ENVIRONMENTAL ASSESSMENT

HIGH HEAT FLUX FACILITY
JOHN C. STENNIS SPACE CENTER
HANCOCK COUNTY, MISSISSIPPI

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ABSTRACT

NASA is proposing the construction and operation of a high heat flux panel testing facility at Stennis Space Center that will be used to experimentally determine the material performance and capabilities of actively cooled panels during thermal cyclic testing. Under planned construction and operations, the Proposed Action will not result in significant effects to the environment. A Finding of No Significant Impact should be prepared.

HIGH HEAT FLUX FACILITY
ENVIRONMENTAL ASSESSMENT

CONTENTS

ENVIRONMENTAL ASSESSMENT
HIGH HEAT FLUX FACILITY

CONTENTS
(Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF EXHIBITS

LIST OF ABBREVIATIONS AND ACRONYMS

atm	atmosphere
ASRM	Advanced Solid Rocket Motor
CTF	Component Test Facility
cm.	centimeter
cm^3	cubic centimeters
DOD	Department of Defense
DTF	Diagnostic Test Facility
EA	Environmental Assessment
e.g.	for example; such as
EIS	Environmental Impact Statement
ERD	Environmental Resource Document
FONSI	Finding of No Significant Impact
g	grams
HHFF	High Heat Flux Facility
i.e.	that is
JPO	Joint Program Office
kVA	kilovolt ampere
l	liters
m^2	square meters
m^3	cubic meters
MMBTU	million British Thermal Units
NASA	National Aeronautics and Space Administration
NASP	National Aero-Space Plane
NFPA	National Fire Protection Association
PCB	polychlorinated biphenyls
psi	pounds per square inch
psig	pounds per square inch, gauge
PTO	Propulsion Test Operations
RCRA	Resource Conservation and Recovery Act
scf/hr	standard cubic feet per hour
scf/min	standard cubic feet per minute
SSC	Stennis Space Center
USAF	United States Air Force
USFWS	Fish and Wildlife Service
VOC	Volatile Organic Compound

ENVIRONMENTAL ASSESSMENT
HIGH HEAT FLUX FACILITY

1.0 SUMMARY AND CONCLUSIONS

1.1 Proposed Action

The United States Air Force (USAF), in a joint research effort with the National Aeronautics and Space Administration (NASA), is initiating the development, design and testing of the next generation of space transportation. There is a need for increased research and testing facilities to assist in the development and testing of improved propulsion systems/components technology. This research and testing will reduce design uncertainties and program risk.

NASA's John C. Stennis Space Center (SSC) has been conducting research, and ground testing of liquid rocket engines and stages and high pressure cryogens, since the mid-1960's. SSC is the largest handler of cryogens (propellants and pressurants) of all NASA centers. The USAF is proposing to utilize NASA's expertise in this field through a proposed High Heat Flux Facility to be located at SSC. The proposed High Heat Flux Facility (HHFF) will expand NASA's capabilities in the field of research and testing of innovative propulsion systems/component technology.

The proposed action covered by this environmental assessment is the construction and test operation of the High Heat Flux Facility at SSC. This involves utilization of an area of approximately four (4) acres [1.62 hectares] that has been previously cleared and partially graded. Actively cooled panel technology will be demonstrated in a test program utilizing a test rig that provides high levels of heat flux across a 20 inch by 20 inch [50.8 centimeters by 50.8 centimeters] panel. The anticipated operational start date is August 1993 with a test frequency of a maximum of one (1) 60 second duration test per day, 5 tests per week. Shorter duration tests are anticipated but the cumulative active testing period would not exceed 60 seconds[1].

1.2 Alternative Actions

There are currently no existing government or private sector testing facilities capable of validating material performance and cooling techniques for high heat/high pressure conditions under the proposed time duration sequences and panel dimensions. The Joint Program Office (JPO) for the National Aero-

Space Plane (NASP), as well as NASA contractors, have performed preliminary evaluations on various alternate concepts for supplying high levels of heat flux on panels/components. Preliminary evaluations concluded that the techniques employed by the High Heat Flux Facility (liquid propellant combustion processes) would be the most feasible.[2] Based on the techniques required for this testing, alternative sites were evaluated for environmental and economic impacts for selection of the proposed site.

1.3 No Action

The no-action alternative is considered to be the continued use of existing panel composites on current space transportation systems. The no-action alternative will result in no impacts on the environment from either construction or operations. The no-action alternative would not provide NASA with the additional facilities necessary to conduct research and testing of propulsion system components and subsystems relative to cooling panel technology.

1.4 Environmental Consequences

The environmental impacts identified as a result of this assessment are sufficiently minor to preclude the need for an Environmental Impact Statement for the proposed construction and operation of the High Heat Flux Facility. Air emissions include natural gas combustion byproducts and minor amounts of hydrogen fluoride and fluorine from a fluorine ignition system. Process wastewater consists of non-contact cooling water. Air and wastewater discharge permits will be required and the design and operation of the facility will comply with federal, state and local regulations. No other matters of potential environmental concern have been identified.

1.5 Recommendation

A Finding of No Significant Impact should be prepared as a result of minimal short-term and long-term environmental impacts of the proposed action. This finding would apply to the High Heat Flux Facility as an independent facility continuing NASA's objective for basic research and development in propulsion systems/components technology.

ENVIRONMENTAL ASSESSMENT
HIGH HEAT FLUX FACILITY

The capabilities of the High Heat Flux Facility are needed independent of the National Aero-Space Plane (NASP) program. This finding does not apply to the overall impacts associated with the NASP program or other future hypersonic vehicles. An Environmental Impact Statement (EIS) for NASP is currently under preparation under the guidance of the NASP Environmental Team through the United States Air Force Environmental Impact and Analysis Process, with NASA as a cooperating Agency[3].

2.0 PURPOSE AND NEED

The High Heat Flux Facility will expand NASA's objective to promote the growth of innovative propulsion/component systems technology in order to assist in the development and design of new space transportation vehicles. The proposed action is a research activity that will assist in development and testing of components of the National Aero-Space Plane and other hypersonic vehicles. The development of this testing facility is necessary in order to incorporate actively cooled panel technology into the design of the space vehicles' exterior skin and engine cowling to protect against aerodynamic and engine exhaust heating. Material characteristics and behavior under anticipated load conditions are not able to be accurately predicted analytically.[4]

A test program is proposed to validate material performance and cooling techniques for high heat/high pressure conditions, and to reduce design uncertainties and program risk. There are currently no existing government or private sector testing facilities capable of validating material performance and cooling techniques for high heat/high pressure conditions under the proposed time duration sequences and panel dimensions.

The USAF and NASA are proposing to construct this test facility at the John C. Stennis Space Center (SSC). SSC has been conducting research and ground testing of liquid rocket engines and stages and high pressure cryogens since the mid-1960's. SSC is the largest handler of cryogens (propellants and pressurants) of all NASA centers.

