John C. Stennis Space Center

History of Stennis Space Center

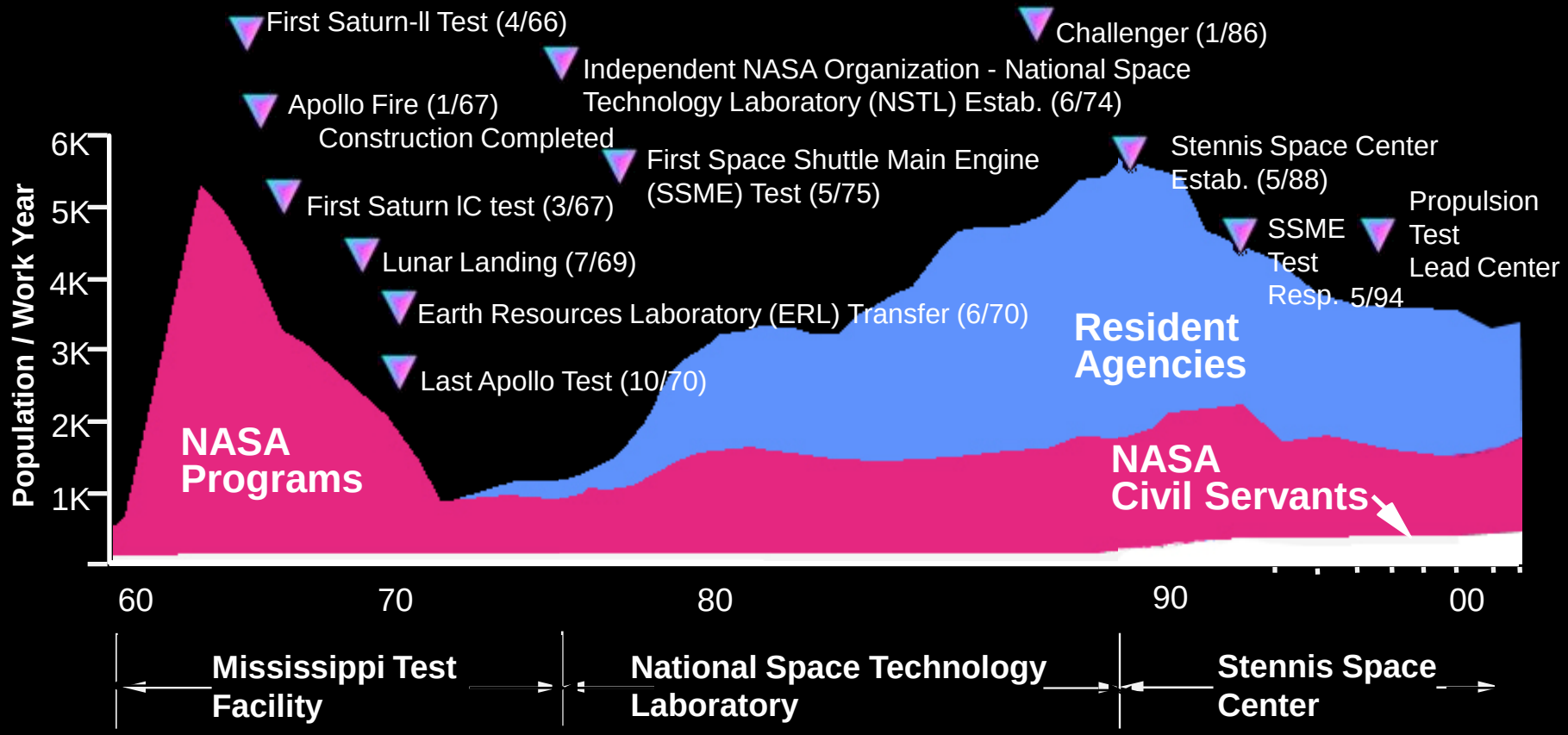
John C. Stennis Space Center was established to test the engines used to propel the Apollo spacecraft to the moon.

