

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR
SPACEPORT CAMDEN
BY THE

**ENVIRONMENTAL ISSUES SUBCOMMITTEE OF THE
SPACEPORT CAMDEN STEERING COMMITTEE**

A Subcommittee appointed by the Camden County Board of Commissioners
[Rev 3.2 (final), 14 June 2018]

Compiled for the Subcommittee Members and Transmitted to the FAA
by
Clay L. Montague, Subcommittee Chair

While Camden County has facilitated and participated in the discussions of the Environmental Issues Subcommittee, the Subcommittee's opinions and statements, including those in this list of major comments, do not represent the positions of Camden County or its officials.

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Goal of the Subcommittee's public comments on the DEIS.

Herein we present a coordinated effort by stakeholders in the community that will be impacted by the proposed Spaceport Camden. Our purpose is to identify errors and omissions in the Draft Environmental Impact Statement (DEIS), in particular those that could change the overall decision or a mitigation plan. We are directly communicating with those who must make the decision, as well as those who prepare the final Environmental Impact Statement (EIS). Our goals are to provide a better basis for an appropriate licensing decision and if the license is granted, to guide improved mitigation of the environmental impact of Spaceport Camden.

COMMENTS ON GENERAL ORGANIZATION AND CONTENT

*Principles of findings of significant impact: **The Final EIS should include a discussion of the principles used in determining the significance of an impact*** in the Introduction (Chapter 1). It is unclear how the decisionmaker assesses impact significance in the consideration of adverse impacts, and whether the EIS preparers share the same principles. Adding to this difficulty are the many statements of insignificant impact that occur abruptly and without explanation, but after a number of adverse impacts

have been identified and discussed. An example among many is in Biological Resources, Page 4-9, line 44, which simply states after a number of adverse impacts to migratory birds are mentioned: “Construction activities would not have any significant impacts on migratory birds.”

A distinction is needed between significance that drives the need for special mitigation above and beyond the requirements of existing laws, regulations, and permits, and significance that is already sufficiently mitigated by existing laws, regulations, and permitting requirements. Differentiation is also needed between non-mitigatable significant impact and mitigatable significant impact. Finally, in each section where it is stated that no significant impact was found, a justification should be provided that draws upon the stated principles in this requested section to add to Chapter 1.

Although no significant impacts are reported, mitigation sections include recommendations. It is unclear whether these are necessary in order to reduce impact below significance thresholds, or are simply presented as good practices to follow. Furthermore, in some discussions of environmental consequences, (Chapter 4), a variety of environmental management plans, permits, and recommendations are given that would seem to mitigate impact, but they are not included in the corresponding mitigation sections (Chapter 6). This transfer of good practices to mitigation seems needed especially in the biological resources sections, but we point this out in other sections in our comments below.

***Risk analysis:* The Final EIS should include a subsection describing the risk of mishaps (chances and consequences), including launch and landing failures, in each section of Chapter 4 (Environmental Consequences) and Chapter 6 (Mitigation).** Drivers of impact include explosion shock waves, fires, flying debris, emergency response, post-accident cleanup, impacts of parts recovery, and subsequent resource restoration. Risk analysts usually define risk as the product of the chances of an event and the consequences of the event. The chance of launch failures and other mishaps may be small, but the consequences are potentially so great as to require planning and consideration in the Final EIS. Environmental consequences of mishaps will *not* be covered in the FAA Safety Review, so this will not be a duplication of effort.

Many of the concerns that we and others in our community have about the proposed Spaceport Camden involve mishaps, rather than just the impacts from construction and normal operations. We note that the EIS identifies launch failure probabilities of 2.5 to 6% (Page 2-34, Lines 20-21). We recognize that several categories of failure are included in failure statistics, some of which would not have impacts on the environment (e.g., failure to reach the correct orbital position). We are concerned about the fraction that will (e.g., explosions and crashes). Please estimate this fraction.

Page 4-3, lines 12-14 indicate that insufficient data are available to estimate impacts quantitatively, but chance of occurrence of launch pad explosions, and in-flight explosions over the overflight exclusion zone can be estimated. Quantitative estimates should be used instead of “unlikely.”

We note that the Environmental Consequences section for Biological Resources includes a subsection entitled, “Launch Failure and Emergency Procedures” (beginning on Page 4-20, line 14). We think the decisionmaker should have the benefit of launch and landing failure impacts in all sections within the chapter on Environmental Consequences (Chapter 4).

Landing Risk: We believe an expanded standalone section is warranted in the EIS to inform the decisionmaker of certain unique aspects of landing failures that could occur with the proposed action*. It appears to us that landings would pose additional risk for people, habitat, historical structures, and ecosystems on Cumberland Island National Seashore as well as within a corridor from there back to the landing zone and perhaps a mile or two around the landing zone. Discuss the liability created by this additional risk.

First, a quantitative estimate of the failure rate of landings seems warranted. Only four sentences are devoted to landing failures (Page 2-34, lines 25-27, and lines 32-35). An estimate of the uncertainty

in this failure rate should be included. It is likely to be high given the very low number of instances of first-stage landings. We believe along with risk analysts that uncertainty enhances rather than diminishes risk and risk perception.

Second, the DEIS states that the return would be along the same path as the vehicle ascent, “and would not require an expansion of the security and safety zones” (Page 2-34, lines 2-4). This statement seems not to be precisely true given the positions of the launch pad and the landing zone about 2 miles to the south. As a returning first stage approaches the landing zone, the safety and security zone for landing would likely shift somewhat to the south, perhaps starting at a point within Cumberland Island National Seashore, and including segments of both the Intracoastal Waterway and Alternate Intracoastal Waterway. A separate graphic exhibit should show the flight corridor and overflight exclusion zones for landings as they begin to deviate from those of the accompanying launch.

Third, the nature of landing failures at the Landing Zone of Spaceport Camden seem to have very different potential for environmental impact compared to launch crashes and explosions. In particular the intended target is on land rather than in orbit. While a launch vehicle quickly reaches beyond land to a somewhat safer area over the ocean (at least to people and land resources), a landing involves a first stage returning at high speed toward a zone with specific hazards and people on land. In the case of the proposed action, very nearby hazards include visitors and residents; users of Section 4(f) property; a highly toxic landfill managed under RCRA permit that is at the edge of the Satilla River estuary; terrestrial, wetland, and estuarine habitats with species of special concern; historical, archeological, architectural and cultural resources; and a landscape prone to fire.

Finally, no mention is made of whether a “destruct signal” can be sent to a first stage that is attempting to land. If so, the nature of the considerations for the abort decision should be presented so that all involved can be better assured that intentional destruction is a good option that can be done safely with lower liability rather than increasing risk to the uninvolved public and “authorized persons.”

* The proposed action includes possible recovery of the first stage of the launch vehicle by vertical landing at Spaceport Camden (Page 2-1, lines 8-10). Up to 12 such landings would occur per year (Page 2-6, lines 1-2), and all would require the flight of the first stage westward along a flight path similar flight path used for the eastward launch (Page 2-6, lines 3-4 and lines) and within the same range of trajectories (lines 8-9).

Tideland use and ownership in Georgia: **Tidal marshlands are likely owned by the State of Georgia, not Union Carbide or Bayer Crop Science, and their use for Spaceport Camden must be negotiated.** Except for rare cases in which a clear title through a Crown Grant (King’s Grant) can be established, the State of Georgia claims ownership of tidal marshland under its Coastal Marshlands Protection Act of 1970 (mentioned on Page 3-106, lines 14-17). In the DEIS, Union Carbide Corporation and Bayer Crop Science are said to own 10,600 acres of tidal marshland, and the text indicates that these can be used as safety, security, and environmental buffers (Page 5, lines 2-3 and 15; Page 2-2, Lines 11 and 31, also Footnote 5, and stated within the inset box, last line of third paragraph; Page 2-40 line 37; Page 3-95, line7; Page 5-10 lines 37-39; Page 7-1, lines 32-34). However, any proposed use of tidal marshes for spaceport operations, seems likely to be subject to negotiation with the State of Georgia.

Description of setting: **Correct and unify in all sections the apparently varied understanding of the general physical environment and setting of the proposed spaceport.** The description of the coastal and estuarine environment of the ROI is inconsistent from section to section, often with inaccuracies that may affect interpretations of impact, and diminish confidence in the document. In the Introduction (Chapter 1), establish accurate descriptions of the following parts of the ROI in southeastern Georgia and

use these consistently from section to section: continental shelf, barrier islands, coastal plain, physical processes of estuarine, tidal, and riverine flow, circulation, turbidity, geographical boundaries, biology, ecology, and land use. In particular, the Final EIS should recognize that the estuary adjacent to the proposed spaceport and under its flight corridors is a major dynamic, interconnected system that contains wildlife from microbes to plants, fish, and shellfish, all of which are necessary to support commercial, recreational, and sustenance fishers. Damage done in one area can quickly spread by tidal and estuarine circulation to an area that would be very difficult to control and remediate.

Complex estuarine and tidal circulation will spread toxic spills, seeps, and runoff in many directions, a phenomenon that threatens commercial fishing, commercial shellfish leases, sustenance fishing, public shellfishing grounds, and recreational fishing, boating, swimming, tourism, and damage to both public and private property in the vicinity of the proposed spaceport. When toxic chemicals enter the Satilla River estuary, tidal action spreads them in all directions, including upstream. The vertical range of tides in the Satilla River estuary exceeds six feet at a frequency of roughly twice per day. Water moves horizontally with the tides upstream for 10 miles or more, and works its way into many tidal tributaries and marshlands along the way. For example, an overhead explosion close to the launch point would likely spill unburned rocket, satellite, and special fuels (see Footnote 14 on Page 2-10) into the waters and tidelands below the explosion. Tidal circulation would move these contaminants in multiple directions outside the region of initial exposure.

The decisionmaker should keep in mind that the Satilla River estuary has a substantial tidal range that can rapidly send pollutants in upstream and downstream directions, laterally, and into vast areas of tidal marshland. Mitigation plans must be commensurate with wide ranging contamination when estuarine circulation is involved. To protect the adjacent estuary, we recommend a very wide, up to ¼ mile upland zone of no activity to separate any spaceport operations from the tidal marshland and tidal creeks and rivers of the Satilla River estuary. This would preserve the qualities of the Satilla River that are listed on the Nationwide Rivers Inventory, and retain its potential for future Wild & Scenic River designation. Given the spreading potential created by the high tidal range, we recommend in general a doubling of the measures designed to prevent hazardous spills, seepage, or runoff from the spaceport property, and doubling cleanup preparedness when considering mishaps in the flight corridor over the estuary and tidal marshlands.

New safety terminology: **Define and unify in all sections new technical terms involving launch and landing safety with meanings that are not standard in FAA regulations.** Especially: “authorized persons,” “hazard area,” and “closure area” and their relation to FAA regulatory terms found in Title 14 C.F.R. Part 420, such as “person who is not associated with the activity,” “flight corridor,” and “overflight exclusion zone.” Although this is the subject of the Safety Review, the concept is repeatedly mentioned in this EIS in connection with certain impact determinations. Therefore, it is appropriate to justify and define these concepts and should they be found to be in conflict with what is allowable, the sections of the EIS that depend on these concepts should be re-evaluated.

Certain campers on Cumberland Island National Seashore and private property owners on Cumberland Island and Little Cumberland Islands are identified in the DEIS as “authorized persons” who “could remain if they wished” (Page 4-59, lines 20-22; Page 4-95, lines 2-6). Non-authorized persons would be evacuated from the hazard area (Page 4-69, lines 35-37). It seems clear in the DEIS that the aforementioned “authorized persons” would not be required to evacuate the hazard area (see Access Restrictions on Page 4-62, lines 29-32). Because these “authorized persons” are not authorized personnel for launch operations, but rather are part of the uninvolved public, we believe this unusual designation conflicts with the FAA’s rule about persons remaining in the overflight exclusion zones (OEZ). By definition of OEZ, it would appear that one person could cause any launch to be scrubbed by remaining in

the OEZ. According to Part 420 of Title 14 of the Code of Federal Regulations, “An OEZ defines the area where the public risk criteria of 30×10^{-6} would be exceeded if one person were present in the open” (page 62826c of the 19 Oct 2000 Federal Register Vol. 65, No. 203). Also note that, “The FAA requires that an applicant demonstrate either that the overflight exclusion zone is unpopulated, that there are times when no one is present, or that the public can be excluded from this area during launch. Although a determination of this nature encompasses issues that will be addressed in a launch license, a launch site cannot support safe launches unless overflight of the highest risk area in close proximity to a launch point takes place without the public present” (page 62843a,b of the 19 Oct 2000 Federal Register Vol. 65, No. 203).

Therefore, we believe that the FAA must clarify whether the referenced campers and private property owners (and their guests) will in fact be required to leave the overflight exclusion zone (OEZ) regardless of the reason for their presence therein.

Describe common impact drivers uniformly: **Unify in all sections the description and quantity of given drivers of impact that affect more than one of the 14 types of resources considered.** For example, the amount and type of traffic expected on Harrietts Bluff Road could reasonably impact biological resources, air quality, noise, land use, visual effects, and cumulative impacts of future infrastructure development. A shockwave and vibration study done to evaluate impact on architectural resources should use the same shockwave and vibration intensities as those used to assess damage potential to the RCRA-permitted toxic landfill adjacent to the proposed spaceport (and both studies should include shock and vibration from explosions caused by launch and landing mishaps). Day-night average sound level (DNL) should not be used when maximum sound level is appropriate (such as when evaluating disturbance by pile-driving to wilderness experience and to wildlife).