3.0 DESCRIPTION OF THE HIGH HEAT FLUX FACILITY AND ALTERNATIVE ACTIONS

3.1 Proposed Action

The United States Air Force (USAF) and the National Aeronautics and Space Administration (NASA), in a joint research effort, are initiating the development, design and testing of the next generation of space transportation. The proposed action of this Environmental Assessment is the proposed construction of a High Heat Flux Facility (HHFF) at Stennis Space Center (SSC). This action is a research activity that will assist in development and testing of potential components of the National Aero-Space Plane and other hypersonic vehicles.

The proposed HHFF is designed to test external space vehicle panels under high heat/high pressure conditions. The development of this testing facility is necessary in order to incorporate actively cooled panel technology into the design of the space vehicles' exterior skin to protect against aerodynamic and engine exhaust heating.

The facility will assist in the demonstration of actively cooled panel technology and experimentally determine material performance and the capabilities of actively cooled panels during thermal cyclic testing. The facility will also assist in the validation of material performance and cooling techniques, and reduce design uncertainties and program risk[5].

Design, construction and activation of the facility are anticipated to occur over a sixteen (16) month period with an anticipated operational test start date of August 1993.[6]

A conceptual layout of the facility is provided in Figure 1. The proposed HHFF will occupy approximately four (4) acres [1.62 hectares] and will consist of: one (1) test cell, a gaseous hydrogen/gaseous oxygen fired gas generator test article, a test control center, high and low pressure storage vessels, a data acquisition facility, and other support and ancillary equipment. Existing equipment located at SSC will be utilized and include a firex system, hydrogen vessels and associated vaporizer and pumps, a liquid oxygen storage vessel and gaseous nitrogen storage vessels. A common test control center will be utilized between the Component Test Facility (CTF) and the HHFF.[5,7]

