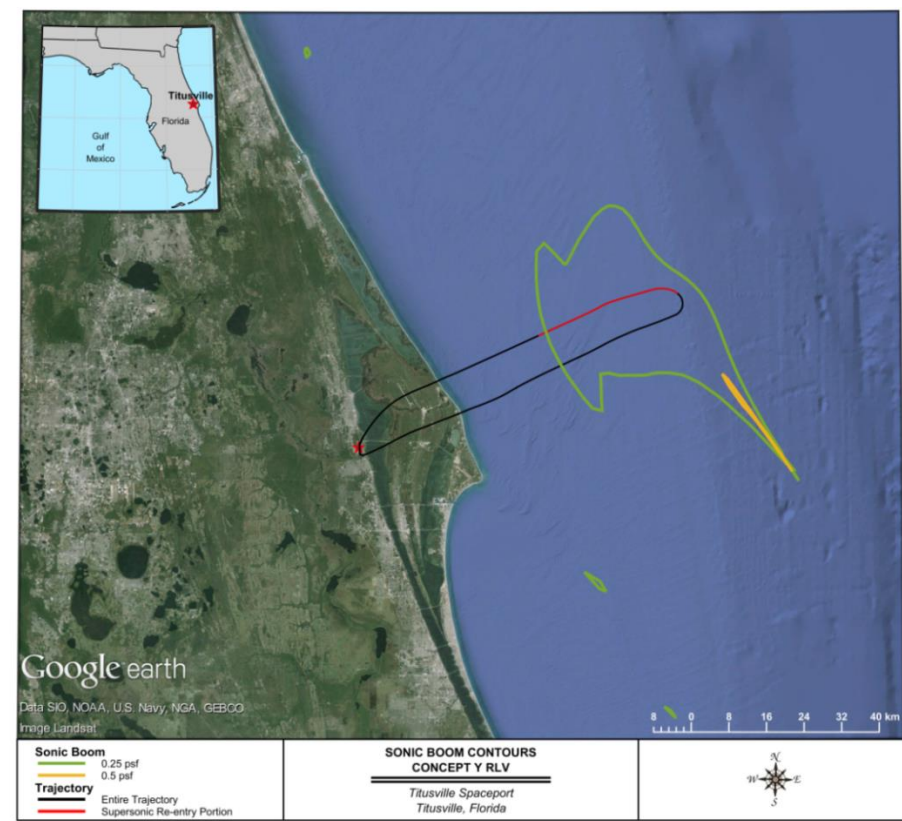


Figure 12. Concept Y RLV sonic boom psf contour resulting from nominal flight profile re-entry



## 6 Summary

The TICO is proposing to operate a commercial space launch site at the TIX in Titusville, Florida, for the horizontal operations of reusable launch vehicles (RLV). The issuance of a launch site operator license is considered a major Federal action subject to environmental review under the NEPA of 1969 as amended (42 U.S.C. §4321, et seq.). The noise impact of the proposed future actions is evaluated based on the FAA Order 1050.1F, Environmental Impacts: Policies and Procedures. A significant noise impact is one in which the “action would increase noise by DNL 1.5 dB[A] or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB[A] noise exposure level, or that will be exposed at or above this level due to the increase, when compared to the No Action Alternative for the same timeframe.”

The Titusville Spaceport (the Proposed Action) would include 50 departures and arrivals per year of each of the Concept X, Y, and Z RLVs, in addition to the existing aircraft operations at TIX. Michael Baker International prepared the environmental noise analysis corresponding to the projected aircraft operations at TIX (No Action Alternative) and the proposed operations of the Concept X and Concept Z RLVs. This report documented the noise analysis for operations of a Concept Y RLV and the community noise exposure of the Proposed Action (Concept X, Y, and Z RLVs in addition to the projected aircraft operations).

The noise levels generated from the Concept Y RLV space launch vehicles were predicted by RUMBLE. The majority of the noise generated by a rocket launch is created by the rocket plume, or jet exhaust, interacting with the atmosphere along the entire plume, and combustion noise of the propellants. When comparing the 2018 or 2023 No Action Alternative with the 2018 or 2023 Proposed Action, off-airport areas would not receive a 1.5 dBA DNL or greater increase. Therefore, significant noise impacts would not occur as a result of the 2018 or 2023 Proposed Action.

Sonic boom analysis was completed using PCBoom4 for the supersonic re-entry of the nominal Concept Y RLV operation. A sonic boom is the sound associated with the shock waves created by the launch vehicle traveling through the air faster than the speed of sound. The maximum sonic boom overpressure of 0.9 psf along with the proposed operational tempo will result in a maximum equivalent A-weighted DNL of 52 dBA. Thus, the noise impacts, in relation to DNL, from potential sonic booms would not be significant since the maximum predicted levels are less than the 65 dBA noise exposure criteria. The predicted sonic boom overpressure levels over land are less than 0.5 psf; therefore the potential for structural damage is negligible (Haber, et al., 1989). The potential for hearing damage is also negligible, as the predicted sonic boom overpressure levels are substantially lower than the ~4 psf impulsive hearing conservation noise criteria. Note, the sonic boom resulting from the supersonic portion of the departure will not reach the ground due to the steep ascending flight path angle.

Overall, including both the launch and sonic boom noise the Proposed Action resulted in a negligible change (less than 1.5 dBA) to the DNL contours when compared to the No Action Alternative over the 2018 to 2023 launch site operator licensing duration, indicating no significant impacts.