SITE PLAN, INFRASTRUCTURE, MANAGEMENT PLANNING

Launch site boundary: **Determine a location of the launch point at Spaceport Camden that can satisfy the requirement that it be a certain distance from the nearest launch site boundary (e.g., 10,600 ft).** Section 2.1.2.8 Launch Failures mentions this distance requirement which does not seem to be satisfied with the boundaries given. Although this is a launch safety issue, launch failures and launch point location have large consequences to essential fish habitat, wildlife, water resources, and public use of tidal marshland and waterways that are within the 10,600 ft. radius of the indicated launch point, seemingly far beyond the proposed launch site boundary. It seems to us that the decisionmaker must somehow resolve the apparent failure to meet the required minimum distance by changing one or more of the following: the launch point, the launch site boundary, the maximum allowable size of launch vehicle, or the FAA regulation (Title 14 C.F.R. Part 420.21). For medium-large orbital expendable vehicles identified for use at Spaceport Camden (Page 2-1, line 42), the required minimum distance seems impossible to obtain, given the launch point and launch site boundary indicated in the DEIS (numerous exhibits, e.g., Exhibits ES-3 through ES-6; 2.1-2 through 2.1-4; and others). Table 2 of Part 420.21 requires a minimum distance from the launch point to launch site boundary of 10,600 ft for medium-large orbital expendable launch vehicles. As indicated in the same table, a small launch vehicle requires 7,300 ft, which would apparently necessitate extending the launch site boundary into tidal marshland thought to be owned by the State of Georgia (See Item 2 above).

A 10,600 ft radius around the launch point includes a section approximately two nautical miles long within a deep-draft navigable channel in the Satilla River estuary, a four nautical mile section of the

Alternate Atlantic Intracoastal Waterway, roughly 4,500 acres of tidal marshland south of the Satilla River, plus a small amount (roughly 50 acres) of tidal marshland north of the main stem. Even if the launch site boundary is legally recognized by the State of Georgia to extend to the maximum of the supposed property boundaries of Union Carbide and Bayer CropScience, so that it includes all state-owned tidal marshland up to the southern edge of the main stem of the Satilla River estuary, the waters of the main stem and the marshland to the north would seem to remain in public ownership. In that case, the launch site boundary would have to contain publicly owned lands and a portion of a major deep-draft navigable waterway. This situation would require consultations and negotiations with the Coastal Resources Division of the Georgia DNR as well as the US Army Corps of Engineers. We urge the decisionmaker to seek conclusions of such consultations prior to making a decision, or to determining mitigation requirements.

Barge Channel: **Describe the impacts of any estuarine channel modifications needed to operate a barge of size and draft suitable to return first stages landed at sea to Spaceport Camden.** The Final EIS should analyze navigation difficulties with respect to required turning radii and depths, evaluate the potential need for channel dredging or straightening, and provide a significance determination of subsequent impacts to flow circulation and habitat.

Facility Closure Plan: **Upon eventual closure of Spaceport Camden, decommissioning of the site should be coordinated with fish and wildlife agencies and funded by a spaceport authority or land trust.** The DEIS does not reference a facility closure and site restoration plan. In the event that the Spaceport closes, the site should be restored for wildlife habitat and donated to an appropriate conservation organization or land trust. The SpaceX Texas EIS, for example, includes coordinating the decommissioning of the site with the USFWS as a special conservation measure for biological resources.

Septic Systems: **The Final EIS should fully address site suitability for septic systems, including potential impacts to systems from sea level rise, use advanced systems, frequently inspected.** The DEIS references septic systems as the method for sewage treatment and disposal at the construction ROI (page 4-66, lines 33-41), but the location of these systems and their drain fields are not included on any site visualizations. Coastal Georgia soils are typically poor for the operation of conventional septic systems, and the large systems referenced in the DEIS (60,000 gpd) would require very large drain fields. In addition to poor soils, sea level rise will also impact septic systems on the coast as rising water tables impact drain fields and treatment. Partially treated sewage from such large septic systems has the potential to impact biological resources. The Final EIS should clearly state that, if site conditions are less than desirable for conventional septic systems, advanced/alternative systems will be utilized. Regardless of the type of system used, the Final EIS should clearly state that a septic system maintenance and repair plan will be developed and implemented, and that Camden County Health Department personnel will be granted right of entry to inspect the septic systems to ensure all components of the plan are being implemented.

Environmental Management: **Identify the institutional controls and environmental management systems required to develop and implement the 20+ environmental management plans.** A standard of practice should be required, such as ISO 14001:2015. One or more Environmental Management Systems (EMS) and Institutional Control, Implementation, and Assurance Plans (ICIAP) are needed to manage the collection of environmental management requirements. Refer to EPA for documentation on creating and implementing an EMS (<https://www.epa.gov/ems>). Plans mentioned in the DEIS include: Hazardous Materials Emergency Response Plan; Wildland Fire and Burn Plan; Fire Management Plan; Munitions

and Explosives of Concern Corrective Action Plan; Spill Prevention, Control, and Countermeasure Plan; Lighting Management Plan; Light Management Plan; Artificial Lighting Management Plan; Essential Fish Habitat and Fishery Management Plan; Protected Species and Habitat Management Plan; Storm Water Pollution Prevention Plan; Sediment and Erosion Control Plan; Site Revegetation and Landscaping Plan; Emergency Response Plans; Catastrophic Launch Failure Response Plan; Chemical-specific spill response plans; Material-specific management plans; Corrective Action Plans; Safety Review Process; Operations Safety Plan. Additional plans recommended by the subcommittee include: Safety and Security Plans with measures to avoid impacts to biological resources including protected species; Hurricane Planning and Response Plan; Sea Level Rise Adaptation Plan; Facility Closure and Site Restoration Plan; Long-term Wildlife Monitoring Plan.

Stakeholder Comment on Plans and Reports: **Public, private, nonprofit, government, and industry stakeholders should review and comment on drafts of environmental management planning documents.** The final EIS should clearly state that stakeholders will be provided opportunity to review and comment on drafts of these documents. Stakeholders include especially those that own or manage upland or estuarine resources within overflight exclusion zones. The DEIS references many plans and reports that will be developed in order to minimize and mitigate impacts. More than 20 are listed in the previous paragraph (along with a few suggested additional plans).

Deluge Water Recovery System: **Describe the amount, quality, and ultimate fate of the deluge water that is captured in a retention tank (e.g., analyzed for contaminants, treated, recycled to the water tower, disposed by infiltration, discharged to surface water via an NPDES permit, or something else).** The deluge water system is used in launches and static fire engine tests. Page 2-33, lines 12-16 describes a system in which 100,000 to 250,000 gallons of water is rapidly discharged from the water tower, with much evaporating and some captured in a water retention tank. The Final EIS should include estimates of the portion evaporated and portion retained, and describe the quality, treatment, and ultimate disposition of the water captured in the retention tank.

Obtaining Information about the Bayer CropScience Property: **The Final EIS should better describe the data needs and acquisition plan for a supplemental environmental impact statement should Bayer CropScience property be leased or acquired for use by Spaceport Camden.** The possible use of Bayer CropScience property triggers the need to plan contingencies to discover toxins, resources, and artifacts, and to develop environmental controls. Yet access to the Bayer CropScience property apparently has been so restrictive that it has not been evaluated with the rigor done on the Union Carbide tract. Yet toxic wastes from pesticide manufacture, Munitions and Explosives of Concern (MEC), biological resources of special management status, and archeological, historical, architectural, or cultural resources are likely to be present on the Bayer CropScience property. At least a portion of Bayer CropScience property seems necessary in order to build and use heavy roadways for the return of first stages barged to the dock. Other indicated uses include the siting and construction of an alternate control center and visitor center. The Final EIS should guide the collection and analysis of the necessary information depending on the portions ultimately leased or acquired for use with Spaceport operations.

1. AIR QUALITY

Major Source of Air Pollution: **Page 4-2, Table 4.1-1: Estimated first year PM₁₀ emissions are a “major source” that apparently would trigger the need for a Title V permit, under the Clean Air**

Act, Title 42 U.S.C. Chapter 85, Subchapter V. Page 1-6, line 35 states that Spaceport Camden would not be a major source, but Table 4.1-1 estimates a very high 332.19 tons per year (tpy) emission of PM₁₀ particles during the first year of construction. This amount would seem to qualify as a major source (> 100 tpy) that requires a Title V permit (see <https://www.epa.gov/title-v-operating-permits>). Check the estimate and the requirements, and omit statements that a Title V permit is unlikely to be required.

Air Quality Mitigation under mishap scenario: **Mitigation should specify air quality considerations in the Hazardous Materials Emergency Response Plan.** In the context of an accident that impacts air quality, Page 4-4, lines 3-4 mentions the Hazardous Materials Emergency Response Plan (also identified on Page 2-26, line 10). This plan should also be named in the mitigation for air quality under the condition of emergency releases during construction or operations, including a launch or landing mishap emergency. Please add this recommendation to the air quality mitigation section (Chapter 6.1) as well as to the Hazardous Materials mitigation section (Chapter 6.7).

2. BIOLOGICAL RESOURCES

The NMFS documentation and consultation has not been finalized. **The Final EIS should include all specific mitigation measures recommended by the National Marine Fisheries Service (NMFS) once consultation is complete.** Affected commercial, sustenance, and recreational fishers (and their families and dependents), and fisheries researchers have not been given an opportunity to review and comment on the recommendations because they were not included in the DEIS. The FAA should make an effort to invite these stakeholders to carefully review the final EIS.

Mitigation should be specific, include all assertions in the DEIS, and all recommendations of the USFWS (and NMFS when available): **Among 20 assurances given in Ch 4.2, only three are included in mitigation (Ch 6.2). The Biological Assessment appendix and agency responses contain others to include.** All the assurances given in Chapter 4.2 should be included in the required mitigation for Biological Resources (Chapter 6.2). However, only three of roughly 20 assurances are mentioned in the mitigation section: the Lighting Management Plan, the National Bald Eagle Management Guidelines, and the Georgia Power Avian Protection Plan. A Natural Resources Specialist would be hired to implement these. Additional items required by the USFWS include a Wildland Fire Management and Burn Plan, and a Protected Species and Habitat Management Plan.

For the record, the following assurances are mentioned: Page 4-6, lines 10-13: protected species survey and habitat avoidance marks; Page 4-7: Hazardous Materials Emergency Response Plan; Page 4-8: Invasive species control; erosion and stormwater control BMPs; daytime construction only; Lighting Management Plan; nest surveys within 5 days of construction and establishing buffer zones around bald eagle nests; removal of vegetation outside of peak nesting season; following the Georgia Power Avian Protection Plan; installing devices that discourage perching and nesting in areas unsafe; following BMPs for towers. On page 4-11: follow the National Bald Eagle Management Guidelines; no in-water construction activities. Page 4-12 adds: vegetated upland buffer of at least 25 feet along all creeks. Page 4-12 mentions including the yet to be identified conservation measures from the missing NMFS consultation; unspecified permits and requirements to reduce spills, fires, explosions, etc. that could harm vegetation; fire management to return a fire-tolerant community to the area; unspecified permits and requirements for water resources management. Page 4-15 mentions unspecified outcome measures. Page 4-19 mentions security boats to warn of marine mammals out 60 miles and coordinating with NMFS on each launch event. Page 4-20 mentions briefing launch personnel about avoiding sensitive habitats. Page

4-21 mentions maps that identify sensitive species and habitats, but names no one as responsible for updating such maps.

Mitigation of Terrestrial Special Status Species – Longleaf Pine Ecosystems: **Require coordination with longleaf pine restoration organizations and government agencies to identify protection measures.** The DEIS lists a number of construction and operations impacts to special status species and their habitat, including permanent habitat removal, increased traffic, development of new roads, fencing installation (habitat fragmentation), erosion, invasive species, exterior lighting, noise, vibrations, and other impacts. These impacts are generally addressed individually, but the combination of these impacts on terrestrial special status species could be significant. Of particular concern are special status species known to occur on the site, including gopher tortoise and indigo snakes, and those that could occur, including the striped newt. All of these species are found in longleaf pine ecosystems. Mitigation could require Spaceport Camden to coordinate with longleaf pine restoration organizations or state and federal agencies to identify measures to protect and/or restore longleaf pine habitat in coastal Georgia. Other spaceport EISs include similar actions. The SpaceX South Texas Launch Site EIS, for example, includes measures to assist efforts to increase releases or nest boxes in northern aplomado falcon habitat and identify reasonable measures to protect and/or preserve suitable ocelot/jaguarondi habitat within the Rio Grande Wildlife Corridor.

Mitigation for Potential Launch Failures – Support for Cumberland National Seashore and Jekyll Island Authority: **Spaceport Camden should contribute funding/resources to support the general mission as well as launch-induced activities at both Cumberland National Seashore and Jekyll Island State Park.** Even if a launch failure does not occur, such contributions would support the biological resources on Cumberland and Jekyll Islands and help compensate for other impacts that may occur (noise, vibrations, etc.). The chance of a launch failure may be minor, but if one did occur the impacts to biological resources could be devastating, even if emergency procedures mentioned in the DEIS are followed. Existing regulations may not require Spaceport Camden to carry appropriate insurance to cover potential losses to biological resources, including habitat and species on Cumberland National Seashore and Jekyll Island. A contingency fund provides some insurance.

Buffer to protect bald eagles: **A 660-foot buffer should be maintained between active nests and construction, off-road vehicle no closer than 330 feet, and pile-driving no closer than 0.5 miles.** These items are listed in the Environmental Consequences section (Page 4-11, lines 7-9), however, they do not appear explicitly in the mitigation section.

Protection of inactive bald eagle nests: **Destruction of inactive nests may require an incidental take permit since bald eagles return to the nest site year after year.** If inactive nests will be destroyed, the Final EIS must indicate that construction activities are expected to result in take of bald eagles, and an incidental take permit will be required. The DEIS currently states that construction activities are not expected to result in a take of a bald eagle (page 4-11, line 15). Bald eagle nests occur within the construction ROI or nearby (page 4-10, lines 17-20). The DEIS states that active nests with eggs or chicks will be protected until the chicks have fledged. However, the DEIS does not clearly state what will happen to inactive nests. The destruction of a nest would constitute a take under the Bald and Golden Eagle Protection Act.

Sea turtle lighting disturbances: **Restrict annual nighttime launches to months outside of nesting season. Develop the Lighting Management Plan through professional facilitation of interagency**

and technical personnel, using funds from Spaceport Camden. To reduce the risk of take for federally protected Loggerhead Sea Turtles, and reduce degradation of federally-designated Critical Habitat for Loggerhead Sea Turtles within Cumberland Island National Seashore, restrict the proposed annual nighttime launch to November 1 through April 30 (outside of sea turtle nesting season). The Lighting Management Plan, Light Management Plan, and Artificial Light Management Plan should be developed through interagency consultation (personnel from USFWS, Georgia Department of Natural Resources, Georgia Sea Turtle Center, along with technical advisors such as an industrial lighting specialist). The planning process should be professionally facilitated and funded by the public-private spaceport partnership so that limited agency funds are not used to facilitate spaceport planning.