- **Site selection of Hancock County, Miss. provided access to:**
  - **Isolated test site with acoustical buffer zone**
  - **Water and road transportation capabilities**
  - **Supportive community**
  - **Climate conducive for year-round testing**
- **Construction began – May 17, 1963**
- **First Saturn V test – April 23, 1966**
- **Space Shuttle Main Engine test role assigned – March 1, 1971**
- **Renamed John C. Stennis Space Center – May 20, 1988**
- **Today – Stennis is America's largest rocket engine testing facility**

"I don't know yet what method we will use to get to the moon, but I do know that we have to go through Mississippi to get there!"

Dr. Wernher Von Braun

Stennis Workforce History



A Unique Federal City

5,200 NASA, contractor and resident agency employees*

- NASA
  - John C. Stennis Space Center*
    - 302 NASA civil servants
    - 1230 NASA contractors
  - NASA Shared Services Center*
    - The NSSC is located on site with 574 employees
    - 143 NASA civil servants
    - 431 NSSC contractors
- NAVY
  - Commander, Naval Meteorology & Oceanography Command
  - Naval Oceanographic Office
  - Naval Research Laboratory
  - Naval Small Craft Instruction and Technical School
  - Navy Special Boat Team 22
  - Navy Human Resources Service Center Southeast
- More than 30 major federal, state, academic and private organizations
  - More than 60 technology-based companies

* Employee numbers fluctuate, and are as of January 2012

Resident Agencies at Stennis Space Center

Department of Defense
- Commander, Naval Meteorology & Oceanography Command
- Naval Oceanographic Office
- Naval Research Laboratory
- Naval Small Craft Instruction and Technical Training School
- Navy Special Boat Team 22
- Navy Human Resources Service Center Southeast

Department of Commerce
- NOAA, NWS, National Data Buoy Center
- NOAA National Marine Fisheries Service
- NOAA National Coastal Data Development Center

Environmental Protection Agency
- Environmental Chemistry Laboratory
- Gulf of Mexico Program

Department of Interior
- U.S. Geological Survey, Hydrologic Instrumentation Facility

Department of Energy
- Strategic Petroleum Reserve

State of Mississippi
- Mississippi Enterprise for Technology
- Enterprise for Innovative Geospatial Solutions

State of Louisiana
- Louisiana Technology Transfer Office, Louisiana Business & Technology Center/LSU