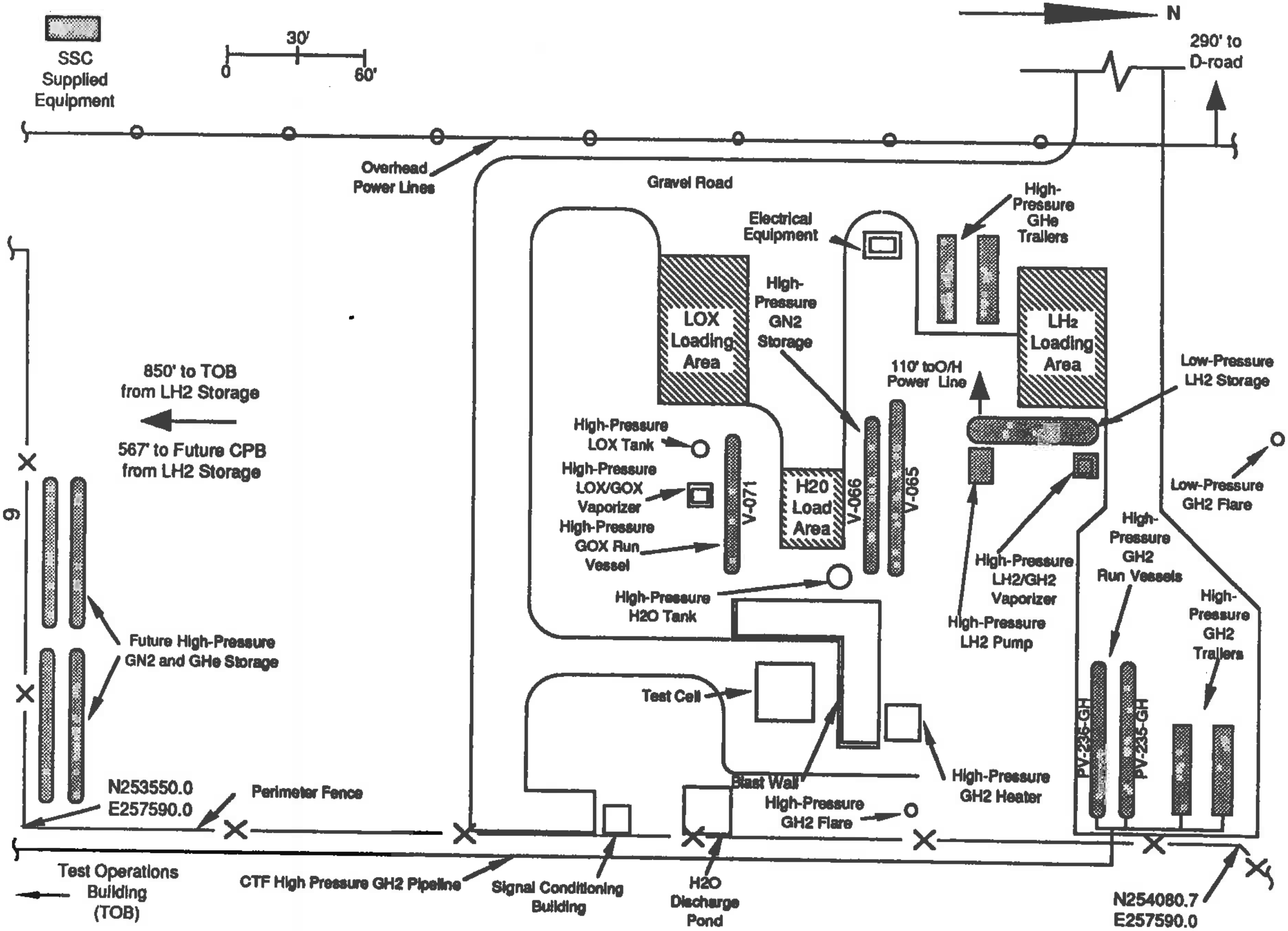


Figure 1 : Conceptual Layout of High Heat Flux Facility Stennis Space Center

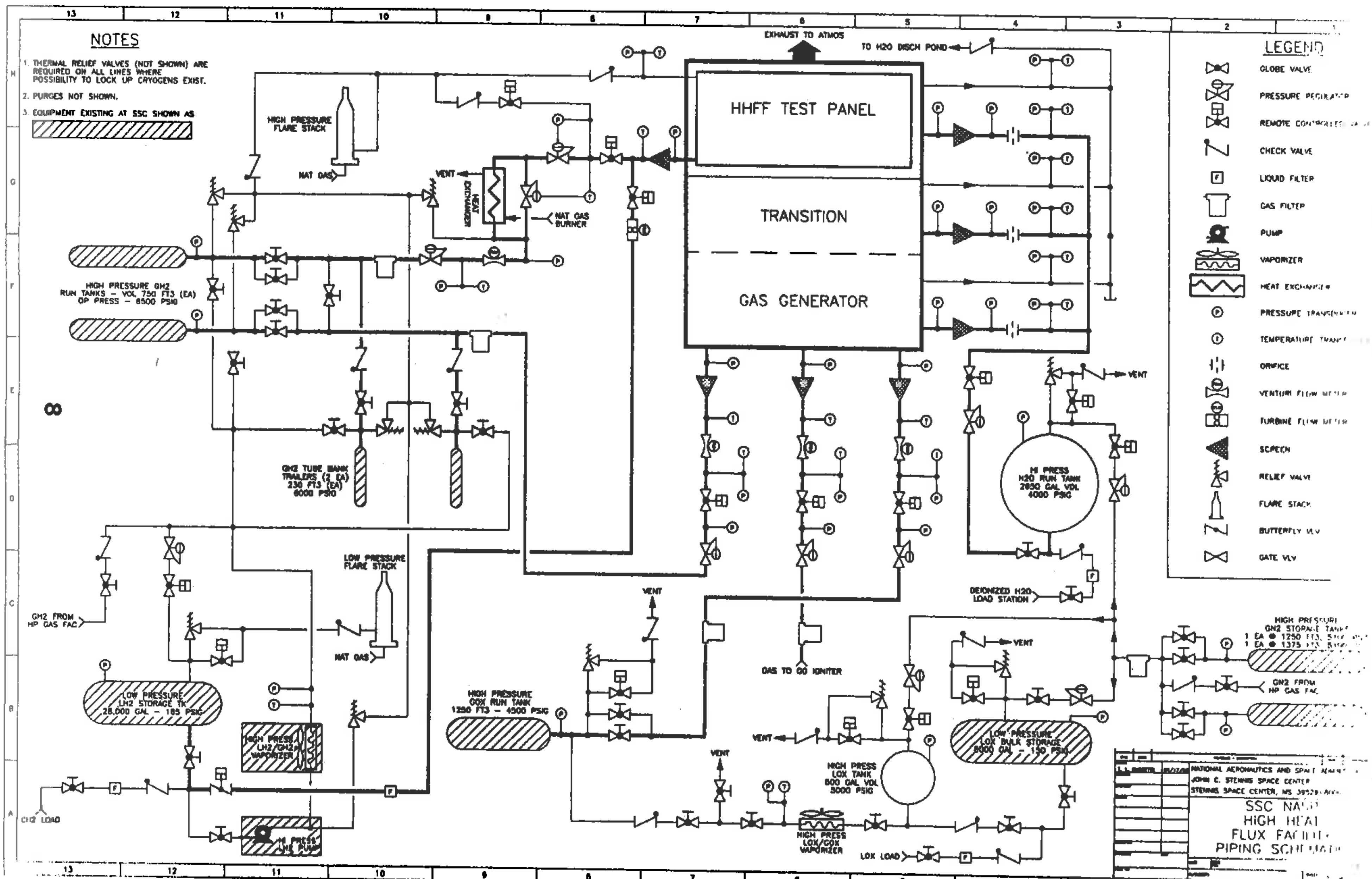
Actively cooled panel technology will be demonstrated in a test program utilizing a test rig that provides high levels of heat flux across a 20 inches by 20 inches [50.8 centimeters by 50.8 centimeters] panel specimen. Panel specimens to be tested include a composite molybdenum/copper structure, Inconel 909 (nickel based super alloy) and/or Norloy-Z (copper based super alloy). The proposed test rig consists of a 2-dimensional array of gaseous hydrogen/gaseous oxygen fired gas generators that provide heat/pressure through a transitional nozzle section. A gaseous fluorine oxidizer ignitor system is proposed.[8] Test panel specimens are mounted upon a rectangular duct for testing. High velocity, high temperature exhaust from the gas generator flows over the test specimen.

A test operation sequence begins with a 30 second prechill of the panel with liquid hydrogen at a trickle flow and low pressure. Gaseous hydrogen is then heated to the required temperature. When prechill is terminated, hot gaseous hydrogen is supplied to the panel, concurrent with firing the gas generators with gaseous hydrogen/gaseous oxygen and cooling the test rig with deionized water. A 100 millisecond charge of gaseous fluorine is used for ignition purposes.

Upon test completion, the generators and coolant will be shutdown and a trickle flow postchill of liquid hydrogen will be supplied to the test panel. Tests will occur for a maximum duration of approximately one (1) minute, at a rate of 1 test per day, 5 tests per week. The fuel and oxidizer (hydrogen and oxygen, respectively) systems will be protected with nitrogen and helium purge gases. Excess hydrogen will be burned at two (2) flare stacks. Natural gas pilot systems in both flare stacks will assure complete combustion prior to discharge to the atmosphere. A process flow diagram is provided in Figure 2.[5]

It is proposed to locate the facility in the Hazardous Testing Area, west of the A-complex, at SSC. The proposed area is adjacent to the Component Test Facility (CTF) and would utilize approximately four (4) acres [1.62 hectares] of cleared/partially developed land directly accessible to existing roads, overhead power, and underground piping supplying necessary resources such as water, gaseous hydrogen, gaseous nitrogen, and gaseous helium. The proposed site location is indicated in Figure 3. The maximum elevation of any structure at the facility will not exceed 60 feet (18.3 meters). Siting also promotes growth of the high-pressure, cryogenic test facility infrastructure and maximizes utilization of existing SSC equipment and supporting infrastructure.