Long-Term Wildlife Monitoring: **Necessary for independent wildlife professionals to evaluate impact of repeated noise and shock exposure from spaceport operations on productivity and mortality of a variety of wildlife for at least 10 years after completion of construction.** The DEIS states that “[n]oise, sound pressure induced vibration, and the visual effect (stimuli) from pre-launch, launch, and landing activities have the highest potential to impact animals” (page 4-14, lines 30-31). Animals could be subject to as much as five minutes of sustained 70 to 117dBA noises during launches, sonic booms between 0.25 and 2 psf, sound pressure induced vibration, and visual impacts (page 4-14, lines 33-43, page 4-15, line 1). The DEIS mentions a startle response as the most common reaction from animals to noise or sound pressure induced vibration, but the long-term response of species to regularly occurring noise, sound pressure induced vibration, and visual stimuli is unknown and difficult to predict. Long-term monitoring is necessary to accurately assess impacts. The DEIS refers to monitoring in Appendix A (Biological Assessment page 35-36 (Appendix PDF page 105-106)), but the duration of monitoring is not specified. The DEIS Appendix A also refers to pre- and post-launch visual surveys for special status species that would occur in the area of impact of launch and landing areas for the first three years of operations (Biological Assessment page 46, PDF page 116). Short-term monitoring will not capture impacts that may occur from changes in operations (i.e., differences in launch numbers from year to year and other changes), and monitoring programs should include both the areas immediately adjacent to launches and landings and other important wildlife areas within the operational ROI (i.e., Cumberland Island National Seashore, Jekyll Island, etc.). Because of the potential for long-term impacts to wildlife, the Final EIS should clearly state that Spaceport Camden will engage a third-party to conduct long-term wildlife monitoring for at least 10 years after completion of construction. Monitoring should include, but not be limited to, all wildlife populations included in Tables 3.2-2, the five species of sea turtle that occur within the ROI, and both species of sturgeon (Atlantic and shortnose) that may occur within the ROI. It should occur in all areas within the operational ROI that may contain populations of these species.

Marine Mammals – Strike Education: **Because of launch spectators in boats, along with clearing the launch corridor, the mitigation should include public education on marine mammal strike avoidance and response targeted up to and on launch days.** Spectators on boats are anticipated (page 4-19, lines 31-32). If they have strike-avoidance training, the potential for marine mammal strikes will be reduced. Maintaining a minimum 50-ft distance from marine mammals is mentioned for security personnel who clear the area 60 miles from shore (Page 4-19, lines 32-34). Appendix A of the DEIS refers to an environmental education program that includes protected species education (Biological Assessment page 39, PDF page 109). To better protect marine mammals during launches, launch-day education of boaters about marine mammal strike avoidance should be a required element of such a program.

Marine Mammals –Distressed Animals at launch time: **Require trained responders to react to distressed marine mammals within the closure area, even if launches must be delayed.** It is unclear what protocols would be in place on launch days if a distressed marine mammal was within the closure area. The Final EIS should clearly state that NMFS and other responders will be allowed to follow all regular procedures in responding to distressed marine mammals within the closure area, even if this necessitates delaying a launch. The DEIS states that access restrictions from marine mammal monitoring, including distressed marine mammals, is unlikely to occur because there are only 12 launches, and that spaceport personnel would coordinate with NMFS prior to launch dates to rectify conflicts (page 4-19, lines 36-41). Nevertheless, provisions for rescuing or assisting distressed marine mammals in closure areas on launch days should be planned.

Migratory bird mortality during construction: **Birds may die flying into tall construction cranes and pile drivers. Evaluate whether this requires a Migratory Bird take permit from the USFWS.** That migratory birds die flying into towers is acknowledged on Page 4-9, line 22. However, line 2 on that same page contradicts this with respect to construction equipment, which includes cranes and pile drivers. Line 2 says injury and mortality are unlikely because “birds can easily avoid (fly away from) construction equipment.” This is simply not the case. Mitigation of such death is needed, which perhaps would include obtaining a Migratory Bird take permit from the USFWS.

Salt marsh is Essential Fish Habitat: **Discuss this value of salt marsh. Mitigate if its use as an environmental buffer is to be allowed in a manner that removes its protection from damage.** Salt marsh is Essential Fish Habitat (http://sero.nmfs.noaa.gov/habitat_conservation/efh.html). No discussion of salt marsh is included in the section on Essential Fish Habitat in the Environmental Consequences chapter (Page 4-18). The ROI includes a lot of salt marsh, which is owned and protected by the State of Georgia. Roughly 10,000 acres of salt marsh is proposed to be used as a buffer for the spaceport. This apparently includes security, safety, and environmental buffer. Use of salt marsh as an environmental buffer could imply that it would be removed from protection from pollution (environmental buffers are usually purposefully set aside between pollution sources and a downstream area to absorb pollutants that would cause damage downstream). Allowing salt marsh to become such a buffer would impact essential fish habitat, so appropriate mitigation would seem warranted.

Invertebrates overlooked: **Almost all species of animals are invertebrates. Some may be of special management concern. Include USFWS and NMFS consultation about the degree of impact.** In the Environmental Consequences chapter, only one sentence is devoted to them (Page 4-18, line 18), and this sentence seems to discount their importance in the area. No invertebrates are mentioned in the Marine and estuarine animals section (Page 4-18, starting at line 31), yet almost all species of animals are invertebrates, including seafoods such as crabs, shrimps, clams, and oysters. Marine invertebrates are taxonomically classified in 34 phyla including Chordata (the one phylum that also has all the vertebrates). All phyla are likely represented in the ROI except perhaps the Placozoa, which may not yet have been found in the ROI (but have been found in South Carolina and elsewhere in Georgia (Pearse and Voigt 2007)). One well-known example is illustrative of perhaps a hundred others: Fiddler crabs are a much studied invertebrate integral to the function of salt marsh as essential fish habitat in Georgia. They are food for a variety of fishes, birds, mammals, and crabs. Toxic chemicals that enter marshes have devastating impacts on fiddler crabs. In addition, fiddler crabs have enhanced sensitivities that help them communicate with one another, avoid predators, find mates, and defend territories. Over time, the sights, vibrations, sounds, and chemical wastes of launches, landings, and mishaps could increase mortality and lower reproductive success of these important invertebrates. Many other invertebrates are similarly

valuable as ecosystem engineers and food-chain intermediates. Any could also be similarly impacted by spaceport operations. An EIS involving an estuary and coastal zone should include a thorough assessment of some key invertebrates.

Deep ocean impacts of rocket debris: **Discuss impacts to biological resources from disposal of expendable rockets at sea, and failures of first-stage landings on barges at sea.** Please comment on the evidence of any impact to biological resources of the practice of allowing first stages to be disposed of at sea by falling, or by failure to land on a barge 200 to 300 miles offshore. Include reference to international agreement and any research done. In particular, consider impacts on marine mammals and deep sea ecosystems and any mitigation guidelines within international agreements.

3. CLIMATE

Climate change analysis: **Appropriately analyze the effect of climate change on Spaceport Camden, as required by the FAA (increased flooding as sea level rises, increased storm intensity and frequency).** According to Section 3.5 of the FAA's 1050.1F Desk Reference, the extent to which anticipated changes in climate can impact the proposed action and alternatives should be included. The launch pad is proposed for a low-lying area within the 100 year floodplain adjacent to an estuary in which sea level has risen about 25-30 mm per year (<https://tidesandcurrents.noaa.gov/sltrends/sltrends.html>). In addition, the launch site should be increasingly subject to flooding by severe storms and very high autumnal "king tides." Although rising sea level and increasing storm frequency and intensity are mentioned as possible impacts on the spaceport (e.g., Page 3-27, lines 12-15), no quantitative analysis is presented that references published sources applicable to the area, as required in Section 3.5 of the Desk Reference.

Hurricane Plan: **Develop and implement a Hurricane Plan that includes elements recommended by coastal resiliency experts:** The construction ROI includes area within a floodplain that seems highly susceptible to impacts from extreme weather events such as tropical depressions, storms, and hurricanes. The DEIS mentions hurricanes only once (page 3-27, lines 12-14). The potential for release of hazardous materials during a tropical storm event may be significant if appropriate precautions and planning are not incorporated into the proposed action. Access to the site may become compromised or limited before, during, and after a significant flooding event. The SpaceX South Texas Launch Site, located on the Gulf of Mexico, had a hurricane plan incorporated into its EIS that embraces the elements listed below. The Final EIS should clearly state that Spaceport Camden will develop and implement a Hurricane Plan including these and other necessary elements determined by coastal resiliency experts:

- Provide elevated and reinforced facilities to withstand wind and waves to mitigate damage and fuel release.
- Size the containment areas around fuel tanks to hold the volume of the largest tank plus sufficient freeboard for a 25-year, 24-hour storm event (or storm frequency and intensity based on climate analysis for coastal Georgia).
- In advance of a storm alert, remove hazardous materials from the site or to high ground.
- Secure to the ground or remove all equipment and loose objects.
- Cancel propellant deliveries.
- Remove vehicles or store in a hangar.
- Communicate storm preparations to local emergency management agencies, USFWS, and Georgia DNR.

Sea Level Rise Plan: **Develop a Sea Level Rise Adaptation Plan that includes provisions for site abandonment if and when sea level rise causes specific measurable impacts on the site.** The construction ROI is vulnerable to sea level rise. Possible problems from sea level rise are given short shrift in the DEIS. Potential impacts are briefly mentioned (page 3-27, lines 12-14, page 4-23, lines 24-27 page 4-24, lines 6-8, page 5-5, lines 28-33, Table ES-1). In every instance except one the statement made is the same, namely, “sea level rise and other climatological changes such as an increase in extreme weather events, may or may not impact the spaceport in the coming years.” The exception, used once, is “[d]ue to Camden County’s coastal location, the area is likely to be more susceptible to the potential impacts of climate change such as sea-level rise and increased frequency of extreme weather events such as hurricanes”. No analysis, preparations, or other responses to sea level rise are mentioned. The Final EIS should provide a detailed analysis of the potential impacts of sea level rise on the construction ROI. The Final EIS should also clearly state that Spaceport Camden will develop a sea level rise adaptation plan that includes provisions for site abandonment if and when sea level rise causes specified impacts on the site (e.g., septic system malfunction or failure, water table rising a specified distance from the surface, flooding of the site a certain number of days per year, other metrics).

4. COASTAL RESOURCES

Coastal Zone Management Plan Consistency Letter: **Report the contents of an approved letter of Federal Consistency with Coastal Zone Management Plan.** Much of interest to coastal stakeholders seems to rest on the Coastal Zone Management Plan Consistency Letter which has not yet been approved by the Coastal Resources Division of Georgia DNR. Of particular concern is the need to resolve the concept of using the tidal marsh as a buffer against Georgia’s Coastal Marshlands Protection Act of 1970. That act allowed Georgia to claim ownership of the tidal marsh. Use of a tidal marsh as an environmental buffer would seem to allow it to absorb pollutants. Normally a wide upland buffer is thought necessary to protect the marsh. Use of tidal marsh as a security or safety buffer would seem to allow it to be patrolled and the public restricted from entering. Normally high tide access is allowed to any marsh as a “navigable water.” Legislative action may be required in order to provide the stated functions of the tidal marshes adjacent to the spaceport.

5. DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Eliminating untenable Overflight Exclusion Zones: **Where possible, the Final EIS should categorically eliminate Overflight Exclusion Zones over Section 4(f) properties.** Assuring evacuation of all uninvolved public within an overflight exclusion zone (OEZ) on Cumberland Island National Seashore, Little Cumberland Island, and Jekyll Island State Park will be difficult. See also our comments on the Land Use section of the DEIS, which includes an analysis of impact to the Cumberland Wilderness experience – a major Section 4(f) issue that we think should be included here instead.

The decisionmaker must consider the unusual nature of the Cumberland Island National Seashore and Jekyll Island State Park. As can be verified by the officials with jurisdiction over these public areas, in both cases, public recreation by a visiting public, and public property are interspersed with private property owners who have their own houses and vehicles, separate binding agreements with park authorities, independent access to these islands, and who independently receive visiting friends and relatives.

Although we recognize that disallowing overflight exclusion zones on all parts of the three islands could obviate an application for a license to operate a launch site at Spaceport Camden, we nevertheless would welcome a statement that would eliminate OEZs at least on Jekyll Island State Park and on any parts of Cumberland Island National Seashore possible to exclude.

Noise on Section 4(f) properties: **Map the 65 dBA L_{Amax} contour to show where outdoor speech-impairing noise would reach Section 4(f) properties.** Ability to conduct normal outdoor speech contributes to the enjoyment of public parks. Plotting the 65 dBA L_{Amax} contour on a map will help the decisionmaker to visualize where outdoor speech-impairing noise would reach over Section 4(f) properties, as described on Page 3-34, lines 13-25. The lowest noise contour shown on Exhibit 4.11-2 is 80 dBA L_{Amax} , but 65 dBA L_{Amax} was the sound level chosen based on “outdoor speech interference as a proxy for potential Section 4(f) impairment” (Page 3-34, lines 18-25).

Increased traffic from mishaps: **Launch or landing mishaps may create constructive use from damage and emergency response in wilderness areas (firefighting, pollution treatment, and debris recovery, habitat restoration).** Include the impact and mitigation of emergency response on Cumberland Island National Seashore and Jekyll Island State Park in the case of a launch or landing mishap that creates overhead explosion, shockwave, ground fire, ground vibration, flying debris, trampling by emergency vehicle response and debris recovery efforts, and a need for habitat restoration and historical building repair. Although such mishaps may be of low chance of occurrence, the consequences could be great enough to consider as a constructive use of Section 4(f) property.

Substantive mitigation: **Proper evaluation of constructive use may require substantive mitigation that could include: purchase of private for wilderness; funding for wilderness management; and requiring local conservation zoning to be maintained with penalties accruing for local variances.** Wilderness experience and historical structures are major attractions to Cumberland Island National Seashore and Jekyll Island State Park. Constructive use appears likely, especially when damage to the wilderness experience and historical properties are brought into consideration from the sections of the DEIS where these are reported (Land Use; Historical, Architectural, Archaeological, and Cultural Resources). Substantive mitigation can also include a contingency fund for evacuation, repairs, and restorations to environmental resources not subject to insurance claims. A contingency fund should be established by the public-private partnership of a Spaceport Camden authority.