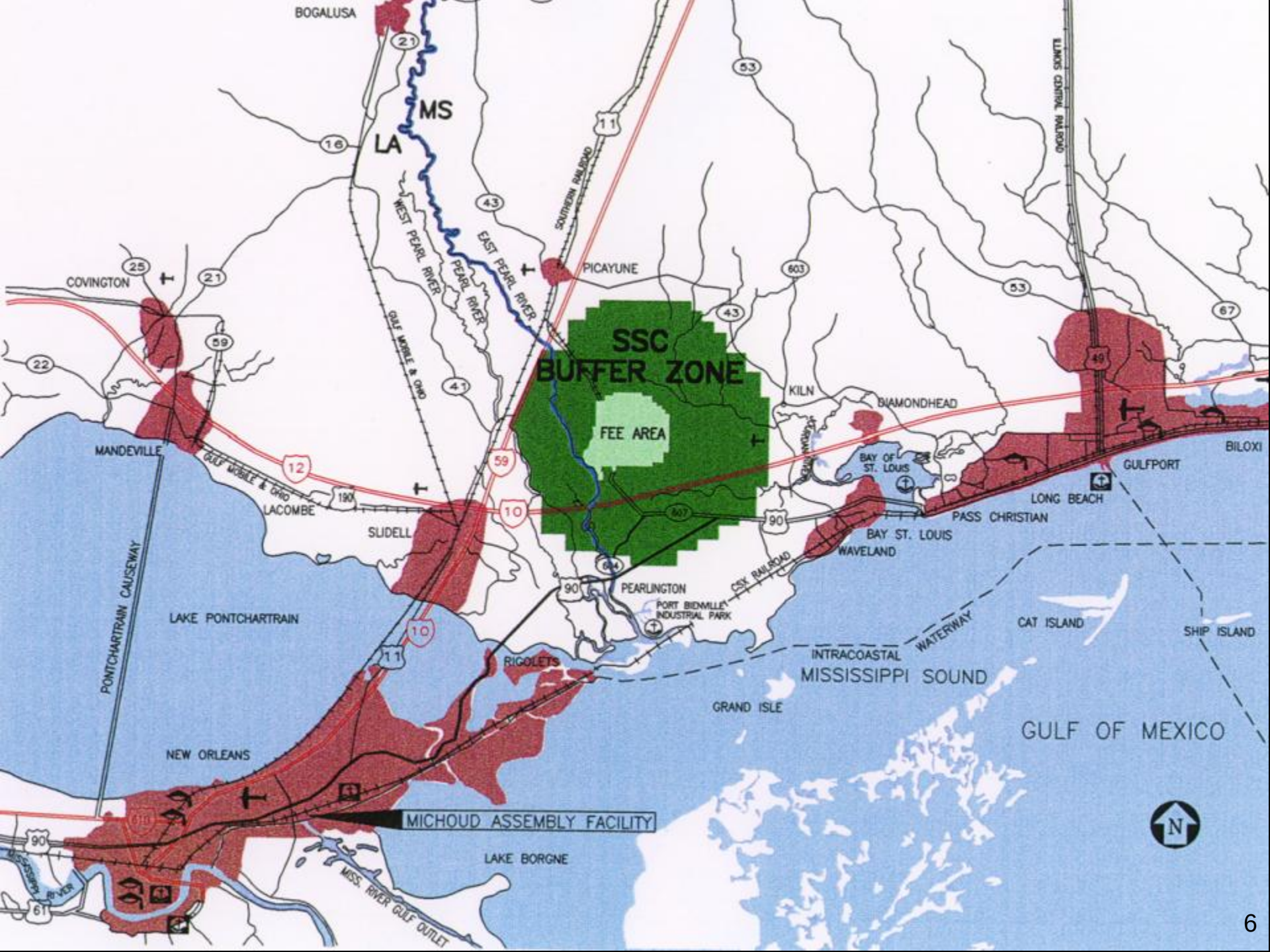
Center for Higher Learning
- Mississippi State University
- University of Southern Mississippi
- University of Mississippi
- University of New Orleans
- Pearl River Community College

Mississippi State University
- Northern Gulf Institute

University of Southern Mississippi - College of Science and Technology
- Dept. of Marine Science

Major Contractors
- Pratt and Whitney Rocketdyne
- Jacobs Technology Inc.
- A2 Research
- ASRC Research and Technology Solutions (ARTS)
- Lockheed Martin
- ISS Action Inc.
- Science Applications International Corporation
- Science Systems and Applications Inc.