Figure 2: Process Flow Diagram



HIGH HEAT FLUX FACILITY

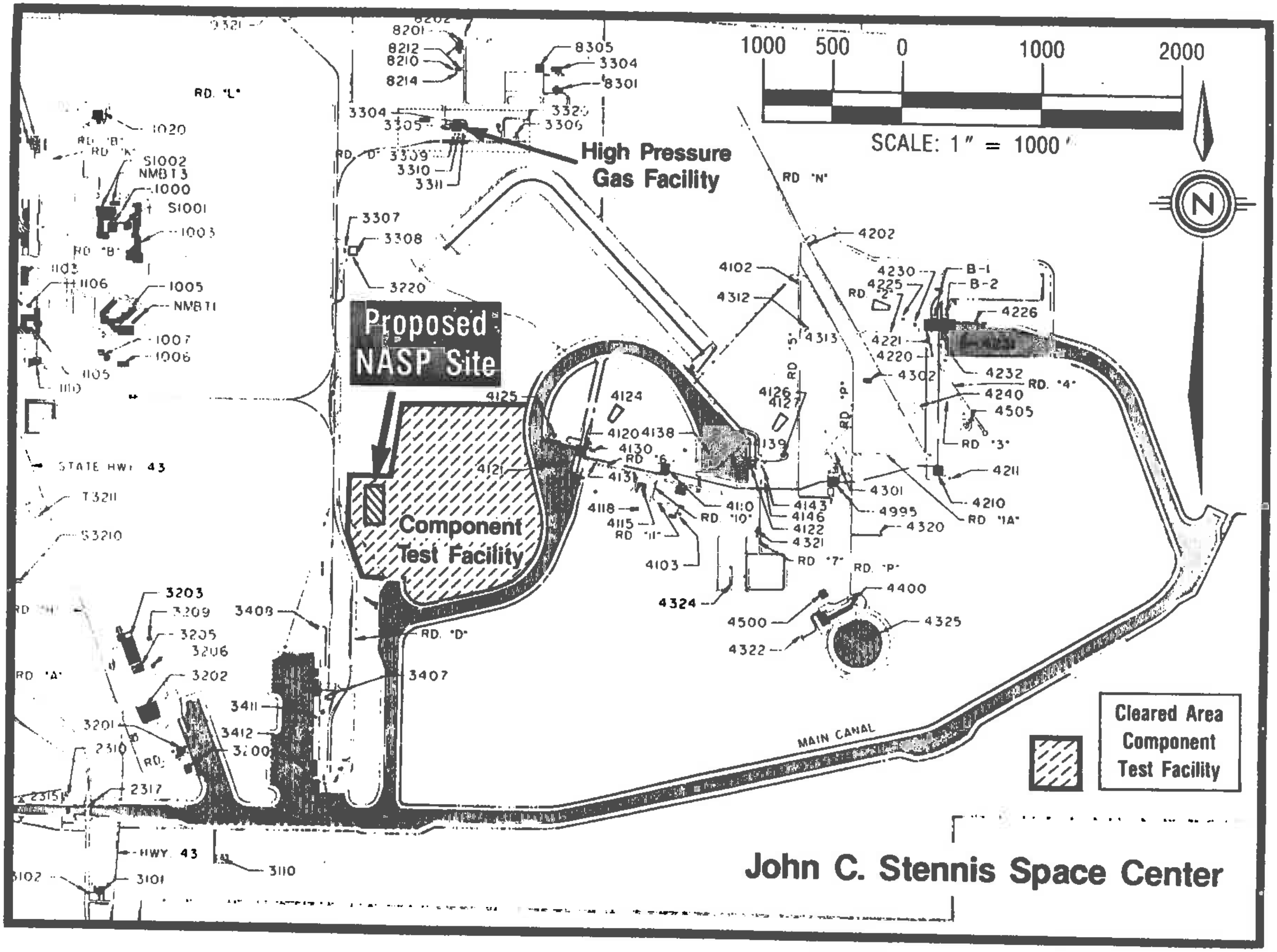


Figure 3: Proposed NASP Site Location

The SSC Environmental Resources Document[9] contains detailed information on environmental conditions at SSC. Furthermore, detailed economic, vegetation and wildlife surveys have been conducted in conjunction with the Advanced Solid Rocket Motor (ASRM) Final Environmental Impact Statement (EIS)[10] and SSC ASRM Program. These documents have been utilized to assist in the environmental assessment of the proposed action and alternatives.

3.2 Alternative Actions

3.2.1 Other Actions

The Joint Program Office (JPO) for the National Aero-Space Plane (NASP), as well as NASA contractors, have performed preliminary evaluations on various alternate concepts for supplying high levels of heat flux on panels/components. Preliminary evaluations concluded that the techniques employed by the HHFF (liquid propellant combustion processes) would be the most feasible.[2] There are currently no existing government or private sector testing facilities capable of validating material performance and cooling techniques for high heat/high pressure conditions under the proposed time duration sequences and panel dimensions.

Based on the techniques required, alternative sites were evaluated for economic and environmental impacts. In addition to SSC, Phillips Laboratory/Test Stand 2-A, located at Edwards Air Force Base, California and the AEROJET, Sacramento, California facility were considered for location of the proposed facility by the JPO. The JPO proposed SSC based on various criteria, including existing infrastructure, manpower and cost effectiveness. Based on the design to date, all locations would require air and wastewater permitting modifications for the activity.

3.2.2 Onsite locations

An evaluation of potential test complex locations at SSC was performed. Sites evaluated were selected to minimize direct impacts from clearing and grading and included annexation of existing operational areas to utilize existing equipment and resources. SSC sites evaluated included the A and B test complexes, the Diagnostic Test Facility (DTF), an eastern annexation of the High Pressure Gas Facility, the Component Test Facility (CTF) and annexation of CTF. Criteria included accessibility of high pressure gases, utilization of existing infrastructure, minimization of construction activities and wetland impacts associated with the proposed location. A summary of advantages/disadvantages of the prime sites that were under consideration is provided in Table 1.[11]

3.3 No Action

The no-action alternative will result in no impacts on the environment from either construction or operations. The no-action alternative would not provide NASA with the additional facilities necessary to conduct research and testing of propulsion system components and subsystems.

Table 1
Advantages and Disadvantages of SSC Locations

ADVANTAGES	DISADVANTAGES
Diagnostic Test Facility (DTF) Support Gas Systems Water Systems Data Acquisition Control System (DACS) Test Team in Place Facility Power Designated Nonwetland Area	No Liquid Hydrogen Flowrates small Interference with other Critical Systems (DTF, NPGF) Expandability Costly for Expansion Limited Gaseous Hydrogen Flow Rates
Component Test Facility (CTF) Volume of Cryogenics and Gas Availability of DACS Support Gas Systems Facility Power Wetland Areas Already Mitigated	Facility Start Date Interference With Construction Costly for Program
D Road Cryogenics Docks Bulk Cryogenic Storage Support Gas Systems Designated Nonwetland Area	No Facility Infrastructure No DACS Interference with Barge Delivery Not Expandable Costly
Annexation to CTF (Proposed Site) Volume of Gas and Cryogenics Support Gas Systems Facility Power DACS Expandable Facility Land Available No Interference With Other Programs Most Economical Designated Nonwetland Area	Duplication of Trailer Off-Loading

Source: NASA SSC Propulsion Test Operations.[11]

4.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND THE ALTERNATIVES

4.1 Summary

This section summarizes the environmental effects resulting from the construction and operation of the proposed facility. Air releases from the operation of a natural gas heater, a gaseous fluorine ignitor system for the gas generation system and two (2) hydrogen flare stacks will be associated with this facility and will require air permitting activities. Minor water impacts will be associated with the discharge of non-contact cooling water. Discharge of the non-contact cooling water will require wastewater permitting activities. The proposed location of the facility is not located in jurisdictional wetlands.

4.2 Air Quality Effects

4.2.1 Proposed Action

Air emissions will result from the construction and operation of the facility. Construction-related emissions will be of short-duration and will be generated by earthwork operations (approximately 9 months)[7] and construction equipment. Utilization of standard construction dust control practices (e.g., wetting surfaces, traffic control, etc.) will minimize fugitive dust emissions.