6. FARMLANDS

Commercial leases of clam and oyster beds: **Acknowledge these as Unique Farmland and Prime Farmland that are potentially impacted by spaceport construction, operation, and mishaps (especially toxic spills distributed widely by estuarine and tidal circulation).** The Farmland section fails to consider aquaculture leases for clam and oyster farming, which occur in Camden and Glynn County in the estuarine waters near the proposed spaceport and under its launch vehicle flight corridors. Clam and oyster farms are included by the US Department of Agriculture (USDA) and clam and oyster farmers qualify for USDA assistance. Such farmland might qualify both as Unique Farmland and as Prime Farmland. The state helps determine and protect the quality of the environment suitable for aquaculture leases. Contact the Coastal Resources Division of Georgia DNR to identify aquaculture lease areas in Camden and Glynn counties. These leases may be damaged from spaceport runoff, spills, explosions, and other mishaps during construction and operation (including launch and landings

explosions). Estuarine and tidal circulation can quickly spread toxins, sediments, and even too much freshwater runoff from spaceport operations and mishaps to lease areas. Please consider aquaculture leases as unique and prime farmlands in Chapters 3.6, 4.6, 5.3.6, and 6.6). Design of erosion control and storm water retention should avoid damage to shellfish beds and leases. Testing for toxins in retention ponds, creekbank seeps and runoff should be included in mitigation, with treatment of storm water as necessary to protect shellfish quality before release or infiltration into the broader environment. With respect to spectacular mishaps, the chances may seem small to the preparers of the EIS, but the consequences seem to us to be sufficient to warrant plans and mitigation.

7. HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

*Mishaps impacting the flow of RCRA-managed toxic groundwater: **Monitor and prepare to mitigate movement of toxic groundwater into Todd Creek if accelerated by unexpected spaceport actions.***

The decisionmaker needs access to available information that can inform about the potential impact on Todd Creek by spaceport construction, operations, and mishaps that could accelerate: a) the movement of highly toxic groundwater toward Todd Creek; b) the efficacy of the oxygen curtain treatment of the toxic groundwater; c) the erosion of the bank of Todd Creek back toward the landfill; and d) the possibility of damage to the landfill cap (which prevents rain from creating hydraulic pressure to push the groundwater plume toward Todd Creek).

Further analysis may be warranted, so the decisionmaker can accurately assess impact on specific operations. Data are needed not only on vibration and sonic booms from normal launches and landings, and pile-driving during construction, but also data on mishaps, such as launch pad and landing pad explosions that could result in shockwave or shrapnel damage to the landfill cap or the in-situ oxygen curtain (ISOC) apparatus, and to the rates of Todd Creek bank erosion and groundwater movement toward Todd Creek. To interpret the needed data will likely require consultation with Dow Chemical's landfill manager (formerly Mr. Tim King) and the corresponding agency regulator of this RCRA-permit, Mr. John Fonk of the Environmental Protection Division of Georgia DNR.

A variety of related reports have been prepared for Union Carbide and Dow Chemical by CH2MHill in Tampa, Florida. These are highly relevant reports that should be reviewed and referenced where appropriate in the EIS. Otherwise the decisionmaker may not have an accurate picture of the risk to Todd Creek. The reports should be available from Mr. Fonk or Mr. King or his successor at Dow Chemical. The reports describe the contaminants found in the hazardous groundwater plume, the movement of that plume toward Todd Creek, the erosion of Todd Creek back toward the plume, the in-situ oxygen curtain (ISOC) now in place to help remediate the groundwater plume, and the nature of the cap over the landfill. One series of reports involves a Todd Creek Bank Stabilization Plan. Other key documents include Table A in the Hazardous Waste Facility Permit HW-063, which lists the hazardous constituents so far discovered in the toxic groundwater of the RCRA landfill, and The Environmental Covenant between Union Carbide Corporation and the Environmental Protection Division of Georgia DNR dated March 29, 2011, which gives site restrictions for the entire 4,011.54 acre property owned by Union Carbide Corporation.

The 58-acre landfill in question is within the rectangular out-parcel immediately adjacent to Todd Creek just outside the northwest corner of the proposed spaceport Site Plan (See Exhibit 2.1-2 on Page 2-4). Mention of this landfill is made on Page 3-43, Lines 40-43; Page 3-44, Lines 18-19; Page 3-65, Lines 6-7). Referenced in the draft EIS is a preliminary vibration study prepared by Tetra Tech in Jacksonville, Florida (Page 4-127, Lines 9-13). However, the highly toxic nature of this landfill and the groundwater plume under it is not brought forward. More specifics need to be given.

Todd Creek is a large tidal creek along the northern upland edge of the proposed spaceport. It is an integral part of the Satilla River estuary. Seepage or a sudden discharge of the highly toxic groundwater would damage or contaminate Todd Creek with contamination rapidly spreading by estuarine and tidal circulation throughout the estuary and even upstream in the main stem of the Satilla River as well as out to sea and along beaches. Contamination would endanger commercial, sustenance, and recreational water users who have direct exposure to estuarine waters or consume its seafoods. Contamination may also impact human health directly for those who come into contact with the water or breathe contaminated aerosols. Among other species, the highly toxic contamination from that landfill could harm or make toxic any fish and shellfish taken for human consumption, marine mammals (such as bottlenose dolphins, West Indian manatees, and river otters), and fish-eating birds (such as terns, pelicans, ospreys, and bald eagles).

Compare results of two vibration analyses: A vibration study of the RCRA landfill concluded no concern, however, another vibration study indicated damage to historical buildings nearby. Revisit whether damage could occur that accelerates toxic groundwater entering Todd Creek. Results of a vibration study done by Cultural Resources Analysts (2017a) is reported on Page 4-46 and elsewhere in Section 4.8.1 of the DEIS. It was done to evaluate damage to historical structures, but the conclusions warrant another look at the threat of the RCRA landfill toxins to Todd Creek and the Satilla River estuary. Page 4-50, lines 22-36 indicate that cracking and displacement of tabby walls and grave markers could occur because of vibrations from spaceport operations. If vibrational damage can occur to the nearby architectural resources, it may also accelerate toxic groundwater flow toward Todd Creek, crack the landfill cap, damage the in-situ oxygen curtain (ISOC), or enhance bank erosion at Todd Creek, all of which could accelerate movement of toxic groundwater into Todd Creek. We note that a different preliminary study indicated no significant vibration effects on the RCRA landfill (TetraTech 2017, reported on Page 4-127, lines 9-13). The conclusions of the two studies may differ enough to warrant a closer look to compare the vibration levels studied and apply the larger level results to each resource in the same way.

We also urge the decisionmaker to consider launch and landing mishaps that cause explosions, shockwave vibration, flying debris, fires, emergency responses that could damage the landfill cap, damage the ISOC system, hasten groundwater movement toward Todd Creek, or accelerate creek bank erosion. Both vibration studies referenced above should be checked to see if such mishaps were analyzed, and if not, we believe this constitutes a significant uncertainty about environmental health and safety involving the potential to contaminate the Satilla River estuary.

Environmental Covenant of March 29, 2011: Consult with Union Carbide and Georgia Brownfields Program personnel to discuss whether imposed limits on activities must be modified. The decisionmaker should consult with Dow Chemical's landfill manager (formerly Mr. Tim King) and the corresponding agency regulator of this RCRA-permit, Mr. John Fonk of the Environmental Protection Division of Georgia DNR to discuss the status of the Environmental Covenant dated March 29, 2011 between Union Carbide Corporation (now owned by Dow Chemical) and the Environmental Protection Division of Georgia DNR. This covenant gives site restrictions for the entire 4,011.54 acre property owned by Union Carbide Corporation. The restrictions may limit activities on the proposed site for Spaceport Camden, which may trigger covenant modification before construction of Spaceport Camden. Such a modification may require specific mitigation to offset an allowance for impact that is now prevented by the covenant. The Final EIS should include detail about the consultation concerning this covenant.

Assessing a possible Clean Water Act violation: **Require testing for any brownfield toxins now entering public waters immediately adjacent to the proposed spaceport property (to establish a liability baseline prior to construction of Spaceport Camden).** To establish a baseline of brownfield impacts prior to construction of Spaceport Camden, and better accomplish due diligence associated with the brownfields throughout the proposed spaceport site, the Final EIS should require a certified determination of whether a Clean Water Act violation has already occurred at the proposed site of Spaceport Camden. In particular, mitigation (Chapter 6.7) should require offsite testing for any brownfield toxins now entering public waters immediately adjacent to the proposed spaceport property. Samples should be taken from multiple creekbank seeps and runoff streams that enter waters of the United States (the Satilla River estuary and tributaries). Required testing should be geographically comprehensive and include the estuary-adjacent upland periphery of both the Union Carbide and the Bayer CropScience tracts (along Todd Creek, Floyd Basin, and Floyd Creek).

Multiple samples should be tested for all chemical analytes listed in the groundwater monitoring list of 40 CFR 1(I), Part 264, Appendix IX. Testing the analytes on this list is standard practice for hazardous sites, including the groundwater from the RCRA landfill site managed by Union Carbide that is immediately adjacent to the proposed spaceport boundary. Chemicals found in the samples should be compared to the chemical constituents known for the groundwater of the RCRA landfill managed by Union Carbide, and any chemical wastes, residues, and byproducts that are common in the manufacture of Temik (i.e., aldicarb), which was manufactured at the site by Bayer CropScience until 2012.

Testing the Bayer CropScience tract: **If acquired or leased, the Bayer CropScience property should be tested for hazardous wastes and enrolled in the Georgia Brownfield program if appropriate.** Little is known about the status of toxins, waste disposal areas, a spray field, and possible unexploded munitions on the Bayer CropScience property. The Union Carbide Property is much better known with respect to these things because of intense management scrutiny by the State of Georgia and RCRA permitting. Bayer CropScience has not been subject to this same scrutiny, but may be found deserving of such management once tested. As mentioned in our comments in our earlier section on Site Plan, Infrastructure, and Management Planning, at least a portion of Bayer CropScience property seems necessary in order to build and use heavy roadways for the return of first stages barged to the dock. Other indicated uses include the siting and construction of an alternate control center and visitor center. The Final EIS should specifically require such testing if any portion of the Bayer CropScience tract is leased or acquired for use in spaceport construction or operations.

8. HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Completing SHPO consultation: **Resolve issues of damage assessment and mitigation with the State Historic Preservation Officer.** The mitigation section (Chapter 6.8) includes worthy items because adverse impacts of vibration are expected, however, the mitigation steps await concurrence with the SHPO. In the mitigation section (Chapter 6.8), describe the processes of damage assessment and repair that would be required. Include consideration of mishap impacts (explosion shock waves, fires, flying debris, impacts of parts recovery, need for resource restoration).

Creditable mitigation items already listed on Pages 6-4 and 6-5 include: monitoring for damage and making necessary repairs; NRHP eligibility testing and archeological data recovery if construction cannot avoid sites; development of resource management plans for affected resources; and continued consultation with the SHPO and NPS. However, the mitigation section does not seem complete, given certain impacts mentioned earlier in the document. These include the following:

Statement needed in mitigation (Ch 6.8) – Bayer CropScience tract: **If leased or acquired, survey Bayer CropScience property for Archeological Resources.** Page 4-47, lines 18-22: Bayer CropScience property has not been surveyed for Archeological Resources. Mitigation steps should include such a survey if Bayer CropScience property is to be used for spaceport construction or operations.

Statement needed in mitigation (Ch 6.8) – site reporting: **Discovery of archeological or historical sites during construction must be reported, possibly triggering additional Section 106 consultation.** The discovery and reporting of additional archeological or historical sites during construction (described on Page 4-47, lines 23-28) should be required mitigation.

Statement needed in mitigation (Ch 6.8) – Agreement: **The Section 106 Programmatic Agreement mentioned in Ch 4.8 should be required in the mitigation section.** The Section 106 Programmatic Agreement mentioned on Page 3-54, lines 37-38 should be required in the mitigation section.

Statement needed in mitigation (Ch 6.8) – Specifics: **Define the objectives of the resource management plans and continuing consultations with the SHPO and NPS.** Although listed in the mitigation section (Page 6-4, lines 36-38), the resource management plans and continuing consultations with the SHPO and NPS need more specifics, at least to define the objectives of the plans and consultations.

Assessing damage probability: **Damage to structures is given at 1 per 100 per event, implying an occurrence within 3 or 4 years at 12 launches per year. Acknowledge, and give the necessary mitigation.** On Page 4-50, lines 33-36 the damage probability to structures is said to be low, however, with 10 engine tests, 10 launches, and 10 landings per year, it would seem that damage is very likely to occur within 3 or 4 years. The Final EIS should give an accurate representation to the decisionmaker about structural damage, include effects of launch and landing mishaps, and provide appropriate mitigation, which should include a contingency fund provided by the public-private Spaceport Camden authority with funds set aside to repair historical and architectural sites damaged by spaceport operations. Substantive mitigation could also include acquiring ownership of historic and architectural resources, providing management funding for historic, architectural, archeological, and cultural resources, that could include museums and public tours.

9. LAND USE

Relocate damage to the Wilderness experience to Section 4(f) constructive: **The discussion of wilderness impacts the concept of constructive use and should be relocated to those sections of the EIS dealing with constructive use of Section 4(f) properties.** Below are a number of comments that together show that the draft EIS significantly underrepresents damage to the wilderness experience on Cumberland Island National Seashore. The impact may create a significant constructive use, so this entire analysis should be relocated to the sections dealing with Section 4(f) of the Department of Transportation Act. The following comments should be addressed and corrected before the decisionmaker considers whether impacts to the wilderness experience are significant and lasting.

Evaluating the wilderness experience on Cumberland Island National Seashore: **Impact seems underestimated for invalid reasons (location in eastern US, presence of few people, changing**

viewing angle if disturbed, using DNL for pile-driving noise, assuming no construction on nights & weekends, failure to include highly consequential mishaps). Cumberland wilderness is among the best wilderness experiences available in the eastern United States because most development has left, few private property owners remain, and access is limited and controlled. Impact from the proposed spaceport should be evaluated in a context of the ability of the eastern US to have any wilderness experience.