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# **APPENDIX I**

## **Comments Received on Draft EA and FAA Responses**



**Florida Fish  
and Wildlife  
Conservation  
Commission**

Commissioners  
**Robert A. Spottswood**  
Chairman  
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**Michael W. Sole**  
Vice Chairman  
Tequesta

**Rodney Barreto**  
Coral Gables

**Steven Hudson**  
Fort Lauderdale

**Gary Lester**  
Oxford

**Gary Nicklaus**  
Jupiter

**Sonya Rood**  
St. Augustine

Office of the  
Executive Director  
**Eric Sutton**  
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**Thomas H. Eason, Ph.D.**  
Assistant Executive Director

**Jennifer Fitzwater**  
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January 3, 2020

Chris Stahl, Coordinator  
Florida State Clearinghouse  
Florida Department of Environmental Protection  
3800 Commonwealth Blvd., M.S. 47  
Tallahassee, FL 32399-2400  
[Chris.Stahl@dep.state.fl.us](mailto:Chris.Stahl@dep.state.fl.us)  
[State.Clearinghouse@dep.state.fl.us](mailto:State.Clearinghouse@dep.state.fl.us)

RE: SAI #FL201912108802C, Federal Aviation Administration Draft Environmental Assessment for the Space Coast Air and Spaceport, Brevard County

Dear Mr. Stahl:

Florida Fish and Wildlife Conservation Commission (FWC) staff reviewed the Environmental Assessment for the Space Coast Air and Spaceport and provide the following comments and recommendations for your consideration in accordance with Chapter 379, Florida Statutes (F.S.), the Federal National Environmental Policy Act (NEPA), and the Federal Coastal Zone Management Act/Florida's Coastal Management Program.

### Project Description

The Federal Aviation Administration (FAA) has prepared a Draft Environmental Assessment (EA) to evaluate the potential environmental impacts associated with the construction and operation of the Space Coast Air and Spaceport, a commercial space launch site at Space Coast Regional Airport (TIX) owned and operated by Titusville-Cocoa Airport Authority (TCAA). Two regions of influence (ROI) were defined: a construction ROI and an operational ROI. The construction ROI is defined as the area where construction would occur within the TIX property boundary on approximately 231 acres. The operational ROI includes the flight paths of the proposed Reusable Launch Vehicles (RLV) and the modeled sonic boom footprints resulting from RLV launches. The construction ROI is located approximately 1.75 miles southeast of the Shepard Drive and State Road 407 intersection on the east side of Grissom Parkway in Brevard County. The landcovers on the construction ROI consists of abandoned citrus groves (113.7 acres), airports (91.4 acres), shrub and brushland (18.2 acres), pine flatwoods (3.4 acres), spoil areas (1.6 acres), freshwater marshes (1.5 acres), mixed scrub-shrub wetlands (0.5 acres), mixed forested wetlands (0.2 acres), upland mixed coniferous/hardwood forests (0.1 acres), and a reservoir (0.01 acres).

### Potentially Affected Resources

The draft *Environmental Assessment* (November 2019) prepared by the FAA, addresses potential impacts to listed species that may result from the construction and operation of the proposed commercial space launch site. Since 2011, a Wildlife Hazard Assessment (WHA) and general protected-species surveys have been conducted within the limits of



Chris Stahl  
 Page 2  
 January 3, 2020

the construction ROI in which the American alligator (*Alligator mississippiensis*, Federally Threatened [FT] due to similarity of appearance), gopher tortoise (*Gopherus polyphemus*, State Threatened [ST]), bald eagle (*Haliaeetus leucocephalus*), Florida sandhill crane (*Antigone canadensis pratensis*, ST), little blue heron (*Egretta caerulea*, ST), least tern (*Sternula antillarum*, ST), and southeastern American kestrel (*Falco sparverius paulus*, ST) were observed. In October 2015, a Florida scrub-jay (*Aphelocoma coerulescens*, FT) survey was conducted in which none were observed within the construction ROI. The report indicates that new listed species surveys will be conducted prior to any construction activities and appropriate permits will be acquired or actions taken to avoid adverse effects on listed species.

In March 2016, the FAA sent an Endangered Species Act (ESA) section 7 consultation letter to the US Fish and Wildlife Service (USFWS). The FAA made a determination of “may affect but is not likely to adversely affect” for the eastern indigo snake and the USFWS concurred. The *Standard Protection Measures for the Eastern Indigo Snake* will be implemented.

### Comments and Recommendations

#### Gopher Tortoise

Due to the documented presence of gopher tortoises on site, we recommend that the applicant refer to the FWC's Gopher Tortoise Permitting Guidelines (Revised January 2017) (<http://www.myfwc.com/license/wildlife/gopher-tortoise-permits/>) for survey methodology and permitting guidance. Survey methodologies require a burrow survey covering a minimum of 15 percent of potential gopher tortoise habitat to be impacted by development activities including staging areas (refer to Appendix 4 in the Gopher Tortoise Permitting Guidelines for additional information). Specifically, the permitting guidelines include methods for avoiding impacts (such as preservation of occupied habitat) as well as options and state requirements for minimizing, mitigating, and permitting potential impacts of the proposed activities. Any commensal species observed during burrow excavation should be handled in accordance to Appendix 9 of the Gopher Tortoise Permitting Guidelines.

#### Least Tern

While the existing conditions onsite likely do not support least tern nesting activity, clearing associated with construction may create conditions conducive for beach-nesting bird nesting. Cleared sites such as areas that have undergone surface scraping may attract ground nesting species such as least terns or other imperiled beach-nesting birds (IBNB) during nesting season. IBNB nests have been documented on a variety of disturbed sites, including construction sites. Least terns deposit their eggs in shallow depressions or scrapes in the substrate, possibly lined with pebbles, grasses, or coquina shells. Egg-laying usually begins in late April or early May and colonies may range in size from a few breeding pairs to many hundreds. FWC staff recommends the following measures to reduce nesting potential during construction:



## COMMENTS RECEIVED ON DRAFT EA AND FAA RESPONSES

Chris Stahl  
Page 3  
January 3, 2020

- Conduct construction activities outside of the breeding season (generally April through August) if feasible, or,
- If the site is cleared during the breeding season, clear the site only when ready to build, and
- Avoid leaving cleared areas with little to no activity for an extended amount of time.