Operation of the facility will require an air permit as a result of emissions from fuel combustion of natural gas. A 10 million BTUs per hour [2.52 million kilogram-calories per hour] natural gas heater is proposed to provide heat to the high pressure high temperature hydrogen heater. Estimated emissions associated from the operation of this heater are provided in Table 2.

Table 2
Emissions from Natural Gas Combustion
10 MMBTU/hr Heater

Pollutant	Emission Factor pounds/10^6 scf[a] [kilograms/10^6 m^3]	Emission Rate pounds/hour [grams/hour]	Emission Rate tons/year [kilograms/year]
Particulate Matter	5 [80]	0.04 [18]	0.05 [45.4]
Sulfur Dioxide	0.6 [9.6]	0.005 [2.3]	0.007 [6.4]
Nitrogen Oxides	140 [2240]	1.2 [544]	1.56 [1415.2]
Carbon Monoxide	35 [560]	0.3 [136]	0.39 [353.8]
Volatile Organics			
Nonmethane VOCs	2.8 [44]	0.02 [9.1]	0.03 [27.2]
Methane VOCs	3.0 [48]	0.03 [13.6]	0.04 [36.3]

Note: [a] Emission factors from AP-42[12] for 10 MMBTU/hr industrial heater assuming 140 scf/min natural gas flow and 2600 hours/year operation.

A gaseous fluorine ignitor system is proposed to initiate the gas generator system. Three 2 cubic feet cylinders [0.06 m^3 per cylinder] of gaseous fluorine (approximately 27 pounds at 2000 psi per cylinder [12.2 kg at 136 atm]) will be stored onsite. Approximately 11 cubic inches [180.3 cm^3] (less than 0.1 pounds [39 grams] per test) of fluorine will be utilized over a 100 millisecond time frame per test.[8] The combustion of fluorine will produce approximately 0.05 pounds [21 grams] of hydrogen fluoride and 0.04 pounds [20 grams] of fluorine per test. Hydrogen fluoride is considered a hazardous air pollutant. The release of hydrogen fluorine and fluorine will occur over a 100 millisecond time period.

The gas generators will utilize gaseous hydrogen and gaseous oxygen as fuel. Combustion of these fuels will produce steam as a major combustion byproduct. As shown in the process flow diagram provided in Figure 2, products of gaseous oxygen/gaseous hydrogen combustion (steam, hydrogen) will exhaust to the atmosphere in combination with the emissions from the gaseous fluorine ignition system.

Excess hydrogen will be burned at two (2) flare stacks. Natural gas pilot systems in both flare stacks will assure combustion of hydrogen prior to discharge to the atmosphere. It is anticipated that approximately 50 standard cubic feet per hour [5.1 million liters per hour] of natural gas will be required for each pilot system.[13] Estimated emissions from the combustion of natural gas of the pilot systems are minimal and are provided in Table 3.

Table 3
Emissions Of Natural Gas Pilots For Flare Systems

Pollutant	Emission Factor pounds/10^6 scf* [kilograms/m³]	Emission Rate pounds/hour [grams/hour]	Emission Rate pounds/year [kilograms/year]
Particulate	5 [80]	0.0005 [0.2]	5.8 [2.6]
Sulfur Dioxide	0.6 [9.6]	0.00006 [0.3]	0.7 [0.3]
Nitrogen Oxides	100 [1600]	0.01 [4.5]	116.8 [53]
Carbon Monoxide	20 [320]	0.002 [0.9]	23.4 [10.6]
Volatile Organics			
Nonmethane VOCs	5.3 [84]	0.0005 [0.2]	5.8 [2.6]
Methane VOCs	2.7 [43]	0.0003 [0.1]	3.5 [1.6]

Note: * Emission factors based on AP-42[12] and assumes worst case 24 hour/day operation of the low pressure flare pilot system and 8 hour/day operation of the high pressure pilot system.

The panels to be tested are proposed to be constructed of either a composite molybdenum/copper structure, Inconel 909 (a nickel based super alloy) and/or Norloy-Z (a copper-based super alloy). Erosion of the panel under testing conditions is not anticipated.[11]

Cleaning and maintenance of this facility will fall under all SSC standards with the majority of rework and repair of components occurring onsite utilizing existing permitted facilities.[11]

An air toxic review was conducted based on preliminary design data of the facility. The substance hydrogen fluoride is listed as a hazardous air pollutant in Title III of the Federal Clean Air Act Amendments of 1990, including subsequent additions and/or deletions as of the release date of this Environmental Assessment, and has been identified as an air release.[14] Minimal amounts of fluorine and hydrogen fluoride (less than 0.05 pounds [21 grams] per test each) will be released as a result of panel testing over a short time period (100 milliseconds). Only one (1) test is proposed per day.

Based on the data provided, the facility is not considered a major source for criteria air pollutants and a major Prevention of Significant Deterioration air permit is not warranted. Normal operation of the facility is not anticipated to violate ambient air standards.[15,16,17,18,19] Permitting of air emission sources will be pursued with the appropriate regulatory agencies.

4.2.2 Alternative Actions

The potential use of an electric heater as an alternative to the natural gas heater is under evaluation.[20] No air emissions would be associated with electric heater usage, although natural gas usage is economically favorable. Utilization of a gas heater represents a worst-case scenario from an air emissions standpoint.

The potential use of an alternative (e.g., oxygen) to gaseous fluorine as an oxidizer for the gas generator ignition system is under evaluation.[8] Utilization of gaseous fluorine represents a worst-case scenario from an air emissions standpoint since the substance and its combustion products are considered toxic and hazardous air pollutants.[14,17,18]

4.3 Water Quality Effects

Short-term limited impacts to water quality will be caused by erosion and siltation during construction activities. These impacts will be mitigated by reseeding and resodding in disturbed areas and by the use of temporary erosion barriers to minimize turbidity to surface waters. No dredging activities are associated with this project. No direct discharges of wastewater to navigable waterways are associated with this project.

Water demands consist of potable water for human consumption and use at the Test Control Center, noncontact deionized cooling water for the gas generator and washdown and emergency fire water supply. Potable water is currently supplied from three (3) potable water wells. Potable water will be deionized onsite at an existing facility or vendor purchased and transported to the test facility. Industrial water for fire protection is supplied from three (3) industrial water wells.

Wastewater discharges will consist of sanitary wastewater, non-contact cooling water and stormwater runoff. Sanitary wastewater will be conveyed to the existing sanitary wastewater treatment system, capable of handling impacts associated with facility use. Sanitary discharge is anticipated to be minimal with the small permanent workforce (6 employees).