Eastern US Wilderness: It is very difficult to have a wilderness experience in the eastern United States that is comparable in quality to less populated and less historically occupied areas of the country found elsewhere. Any eastern US wilderness would seem relatively “degraded” in primitiveness, solitude, evidence of human development, naturalness and other qualities used to evaluate wilderness. All eastern wilderness is somewhat degraded by standards that include the western mountain and plains states. This baseline degradation should not be used as a reason to degrade it further (Page 4-54, line 21 through Page 4-55, line 13; Page 4-57, lines 2-9; Page 4-63, lines 2-4). Instead, baseline degradation should be a reason to elevate the degree of impact of any new small changes that degrade wilderness further. When partial degradation occurs, it is reasonable to imagine that total degradation could sooner reach a tipping point that might eliminate the wilderness experience altogether.

Wilderness Experience Mitigation: The decisionmaker at the FAA can do a better job protecting the wilderness with the ROD for this EIS. This will require substantive mitigation that could include: purchase of significant amounts of private land to set aside as wilderness; providing significant funding for wilderness management; and requiring local conservation zoning to be maintained with penalties accruing for local variances.

Noise from pile-driving will be more damaging to the wilderness experience than implied on Page 4-56, line 34. Give pile-driving noise in L_Amax units not DNL units. Use Table 4.11-1 (Page 4-70) to discuss pile-driving noise in the Cumberland Wilderness area, which may be over 50 dBA. In addition, median sound levels for all of Cumberland Island (36 to 38 dBA, Page 3-67, line 4), are likely to be higher than the levels, frequency distribution, and natural quality of sound in the Cumberland Wilderness. Wilderness sound level should be distinguished from median sound level. The zone where median sound levels are reported as DNL is inappropriate for comparing to the noise level data provided for the Cumberland Wilderness, which was not given as DNL. A comparison between Exhibit 4.11-1 and 4.11-2 shows the magnitude of difference between DNL units and L_Amax units). A better job concerning noise is done for operation (Page 4-60, lines 13-25; Exhibits 4.11-2, 4.11-3, and 4.11-4).

Night and weekend construction: The Final EIS should not continue to assume that pile-driving and other construction work will be done only during regular work days (Page 4-56, line 44 through Page 4-57, line 2). Night and weekend construction work typically occurs to be able to meet construction schedules without penalties. Enforced construction silence on nights and weekends should be a mitigation requirement in the ROD.

Highly consequential mishaps: Page 4-55, line 34, through Page 4-56, line 6 identifies no physical changes to historic and cultural structures on Cumberland Island and no vehicle use of Cumberland Island. However, launch or landing mishaps that affect Cumberland Island may increase traffic in wilderness areas in order to fight fires, treat pollution from unburned fuel, and recover debris. These impacts would seem to be a type of “constructive use” of Cumberland Island National Seashore (see our comments about Section 4(f) properties).

Shifting one’s viewing angle is not an appropriate way to discount impact on a wilderness viewing experience (Page 4-57, line 32). The wilderness experience is surely more holistic than that. Once objectionable non-wilderness views are noticed, it would be hard for most wilderness seekers to remove them from their thinking simply by adjusting their viewing angle.

Few people in wilderness is not an appropriate reason for an EIS to discount impact on a wilderness experience (Page 4-57, lines 40-43). A wilderness experience depends on having few other

people being present. Likewise, when park usage is lowest, the wilderness experience may be enhanced. Seasonally low visitation of Cumberland Island should not be used as justification for lack of significance of impact to a wilderness experience as done on Page 4-58, lines 25-27.

Page 4-59, lines 28-30: The idea that many launches would occur at times when people are not present in the northern part of Cumberland Island is equivalent to saying that some launches will be done when people are present. Launch activities and closures will impact park visits to the northern most reaches of the island. Therefore, the Final EIS should clearly state what must be done to care for those people in those cases.

Limits to flight corridors: **State whether the two representative trajectories to the north and south are binding limits of impact, such that none would be allowed outside those limits.** In the Proposed Action section of Chapter 2 (Section 2.1) clearly state whether trajectories would be allowed outside the trajectory limits shown in this EIS. Page 4-59, lines 3-4 of Land Use indicates that these are binding limits, however, unless the Final EIS explicitly states otherwise, we have been led to understand that other flight corridors could be allowed at launch vehicle licensing time. To prevent launch license applications for untenable flight corridors, the Final EIS should identify these limits in the Chapter 2 at the point where the range of trajectories is first introduced (Page 2-6, lines 7-14). These limits then should help frame all environmental consequences and mitigations that involve flight corridors (not simply here in the Land Use section).

Residents in flight corridors: **Although residents of Little Cumberland Island will be impacted, no detail is given about how this can be mitigated in a manner that follows FAA rules.** Land use on Little Cumberland Island is a particular problem that has resulted in non-standard recommendations for designating “authorized persons” to remain on their property there during launches. Page 4-59, lines 26-27 describes impact to these property owners. It is not clear that this can really be allowed under current FAA rules if they would remain within an Overflight Exclusion Zone (OEZ). Please clarify how residents on Little Cumberland Island will be treated in such a way as to follow FAA rules. This sentiment is also expressed in the first section of this document entitled Comments on General Organization and Content.

Launches when people are present: **Launch activities and closures will impact park visits to the northern most reaches of the island. Clearly state what must be done to care for those people in those cases.** Page 4-59, lines 28-30: The idea that many launches would occur at times when people are not present in the northern part of Cumberland Island is equivalent to saying that some launches will be done when people are present. This needs to square with the FAA rules about Overflight Exclusion Zones and also with the curious notion of allowing “Authorized Persons,” a concept repeatedly presented but not adequately defined against current regulations. As with our concern for residents in flight corridors, this sentiment about park visitors affects Section 4(f) considerations, and is also expressed in the first section of this document entitled Comments on General Organization and Content.

10. NATURAL RESOURCES AND ENERGY SUPPLY

Roadway estimates: **Differences occur in figures may indicate an error in total amount of roads and amount of heavy roads under the Ocean-Landing Only Alternative.** In Chapter 2, on Page 2-37, lines 19-22, an incorrect statement is made about the need for less heavier road in the Ocean-Landing Only

Alternative. This same error may have been repeated in the calculation of less pavement needed for the Ocean Landing Only Alternative in the Natural Resources (Section 4.10.2.1, Page 4-68, line 16). Check this and correct it there too. As described on Page 2-16 (lines 1-4), a heavy road to the dock will be needed for offloading a returning first stage from the barge. Correct this, and also check the figure of 11,250 linear feet of heavier road used in line 22 (see next comment). Page 2-38, lines 6-9 states that 1 mile less of heavier road would be needed. This difference may be based upon the erroneous idea on Page 2-37 that the heavy road to the dock would not be needed with the Ocean Landing Only alternative.

In addition, Table 2.1-4 (Page 2-20) identifies 924,000 square feet of roads, however, Page 4-65, line 11 states that new roads would total 823,200 square feet. The decisionmaker may benefit from an explanation of the difference of 100,800 sq ft. This may also connect back to the error on Page 2-37.

Heating fuel: State the type and amount of fuel to be used for heating (said not to be natural gas, but no alternative given). One of the largest uses of energy in buildings typically is for space heating. Page 3-71, lines 21-22, which state that natural gas will not be used for heating, contradict the statement on Page 3-70, line 7, in which natural gas is said to be used for heating. Page 4-67, lines 13-14 repeat that natural gas will not be used. If not, then state the energy source that will be used for heating during both construction and operation. Propane is commonly used in place of natural gas in rural areas. Use of propane is stated in Table 4.7-1 (Page 4-35) and on Page 4-40, line 17. The Final EIS should quantify propane use and identify the energy sources used for heating and quantify them as well.

Barge fuel: Estimate the increase in barge fuel required in the ocean-landing only alternative in order to more frequently transport barges to and from a point 200 to 300 miles offshore. Page 4-69, lines 13-14: The additional need for barge fuel under the ocean-landing only alternative seems very large given the need to transport barges to and from a point 200 to 300 miles offshore. Please provide the decisionmaker with a quantitative estimate of this difference. However, avoid the erroneous assumption that only one ocean landing per year is likely with the Proposed Action, and 12 are likely with the Ocean-Landing Only alternative. Each would allow from none to 12 per year. A reasonable estimate is needed in this section and in all other parts of the EIS where an unreasonable assumption is made.

Repeated incorrect representations are made in the Biological Resources section about the frequency of ocean landings in the Proposed Action compared to the Ocean-Landing Only Alternative (Page 4-19, line 31; Page 4-22, line 11 and lines 21-22). The difference in number of ocean landings between those two alternatives should be less than stated. It is not true that only one ocean landing is expected under the Proposed Action, or that 12 are expected under the Ocean-Landing Only Alternative. Anywhere from zero to 12 ocean landings would be allowed under either alternative. The Proposed Action seems likely to involve fewer ocean landings, as the option will remain open to land a first stage on land. However, nowhere in Section 2.1.2.7 is the number of ocean landings said to be reduced. Moreover in either alternative, launches would be allowed that use expendable first stages that fall into the ocean and are not recovered (see Page 2-34, lines 7-8 and footnote 23).

Electricity infrastructure: Re-examine the estimated figure of 31 million kWh per year of electrical use and recheck the infrastructure requirements. Page 3-72, lines 20-27 discuss infrastructure for electricity, however, it does not indicate whether this infrastructure will be sufficient to support the supposed 31 million kWh per year of electrical use described on Page 2-16, line 28-29. The 31 million kWh per year figure seems high, so this should be rechecked before reconsidering the infrastructure requirements. On Page 5-8, lines 6-16: The proposed electricity use of 31 million kWh per year is a very large amount – enough to power the electricity use of a community of 2,700 people in the United States, with all its residences, businesses, services, industries, and government. It would seem that if

development occurs outside the spaceport, but on the approach to it, greater capacity will be needed for electric generation and transmission. This could result in a cumulative impact that requires replacement or enhancement of existing infrastructure and generating capacity. Again, check the electricity use figures used in the DEIS and correct these as necessary. 31 million kWh per year seems high.

Mitigation (Ch 6.10) -- Recommend LEED building design: **Chapter 4.10 recommends using the principles outlined in LEED building design for Spaceport Camden. Strengthen this recommendation by including it in mitigation.** Page 4-67, lines 26-27 recommends using the principles of Leadership in Energy and Environmental Design (LEED) for Spaceport Camden. This recommendation should be included the mitigation section (Page 6-5).

Mitigation (Ch 6.10) – Groundwater safety: **Groundwater testing for brownfield toxins in groundwater taken from any depth for any purpose is needed both before it is used and frequently thereafter.** The overall amount of groundwater use is not a great concern (Page 4-66, lines 19-32; Page 4-126, lines 28-34), but the possible contamination of that water is. Some shallow groundwater at the proposed site is known to be highly contaminated, and more may be found upon careful inspection. Even a remote possibility that geological cracks and fissures have already allowed contaminated shallow groundwater to penetrate into the deeper aquifer below it creates a need for health and safety assurances based on frequent water quality monitoring. Contamination of the supply can also occur without geological fissures and cracks if the existing well-casing is not well sealed. Polluted shallow groundwater can move downward along the outside of the well casing and ultimately into the intake of the pipe. Finally, the typical cone of depression that forms around the intake during pumping can draw shallow groundwater through permeable layers toward the well. The proximity of contaminated groundwater to the cone of depression should be identified and its movement toward the water intake should be monitored.

11. NOISE AND NOISE-COMPATIBLE LAND USE

The accompanying study (Appendix C) seems well done. It examines a “medium lift class launch vehicle” (MCLV) (Appendix C, Page C-5). The description of the thrust used in the analysis is in the medium-large payload range, so seems reasonably applicable to the proposed action. However, the mitigation section (Chapter 6.11, Page 6-6, lines 2-3) is extremely sparse and seems wholly inadequate. The suggestion to minimize trajectories over populated areas has little meaning in this case given the range of trajectories always appear to involve the same affected population. Minimizing nighttime launches seems ineffective since they are said to only occur once per year anyway (though that could be reduced to zero, or to once every two or more years). We offer our mitigation recommendations in the comments below:

Assurances about vibration- and shock wave-induced movement of toxins to adjacent waters: **Give evidence that noise, vibration, sonic booms, or explosions during mishaps will not accelerate movement of RCRA landfill toxins or toxins from the Bayer CropScience property.** Give the decisionmaker all the evidence that noise, vibration, sonic booms, or explosions during mishaps will not accelerate erosion of the bank of Todd Creek (page 4-75, lines 9-10), or mobilize toxic groundwater associated with the RCRA landfill or the lesser known Bayer CropScience spray field. This is highly relevant to the brownfields issues at the site (see our comments about section 7. Hazardous Materials, Solid Waste, and Pollution Prevention).

Noise damage to double-paned windows: **Damage to the seals causes fog between the panes. Damage occurs at much less force than window breakage, but the repair cost is similar.** An impact of noise that is not mentioned is damage to the seals in double-paned glass windows, now commonly used to enhance home insulation. Damage to the seals causes the windows to fog between the panes. This damage occurs at much less force than window breakage, but the repair cost is similar. Please include an estimate of damage to the seals of double-paned windows so that damage claims by the uninformed public may be easier to make if window fogging occurs as a result of normal launch-induced vibrations, sonic booms from landings, or shock waves from mishap explosions.

Noise exposure to “authorized persons”: **Exposure to noise of “authorized persons” on Cumberland and Little Cumberland Islands should be addressed.** The notion of allowing certain people not involved with spaceport operations to remain on these islands during launches and landings creates a concern about their health and safety from exposure to noise. The final EIS should contain appropriate comments on the potential for hearing damage or simply for failure to hear important safety messages, such as warnings that may be issued by text, telephone, or loudspeaker. Wearing hearing protection could also interfere with receiving otherwise audible messages. Mitigation may need to include hearing protection, hearing safety education, and visual warning methods. Include damage from explosion-induced shockwaves emanating from launch or landing failures. Although such failures may be rare, hearing loss is a vital consequence

Noise from mishap explosions and crashes: **Analyze disturbance to wildlife, hearing loss, damage claims to windows and structures, Todd Creek bank erosion, and movement of toxic groundwater.** As mentioned in our comment on *Risk Analysis* in first section of this document (Comments on General Organization and Content), shockwaves from explosions and crashes associated with launch and landing failures is a type of noise that has not been adequately examined. Failure-induced shockwaves should not be dismissed because they may be unlikely because the consequences are so great that planning seems warranted. The risk analysis can be based on the best estimates of professional analysts with access to failure statistics. If such statistics are not available, then the uncertainty rises. Uncertainty of the chances enhances the perception of risk that drives an even greater need for analysis. Risk analysis given uncertainty about the chances of an event is typically done by using a range of failure estimates.