If nesting is observed, we recommend contacting FWC staff to discuss necessary nest buffers and potential permitting alternatives. For additional information, please refer to FWC's Breeding Bird Protocol for Florida's Seabirds and Shorebirds located at the following web

address: [http://www.myflorida.com/apps/vbs/adoc/F15907\\_1241AttachmentDBreedingBirdProtocolForFloridasSeabirdsAndShorebirds.pdf](http://www.myflorida.com/apps/vbs/adoc/F15907_1241AttachmentDBreedingBirdProtocolForFloridasSeabirdsAndShorebirds.pdf).

FWC staff appreciate the opportunity to provide input on this project and look forward to working with the applicant throughout the permitting process. For specific technical questions regarding the content of this letter, please contact Michelle Sempstrott at (407) 452-1995 or by email at [Michelle.Sempstrott@MyFWC.com](mailto:Michelle.Sempstrott@MyFWC.com). All other inquiries may be sent to [FWCConservationPlanningServices@MyFWC.com](mailto:FWCConservationPlanningServices@MyFWC.com).

Sincerely,



Jason Hight  
Land Use Planning Program Administrator  
Office of Conservation Planning Services

jh/mls  
Space Coast Air and Spaceport EA\_40821\_010320

cc: Stacey Zee, FAA, [TIX\\_Spaceport\\_EA@icf.com](mailto:TIX_Spaceport_EA@icf.com)

## Florida Fish and Wildlife Conservation Commission

### Response:

The state-protected species, the gopher tortoise, is discussed in Section 4.3, *Gopher Tortoise*, of the EA. In order to avoid impacts to this species, a gopher tortoise permit would be obtained by the Applicant and best practices would be followed to avoid take of the gopher tortoises during construction.

Thank you for your comments on and recommendations regarding the state-protected species, the least tern. As described in Section 4.3, *Other State-Protected Bird Species*, of the EA, the Proposed Action will not impact the least tern or other state-protected bird species. If nesting is observed, TCAA will contact FWC staff to discuss necessary nest buffers and potential permitting alternatives.

---

**From:** mheyden716@aol.com  
**Sent:** Tuesday, January 7, 2020 1:37 PM  
**To:** TIX\_Spaceport\_EA  
**Subject:** new space port in Titusville

I'm writing requesting that the FAA take no action, and not approve the spaceport permit where our airport is now. There are many reasons for this request.

First, It was zoned as an airport. It is an airport. This is what our community needs. The GIGANTIC spaceport is already here and fully operational. The gigantic air force station is already here and operational. Both are visible from the airport, but safely away from populated areas.

Second, in the hundreds of pages of documents that I have read, the statement is made that the purpose is to help the local economy recover with jobs. This is simply not true, and absolute rubbish. Ten years ago, the local economy needed help. Now things are growing incredible fast, with a huge number of developments being completed and we now have a "rush" hour and the traffic is getting to the dangerous level. We don't need anymore jobs at the airport when the existing space center can handle all future development.

Third. The paper work is full of charts, tables, diagrams and text. The text refers to the area as sparsely populated. What? This is an airport surrounded by residences! My home is in one of their many diagrams as being in their impact zone.

What I don't understand is how none of the neighborhoods surrounding the airport were notified. Two days before the hearing at the airport, someone stumbles on it and starts alerting folks.

Finally. This airport, not spaceport is surrounded by endangered lands that were put aside to protect endangered species.

**I urge the FAA to take no action and not approve this permit.** This operation of a space port needs to be put at the space port we already have.

Sincerely,  
Matt Heyden  
Windover Farms.

**Mr. Matt Heyden**

Response:

Thank you for your comments.

A launch site operator license allows an operator to offer their site to commercial space vehicle operators; it does not allow the operator to conduct launches. Should TCAA receive a launch site operator license for TIX, that license would not authorize launches from the site. If a vehicle operator proposes to launch from TIX, they would apply to the FAA for a separate vehicle license. When a launch operator applies to the FAA for a license to operate at TIX, the FAA will develop a new or supplemental EA that will include a public notification and review period. In addition, the FAA would conduct a safety review specific to that license application. During this review, the FAA will ensure that proposed launch operations comply with the requirements in the FAA's Commercial Space regulations. Please see Sections 1.1 and 1.3.1 for additional information on licensing.

Because of concerns raised during the public meeting, the FAA will conduct an additional public review when an operator proposes to operate from TIX. No operator has been identified for TIX at this time. When a launch vehicle operator applies to the FAA to launch from TIX, the FAA will develop a separate EA and public review for that activity. The FAA generated a distribution list over the course of the TCAA launch site operator license EA development. The FAA will add all commenters and public meeting attendees to the project distribution list and will use this list as an initial notification list for future environmental reviews once a launch operator proposes to operate from the site.

---

**From:** Lora Losi <losi.loral@gmail.com>  
**Sent:** Tuesday, January 7, 2020 12:55 PM  
**To:** TIX\_Spaceport\_EA  
**Subject:** Titusville Airport

To the Federal Aviation Administration,

Ms. Stacey M. Lee,

I am writing to request no action be taken on the TICO airport's initiative to launch rockets. This idea seems ill conceived for monetary gain when there is already a spaceport with protections existing.

Concept x and z would be a ridiculously terrible disturbance to the surrounding town. While currently not in question, Concept Y RLV is entirely a danger far too impressive to allow. 50 or 520 rocket launches seem beyond what any community so close to TICO should have to endure.

A quick look at the many maps in the EA show that extremely close to the airport are 3 schools, an environmental sanctuary, several existing large neighborhoods and potentially new subdivisions. The disruption seems absurd for 20 to 40 jobs, when hundreds of jobs are available where a rocket launch area should be. The existence of the Air Force Station and Kennedy Space Center seems a much better plan for our country's military and commercial rockets.

The first annoyance I thought of was the noise pollution.