Deionized water at a rate of approximately 2500 gallons [9,463 liters] per test is necessary for coolant of the gas generator.[5] Potable water will be deionized at Building 2205 in the Millipore IonPure System and transported to the proposed facility.[11,21] The deionized water will not come into contact with the combustion gas stream or the tested side of the panel. This uncontaminated non-contact cooling water will be routed to a small cooling basin for eventual discharge through a permitted outfall[11]. The deionized water will be released from the basin when proper temperatures have been reached to safely discharge into the existing drainage system. Due to the infrequent and short test frequency of the operation, impacts on water are anticipated to be minimal. Permitting of wastewater discharges will be pursued with the appropriate regulatory agencies.

The facility will be constructed on a concrete foundation. Industrial water will be supplied for deluge/fire protection. Stormwater from the area will be routed by grading to drain to existing drainage ditches. No groundwater effects from the proposed facility are anticipated.

4.4 Wetland and Floodplain Impacts

Approximately four (4) acres [1.62 hectares] of land are necessary for the construction and operation of the proposed facility. The SSC Fee Area was recently assessed by the U.S. Army Corps of Engineers, Vicksburg District[22] for wetland determination. The proposed location of the facility does not encroach on jurisdictional wetlands as defined by the Federal Manual for Identifying and Delineating Jurisdictional Wetlands[23]. The proposed location of the facility relative to the Component Test Facility area and associated wetland jurisdictional determination is provided in Figure 4.

This activity is not considered a critical action activity per NASA regulations. Critical action is any activity for which even a slight chance of flooding would be too great, such as storing lunar samples or highly toxic or water reactive materials.[24] The proposed location is not located in the base flood area (100-year floodplain) and is considered Zone C per the Flood Insurance Rate Map of Hancock County, Mississippi, Panel 125 of 195, revised 18 September 1987, Federal Emergency Management Agency. Zone C is defined as areas of minimal flooding[25].

4.5 Biotic Resources

The proposed location of the HHFF is in an area which was previously cleared in association with the construction of the Component Test Facility. A detailed assessment of the terrestrial fauna was conducted throughout a portion of the SSC fee area by Drs. Edmund Keiser and Paul Lago[26]. Dr. Jean Wooten[27] also performed botanical studies of the general test area. Detailed descriptions of the biological communities in the area of the proposed facility are provided in the SSC Environmental Resources Document[9], which utilizes the aforementioned studies.

Construction impacts due to the previous clearing and grading of this area have already resulted in long-term impacts resulting from habitat loss. See Figure 3 for the location of the proposed site relative to cleared areas of the Component Test Facility.

Atmospheric releases of fluorine and hydrogen fluoride can pose an indirect impact to public welfare through the adverse effects on vegetation. A small quantity of fluorine and fluorine compounds will be released over a brief

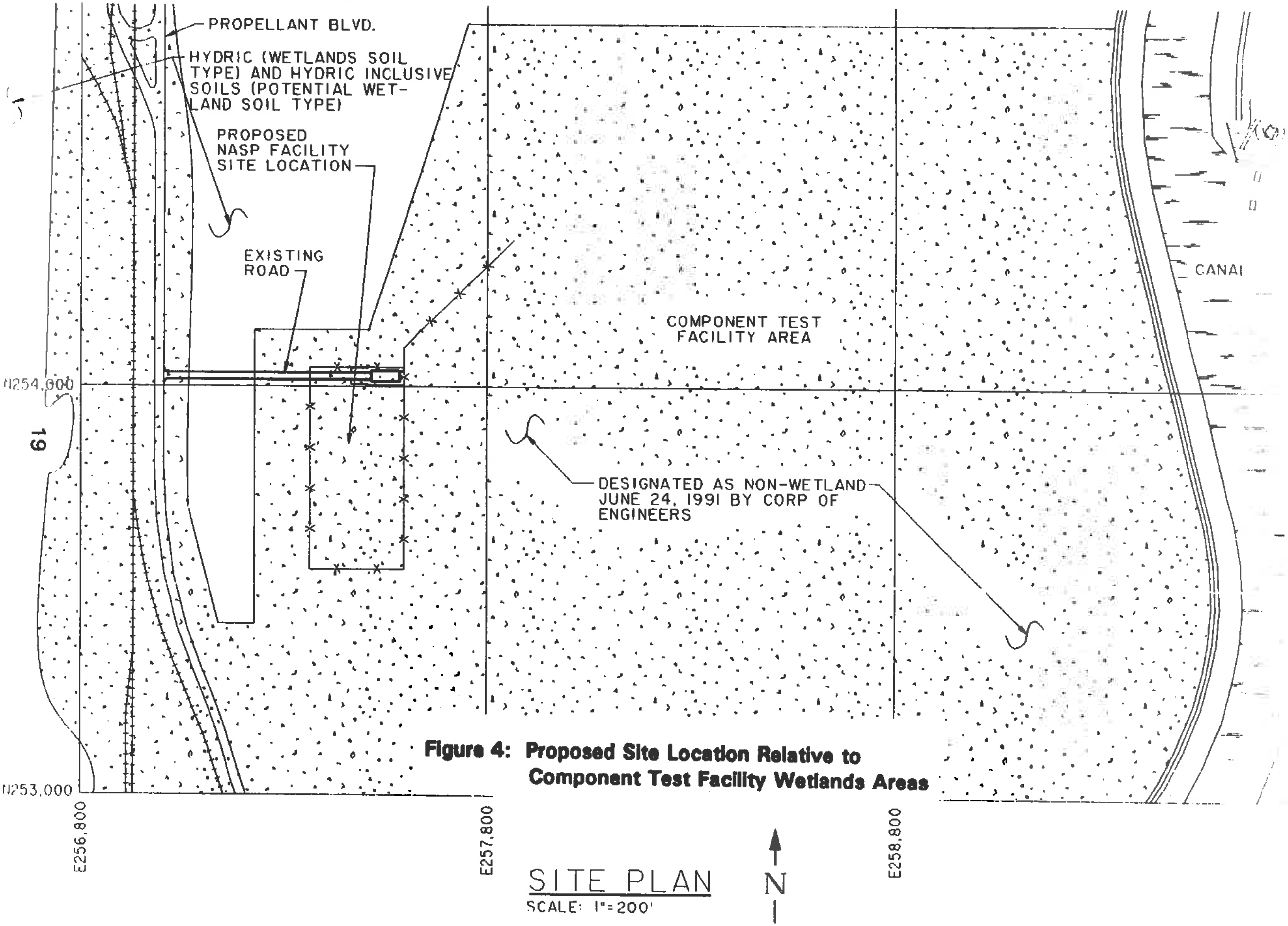


Figure 4: Proposed Site Location Relative to Component Test Facility Wetlands Areas

time period as a result of proposed operations, and is relatively insignificant such that no adverse effects are anticipated.