Noise Mitigation –limit duration of the construction phase: **Limit duration of construction with delay penalties in contracts that can be used to fund wildlife and wilderness management.** A requirement that construction be limited to a certain reasonable duration (15 months) with financial penalties if longer, would be valuable mitigation. Penalties could fund wilderness management on Cumberland Island and wildlife management at the spaceport (to offset noise disturbance to people and wildlife productivity during construction).

Noise Mitigation – prevent night and weekend construction: **Contracts should specifically disallow night and weekend work. A lack of significant impact is based upon such assurances.** Construction contracts should specifically disallow night and weekend work. Oft-repeated assurances in the draft EIS say construction will not occur at night. Disallowing night time construction work should be a mitigation requirement because a lack of significant impact seems based upon those assurances. If financial penalties for failure to meet construction deadlines are in a construction contract (see previous comment), and night and weekend work is not disallowed, then night and weekend work seems more likely,

especially as deadlines approach. To prevent night and weekend work, construction contracts must be written accordingly.

Noise Mitigation – Identify where to make damage claims: **Damage claims may range from damaged windows and historical sites, to claims for damaged hearing and disrupted wilderness experience.** Mitigation should require that the Spaceport Camden authority identify where damage claims are to be made, what remedies are available, and the sources of funding for those remedies.

Noise Mitigation – Night launches: **Strengthen the assurance that no more than one nighttime launch could be allowed per year by disallowing it, rather than having it trigger the need for a supplemental EIS.** The proposed action states that “One of the 12 launches could be a night launch” (Page 2-21, lines 4-5). Presumably no more than this could be allowed without a supplemental EIS. Alternatively, for a more effective mitigation of night noise, the Final EIS can expressly disallow more than one night launch and landing per year, thereby averting unsuitable launch applications once that quota had been filled in a given operation-year.

12. SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, & CHILDREN’S ENVIRON. HEALTH AND SAFETY RISKS

Interruption to ocean-based commerce: **Quantify the economic consequences of expected interruptions to ocean-based commerce (commercial fishing, shellfish farming, and shipping to and from Brunswick).** Closures along the flight corridor interrupt various socioeconomic activities from the launch point to the extremum in the open ocean, hundreds of miles offshore where expendable launch vehicles are allowed to fall, or first stages are landed on barges. These temporary closures can interrupt commercial seafood harvest of clams, oysters, shrimps, and fishes in coastal Georgia, interfere with tending clam and oyster farming operations on aquaculture leases under the flight corridor, and slow the transfer of shipped goods to and from the Port of Brunswick and other ports where shipping lanes must wait to cross closure areas. The interruptions may seem relatively short, but they have financial consequences to industries that must keep tight schedules, or are operating in a cash-flow manner where equipment is mortgaged and payments are due. The Final EIS should quantify the economic losses to ocean-based commerce caused by closures along launch-vehicle flight corridors.

Damage to seafood harvest: **Discuss potential for damage from spaceport operations (including mishaps), and recommend compensation of lost income to commercial fishers.** The ocean and estuarine waters along the proposed range of launch vehicle flight corridors include large areas used gathering seafood for commercial, recreational, and subsistence use. Major seafoods in the vicinity of the proposed spaceport and flight corridors include shrimps, crabs, oysters, clams, and several finfishes (e.g., seatrouts, flounders, white catfish, drums, snappers, groupers, and seabasses). A section should be devoted to fishing and seafood gathering in Chapters 3.12, 4.12, 5.3.12, and 6.12. The Final EIS should consider the potential for damage both to commercial clam and oyster leases and to public shellfish harvest areas caused by the spread of toxins from an accident site into such areas by way of estuarine and tidal circulation.

Toxic runoff and seepage from spaceport operations or from the adjacent RCRA landfill, and toxic releases from catastrophic mishaps of launches and landings could pollute oyster and clam beds. These beds require excellent water quality in order to remain open. Moreover, should the toxic groundwater under the RCRA landfill reach Todd Creek, serious contamination of the entire Satilla River

estuary could result (see our comments about Hazardous Materials, Solid Waste, and Pollution Prevention). Toxin release from the RCRA landfill could damage commercial, subsistence, and recreational fishing, as well as tourism.

Furthermore, subsistence fishing and shellfish harvest support some families and children in Camden and Glynn Counties. Damage to approved harvest areas or to the safety of fishes may disproportionately impact those who depend on subsistence catch and harvest. Mitigation could include an effort to identify those at risk, notify them of launches and spill emergencies that may impact the safety of seafoods harvested from the vicinity of the Spaceport or flight corridor.

Commercial shrimping must be suspended during launches, which may affect income enough to require some sort of compensation to affected shrimpers, as indicated in the thesis of Rossiter (2017), available at: https://getd.libs.uga.edu/pdfs/rossiter_ian_r_201712_ms.pdf. An executive summary of this work may be obtained from Dr. Mark Risse, Director, Marine Extension and Georgia Sea Grant, University of Georgia, Athens, Georgia (document is entitled, “*Independent Research Executive Summary: Charting Contentious Spatialities Between Commercial Shrimping and Spaceport Industries*”).

Damage to shellfish farming research: **Research must be suspended during launches, which could affect present and future shellfish farming income. Require compensation for lost research data.** Oyster and clam farming is being developed in Camden County on aquaculture leases from the State of Georgia. In addition, newly approved beds of clams and oysters are open for public harvest under the proposed launch vehicle flight corridors associated with Spaceport Camden.

Shellfish farming and shellfish farming research must be suspended during launches, which could affect present and future shellfish farming income. Mitigation could include compensation for lost income and research data. Our comments about Farmlands reiterate these concerns and suggestions.

Forestry: **The section on Forestry needs work to accurately reflect the importance of forestry to the economy of southeastern Georgia.** Pages 3-82 and 3-83: This entire paragraph on Forestry is very poorly written. Forestry is very important to the economy of coastal Georgia. It should be treated with far greater care than shown in this paragraph (see some suggestions in the Typographical errors section below). Forestry, primarily pine silviculture, is the prevalent land use in the county and region. Forest practices produce a variety of wood products from cellulose fiber and turpentine chemicals to saw timber. Wildlife is an important feature of managed forests, including those adjacent to the proposed spaceport. Wildlife management in forests includes hunted wildlife, especially deer, and species of conservation concern, such as gopher tortoises and indigo snakes.

Land in pine silviculture is abundant both east and west of US 17 (not just west as stated on Page 3-83, line 6). Harvestable pine plantations are found in many locations not zoned as agricultural land use. The spaceport property itself includes some land in silviculture, as pointed out on Page 4-32, lines 9-11. Managed forests nearly surround the spaceport as well, all of which are east of US 17.

Addressing scoping comments: Page 4-90, lines 11-24 -- **Thank you for addressing some important scoping comments. Such would be highly appropriate and much appreciated if done in all sections of this EIS.** We have been dismayed by the lack of appropriate treatment of important and relevant scoping comments submitted during the Public Scoping period in January 2016. We very much appreciate the consideration of a few of these in this section. We request that similar effort is made in all sections of the Final EIS to explicitly address key scoping comments in a similarly overt manner.

“Authorized Persons”: **Whether or not these authorized persons could remain in the Overflight Exclusion Zone must be clearly communicated to everyone involved.** Such does not seem allowable under FAA safety rules, so we question how authorized persons are defined and how rules may be modified if required (see our comments about *New Safety Terminology* in the first section of this document (Comments on General Organization and Content). In addition, the notion of a VIP launch-viewing pass may not seem like sufficient compensation to those who want to leave the islands or would be required to relocate during launches.

“Significant unmitigated impacts”: **Drives the need to provide principles of significance determination.** We strongly feel that the principles used to find significant impacts and drive mitigation actions should always be shared with the readers of any EIS. Moreover, it should be certain that the EIS preparers and the FAA’s decisionmakers share the same principles and concepts of significance determination.

Page 4-93, lines 28-29 about Environmental Justice use the phrase “no significant unmitigated impacts.” This phrase is repeated for Children’s Environmental Health and Safety Risks on the same page (line 31), and again twice on Page 4-96 (lines 25 and 32). In similar significance conclusions about other resource categories, a phrase “no significant adverse impacts” is used (e.g., Page 4-25, lines 15-16; Page 4-127, line 14 and 17), and in other places the phrase is simply “no significant impact” (e.g., Page 4-25, line 21; Page 4-26, line 27), or no significant xxx impact (e.g., xxx= “noise” on Page 4-90, line 5).

The idea that significant unmitigated impacts may be distinct from other significant impacts is one reason that we request an authoritative statement about the principles of significance determination and the meaning of impact mitigation as used in this EIS (see *Principles of findings of significant impact* under Comments on General Organization and Content at the beginning of this document). Although no findings of significant impact occur, many mitigation steps are recommended. This adds to the confusion about whether there are significant impacts that must be mitigated or the impacts for which mitigation suggestions are offered are truly insignificant impacts without implementing the mitigation suggestions (such that the mitigations mentioned could seem like optional suggestions rather than essential).

Mitigation -- Notifications: **Commercial clam and oyster farmers must be notified of launches.** To be thorough, the mitigation on Page 6-6, lines 13-14 should explicitly include notification of clam and oyster farmers and associated researchers in addition to commercial fishermen so that those involved in these important socioeconomic activities can better schedule their work around launch days.

Mitigation -- Disruption: Page 6-6, lines 15-16: Explain some of the aspects of coordination with management that are needed in order to reduce disruption. Specific elements to be covered with coordination with the management of Cumberland Island would be most welcome, especially considering the necessary distinction between “authorized persons” and others. An important aspect is how to locate these different categories of people at the proper time and lead them effectively to safe zones. The situation seems inherently disruptive and very difficult to manage.

Children’s Health & Safety Risks: Consider the 80 dBA L_{Amax} noise level impact to children at Camp Jekyll on Jekyll Island. Sound reaching Camp Jekyll is within the 80 dBA L_{Amax} noise contour (Exhibit 4.11-2, Page 4-77). Children’s hearing sensitivity may cause annoyance, and camp activities may be disrupted by launch noise. Please address the amount of disruption and whether any hearing damage is possible to children. Education of parents and children at Camp Jekyll, schools, and community gatherings may help mitigate these impacts. Whether or not hearing protection is needed at this sound level should also be stated.

The National Institutes of Health reports that sounds above 85 dBA can induce hearing loss <https://www.noisyplanet.nidcd.nih.gov/parents/too-loud-too-long>. See also <https://www.entnet.org/content/noise-induced-hearing-loss-children>. Children live at Harrietts Bluff which is within the 85 dBA L_{Amax} contour. Please address hearing loss probabilities within the 85 dBA L_{Amax} contour. Recommend hearing protection and education as appropriate.

Children's Health & Safety Risks: Consider **Impacts to children by the total sound energy within the 111 dB L_{max} contour**. Children live, play, and study at points within the 111 dB L_{max} contour. The total sound energy may vibrate windows, shake items, and be felt by children in addition to the disturbance caused by hearing the sound. Such vibrations and shaking may be disruptive to learning and be frightening. Mitigation could include education of parents and children in community centers, schools, and day care facilities about the intensity and duration of disturbances, with appropriate assurances about health and safety.

13. VISUAL EFFECTS

Praise for the Visual Effects sections: **The region and various spaceport design considerations are treated with great care for visual impact and night lighting.** In general, the sections of this draft EIS that concern Visual Effects treat the region and various spaceport design considerations with great care for visual impact and night lighting. It seems to be among the best work given in the draft EIS – an example for other sections to achieve. Page 4-117, lines 25-27 recommends using LEED program for designing facilities. This recommendation should be repeated in the mitigation section (Section 6.13). Page 6-6 details some of the components of the “Artificial Lighting Management Plan.” The lighting plan should be coordinated with the USFWS Lighting Management Plan for consideration of disturbances to nesting and hatching sea turtles and to other wildlife.

Unfortunately, the recommended web link is broken to the Bureau of Land Management about paint color selection techniques for structures. Use of native plants with low irrigation requirements is recommended, as is using existing utility corridors for new utility infrastructure. Thankfully, these professionally done sections on Visual Effects never suggest that offensive views be mitigated by changing one's “viewing angle” as suggested in the section on impacts to Land Use (Page 4-57, line 32).

One concern raised, however, is the choice of viewpoint location used on Little Cumberland Island (Viewpoint No. 14 in Exhibit 3.13-3 and Table 3.13-1). The only point on Little Cumberland Island was on the east side of the island where views of the spaceport are blocked by terrain and forest (Table 3.13-1). The most offending view of the spaceport to residents of Little Cumberland Island would be from the west side, where viewers would have a view similar to that experienced at Cumberland Wharf (Viewpoint No. 4 in in Exhibit 3.13-3 and Table 3.13-1). Please expound upon the view that the many property owners on Little Cumberland Island will have when they visit that side of this small island.

14. WATER RESOURCES

Wetlands: **Compliance with existing wetlands protection laws should be sufficient for mitigation of damage to isolated wetlands within the uplands of the construction ROI. However, greater protection may be warranted doe the tidal marshland and surface waters adjacent to the spaceport.** The usual protective and mitigation processes involved with complying with Sections 401, 402, 404, and possibly 313 and other parts of the Clean Water Act, as required in Georgia, seem sufficient to protect and

mitigate damage to the freshwater wetlands disturbed on the site, and concerning sediment and pollutants entering adjacent waters. However, greater protection may be warranted in Georgia for the tidal marshland adjacent to the spaceport. One mitigation suggestion is to reserve a wide, protective upland zone between any spaceport activity (including mowing and pruning) within 200 ft of the normal high water mark in the adjacent intertidal zone. This kind of protective zone will help maintain high quality estuarine water, protect the essential fish habitat associated with salt marsh ecosystems adjacent to the spaceport, and will help preserve the opportunity for future designation of the Satilla River estuary as a Wild & Scenic River. The wide zone to protect tidal marshland could be added to the section on wetlands mitigation (Page 6-9).