Although supersonic booms would supposedly not be near people, the takeoffs, (and launches potentially) would be a severe change to the quality of life of the many communities near the airport. Those of us that chose to live near (and now within the proposed flight tract) of a small airport already have major disturbances. The Warbird Show each March is a preview of the intense effect huge jets taking off would be like. Having done bird surveys and educational activities at the Enchanted Forest Sanctuary for many years, I can tell you that although the takeoff and landing noise area is shown on your maps as small it has a huge effect on the wildlife and lessons anywhere in the sanctuary. Sculptor Charter School in and those of us close to the noise impact zone will have an extreme change in property values and quality of life.

As a trained scientist the thought of rocket fuel (and for that matter more aviation fuel) and the combustion products thereof being this close to schools, residences etc. is terrifying. I know there are existing safe practices, but accidents (and acts of terrorism) do exist. The ground water on north Merritt Island is still polluted from what was thought to be safe practices. The city of Titusville's people and well fields are not expendable.

As for the wildlife, ground water, runoff to the St Johns river ( and possibly the Indian river lagoon) to be effected by the construction proposed the surveys seem short term and therefore incomplete.

Again I ask that you be forward thinking, and take no action. This would mean that we can further explore with the many companies already locating there the great possibilities of the existing space port.

Sincerely,

Lora Losi

## COMMENTS RECEIVED ON DRAFT EA AND FAA RESPONSES

Windover Farms

Titusville Florida 32780

**Ms. Lora Losi**

Response:

Thank you for your comments.

Please refer to Section 2.1.2, *Operation of Horizontal Takeoff and Landing Vehicles*, for a discussion of the operations included in the Proposed Action, including the safety procedures. As noted, Concept X and Z vehicle would take off under aircraft power; rocket powered operations would take place over open ocean. Concept Y operations are not being considered at this time.

A launch site operator license allows an operator to offer their site to commercial space vehicle operators; it does not allow the operator to conduct launches. Should TCAA receive a launch site operator license for TIX, that license would not authorize launches from the site. If a vehicle operator proposes to launch from TIX, they would apply to the FAA for a separate vehicle license. When a launch operator applies to the FAA for a license to operate at TIX, the FAA will develop a new or supplemental EA that will include a public notification and review period. In addition, the FAA would conduct a safety review specific to that license application. During this review, the FAA will ensure that proposed launch operations comply with the requirements in the FAA's Commercial Space regulations. Please see Sections 1.1 and 1.3.1 for additional information on licensing.





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[www.aopa.org](http://www.aopa.org)

January 8, 2020

Ms. Stacey M. Zee  
Environmental Protection Specialist  
Federal Aviation Administration  
c/o ICF  
Attention: FAA TIX EA  
9300 Lee Hwy  
Fairfax, VA 22031

**Re:** *Request for Comment on the Draft Environmental Assessment for the Titusville-Cocoa Airport Authority Launch Site Operator License.*

Dear Ms. Zee,

The Aircraft Owners and Pilots Association (AOPA), the world's largest aviation membership association, submits the following comment in response to the request for comments on the draft Environmental Assessment (EA) for the Titusville-Cocoa Airport Authority (TCAA) application for a Launch Site Operator License to operate a commercial space launch site at the Space Coast Regional Airport (TIX), also known as the Space Coast Air and Spaceport. While AOPA supports the advancement of the commercial space industry, full consideration must be given to the impact commercial space operations will have on General Aviation operations within the National Airspace System (NAS). It is important the FAA integrate commercial space operations into the NAS and take care to not give one commercial operator priority access to the airspace over all other NAS users. AOPA contends that the establishment of commercial space ports and subsequent commercial space launches should not lead to additional temporary or permanent airspace restrictions.

#### **Commercial space launches in the National Airspace System**

Safety is paramount and must be the primary consideration regarding integration of commercial space operations into the NAS. AOPA recognizes the FAA has a congressional mandate to ensure that commercial space launches provide a sufficient level of safety for all users of the NAS. However, the FAA must ensure that Temporary Flight Restrictions (TFR) are justified and minimized to what is necessary for the safety of the NAS. AOPA has regularly gone on record since the early 2000s noting our serious concerns with any long-term strategy that would rely on TFRs for air traffic separation to accommodate commercial space operations given the negative impact they have on routine operations.

AOPA encourages the FAA to leverage the industry recommendations submitted by the Airspace Access Priorities Aviation Rulemaking Committee (ARC) and Spaceport Categorization ARC to ensure commercial space transportation occurs seamlessly within the NAS. Considering many of the proposed launch vehicles will simply be altered versions of certified aircraft, the FAA could reasonably be able to provide standard separation services for non-participating aircraft. Additionally, depending on the risk contour, manned aircraft may be able to safely transit a TFR by maintaining a minimum speed or by flying a set route, which would minimize any exposure to the hazard while mitigating the adverse effects of the TFR. It is important the FAA leverage the consensus recommendations being made in the ARCs to find effective solutions for all airspace users.

Ms. Stacey M. Zee  
January 8, 2020  
Page 2 of 3

### Space Coast Air and Spaceport Draft EA

AOPA is concerned that the draft EA for the Space Coast Air and Spaceport does not adequately assess the airport and airspace impacts that commercial space launches from TIX will have on General Aviation flight operations. As the draft EA points out, there are well over 100,000 annual operations at TIX every year with almost all being General Aviation. This is a significant traffic count that would put TIX in the top 200 busiest air traffic control towers in the country. TIX also has over 50 based General Aviation aircraft and a significant flight school presence. As the draft EA points out, “TIX’s primary role is to serve the corporate, General Aviation and flight training demands of the Space Coast Region.”