4.6 Threatened and Endangered Species

Threatened and endangered species surveys are addressed in the terrestrial fauna report of Drs. Edmund Keiser and Paul Lago[26] and the botanical studies of Dr. Jean Wooten[27]. Construction and operation of the HHFF should not adversely affect any species or species habitat (e.g., gopher turtle, rainbow snake, hognose snake, Florida panther, etc.) possibly known to exist on the SSC fee area. Management procedures will be implemented during construction activities to minimize impacts on protected species discovered during construction. These procedures will be coordinated with the United States Department of the Interior, Fish and Wildlife Service (USFWS) who has concurred with the threatened and endangered species evaluation.[28] A copy of the correspondence from USFWS relative to this matter is provided in Exhibit 1.

4.7 Waste Generation, Treatment, Storage and Disposal

Minimal waste generation is anticipated from this facility. Nonhazardous waste will be collected, transported and disposed of in the permitted sanitary landfill located onsite. Fluorine is listed as an acutely hazardous waste (P056) under the Resource Conservation and Recovery Act (RCRA) and residual fluorine from storage containers and/or cylinders will be properly disposed of using RCRA guidelines. Treatment/disposal will consist of offsite treatment/disposal at an approved RCRA facility or onsite treatment using an approved and permitted scrubber system.

The test panel will require further testing and analysis after it has completed its testing requirements at SSC. The test panel will be forwarded to the appropriate JPO contact or affiliate. Disposal of the test panel at SSC is not anticipated. No other hazardous waste streams are anticipated to be generated as a result of the operation of this facility.

4.8 Toxic Substances

Air emissions from natural gas combustion and fluorine are minimal. The facility plans to store three 2 cubic feet cylinders with less than 81 pounds [36.7 kilograms] total gaseous fluorine at the proposed pressures. The Threshold Planning Quantity for fluorine is 500 pounds [226.8 kilograms]. Fluorine is considered highly toxic, corrosive and an oxidant. Proper safety precautions and relief systems will be designed to ensure worker safety and protection.

No polychlorinated biphenyls (PCBs), asbestos, hexavalent chromium or chlorofluorocarbons are anticipated for release or use in the operation of the proposed facility.

4.9 Radioactive Materials and Nonionizing Radiation

No radioactive materials or nonionizing radiation will be used or released in the construction or operation of this project.

4.10 Noise

Minor impacts resulting from steam emissions and noise associated with the flaring of hydrogen are anticipated. Due to the infrequent and short-duration of the test schedules, noise impacts under normal operation are anticipated to be minor.

4.11 Land Use Effects

The proposed facility is located in an area that has been designated by NASA in the Facilities Master Plan[29] as Hazardous Test Area and utilizes approximately 4 acres [1.62 hectares] of industrial-type land that has been previously cleared for access and maintenance of the Component Test Facility.

4.12 Socioeconomic Impacts

The proposed facility will employ approximately 35 people temporarily during the construction phase and approximately 6 permanent employees during operations. The current employment population at SSC is approximately 4,000 people. No new permanent employees are associated with the operation of this facility; therefore, this facility will not have a significant socioeconomic impact on SSC.

4.13 Historical, Archaeological and Cultural Impacts

During 1988, the Mobile District, U.S. Army Corps of Engineers conducted an archaeological survey and reconnaissance of lands with the SSC Fee Area[30]. No archaeological resources were located on any of the land surveyed. The Mississippi Historic Preservation Office and the Archaeological Services Branch of the National Park Service concurred with these findings.[30]

4.14 Resource Use

The HHFF will utilize common site resources (e.g., gaseous nitrogen, gaseous helium, and hydrogen services) as well as electrical, potable water and telephone utilities.[7] Supply of cryogens and other needed gases are readily available due to the high volume usage and low transportation costs associated with the SSC facility.

4.15 Energy Requirements

A preliminary assessment of the electrical needs indicate that less than 100 kVA will be required for operation of the facility and accounts for electronic, control system and small building utilities plus power loads for vaporizer fans and the water pump system. A distribution electric utility line is adjacent to the proposed site.

4.16 Accidents and Safety Issues

The facility will be designed in accordance with applicable NASA, federal and state codes, standards and regulations, including Department of Defense Explosive Safety Board standards and National Fire Protection Association codes 50, 50A and 50B. Concurrent with design, a hazard analysis will be conducted identifying those component and test system failures that will adversely affect continued operation of the facility. Overall operations of the facility are minimized by the extensive SSC experience in operations of cryogenic related test facilities. Design and operation of the fluorine ignitor system will follow Department of Defense and NASA standards.

No other matters of environmental concern have been identified.

5.0 INDIVIDUALS AND ORGANIZATIONS CONSULTED

Table 4 provides information on the individuals and organizations consulted for the preparation of this environmental assessment.

Table 4
Individuals and Organizations Consulted
For HHFF Environmental Assessment

Individual	Organization	Area of Information
SSC PARTICIPANTS		
Anne Johnson	NASA-SSC Center Operations	Environmental Concerns
Ron Magee	NASA - SSC Center Operations	Environmental Concerns
Bruce Davis	NASA - SSC Science and Technology Laboratory	Biotic/Soils/Vegetation/Wildlife
John Webb	NASA - SSC Center Operations	Construction Details
Patrick Scheuermann	NASA - SSC Propulsion Test Operations	Program Requirements
Bartt Hebert	NASA - SSC Propulsion Test Operations	Program Design - Test Engineering Lead
Paul Rider	NASA - SSC Propulsion Test Operations	Hydrogen Systems
Thom Arceneaux	NASA - SSC Center Operations	Design Coordination/Facility Resources
Ellen Eagan	Sverdrup Technology, SSC Group	Environmental: Air/NEPA; Environmental Regulations
Tracy Moragas, P.E.	Sverdrup Technology, SSC Group	Engineering Support
Gary Ransford	Sverdrup Technology, SSC Group	Noise
Carolyn Kennedy	Sverdrup Technology, SSC Group	Environmental
Marcia Stewart	Johnson Controls	Deionized water system requirements/Facility Support
Larry Meindes	Johnson Controls	Flare Systems - Natural Gas Supply and Specifications

Individual	Organization	Area of Information
OTHER NASA FACILITIES		
Ken Kumor	NASA Headquarters	NEPA Procedures
OUTSIDE AGENCY CORRESPONDENCE		
Tom Thornhill Larry E. Goldman	U.S. Fish and Wildlife	Threatened and Endangered Species
Don Watts	Mississippi Department of Environmental Quality - Air Division	Air Permitting
Lou Lavalle	Mississippi Department of Environmental Quality - Water Division	Wastewater Impacts/NPDES Permitting
Jerry Cain	Mississippi Department of Environmental Quality - Water Division	Wastewater Impacts/NPDES Permitting

6.0 REFERENCES

1 Magee, R.G. NASA Center Operations. Personal communications with E. Eagan of Sverdrup Technology Inc., SSC Group. April, 1992.