On a separate issue, note also that the State of Georgia claims ownership of tidal marshland under its Coastal Marshlands Protection Act of 1970 (Page 3-106, lines 14-17). "The State holds title to the beds of all tidewaters within the State up to the high water mark, except where a private party's title to a tidal waterbed is based on a valid Crown or state grant. *Black v. Floyd*, 280 Ga. 525, 630 S.E.2d 382 (2006); OCGA § 52-1-2." Any proposed use of tidal marshes for spaceport operations, including as safety, security, and environmental buffers seems likely to be subject to negotiation with the State of Georgia.

Groundwater: Concerns about the hazardous groundwater associated with the RCRA landfill and Bayer CropScience spray field are paramount. The amount of groundwater withdrawals proposed seems very small compared to typical urban and industrial withdrawals in southeastern Georgia. However, concerns about the hazardous groundwater associated with the RCRA landfill are paramount. Mishaps of launches and landings may damage the landfill more than the preliminary vibration study indicates (Page 4-128, lines 9-13). Moreover, given the history of hazardous waste disposal onsite, groundwater withdrawal onsite or in adjacent sites, withdrawn from any depth and for any purpose, may warrant safety monitoring. Such monitoring should be included in the water resources mitigation section (Chapter 6.14). Presently, no subsection on mitigation of groundwater issues appears there. The requirements of the Georgia Brownfields Program for groundwater seem appropriate to mention in groundwater mitigation. These comments about testing groundwater also apply to the mitigation section on Natural Resources and Energy Supply (Chapter 6.10). See also our comments about groundwater given in the section of this document about Natural Resources and Energy Supply.

Wild & Scenic Rivers: The Final EIS should consider protection of the potential for designating the Satilla River estuary as a Wild & Scenic River (consultation with the NPS, acknowledging the proper boundary of the estuary, providing a wide upland buffer zone). Wild and Scenic Rivers get special protections. The Satilla River is listed in the Nationwide Rivers Inventory (NRI), as described on Page 3-114, lines 4 through 10). Rivers listed in the NRI (Nationwide River Inventory) also get some protections: Federal agencies are to avoid or mitigate action that adversely impact NRI-listed rivers. Lights, noise, and buildings evident at the proposed spaceport will disrupt the scenic qualities of the estuary. Spaceport structures and operations could place in jeopardy the future ability to designate the Satilla River estuary as a Wild & Scenic River. Therefore, mitigation steps are needed to limit impact so that future designation remains possible. The DEIS acknowledges a need for protecting this NRI status on Page 3-101, lines 37-40.

However, no record appears in the DEIS of an attempt to contact the National Park Service about the Satilla River listing in the NRI. Contact for consultation about NRI rivers seems to be a requirement of FAA Order 1050.1F (see Section 14.5 of the FAA 1050.1F Desk Reference). Moreover, if the FAA finds no significant impact on river, they must send a letter of documentation to the regional NPS office.

If there is potential for impact, the FAA must request assistance from NPS to do the analysis. All of this should be documented in the Final EIS.

Continued effort to seek Wild & Scenic status for the Satilla River estuary is desired by many stakeholders now using, restoring, and protecting the estuary (e.g., the Satilla Riverkeeper organization and other environmental non-profits operating in southeastern Georgia and along its coast).

In order to protect the potential of the estuary to be designated Wild & Scenic, the correct boundary of the Satilla River estuary should first be recognized. The boundary implied in the draft EIS is too narrow and seems only to include the main channel of the Satilla River (Page 4-125, lines 5-6). However, the full breadth of the estuary is defined as the river expands into a multi-branched, intertidal and subtidal estuary. The Satilla River as it exists near the proposed spaceport is more accurately represented as a delta on Page 4-101, line 5 (and Page 4-112, line 14; Page 3-91, line 34; 3-100, lines 13 & 26; 3-101, line 37), however, even this description can be improved as follows: The estuarine boundary of the Satilla River as described by most estuarine scientists would at least include all intertidal and subtidal waters below the normal high water mark that lie between the uplands of Floyds Neck and Hazzards Neck and extending eastward to include all such waters between Floyds Neck and Cumberland Island and Hazzards Neck and Jekyll Island, including all estuarine hammocks and islands and the ocean inlet at St Andrews Sound.

Presently, the water resources mitigation section of the draft EIS contains no subsection on mitigation of damage to the potential for the Satilla River estuary to receive designation as a Wild & Scenic River. Mitigation could recommend the use of very wide upland zone (1/4 mile) between spaceport facilities and maintenance operations and the edge of the intertidal waters of the estuary (defined by the normal high water mark), except as needed to patrol. However, mowing and pruning of vegetation in this zone should be minimized so that the upland edge habitat is preserved for nesting birds and roaming animals, the adjacent intertidal areas are protected better from pollution originating on spaceport property, and the view of spaceport structures, lighting, and operations remains as obscured as possible from Satilla River estuary.

THREE LISTS OF BRIEF ERRORS FOLLOW

Three lists of errors are provided: A) Factual Errors; B) Brief Statements that are Confusing, Incomplete, or Concerning; and C) Typographical Errors). The collection as a whole can greatly interfere with comprehension by the decisionmaker. We encourage correction of all these.

A) FACTUAL ERRORS

A large number of small factual errors can damage the quality of a decision. In many of these instances, the EIS preparers seem unfamiliar with the local area. Correct all of these factual errors before the decisionmaker sees the final EIS.

1. Ownership of the tidal marshlands is claimed by the State of Georgia under the Coastal Marshlands Protection Act. It is unlikely that Union Carbide Corporation or Bayer Crop Science presently owns any of the roughly 10,600 acres of tidal marshland depicted in the following descriptions that refer to the 11,800 acre area, and the exhibits that illustrate the supposed property boundaries: Exhibit ES-2

(Page 6); Exhibit 2.1-1 (Page 2-3); Page 4, line 42; Page 5, line 2; Page 1-3, lines 19; Page 2-2, lines 3-12 and the inset box; Page 2-35, lines 20-22; Page 3-33, line 20; Page 3-64, line 17; Page 3-106, line 34; and Page 4-56, line 9.

2. *Contradictory Wording*: Table ES-1 on page 18 of the Executive Summary states that not enough information has been made available to determine constructive use of Cumberland Island, but Section 6.5 on page 6-3 (Lines 13-21) indicates a preliminary determination of no constructive use. Correct the contradictory wording in the EIS about the Section 4(f) status of Cumberland Island so that the decisionmaker can fully understand the potential for “constructive use” of Cumberland Island National Seashore before making a decision or determining mitigation measures.
3. Page 1-3, lines 18-19. The property for the proposed spaceport is mischaracterized in this sentence (though it is more accurately depicted later on Page 2-2). The entire proposed spaceport site as outlined (without Bayer CropScience property) has only about 1,400 acres of uplands (not 11,800 acres). In addition, the 11,800 acres referenced is not all claimed by Union Carbide Corporation. Most is claimed by Bayer CropScience (and the State of Georgia claims all the marshland, which occupies roughly 80% of the 11,800 acres mentioned).
4. Acreages are inconsistently and inaccurately given. Tract sizes are important to get right, given several difficulties with site layout, buffer zones, and the large amount of tidal marshland that is likely of disputed ownership (claimed by the State under Georgia’s Coastal Marshland Protection Act of 1970). Large inconsistencies of acreage are stated for the proposed spaceport site, the amount of uplands present, and the uplands on Union Carbide land and on Bayer CropScience land. Approximate acreage is easy to check with GIS software, such as Google Earth. Acreage within the proposed site boundary is roughly 1,400 acres, correctly stated in Appendix G (Soils and Geology). However, several places in the document claim the upland portion is 1,200 acres (Page 2-2, line 7 and inset box; Page 4-56, line 10). The difference is not due the presence of wetlands within the boundary. The Wetlands Delineation Report (Appendix H) identified only 3.6 acres of wetlands within the proposed site boundary. The uplands of the adjacent Bayer CropScience land cover about 800 acres. The total upland area that could be included in an expanded spaceport (including Union Carbide and Bayer CropScience property) totals about 2,200 acres. Statements are incorrect that claim 4,000 acres of uplands at the site (Page H-4), and 11,800 acres of uplands (Page 1-3, lines 18-19), or 11,800 acre footprint of the spaceport (Page 3-33, line 20).
5. Page 26 (last six lines in Table ES-1); Page 4-25, lines 12-13; and Page 4-125, lines 5-6. The statement that the Satilla River is “located more than 1 mile from proposed construction activities” is incorrect. Because the Satilla River is on the National Rivers Inventory (NRI), its proximity to the proposed spaceport must be considered accurately. Estuaries can be included in Wild and Scenic River designations (See NPS Reference Manual #77 for Wild and Scenic River designation: <https://www.nature.nps.gov/rm77/specialdesignations/Rivers.cfm>). Few estuaries qualify for this status, however, because they are usually heavily populated with residences and coastal industries. The Satilla River estuary is an exception. The estuary is well qualified for Wild and Scenic status because of the lack of development on it. Therefore, we ask that the decisionmaker consider this potential whether or not an NPS consultation has been completed about the Wild and Scenic River potential of the Satilla River estuary.
6. Page 2-6, lines 7-9 and Exhibit 2.1-4; also Page 2-34, line 3: launches and landings do not use the same trajectory range as the returning first stage flies closer to the landing pad. This is because the landing pad is displaced from the launch pad by about 1.5 miles southeast of the launch pad. This is particularly relevant to consideration of impact of a landing mishap on the control of toxins from the RCRA landfill nearby. Correct this statement as well as the illustration given in Exhibit 2.1-4. Also

give the elevations over Cumberland Island and Little Cumberland Island that would be allowed for an overflight of the returning first stage.

7. Exhibit 2.1-8 (Page 2-15) gives a misleading representation of the size of the first stage that may be landed at Spaceport Camden. The illustration substantially underrepresents the size of the first stage on the landing pad. Scale the first stage drawing to fit the description given on Page 2-22, lines 11-19, namely, 10 to 14 feet diameter, 125 to 175 feet tall.
8. Page 2-16, lines 24-31, and footnote 15; also Page 4-66, line 13; and 4-67, line 1. Incorrect electric power units. Electric power units are either volt-amp hours per day, or just volt-amps. The unit “volt-amps per day” is incorrect. Change all occurrences of this incorrect unit to one or the other correct choice, depending on what is meant. In addition, the estimated annual power requirements during launch site operation of 31 million kilowatt hours per year (line 28) seems excessive. This is enough power to supply an average US town of 2,700 people with all of their residences, industries, businesses, government, and other organizations. Given the lack of confidence caused by incorrect use of electric power units, have an electrical engineer double check all electricity use figures and the computations used to arrive at them. Finally, in footnote 15, indicate the power factor (i.e., power efficiency) used in the conversion of actual volt-amps to apparent watts.
9. Page 2-23, lines 14-22: Simplify this paragraph. It is wordy, hard to follow, but says very little, and it seems to stray from the topic at hand (vehicle assembly).
10. Page 2-34, line 17: The statement about the land-based mobile crane applies only to dock landings. Clearly state that landing pad landings will require the mobile crane at the landing pad, not the dock area. This is an important distinction given the need for roadways that can support the mobile crane and its cargo.
11. Page 2-37, lines 19-22: Incorrect statement about the need for heavier road in the Ocean-Landing Only Alternative. As described on Page 2-16 (lines 1-4), a heavy road to the dock will be needed for offloading a returning first stage from the barge. Correct this, and also check the figure of 11,250 linear feet of heavier road used in line 22 (see next comment).
12. Page 2-38, lines 6-9: Line 22 on Page 2-37 states the reduction of heavier road would be 11,250 ft rather than 5,280 ft. This difference may be the erroneous idea on Page 2-37 that the heavy road to the dock would not be needed with the Ocean Landing Only alternative (see previous comment). Find the source of the error and correct this inconsistency. This same error may have been repeated in the calculation of less pavement needed for the Ocean Landing Only Alternative in the Natural Resources (Section 4.10.2.1, Page 4-68, line 16). Check this and correct it there too.
13. Page 2-42, lines 6-9. It is incorrect to refer to the general upland area between the Satilla River estuary and Crooked River as “Harrietts Bluff.” This area is instead known as “Floyds Neck.” Harrietts Bluff is a small community on Crooked River in the southeastern part of Floyds Neck. Although a developer may refer to the West Site as part of Ceylon, historically Ceylon was much further west. Latitude and longitude (Lat-Long) for historical Ceylon is approximately 30deg57'42"N, 81deg39'2"W. Lat-Long for Harrietts Bluff is in the vicinity of 30deg52'30"N, 081deg35'W. See USGS 7.5 minute topo maps for Harrietts Bluff, for Kingsland NE, and for Woodbine to find more accurate place names.
14. Page 3-5, lines 5-6: Correct this incorrect overstatement, “Only emissions occurring below 3,000 ft AGL....” For example, ozone-depleting chemicals released in the stratosphere increase UV radiation to the Earth’s surface, causing increased rates of skin cancer. Ozone depletion is a human health issue of international stature. The 3000 ft limit involves the conceptualization of the major mixing layer only, in which release of toxins, mutagens, or carcinogens can readily mix downward and thereby affect human health. The 3000 ft limit, however, is not intended to cover all human health

concerns from impacts to the atmosphere. Ozone-depleting chemicals and greenhouse gases affect human health and well-being well above 3000 ft.