Despite the significant presence of existing users of TIX, very little information is included in the draft EA as to what General Aviation operators can expect if the Launch Site Operator License was granted. For example, the draft EA states, “[a]irspace would be cleared for departure and return using existing Air Traffic Control procedures” (page 1-11). This is particularly vague such that a layman or even a pilot would not be able to decipher precisely what this means. To “clear” airspace appears to indicate the commercial space vehicle would be segregated and that their operation would be given prioritization by air traffic control. Further, AOPA contends this statement in the draft EA is not accurate given other statements in this document appear to indicate the Reusable Launch Vehicle (RLV) may be given priority handling and may lead to delays or reroutes for other users of the NAS. As an example, the RLV may close a runway or even the airport for an extended amount of time (page 2-14).

With potential airspace and airport closures likely for some RLV operations, this draft EA is woefully inadequate at articulating what General Aviation operators and local tenants can expect. The publication of a NOTAM is mentioned once but there are no details of what the NOTAM might consist of or how far in advance these notices will be published. Additional clarity is also needed on how RLV operators will conduct see-and-avoid operations when outside the TIX Class D airspace where they may encounter General Aviation aircraft not in communication with air traffic control. Details on how the glider operations will be conducted, including if they will be given priority over airplanes and helicopters in accordance with 14 CFR 91.113(d)(2). The lack of details inhibits the public’s ability to fully understand the proposal and adequately comment. The FAA must address these gaps in information to ensure other TIX users are fully informed as to what the RLV operations mean in terms of airport and airspace access and efficiency.

There would be an excessive economic hardship for those who need to detour, delay, or divert due to airspace or airport restrictions that could be as frequent as what is proposed in the draft EA. These impacts must be identified and calculated in the draft EA. The communication of airport and airspace restrictions may also not be transmitted clearly to pilots, which would exacerbate the impact, as there is no information in the draft EA that discusses this aspect. Bottom line, we do not believe integration of commercial space operations at TIX should come at diminished airport utility for the existing and long-term users of the airport. We believe it is important that TIX remain available and accessible for the primary customers of the airport – General Aviation.

### Conclusion

AOPA recognizes the importance of commercial space operations and is supporting their integration by participating in the FAA ARCs and other FAA sponsored working groups. The operation of an RLV at Space Coast Air and Spaceport may not require any airspace restrictions, as it may fly like a conventional aircraft; however, there is the potential for an RLV that would use rockets, operate like a glider, and potentially require airport and airspace restrictions during operations. Integration of these aircraft at TIX should not come at a disproportionately adverse impact to the existing users of the airport.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

## COMMENTS RECEIVED ON DRAFT EA AND FAA RESPONSES

Ms. Stacey M. Zee  
January 8, 2020  
Page 3 of 3

We encourage the proponent and the FAA to integrate any RLV operations at Space Coast Air and Spaceport into the NAS without a noticeable effect on other users. We believe the various ARC recommendations could help inform a seamless integration and further support the case to not implement airspace and airport restrictions.

We believe the draft EA is too ambiguous for us to fully detail the potential impact any airport or airspace restrictions will have on General Aviation in this area of the country. Due to the lack of details, the FAA must fully examine the potential impacts of the proposed spaceport's establishment on General Aviation operations before entering into a final agreement on this spaceport's operation, and, should there be an adverse effect expected, allow the public an opportunity to comment.

Thank you for reviewing our comment on this important issue. Please feel free to contact me at 202-509-9515 if you have any questions.

Sincerely,



Rune Duke  
Senior Director, Airspace, Air Traffic, and Aviation Security

The Aircraft Owners and Pilots Association (AOPA) is a not-for-profit individual membership organization of General Aviation Pilots and Aircraft Owners. AOPA's mission is to effectively serve the interests of its members and establish, maintain and articulate positions of leadership to promote the economy, safety, utility, and popularity of flight in General Aviation aircraft. Representing two-thirds of all pilots in the United States, AOPA is the largest civil aviation organization in the world.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

**Aircraft Owners and Pilots Association (AOPA)**

Response:

Thank you for your comments. The FAA works collaboratively to ensure a safe National Airspace System for all airspace users. The FAA will continue to consider the recommendations made by the Airspace Access Priorities Aviation Rulemaking Committee (ARC) and Spaceport Categorization ARC.

Section 1.3.3, *Letter of Agreement*, in the EA describes how TCAA will enter into a Letter of Agreement with Air Traffic Control facilities to establish procedures for the issuance of a Notice to Airmen prior to a launch and for closing of air routes during the launch window and other such measures as the FAA Air Traffic Control office deems necessary to protect public health and safety. This is part of TCAA's launch site operator license application process. This measure, along with the measures described in EA Section 2.1.2.1, *Pre-Flight Activities*, are meant to minimize effects on General Aviation at TIX while ensuring public health and safety.

TCAA does not have a commitment from a launch operator at this time, so specific details about the characteristics and flight profile of the RLVs proposed to launch at the site are unknown. Consequently, the FAA has conservatively assessed the potential environmental impacts of launch vehicle operations at TIX based on the concept vehicles described in the EA.

A launch site operator license allows an operator to offer their site to commercial space vehicle operators; it does not allow the operator to conduct launches. Should TCAA receive a launch site operator license for TIX, that license would not authorize launches from the site. If a vehicle operator proposes to launch from TIX, they would apply to the FAA for a separate vehicle license. When a launch operator applies to the FAA for a license to operate at TIX, the FAA will develop a new or supplemental EA that will include a public notification and review period. In addition, the FAA would conduct a safety review specific to that license application. During this review, the FAA will ensure that proposed launch operations comply with the requirements in the FAA's Commercial Space regulations. Please see Sections 1.1 and 1.3.1 for additional information on licensing.

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**From:** Norm Daniels <Norm.Daniels@valiantaircommand.com>  
**Sent:** Wednesday, January 8, 2020 3:52 PM  
**To:** TIX\_Spaceport\_EA  
**Subject:** Draft Environmental Assessment for the Space Coast Air and Spaceport, City of Titusville, Brevard County, Florid

1. The Valiant Air Command Warbird Museum, Inc. supports the awarding of a Launch Site Operators License to TCAA for launching and landing (horizontal take -off and horizontal-landing) reusable launch vehicles. We note the May/17/2018 letter to the FAA regarding "Concept Y RLV" which withdraws the concept from the Launch Site Operators License yet remains as part of the Environmental Assessment should the concept become a viable option for future space flight.