2 Moragas, T. Sverdrup Technology Inc., SSC Group. Memorandum to F.W. Roberts on Supply of high heat flux for NASP Panel testing. February, 1991.

3 Reda, H. NASP and the Environment, AIAA-91-5051. NASP Joint Program Office, Wright-Patterson Air Force Base, Ohio. December, 1991.

4 NASA. High Heat Flux Facility Project Requirements Document. Draft Document. April, 1992.

5 NASA. Propulsion Test Operations, Stennis Space Center. High Heat Flux Facility, Preliminary Assessment Update, John C. Stennis Space Center, National Aeronautics and Space Administration, Stennis Space Center, February, 1992.

6 NASA. Propulsion Test Operations, Stennis Space Center. Baseline of Integrated Schedule for High Flux Facility. P. Scheuermann. April, 1991.

7 Arceneaux, T. NASA Center Operations. Correspondence to R. Magee. High Heat Flux Facility. April, 1992.

8 Magee, R.G. NASA Center Operations. Telephone communications with E. Eagan of Sverdrup Technology Inc., SSC Group. April 20, 1992. Revised information of May 21, 1992 on fluorine ignitor system.

9 NASA. Environmental Resources Document, Stennis Space Center, April, 1992.

10 NASA. Final Environmental Impact Statement Space Shuttle Advanced Solid Rocket Motor Program. John C. Stennis Space Center, March, 1989.

11 Scheuermann, P. NASA Propulsion Test Operations. Correspondence to R. Magee on High Heat Flux Facility. April, 1992.

12 United States Environmental Protection Agency. Compilation of Air Pollutant Emission Factors. Volume 1. Stationary Point and Area Sources. Fourth Edition. Supplement C. September, 1990.

13 Meindes, L. Johnson Controls, Inc. Telephone communications with E. Eagan of Sverdrup Technology, Inc., SSC Group. April, 1992.

14 Clean Air Act Amendments of 1990. 15 November 1990.

15 Code of Federal Regulations. Protection of the Environment. Title 40 Part 50 (40 CFR 50) - National Primary and Secondary Ambient Air Quality Standards.

16 State of Mississippi. Department of Environmental Quality. Guidelines for Review of Siting Criteria in Applications for Air and Water Pollution Control Permits. Permit Board Rule 1-82. July, 1987.

17 State of Mississippi. Department of Environmental Quality. Air Emission Regulations For The Prevention, Abatement, and Control of Air Contaminants. Regulation APC-S-1. August 1989. Amended April 25, 1991.

18 State of Mississippi. Department of Environmental Quality. Permit Regulations For the Construction and/or Operation of Air Emissions Equipment. Regulation APC-S-2. August 1989. Amended April 25, 1991.

19 State of Mississippi. Department of Environmental Quality. Regulations For the Prevention of Significant Deterioration of Air Quality. Regulation APC-S-5. Amended April 25, 1991.

20 Moragas, T. Sverdrup Technology Inc., SSC Group. Communications with E. Eagan, Sverdrup Technology Inc., SSC Group. April, 1992.

21 Stewart, M. L. Johnson Controls, Inc. Telephone communications with E. Eagan, Sverdrup Technology Inc., SSC Group. April, 1992.

22 McGregor, E.G. U.S. Army Corps of Engineers, Vicksburg District Correspondence to R.G. Magee, NASA. Jurisdictional Wetland Determination of SSC. June, 1991.

23 Fish and Wildlife Service, Environmental Protection Agency, Department of the Army and Soil Conservation Service. Federal Manual For Identifying and Delineating Jurisdictional Wetlands, December, 1991.

24 NASA. NMI 8800.10B, Attachment A. Floodplain and Wetlands Management. December, 1991.

25 Federal Emergency Management Agency. Flood Insurance Rate Map: Hancock County, Mississippi, Panel 125 of 195. Community Panel Number 285254 0125 C, Map Revised: September 18, 1987.

26 Keiser, E. and Lago, P. Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 acre Stennis Space Center ASRM Site, Final Report. October, 1991.

27 Wooten, J.W. A Fall Botanical Survey of A Portion of the National Aeronautics and Space Administration Installation. Stennis Space Center, Mississippi. Parts I and II. October, 1991.

28 Goldman, L.E. United States Department of the Interior. Fish and Wildlife Service. Correspondence to R.G. Magee, NASA. April, 1992.

29 NASA. Facilities Master Plan. National Space Technology Laboratory. May, 1979.

30 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. Concurrence with Report by Mississippi State Historic Preservation Officer and Archaeological Services Branch Chief, May, 1988.

Other Reference Materials Not Specifically Cited

NASA. Implementing the Provisions of the National Environmental Policy Act, NHB8800.11. April, 1980.

State of Mississippi. Department of Environmental Quality. Wastewater Permit Regulations for National Pollutant Discharge Elimination System (NPDES), Underground Injection Control (UIC) and State Operating Permits. WPC-1. Amended July 25, 1991.

Sutton, George P. Rocket Propulsion Elements: An Introduction to the Engineering of Rockets. 5th Edition. John Wiley and Sons, 1986. pp.361.

Chemical Propulsion Information Agency. Hazards of Chemical Rockets and Propellants. Volume III. Liquid Propellants. CPIA Publication 394, Volume III. J.A. Hannum, Editor. September, 1984.

EXHIBIT 1

CORRESPONDENCE FROM THE UNITED STATES DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE

United States Department of the Interior
FISH AND WILDLIFE SERVICE

P.O. Drawer 1190
Daphne, AL 36526

April 27, 1992

Mr. Ronald G. Magee, Environmental Officer
NASA-John Stennis Space Center
Code GA00
Stennis Space Center, MS 39529-6000

Dear Mr Magee:

This regards your April 20, 1992 letter relative to the possible impacts that construction of the proposed National Aerospace Plane Facility at Stennis Space Center (SSC) may have on federally listed species. The U.S. Fish and Wildlife Service (Service) has reviewed the surveys, provided with your letter, that were conducted on the Flora and Fauna of the Advance Solid Rocket Motors test (ASRMS) area. The location of these surveys also encompassed the area that is being proposed for the Aerospace plane facility. The results of these surveys indicate that no endangered, threatened, or proposed species are within this proposed project area. Therefore, no further consultation regarding this particular construction will be necessary.

As stated in your letter, there are two species of plants considered as candidates for possible listing, (category 2), Ilex amelanchier and Lilaeopsis carolinensis within the ASRMS test area. You should stay aware of any possible future changes in the status of this species.

The Service appreciates your concern and efforts to protect federally listed species. We also look forward to working with you on future projects at SSC.

Sincerely,

Larry E. Goldman
Field Supervisor

cc: EPA, Atlanta, GA
NMFS, Panama City, FL
MDWFP, Jackson, MS
BPC, Jackson, MS
BMR, Biloxi, MS