15. Page 3-12, line 8: replace “e” with “a” to make the correct spelling “*Quercus geminata*.”
16. Page 3-13, lines 1-5: The section title (line 1) is incorrect or is a misnomer. In either case it requires a change. The description below the title (lines 2-5) is not of a tidal marsh, which is regularly flooded by tides, and would not be accurately described as “infrequently flooded.” Moreover, the description is of a terrestrial wooded community, perhaps hammock islands surrounded by tidal marsh. Change the title to match the description.
17. Page 3-19, line 14: Change title to “Submerged Vegetation.” Seagrasses are absent in Georgia.
18. Page 3-25, lines 5-6: Non-standard use of the term phylum. Almost all species of animals are invertebrates. Marine invertebrates are taxonomically classified in 34 phyla including Chordata (the one phylum that also has all the vertebrates). All phyla are likely represented in the ROI except perhaps the Placozoa, which may not yet have been found there, but have been found in South Carolina and elsewhere in Georgia (Pearse and Voigt 2007).
19. Page 3-27, line 2. Hydrofluorocarbons should not be in a list of gases used primarily in niche industries. They are the main gases used for refrigeration and air conditioning worldwide, including in the US. They are produced in large quantities.
20. Page 3-27, line 6. Because air conditioning and refrigeration units will be used at the site, state why hydrofluorocarbons can be excluded from the GHG analysis (or else include it).
21. Page 3-30, Section 3.4.3.1. Most of the description of the Satilla River Marsh Island Natural Area is about the Satilla River, but is not particularly relevant to the designated area, which is in the Satilla River estuary. Include an accurate description of the estuary. Such a description would help in other regards as well, such as accurately depicting the proximity of the spaceport to the estuary, and the work of the tides in mixing salt and fresh waters and contaminants in all directions.
22. Page 3-65, line 18. The creek mentioned on this line is clearly not Fancy Bluff Creek (which is roughly 16 miles to the north in Glynn County). The creek mentioned on this line may be Crooked River, or it could be smaller tributaries to Crooked River, such as Grover Creek or Black Point Creek. Google Maps erroneously calls many creeks in Camden County Fancy Bluff Creek. Please do not continue this error. Instead, take all creek names from NOAA coastal navigation charts (e.g., NOAA chart 11504) or USGS topographic charts (e.g., USGS Kingsland NE quadrangle).
23. Page 3-71, lines 21-22, which state that natural gas will not be used for heating, contradict the statement on Page 3-70, line 7, in which natural gas is said to be used for heating. Accurately report the energy source that will be used for heating during both construction and operation.
24. Page 3-82, lines 21-23. No rainbow trout or brown trout are in the Cumberland River. The Cumberland River in Camden County, Georgia is a warm, saline, tidal estuary, not a cool mountain stream. Popular species caught there include spotted seatrout, channel bass (also known as red drum or spot-tailed bass), southern flounder, summer flounder, and striped mullet. Striped bass were mentioned, and would be a very rare catch.
25. Page 3-84, line 4 and line 6 and throughout Tables 3.12-5 and 3.12-6: Change “City” to the lower case “city” or use “City of ____.” For example, Woodbine should be the City of Woodbine. It is not Woodbine City.
26. Exhibit 3.13-1, Page 3-93: Photo N is incorrectly identified as “Satilla Creek.” It should say “Floyd Basin.” No creek in the vicinity is named Satilla Creek. Use NOAA coastal navigation charts to check estuarine creek names.
27. Page 3-102, line 25: Change “Dover Road” to “Dover Drive.” There is no Dover Road in Camden County. Also insert “and” before “on Piney Bluff...” Dover Road is neither on Piney Bluff, nor on Dover Bluff. Dover Bluff Road and Piney Bluff Road intersect, but light from the Spaceport is likely

to go unnoticed from that point except perhaps as diffuse light over the forest on Piney Bluff. However, light from the spaceport would surely be seen from the houses at the southern part of Piney Bluff and from southern facing parts of Dover Bluff.

28. Page 3-107, lines 4-7. The tidal marshes around the proposed site of the spaceport are in a warm, saline, tidal estuary (the Satilla River estuary). The large areas of tidal marshland referenced in the text are characterized by smooth cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*). Very little, if any, of the tidal waters around the proposed spaceport site are fresh enough to support soft rush (*Juncus effusus*) or broad-leaf cattail (*Typha latifolia*) in the tidal marshlands, however these species may occur in isolated freshwater wetlands within the adjacent uplands.
29. Page 3-107, line 39: Final versions of the FEMA flood insurance maps are now available. Contact Mr. Scott Brazell, Community Rating System manager in Camden County [(912) 510-4320].
30. Page 3-109, line 21: The Satilla River is incorrectly described as a tidal river. It is a very large river that drains a watershed that reaches hundreds of miles inland and touches all or parts of 13 southeastern Georgia counties. It has a tidal estuary, which includes the portion immediately adjacent to the upland of the proposed spaceport.
31. Page 3-109, line 23-25: Omit the phrase “with limited fish species diversity due to extreme variations in flow and the relatively homogenous habitat within the river system.” This is not a defensible statement and gives no authoritative references for the presumed rationale. It is no more extreme in flow variation than other blackwater coastal plain rivers. The habitat is no more homogenous than others. Moreover, the definition of habitat generally includes the spatial and temporal variation experienced by a given organism in its environment, so to claim extreme variation in flow and homogenous habitat is contradictory. The phrase incorrectly and negatively flavors the value of the river’s species diversity and habitat, which is sufficient to have placed the river in the Nationwide Rivers Inventory of rivers with potential to be named Wild & Scenic. The Satilla River is one of the most popular fishing destinations in Georgia.
32. Page 3-109, line 25: Omit the word “does” because it flavors the sentence incorrectly (and add and “s” to the verb to make “supports”). The Satilla River is among the most popular fishing destinations in Georgia. Its fresh waters are famous for plentiful and large redbreast sunfish, and the river contains many other freshwater and estuarine species desired by fishers.
33. Page 4-12, line 2: No seagrasses are in Georgia. Fresh and brackish submerged vegetation exists in Georgia, but probably nowhere in the region of impact except perhaps in freshwater ponded areas within uplands.
34. Page 4-15, line 18: delete “no” because secondary effects could in fact include auditory effects similar to those of humans even if hearing is not exactly the same.
35. Page 4-15, lines 30-42: Noise effects on birds is misrepresented Hearing with ears is only one mechanism by which noise can disturb an animal. All body cavities resonate sound vibrations: These include chest, oral, and intestinal cavities. Birds also have cavities within their bones. Bird bones are filled with spaces that make the bones lighter, presumably assisting flight. However, the cavities within bones can resonate sounds of various frequencies. One possible reason for reduced sound detection by the ears of certain species of bird may be a lack of need. Sound does not have to be heard by ears in order to be startling enough to allow better survival of the species. For a very impressive story about detection of sound by other parts of the body besides the ears, read about Dame Evelyn Glennie, a deaf virtuoso marimba player who is among the most accomplished percussionists in the world.

36. Page 4-56, line 12 of EIS says no facilities planned for the adjacent Bayer property other than Alt Control Center and Visitor Center. However, heavy roadways are planned for the Bayer property for a mobile crane to retrieve the first stages from the barge returning to the dock there.
37. Page 4-75, line 16: replace “Brunswick” with “Glynn” (Jekyll Island, St Simons Island, and the City of Brunswick are all in Glynn County). No county in Georgia is named Brunswick County.

B) BRIEF STATEMENTS THAT ARE CONFUSING, INCOMPLETE, OR CONCERNING

The following statements should be relatively easy to address in a manner that will improve comprehension of the intended content by the decisionmaker.

1. Page 3-47, line 37: In Solid Waste Management Unit 6, corncob grit has been found. It should be tested for toxins. If the corncob grit has been used in manufacturing or cleaning processes, then it could contain a variety of toxins.
2. Page 3-53, lines 4-14: This paragraph needs updating. More than a year has passed since it was written (note the date stated in the paragraph). Furthermore, no mention is given here of the response of the Muscogee (Creek) Nation that is included in the Appendix. And no correspondence from the Choctaw Nation is in Appendix A, where all are said to be.
3. Page 3-58, footnote 1 of Table 3.8-1: No reference to this footnote is given in the table, so it is not possible to tell which resources may require further investigations about eligibility for the NRHP.
4. Page 3-67, lines 23-24: The notion that private inholdings in the Cumberland Island Wilderness “impact the use of the island by private residents” needs explanation. It would seem more sensible that such private inholdings would impact the use of the island by public visitors instead.
5. Page 3-71, line 21: If natural gas is not expected to be used for heating, then state the energy source that will be used, and include it in the analysis.
6. Page 3-72, line 20: Check to be sure that the existing infrastructure is really capable of handling the 31 million kWh per year of electrical use (amount indicated on Page 2-16, lines 28-29). On the other hand, the amount indicated may be incorrect. If so, correct it.
7. Page 3-77, line 17: Although sound pressures may not break glass, an equally costly issue not discussed is the breakage of the seal between double-paned windows and doors, which can occur with much less force than required to break glass. Double-panes are now widely used for energy savings. A fogged double-pane window would be a type of damage caused by shock that would be less than that required to break the glass, but repair cost is similar. This type of damage should be assessed and accurately considered.
8. Page 3-77, line 21: Damage from 2 psf may be unlikely on well-maintained structures, but an expert should be consulted about damage to old tabby ruins at the site.
9. Page 4-40, line 14: fuel spills can damage resources beyond “tidal resources.” Replace “tidal resources would not be impacted...” with “people, nature, and other resources would not be impacted...”
10. Page 4-94, lines 15-17: The need for the indicated funds provided by vote in response to launch delays and cancellations should be made clear.

C) TYPOGRAPHICAL AND STYLISTIC ERRORS

Many typographical and stylistic errors can be very distracting to comprehensive reading by anyone, including the decisionmaker. To ensure an appropriate decision is made, eliminate these.

1. Page 2-16, line 8: change “Country” to “County.”
2. Page 2-16, line 14: change “of” to “or.”
3. Page 2-19 and 2-20: the total area for the Proposed Action given in Table 2.1-3 is 68.1 acres, however, the square footage of the component footprints given in Table 2.1-4 totals only 46.1 acres (including roads). Clearly account for the difference.
4. Page 3-2, Table 3.1-1, third column, next to last row: Incorrect footnote reference for 0.50 ppm. The footnote should be “(d)” not “(c).”
5. Page 3-13, lines 14-17: The word “community is used two ways, which is confusing: once in line 15, and then again twice in line 17. To improve this, replace the first “communities” in Line 17 with “associations” and end the sentence with “forests.”
6. Page 3-24, line 27. Delete the repeated “in the” in this sentence.
7. Page 3-27, line 2. Place period (rather than comma) after “hexafluoride” strike the next word “hydrofluorocarbons” to begin the next sentence with “Perfluorocarbons.”
8. Page 3-27, line 19. Insert “other” before “animals” (since fish are animals too).
9. Page 3-29, line 10. Change “16” to “15” to give the correct title number in the Code of Federal Regulations.
10. Page 3-30, line 3: change “acres” to “acreages” (acres do not vary in size, so cannot be “large”).
11. Page 3-30, line 28: change “are” to “is” to give the correct verb tense.
12. Page 3-33, footnote 25: Omit the word “Draft” if this footnote remains in effect in the final EIS.
13. Page 3-34, line 41: change “considering” to “considered” to correct the grammar.
14. Page 3-43, line 25: change “licenses” to “license” to correct the grammar.
15. Page 3-54, line 35: delete “but” before “has not been...”
16. Page 3-58, Footnote 1 of Table 3.8-1: No reference to the footnote is given in the table, so it is not possible to tell the resources applicable to it.
17. Page 3-68, line 46: change “includes” to “include” to correct the grammar.
18. Page 3-69, line 21: insert comma after “vegetation” and delete “in” after “and.”
19. Page 3-72, line 18: remove the comma between “landfill” and “gas” to make one item that is “landfill gas.” Landfill gas is a type of alternative fuel sometimes promoted as a possible energy source, however it usually contains a lot of water vapor that must be removed for efficient burning, so often it is simply flamed at the landfill site.
20. Page 3-73, line 22: insert “on” between “concentrate” and “general.”
21. Page 3-75, line 31: change “associate” to “associated” to correct the grammar.
22. Page 3-76, line 25: change “inference” to “interference.”
23. Page 3-76, line 27 and line 30: to be consistent with the DNL criterion given in Line 8 on this page, change “66” to “65” in lines 27 and 30.
24. Page 3-76, line 34: Add “s” to “Standard” to correct the institution’s proper name, which uses the plural “Standards.”

25. Page 3-81, line 10: remove the misplaced closed parenthesis that is immediately after “percent.”
26. Page 3-82, line 27: delete the word “industry.” Page 3-83, lines 3-4: replace beginning of sentence with “In 2015, the forest industry’s impact in the coastal region was \$1.69 billion....” Then at the end of the sentence reference the Coastal Regional Commission’s document you used to make this statement.
27. Page 3-83, lines 5-6: Rephrase to” Timber mills and forested land are located in the western part of Camden County, west of US Highway 17. Forested land is also abundant east of US Highway 17.”
28. Page 3-83, line 19 and line 21: These figures are probably annual revenue figures. Therefore, check the facts, and add “per year” after million (line 19) and after billion (line 21).
29. Page 3-84, lines 18-23: This entire section starting with “and Little Cumberland...” should be deleted. It is misplaced and redundant, and indicates very poor proof-reading.
30. Page 3-100, line 13: Change “Exhibit 3.13-2” to “Exhibit 3.13-3” to provide the correct Exhibit number (which is found on Page 3-97).
31. Page 4-2, Table 4.1-1, column 1, rows 1 and 2: Recommend changing the indicated years from 2018 and 2019 to “Year 1” and “Year 2” to provide generality in case construction cannot begin in 2018.
32. Page 4-5, line 33: change “site” to “sites” to correct the grammar.
33. Page 4-13, line 15: change “downgradient” to “down range” for the usual term.
34. Page 4-22, line 10: replace “to” with “beyond” or “over” for a more appropriate preposition.
35. Page 4-27, line 30: delete “of” at end of line between “use” and “was”
36. Page 4-54, line 10: delete “designated” to avoid redundant phrasing.
37. Page 4-56, line 18: insert “the” before “marsh”
38. Page 4-58, line 14: remove comma after “minimize”
39. Page 4-58, line 18: insert “the” between “to” and “natural”
40. Page 4-62, line 20: change “and” to “so” to be more direct with the justification.
41. Page 4-74, line 6: change “below 65 dB DNL” to “below 65 dBA DNL” since DNL always refers to dBA (sound relevant to human hearing rather than total sound energy as dB without the A).
42. Page 4-89, line 38: change “results” to “result” to correct the grammar.
43. Page 6-5, line 19: insert a period after “closures” to complete the sentence.