

## ENVIRONMENTAL ASSESSMENT

Component and Subsystem  
Development Test Facility

John C. Stennis Space Center  
Stennis Space Center, Mississippi

### ABSTRACT

NASA is proposing the construction and operation of a Component and Subsystem Development Test Facility at the Stennis Space Center. This facility will be used to test ultra-high pressure gas generators and turbopumps for LOX/LH<sub>2</sub> and LOX/LCH<sub>4</sub> propulsion systems. Minimal long-term environmental impacts are expected to result from the proposed action, and therefore a Finding of No Significant Impact should be prepared.

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## I. SUMMARY AND CONCLUSIONS

The proposed Component and Subsystem Development Test Facility (CSDTF) is designed to enhance NASA's continuing research and testing effort to promote the growth of innovative propulsion systems technology. Advanced technology is essential to provide the United States Air Force with design and testing criteria to develop a new generation of space transportation. The Air Force will use NASA's expertise in this field at the proposed CSDTF located at the John C. Stennis Space Center near Bay St. Louis, Mississippi.

The previously described and the no-action alternative are the only alternatives considered in this environmental assessment.

The nature and scope of the potential environmental impacts identified in this environmental assessment are sufficiently minor as to preclude the need for an Environmental Impact Statement for the proposed construction and operation of the Component and Subsystem Development Test Facility.

This Finding of No Significant Impact applies only to the CSDTF as an isolated facility continuing NASA's basic research and development work on propulsion systems technology and, thus, is categorically excluded from a requirement to prepare an Environmental Impact Statement. This finding does not apply to overall impacts associated with the Advanced Launch System (ALS) program. An Environmental Impact Statement will be prepared for the ALS by the U.S. Air Force with NASA's assistance as a participating Agency. This EIS will specifically address environmental issues stemming from testing of complete new propulsion systems at Stennis Space Center.

## II. PURPOSE AND NEED

As previously summarized, the CSDTF will continue NASA's basic research and testing work on propulsion systems technology. Since NASA currently has no facilities capable of developing and testing high pressure components, research activities for improved propulsion systems are limited.

The proposed facility will enable NASA to pursue these research activities in a timely manner. This research will help lay the framework for the development and testing of the Advanced Launch System, scheduled for completion in the mid-1990s.

### III. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

#### A. PROPOSED ACTION

The United States Air Force, with support from the National Aeronautics and Space Administration (NASA), is proposing to begin the design and testing of the next generation of space transportation to follow the Space Shuttle. This Advanced Launch System (ALS) will consist of a shuttle-like core vehicle with a number of external boosters. New propulsion system technology is required for the ALS. The Air Force is intending to make extensive use of NASA's expertise and on-going research and test efforts in propulsion system technology. As a part of NASA's on-going program, a facility capable of testing components and subsystems at pressures of up to 14,000 psi is needed.<sup>(4)</sup>

The proposed Component and Subsystem Development Test Facility (CSDTF) will cover approximately five acres and will consist of: three test cells, one test control center, one component preparation building, and other support equipment. A new ultra-high pressure gas generation and storage system will also be included. Support and ancillary systems will include: propellant venting systems, flare stacks, catch/dumping systems, hot water and high pressure water systems, access roads, parking lots, sanitary sewer lines, potable water lines, and barge docking facilities. The propellants (liquid hydrogen and liquid methane) and oxidizer (liquid oxygen) will be used to test gas generators and turbopumps. The test control center will cover approximately 11,000 square feet and the component preparation building will cover approximately 4,500 square feet. The barge facility will be necessary for unloading liquid hydrogen propellant, and will consist of a single barge dock requiring approximately 4,500 cubic yards of excavation/ dredging, 5,000 square feet of sheet piling, and 2,000 square feet of concrete pavement. The new ultra-high pressure gas bottles will each be surrounded by a 10-foot high earthen berm to minimize blast effects in case of failure.<sup>(4)</sup>

Since the CSDTF will not include a thrust chamber, all propellants, oxidizers, and mixtures will be either routed to a dump pit for evaporation or burned at a flare stack. The component tests will last for approximately 25 seconds, and will occur three to six times per week.<sup>(5)</sup>