2. The FAA study (12/2019) explicitly describes the conditions and impact of the physical improvements necessary at the proposed site to make the launch and landing of reusable vehicles viable. Three of our Board of Directors either worked for NASA or were NASA contractors and are familiar with the studies necessary to verify the feasibility of the project without deforming existing environmental conditions or disturbing potential Native American resources or other archaeological resources. Additionally, the subjects of air quality, water issues: contamination/supply, wildlife and noise concerns are covered extensively in the study.

Sincerely,

Norman Daniels

Commander,  
Valiant Air Command  
[Norm.Daniels@valiantaircommand.com](mailto:Norm.Daniels@valiantaircommand.com)  
321-268-1941 X 4101

**Mr. Norman Daniels, Valiant Air Command Warbird Museum**

Response:

Thank you for your comments.



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**From:** Barry Clinger <barry.clinger@riptidesoftware.com>  
**Sent:** Thursday, January 9, 2020 3:59 PM  
**To:** TIX\_Spaceport\_EA  
**Subject:** Comments concerning: Space Coast Air and Spaceport EA

Barry Clinger  
2680 Bobcat Trail  
Titusville, FL 32780  
321-269-0492  
[Barry.Clinger@riptidesoftware.com](mailto:Barry.Clinger@riptidesoftware.com)

I have reviewed the EA and believe there are two issues not addressed sufficiently:

1. Landing of unpowered rocket aircraft at a civilian airport in close proximity to neighborhoods on 3 three sides, and the very close proximity of the Sculptor public school on Grissom parkway. These aircraft will be returning to the airport without additional power to make corrections immediately after completing suborbital altitudes. The opportunity for missing the runway after experiencing anomalies in their flight path seems likely to happen within the 250 planned flights (first 5 years) and contingency coarse of actions for the pilot seems very limited.
2. In alternatives, the alternative of leasing KSC facilities to accomplish the rocket tests utilizing the existing KSC landing strip and surrounding facilities should be a consideration. KSC has privatized their facilities, and although it might not be the best alternative for TCAA, it most likely is the best alternative for the local community and the support of the KSC facilities.

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Barry Clinger

CTO  
Riptide Software

Cell: 407-592-2349  
[www.RiptideSoftware.com](http://www.RiptideSoftware.com)



**Mr. Barry Clinger**

Response:

A launch site operator license allows an operator to offer their site to commercial space vehicle operators; it does not allow the operator to conduct launches. Should TCAA receive a launch site operator license for TIX, that license would not authorize launches from the site. If a vehicle operator proposes to launch from TIX, they would apply to the FAA for a separate vehicle license. When a launch operator applies to the FAA for a license to operate at TIX, the FAA will develop a new or supplemental EA that will include a public notification and review period. In addition, the FAA would conduct a safety review specific to that license application. During this review, the FAA will ensure that proposed launch operations comply with the requirements in the FAA's Commercial Space regulations. Please see Sections 1.1 and 1.3.1 for additional information on licensing.

Section 2.2.2, *Alternatives Considered but Dismissed from Detailed Analysis*, discusses the alternatives to the Proposed Action that were considered as well as the reasons why only the Proposed Action and No Action Alternative are carried forward for detailed analysis in the EA. The alternative of leasing facilities at NASA's Kennedy Space Center was not analyzed in detail in the EA because it would not meet TCAA's stated purpose and need.

Thank you for your comments.

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**From:** Kevin Panik <kpanik@hotmail.com>  
**Sent:** Wednesday, January 15, 2020 8:49 PM  
**To:** TIX\_Spaceport\_EA  
**Subject:** EA Should include processing area and allowances for Solid Propellant (Pegasus Class) Rockets

FAA Team,

The proposed area(s) only consider RLV's and liquid propellants. It is more likely this Spaceport would process, integrate, (possibly transport to KSC) Solid Propellant Expendable launch Vehicle(s) of the Pegasus Class size (or smaller). Properly sited processing areas for these class of rockets pose (in general) less risks than liquid propellant storage already sited and analysed in this EA.

Years ago solid Cruise Missiles (solid boosters?) were produced at this very airport. Allowing for solids will (in all probability) enable Startups currently in-work to site this location and provide economic development and local high-paying jobs sooner than the liquid rockets (RLV) proposed.

Kevin Panik  
iPhone= 321-313-5618  
Brevard County Citizen since 1976

**Mr. Kevin Panik**

Response:

Thank you for your comment. In accordance with TCAA's proposal, this EA evaluates the construction needed to support launches of liquid-propellant RLVs.

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**From:** sandysmc@cfl.rr.com  
**Sent:** Friday, January 17, 2020 11:23 PM  
**To:** TIX\_Spaceport\_EA  
**Subject:** Objection to FAA issuance of permit for horizontal launch at TICO Airport

I have reviewed the EA regarding the proposed FAA authorization for horizontal launch activities at TICO airport based on two prototype aircraft designs that will be conducting R&D activities associated with the horizontal launches and attended the public meeting on January 8, 2020 to ask questions. I object to the issuance of the FAA permit for these activities based on the following issues not adequately addressed or considered in the EA. These activities are most appropriately conducted on NASA property where existing publicly funded infrastructure exists and adequate safety buffers put all associated risk much further away from populated areas, while still providing all the economic benefits to the community.