Testing at the CSDTF will simulate actual operating conditions for rocket engine components by making short test runs using the propellant for which the components are designed (i.e., LOX, LH<sub>2</sub>, or LCH<sub>4</sub>). Both dynamic and steady-state

testing will be accomplished, and only gas generator driven turbopumps are the test articles to be utilized. The test articles are identified as follows:

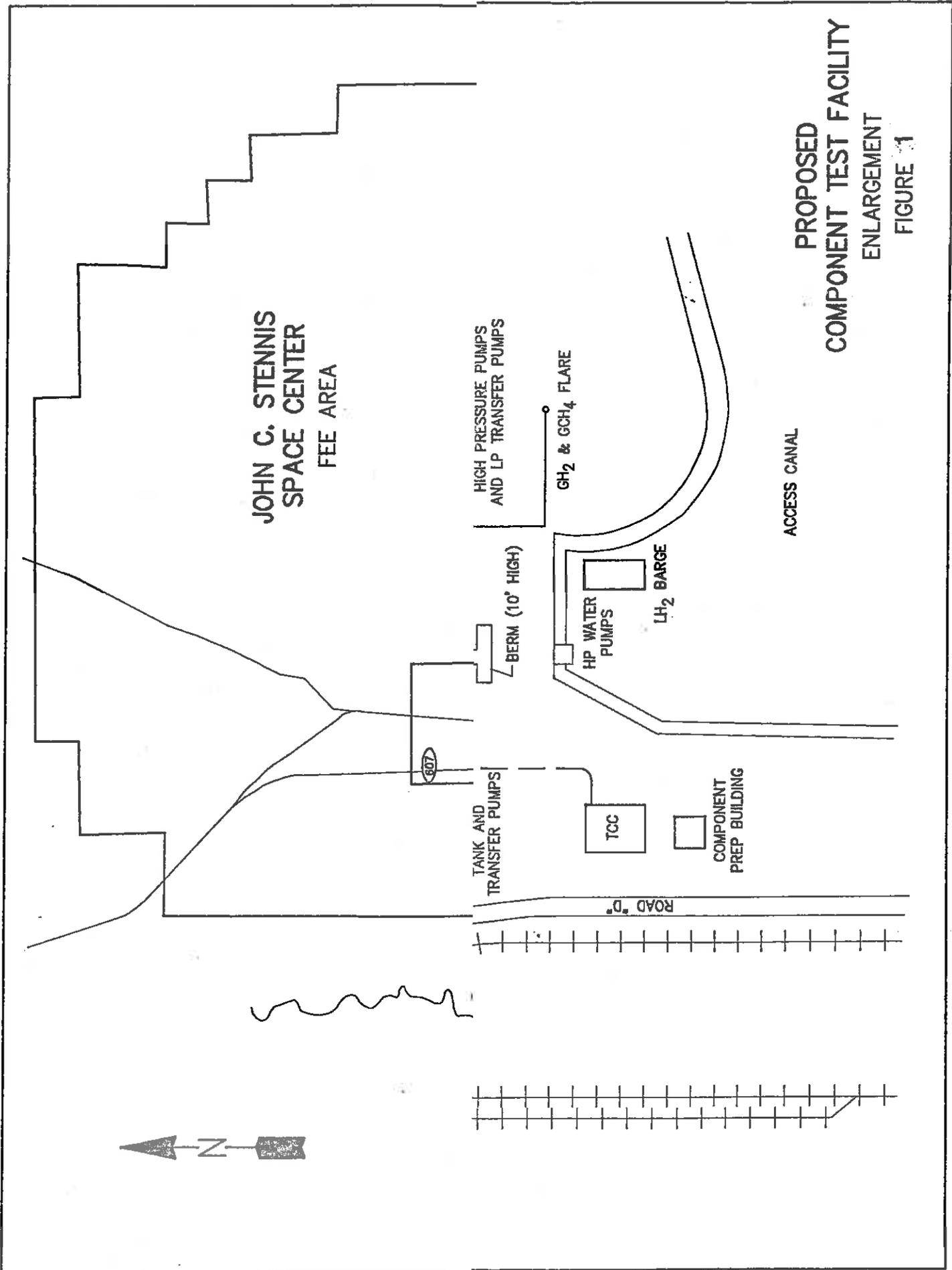
<u>Gas Generator Propellant</u>	<u>Turbopump Fluid</u>
1. LOX/LCH <sub>4</sub>	LCH <sub>4</sub>
2. LOX/LH <sub>2</sub>	LH <sub>2</sub>
3. LOX/LH <sub>2</sub>	LOX

Although the steady-state test duration for each test series will be 25 seconds, both the gas generator and turbopump flows will occur for a maximum of 55 seconds. Since the CSDTF will not include a thrust chamber, all fluids pumped by turbopumps during testing must be either burned at a flare stack or routed to a dump pit for evaporation.

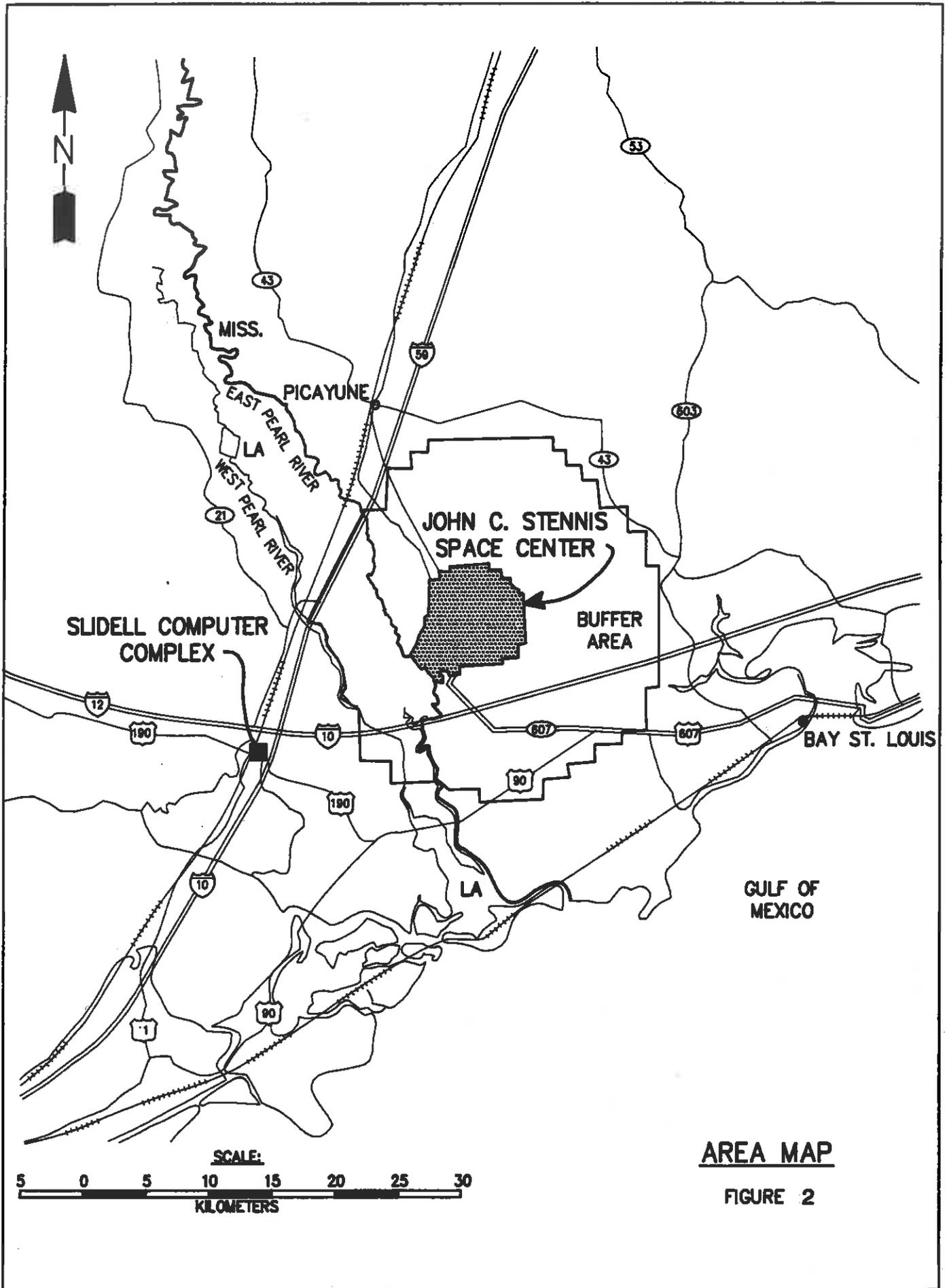
The proposed Component and Subsystem Development Test Facility will be located at the John C. Stennis Space Center (SSC) situated between the towns of Picayune and Bay St. Louis, Mississippi (See Figure 1). SSC occupies 13,480 acres in western Hancock County known as the "Fee Area". The Fee Area is totally surrounded by a Buffer Zone of approximately 125,330 acres. The Buffer Zone is an acoustic barrier to prevent public exposure to extreme rocket-generated noise. The land use in the Buffer Zone is limited to forestry, farming, animal husbandry, mining and related activities. Construction of habitable structures and human occupancy in this area is prohibited <sup>(1)</sup> (See Figure 2).