1. PUBLIC SAFETY

a. Inadequate Safety Buffer for the Proposed activities

The EA has not adequately addressed the safety buffers required for the proposed R&D horizontal launch activity. There is no actual vehicle to be assessed, only two prototypes one of which doesn't even exist yet. How can the FAA in any reasonably assured way assess impacts of these vehicles, in that at least on is only theoretical at this point. These vehicles are R&D and with any R&D activity there are failures during development. FAA staff confirmed that the payload on the rockets would contain hypergolic fuels. What is the area of potential impact for catastrophic failure during all points of takeoff, delivery and return? Takeoff would be the most dangerous time with maximum fuel on the aircraft and rocket, under all possible wind patterns and speeds what is the potential for impact of hypergolic fuels? Given the immediate proximity of urbanized areas including multiple residential communities and Sculptor Charter School (preK-8<sup>th</sup>) located directly across Grissom from the proposed facility site, how would these communities and the public be protected from inadvertent impacts during catastrophic launch failures? What about leaks during payload processing and loading?

b. Increased risk due to prototype design and lack of pilot experience hours operating these aircraft. The nature of new test craft is precisely why NASA is located in the remote location it is. New designs and new technology will encounter failures during the design and testing phases. It is inappropriate for these activities to be performed in an urbanized area surrounded by residential communities and a school. One of the prototype designs returns to the airport after delivering the rocket to altitude as a glider. This will require a relatively steep return slope to approach the airport and any deviation during the approach, if he overshoots the airport or ends up too much north or south or west could impact residential communities on three sides of the airport. Also being newly designed aircraft there will be no opportunity for pilots to be highly experienced operating any of these craft.

2. NOISE

The EA presented a sonic boom area based on models created based on the two theoretical prototype launch vehicles and presented to the public that all associated sonic booms will only be audible in a fixed location over the ocean. Models are only projections of what MAY occur based on the data input into the model. Any deviation or inaccuracy in the data input can vastly affect the models sonic boom location outcomes. What happens if the modeled data is not representative of the actual launch vehicle parameters? What recourse do residential communities have if the real-world sonic boom area does not correspond to the areas presented by the FAA to the public as shown in the EA after the FAA issues the permit?

3. INADEQUATE PUBLIC NOTICE.

There are residential communities on three sides of the Airport property most likely to be affected and none of

## COMMENTS RECEIVED ON DRAFT EA AND FAA RESPONSES

the HOAs of these communities were contacted regarding this proposed activity. For future reference the Windover Farms HOA can be reached at wfboard@windoverfarms.org; TICO airport management is well aware of our community, having conducted meetings in the community as affected parties when past changes in operation were being considered. Windover Farms, a 600 home residential community located on the west side of TICO airport. Meadow Ridge and Bent Oak at Meadow Ridge are two other residential communities located immediately north of the airport and they also have HOA.

4. INADEQUATE ASSESSMENT FOR IMPACTS TO CRITICALLY ENDANGERED NORTH ATLANTIC RIGHT WHALE. In its assessment of the "Affected Environment" in Chapter 3 of the EA, there is no discussion of impacts of the modeled sonic boom footprints overlapping critical habitat of the North Atlantic Right Whale. It is only glossed over stating: "One whale species, the North Atlantic right whale, uses waters in closer proximity to the shoreline within the operational ROI. Critical habitat for this species occurs in a zone from the shoreline to approximately six miles seaward and parallels the coast through the operational ROI." Every other species there is mention of the sonic boom footprint, but for the species potential impacted there is not discussion included in the EA.

As stated in the EA, "The FAA Office of Commercial Space Transportation's mission is to ensure **protection of the public, property**, and the national security and foreign policy interests of the United States during commercial launch or reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation." Authorization of the proposed R&D horizontal rocket launch activities at TICO airport does not provide sufficient safety and noise buffers to meet the FAA's stated mission of protecting the public and property, and should not be approved.

Thank you for your consideration of these comments. Any answers to the included questions above would be appreciated.

Sandra Clinger  
2680 Bobcat Trail  
Titusville, FL 32780

**Ms. Sandra Clinger**

Response:

*Public Safety*

A launch site operator license allows an operator to offer their site to commercial space vehicle operators; it does not allow the operator to conduct launches. Should TCAA receive a launch site operator license for TIX, that license would not authorize launches from the site. If a vehicle operator proposes to launch from TIX, they would apply to the FAA for a separate vehicle license. When a launch operator applies to the FAA for a license to operate at TIX, the FAA will develop a new or supplemental EA that will include a public notification and review period. In addition, the FAA would conduct a safety review specific to that license application. During this review, the FAA will ensure that proposed launch operations comply with the requirements in the FAA's Commercial Space regulations. Please see Sections 1.1 and 1.3.1 for additional information on licensing.

Please refer to Section 2.1.2, *Operation of Horizontal Takeoff and Landing Vehicles*, for a discussion of the operations included in the Proposed Action, including the safety procedures.

*Noise*

The noise contours presented in the EA (Figures 4-5 and 4-6) avoid residential neighborhoods. The FAA does not anticipate that residential neighborhoods would be significantly impacted by the Proposed Action. The supersonic operations associated with these types of vehicles would only occur over the open ocean and sonic booms would only be propagated over ocean areas.

*Public Notice*

Thank you for providing contact information for the Windover Farms HOA. Because of concerns raised during the public meeting, the FAA will conduct an additional public review when an operator proposes to operate from TIX. No operator has been identified for TIX at this time. When a launch vehicle operator applies to the FAA to launch from TIX, the FAA will develop a separate EA and public review for that activity. The FAA generated a distribution list over the course of the TCAA Launch Site Operator License EA development. The FAA will add all commenters and public meeting attendees to the project distribution list and will use this list as an initial notification list for future environmental reviews once a launch operator proposes to operate from the site.

*Endangered Species*

The FAA consulted with the U.S. Fish and Wildlife Service as part of this project. Please refer to EA Section 4.3, *Impacts to ESA-Listed Species and Impacts to Marine Mammals and Fish* for a detailed discussion.

Thank you for your comments.

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**Subject:** FW: EXTERNAL: State\_Clearance\_Letter\_for\_FL201912108802C\_Draft Environmental Assessment For The Space Coast Air And Spaceport, City Of Titusville, Brevard County, Florida

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**From:** Andersen, Mariben <[MAnderesen@mbakerintl.com](mailto:MAnderesen@mbakerintl.com)>  
**Sent:** Monday, January 27, 2020 11:06 AM  
**To:** Zee, Stacey (FAA) <[Stacey.Zee@faa.gov](mailto:Stacey.Zee@faa.gov)>  
**Cc:** McDaniel, Aaron <[Aaron.McDaniel@mbakerintl.com](mailto:Aaron.McDaniel@mbakerintl.com)>; Gable, Jay <[JGable@mbakerintl.com](mailto:JGable@mbakerintl.com)>  
**Subject:** FW: EXTERNAL: State\_Clearance\_Letter\_for\_FL201912108802C\_Draft Environmental Assessment For The Space Coast Air And Spaceport, City Of Titusville, Brevard County, Florida

Stacey – below is the State Clearance Letter from the State of Florida Clearinghouse. Please contact Chris Stahl if you have any questions.

**Mariben Andersen** | Department Manager - Environmental  
4211 W Boy Scout Blvd. Suite 500 | Tampa, FL 33607 | [O] 813-466-6026 | [M] 727-560-6757  
[mandersen@mbakerintl.com](mailto:mandersen@mbakerintl.com) | [www.mbakerintl.com](http://www.mbakerintl.com) | [f](#) [t](#) [@](#) [in](#) [v](#)



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**From:** Stahl, Chris <[Chris.Stahl@dep.state.fl.us](mailto:Chris.Stahl@dep.state.fl.us)>  
**Sent:** Monday, January 27, 2020 11:03 AM  
**To:** Andersen, Mariben <[MAnderesen@mbakerintl.com](mailto:MAnderesen@mbakerintl.com)>  
**Cc:** State\_Clearinghouse <[State\\_Clearinghouse@dep.state.fl.us](mailto:State_Clearinghouse@dep.state.fl.us)>  
**Subject:** EXTERNAL: State\_Clearance\_Letter\_for\_FL201912108802C\_Draft Environmental Assessment For The Space Coast Air And Spaceport, City Of Titusville, Brevard County, Florida

January 27, 2020

Mariben Andersen  
Michael Baker International, Inc.  
4211 West Boy Scout, Suite 240  
Tampa, Florida 33607

**RE: Federal Aviation Administration - Draft Environmental Assessment for the Space Coast Air and Spaceport, City of Titusville, Brevard County, Florida**  
**SAI # FL201912108802C**

Dear Mariben:

Florida State Clearinghouse staff has reviewed the proposal under the following authorities: Presidential Executive Order 12372; § 403.061(42), Florida Statutes; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.



## COMMENTS RECEIVED ON DRAFT EA AND FAA RESPONSES

The proposed project has been reviewed by the Central District of the Florida Department of Environmental Protection and the proposed project will require a NPDES Stormwater permit, a Industrial Waste permit, and may require Dewatering permit, a DEP Domestic Wastewater Collection/Transmission System Permit and a Drinking Water Main Extension Permit.

The Draft Environmental Assessment acknowledges that certain environmental permits will be required to be obtained from St. Johns River Water Management District SJRWMD. Therefore, SJRWMD has NO comments. However, the following technical assistance is provide to assist with the permitting process. • SJRWMD recommends a pre-application meeting with the project team. Early coordination with SJRWMD's ERP staff is encourage prior to any site work. For assistance, please contact Marc von Canal, Environmental Resource Program Manager, at 321-676-6626 or [mvoncana@sjrwmd.com](mailto:mvoncana@sjrwmd.com). • The Indian River Lagoon near the project area is regulated as Class II (Shellfish) waters, therefore 50% additional water quality treatment will be required in the stormwater management system. • The project boundary is within multiple impaired water body designations, therefore a nutrient pollutant loading analysis will be necessary for any direct discharge to a designated nutrient impaired waterbody. • Wetland (WL) and other surface water (OSW) boundaries within and immediately adjacent to project need to be delineated and verified by SJRWMD staff. On-site WL and OSW will need to be field delineated (flagged) and approved by SJRWMD staff. • Direct (i.e.: fill, dredge, hydrologic, etc.) and secondary (i.e.: noise, lights, land use intensity, traffic, water quality resulting from use, etc.) impacts need to be identified, quantified, and considered for reduction and elimination of impacts. • An appropriate mitigation plan is needed for unavoidable impacts to wetlands and other surface waters that the require mitigation. • A targeted or updated listed species survey within and area surrounding project area may be needed. • A Consumptive Use Permit may be required for dewatering (if necessary), or increased ground water use to support the new operations.

If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the vicinity of the discovery. The applicant shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section at (850)-245-6333. Project activities shall not resume without verbal and/or written authorization. In the event that unmarked human remains are encountered during permitted activities, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, Florida Statutes. If you have any questions, please contact Rachel Thompson, Historic Preservationist, by email at [Rachel.Thompson@dos.myflorida.com](mailto:Rachel.Thompson@dos.myflorida.com), or by telephone at 850.245.6453 or 800.847.7278.

Based on the information submitted and minimal project impacts, the state has no objections to allocation of federal funds for the subject project and, therefore, the funding award is consistent with the Florida Coastal Management Program (FCMP). The state's final concurrence of the project's consistency with the FCMP will be determined during any environmental permitting processes, in accordance with Section 373.428, Florida Statutes, if applicable.

Sincerely,

*Chris Stahl*

Chris Stahl, Coordinator  
Florida State Clearinghouse  
Florida Department of Environmental Protection  
3800 Commonwealth Blvd., M.S. 47  
Tallahassee, FL 32399-2400  
ph. (850) 717-9076  
[State.Clearinghouse@floridadep.gov](mailto:State.Clearinghouse@floridadep.gov)

## **Florida State Clearinghouse**

Response:

Thank you for your comments.