NASA/SSC (previously known as National Space Technology Laboratories, NSTL) was constructed in 1963-1966 to perform developmental and acceptance static rocket tests for the Saturn S-IC and S-II rocket stages, large liquid propellant systems. In addition to NASA, several Federal, state and research-related organizations are located at SSC. These agencies include: U.S. Department of Commerce, National Oceanic and Atmospheric Administration; U.S. Department of the Interior, National Park Service Science Information Division; U.S. Geological Survey; U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency - Toxicant Analysis Center; U.S. Department of Defense, Mississippi State University Research Center; and Louisiana Office of Science, Technology and Environmental Policy.<sup>(1)</sup>

More specifically, the proposed Component and Subsystem Development Test Facility will be located in the Hazardous Testing Area west of the existing A-stands (See Figure 2).



**PROPOSED  
COMPONENT TEST FACILITY  
ENLARGEMENT  
FIGURE 1**



**AREA MAP**

**FIGURE 2**

The Environmental Resource Document <sup>(1)</sup> for the Center contains detailed descriptions of the various components of the natural and man-made environments at SSC. "An Ecological Survey of the SSC Area Potentially Impacted By An Advanced Solid Rocket Motor Manufacturing and Test Facility"<sup>(2)</sup> and "Cultural Resources Investigations for National Aeronautics and Space Administration at NSTL"<sup>(3)</sup> were prepared for NASA in May, 1988 for use in preparation of the Advanced Solid Rocket Motor Environmental Impact Statement.

**B. NO ACTION/OTHER ALTERNATIVES**

The only location and scope alternatives considered in this environmental assessment are the proposed configuration described in the following section, and the no-action alternative. The no-action alternative would result in no impacts on the environment from either construction or operations; however, this alternative would not produce the facilities necessary for NASA to conduct the desired testing of propulsion system components and subsystems.

## IV. ENVIRONMENTAL IMPACT OF ALTERNATIVES

### A. PROPOSED ACTION

#### 1. Water Quality

The major water resource in the vicinity of the proposed facility is the East Pearl River, which forms the southwest boundary of the Fee Area. A canal system serving the Hazardous Test Area is accessed from the East Pearl River.<sup>(1)</sup>

During the construction of the Component and Subsystem Development Test Facility a stub of the canal will be enlarged, which will require a Corps of Engineers permit. Approximately 4500 cubic yards of dredge material will be removed to build a barge docking facility.<sup>(4)</sup> The dredge material will be disposed of in an existing designated dredge spoil area. The water quality in the canal will be temporarily impacted by an increase in turbidity during dredging operations. This increase in turbidity will cause aquatic life to temporarily move to clearer waters. (See Section IV.A.3 for a discussion of potential impacts to the aquatic biota.) Dredging and fill operations are expected to have minimal long-term environmental impacts.

The fire protection system for the CSDTF will use approximately 10,000 gpm pumped directly from the canal for emergency situations only<sup>(5)</sup>, and therefore will cause no significant impacts to the environment.

Wastewater generated by the addition of approximately 40 employees<sup>(5)</sup> associated with the CSDTF will be conveyed to either Lagoon No. 1 or Lagoon No. 2. Both lagoons currently have the capacity to assimilate the additional loading<sup>(6)</sup>. The existing system was designed for approximately 5000 employees. The existing population is approximately 3700.<sup>(7)</sup> Routing to either lagoon causes minimal impacts to the area, and the alignment will probably be selected on the basis of economics. Discharge of this additional effluent will cause no additional impacts to the environment.

Limited impacts to water quality may be caused by erosion and siltation during construction activities. These impacts may be mitigated by prompt reseeded and resodding in disturbed areas, and by the use of temporary erosion barriers (e.g., stacked hay bales).

#### 2. Air Quality

Construction of the proposed facility will cause the emission of some particulate matter (dust) during earthwork operations. The use of standard construction dust control practices will minimize any dust emissions. Emissions generated by construction equipment (e.g. vehicle exhausts) should be minimal if the

vehicle engines are kept properly tuned and maintained. Thus, the construction of the CSDTF will have no adverse impacts on the air quality of SSC.

The proposed propulsion system for the gas generators and turbopumps will utilize liquid oxygen (LOX), and liquid hydrogen (LH<sub>2</sub>) or liquid methane (LCH<sub>4</sub>). Test frequency is anticipated to be three to six times per week, with a duration of 25 seconds per test<sup>(5)</sup>. The main combustion by-product for both propellants will be steam, with the LCH<sub>4</sub> also producing carbon dioxide (CO<sub>2</sub>) and small amounts of carbon monoxide (CO). According to the Air Emissions Modeling Report<sup>(8)</sup> for the CSDTF, the maximum carbon monoxide concentration level will be 0.00255 mg/m<sup>3</sup>. The National primary ambient air quality standard for carbon monoxide (adopted by the State of Mississippi) is 40 mg/m<sup>3</sup> for a 1-hour average concentration and 10 mg/m<sup>3</sup> for an 8-hour average concentration not to be exceeded more than once per year<sup>(9)</sup>. Therefore, for the proposed testing schedule ambient air quality standards will not be exceeded and no detectable impacts to the area's air quality will occur. The carbon dioxide produced should also cause no detectable impacts on the ambient air quality. Although minimal impacts on air quality are anticipated, an appropriate air emissions permit from the Mississippi Bureau of Pollution Control (MBPC) may be required due to the burning of hydrocarbon fuels.

### 3. Biotic Resources

For a detailed description of the biological communities in the vicinity of the proposed CSDTF, see the SSC Environmental Resource Document, Section 5 and Appendices D and E<sup>(1)</sup>. In addition, Esher and Bradshaw<sup>(2)</sup> recently completed an ecological survey of the eastern portion of the SSC. They identified over 300 species of plants and 180 vertebrates.

The proposed CSDTF will be built in an area where the predominant current land use is forest management for pulpwood production. The vegetation in the area is dominated by slash pine (89% of the forest cover) in the higher (drier) areas<sup>(1)</sup>. Most of the area has been subject to periodic clear-cut pulpwood harvest since conversion from farmland in the 1930s.

Construction of the CSDTF at SSC will result in short-term environmental impacts arising from construction activities, and long-term impacts resulting from habitat loss. Construction impacts will include habitat destruction due to clearing and grading, disruption due to increased noise and traffic levels, and erosion/siltation resulting from construction activities. The habitat loss will be due to the buildings, roads, drainage structures, and other projects associated with the completed CSDTF.

Since the CSDTF will not be constructed in wetland areas, any impacts will occur in the less sensitive, more common upland habitats dominated by slash pine.

a. Terrestrial Biota

Impacts to the terrestrial flora and fauna from the construction and operation of the CSDTF will be minimal. Construction of the CSDTF and support developments will remove approximately 5 acres of even-age pine forest. Approximately 3 acres will be converted into grassed areas, with 2 acres of buildings, parking lots, sidewalks, and roadways. Utility corridors to the CSDTF will follow existing improvements, particularly northward along Road D.

Operation of the CSDTF will generate minor amounts of steam emissions and noise as the propellant/oxidizer is flared.

b. Aquatic Biota

Impacts to the aquatic biota from the construction of the CSDTF will be due to the estimated 4,500 cubic yards of excavation/dredging required for the new barge facility.<sup>(4)</sup> The existing outline of the access canal will remain unchanged, but the NE corner will be deepened to allow dockside access for loaded LH<sub>2</sub> barges. Some rooted macrophytes and benthic invertebrates will be eliminated during the actual dredging. Fish and other vertebrates will be displaced until the dredging is completed. Dredge spoil would be transported to the area south of Test Stand B that has been previously utilized for dredge spoil disposal. Given the limited amount of dredging required, impacts should be minimal.

Since no cooling water is required for the CSDTF, wastewater treatment plant effluent would be the only discharge. As discussed in Section A, the existing wastewater treatment system is well-suited to handle the additional influent from the proposed operation of the CSDTF. Consequently, aquatic impacts from the operation of the CSDTF will be insignificant.

4. Endangered and Threatened Species

As indicated above, an ecological survey<sup>(2)</sup> of the Hazardous Testing Area was conducted during 1988, during which over 300 species of plants and 180 vertebrates were identified. The report stated that no species on the federal "Threatened or Endangered" list were found. However, a single Atlantic sturgeon was netted from the Pearl River in May 1988. This species appears to be abundant in deep holes in the Pearl River in warmer months. The Atlantic sturgeon is on the Mississippi "Endangered"<sup>(2)</sup> list but does not appear on the Federal list. The construction and operation of the CSDTF should not adversely impact this species, since it is not known

to exist in the access canal. (See Section III. A. for a discussion of specific water quality impacts.)

Some controversy continues to exist over the possible presence of the Florida panther (Felis concolor coryi) at SSC. Esher and Bradshaw<sup>(2)</sup> indicate that the panther is listed as "Endangered" under the Endangered Species Act of 1973. They also noted that a survey conducted in 1987 failed to yield any evidence of the panther in southern Mississippi (including a search of SSC). Research conducted for an earlier EIS<sup>(10)</sup> on (then) NSTL included up to eight different sightings of panthers in 1974-75, along with collections of excrement samples and plaster casts of tracks. Consultation with the current District Biologist for the Mississippi Department of Wildlife Conservation (MDWC)<sup>(11)</sup> indicates that sighting reports of panthers persist, but that no absolute evidence yet exists. The MDWC did agree that the small-scale development of the proposed CSDTF would probably not cause any impacts to the Florida panther, if they were in the SSC.

Esher and Bradshaw<sup>(2)</sup> also discuss the "sizable population of American alligators at SSC." They stated, and the MDWC confirmed<sup>(11)</sup>, that the alligator population in southern Mississippi has rebounded. The alligator is being "de-listed" by Mississippi, thereby losing its protected status of "endangered".

#### 5. Waste Generation, Treatment, Storage, and Disposal

Waste material generated during construction and operation of the CSDTF will be collected, transported, and disposed of in a sanitary landfill located within the Fee Area of the Stennis Space Center.<sup>(1)</sup> A new extension to the existing landfill was recently permitted by the MBPC and opened for use. It will be able to handle the waste generated by the construction and operation of the CSDTF. The current acceptance rate is 62 cubic yards/day<sup>(6)</sup>. No hazardous wastes are expected to be generated during the construction and operation of the proposed facility. Waste propellant (LCH<sub>4</sub> or LH<sub>2</sub>) will be collected and flared, and oxidizer spills will be evaporated at the LOX dump pit. The estimated 4500 cubic yards of dredge spoil material will be disposed in the spoil disposal area south of Test Stand B.

#### 6. Noise

Construction of the CSDTF will not require any techniques which will produce unusual noise levels. Normal construction specifications and provisions will be adequate to limit construction noise to acceptable levels.

No significant noise impacts are anticipated from operation of the CSDTF. The turbopump tests will be conducted at pressures up to 14,000 psi, with test durations of 25 seconds, and a frequency of three to six tests per week.<sup>(4)</sup> The

propellant/oxidant mixtures will be flared off at relatively large diameter flare stacks to avoid a "blowtorch" effect. Testing of the turbopumps and gas generators is not expected to produce noise effects that will be perceptible beyond the SSC Fee Area.

#### 7. Toxic Substances

As discussed in Section IV.A.2, the propulsion systems used during the tests of the turbopumps and gas generators are LOX/LH<sub>2</sub> and LOX/LCH<sub>4</sub>. Combustion by-products and their impacts are also discussed in Section IV.A.2. The only toxic by-product would be carbon monoxide in insignificant concentrations. All propellant/oxidizer mixtures will be flared off at isolated flare stacks. These stacks will be designed to flare the mixture with no blowtorch effect, and at a height designed to have minimal environmental impacts from the exhaust. No solvents will be required for post-test cleaning, since the fuels should burn cleanly.

#### 8. Historical, Archeological, and Cultural Factors

During 1988 the Mobile District, U.S. Army Corps of Engineers conducted an archeological survey and reconnaissance of lands within the SSC Fee Area.<sup>(3)</sup> No archeological resources were located on any of the land surveyed.

According to the archeologists<sup>(3)</sup>, none of the buildings on SSC that pre-date NASA's involvement would appear to be eligible for the National Register of Historic Places. Although Test Stands A1, A2, B1, and B2 have been designated as National Historic Landmarks by the Mississippi State Historic Preservation Office<sup>(12)</sup>, construction and operation of the CSDTF will have no impacts on these four test stands.

#### 9. Economic, Population, and Employment Factors

The proposed CSDTF facility will cover approximately 5 acres and employ approximately 40 people.<sup>(5)</sup> The current employment population at SSC is approximately 3,700.<sup>(7)</sup> This facility originally employed approximately 6,000 people,<sup>(1)</sup> therefore an additional 40 employees will have no significant environmental or sociocultural impacts on Stennis Space Center.<sup>(5)</sup>

#### 10. Radioactive Materials and Non-ionizing Radiation

No radioactive materials or non-ionizing radiation will be used or released in the construction or operation of the CSDTF.

#### 11. Wetlands and Floodplains

No general areas of wetlands exist on SSC which meet the established criteria of the U.S. Department of the Interior, Fish and Wildlife Service.<sup>(1)</sup> However, as noted in the 1988 ecological survey<sup>(2)</sup>, apparently localized wetland areas exist on the eastern portion of the Fee Area. No wetlands were noted in a brief

## V. CONSULTATION SUMMARY

In the process of preparing this environmental assessment, a number of organizations were contacted for baseline data and to obtain the opinions and concerns of the various interested parties. These agencies and their expressed areas of concerns are:

<u>Agency</u>	<u>Areas of Concern</u>
Southern Mississippi Planning & Development District	Socioeconomic, Population, Floodplain, Miscellaneous
Mississippi Pollution Control Water Quality Division	Water Quality Impacts
Mississippi Department of Wildlife Conservation	Alligator, Florida Panther, Biotic Resources
Mississippi Pollution Control-South Air Emission Section	Air Quality Impacts
Mississippi State Historical Preservation Office	National Historic Landmarks

Coordination and consultation should continue with the above agencies as the project design proceeds and during the actual component tests.

## REFERENCES

- (1) Anon., Environmental Resource Document: Inventory Summaries, Volume 1; Technical Appendices, Volume 2, NSTL, 1979.
- (2) Esher, R. J., and D. K. Bradshaw. "An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility." NASA, John C. Stennis Space Center. May 20, 1988. 61 pp.
- (3) U.S. Army Corps of Engineers. "Cultural Resources Investigations for National Aeronautics and Space Administration at National Space Technology Laboratories, NSTL, Mississippi." U.S. Army Corps of Engineers, Mobile District. May 1988. 12 pp.
- (4) Bechtel National, Inc. Integrated Component and Subsystem Development Test Facility at NSTL, Volumes 1, 2, and 3. Prepared for Pan Am World Services, Inc. and NASA. Bechtel National, Inc. Oak Ridge, TN. February 1988. 536 pp (total).
- (5) Gerald Pitalo, ALS Project Engineer, SSC. Personal Communications with M. Meierhoff and C. Israel, August 5, 1988.
- (6) Dr. Willard Douglas, Chemist, Sverdrup Technology Inc. at SSC. Personal Communication with C. Israel, September 20, 1988.
- (7) Tom Koger, Engineer, Sverdrup Technology Inc. at SSC. Personal Communication with M. Meierhoff, September 13, 1988.
- (8) El Dorado Engineering, Inc. "Air Emissions Modeling of the Component Test Facility." Prepared for John C. Stennis Space Center. El Dorado Engineering, Inc., Salt Lake City, Utah, September 15, 1988. 49 pp.
- (9) 40 CFR 50 - National Primary and Secondary Ambient Air Quality Standards, Section 50.8, National primary ambient air quality standards for carbon monoxide, U.S. EPA regulations.
- (10) Anon., Final Environmental Impact Statement for the Mississippi Army Ammunition Plant. 1976. U.S. Department of the Army. Vol. 1, 172 pp + Vol. 2, Appendices.
- (11) Bill Thomason, District Biologist, Mississippi Department of Wildlife Conservation. Personal Communication with M. Meierhoff, September 23, 1988.
- (12) Richard Cawton, Mississippi State Historic Preservation Office. Personal Communication with C. Israel, October 27, 1988.