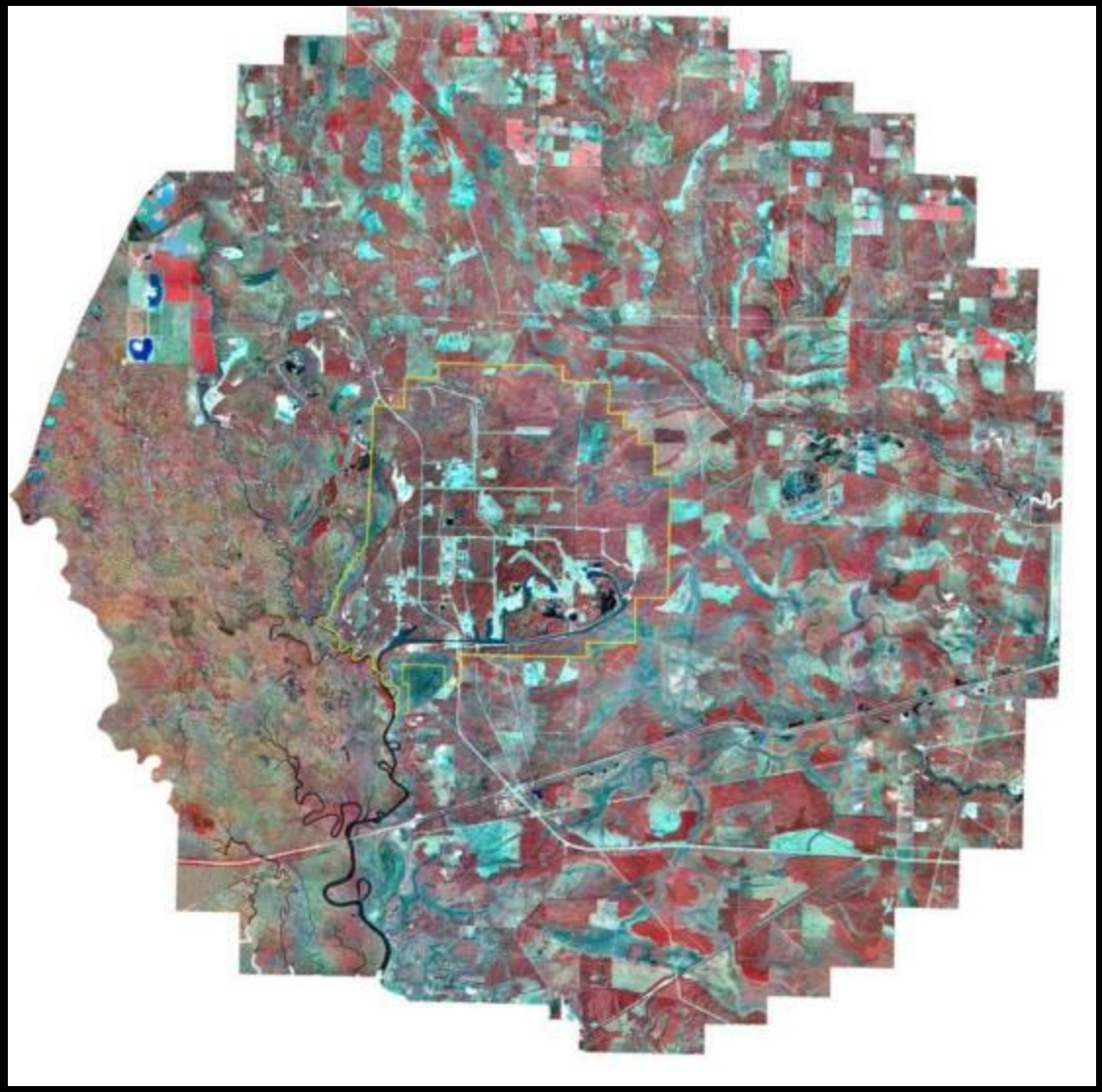
Commercial Companies
- Pratt and Whitney Rocketdyne
- Lockheed Martin IS & GS Defense Systems
- Rolls Royce North America


BOGALUSA
MS
LA
SSC
BUFFER ZONE
FEE AREA
PICAYUNE
COVINGTON
MANDEVILLE
LACOMBE
SLIDELL
KILN
DIAMONDHEAD
BAY OF
ST. LOUIS
BILOXI
GULFPORT
LONG BEACH
PASS CHRISTIAN
BAY ST. LOUIS
WAVELAND
PEARLINGTON
PORT BIENVILLE
INDUSTRIAL PARK
LAKE PONTCHARTRAIN
PONTCHARTRAIN CAUSEWAY
RIGOLETS
CAT ISLAND
SHIP ISLAND
INTRACOASTAL WATERWAY
MISSISSIPPI SOUND
GRAND ISLE
GULF OF MEXICO
NEW ORLEANS
MICHOUD ASSEMBLY FACILITY
LAKE BORGNE
MISS. RIVER GULF OUTLET
WEST PEARL RIVER
PEARL RIVER
EAST PEARL RIVER
SOUTHERN RAILROAD
ILLINOIS CENTRAL RAILROAD
GULF MOBILE & OHIO
CSX RAILROAD
N

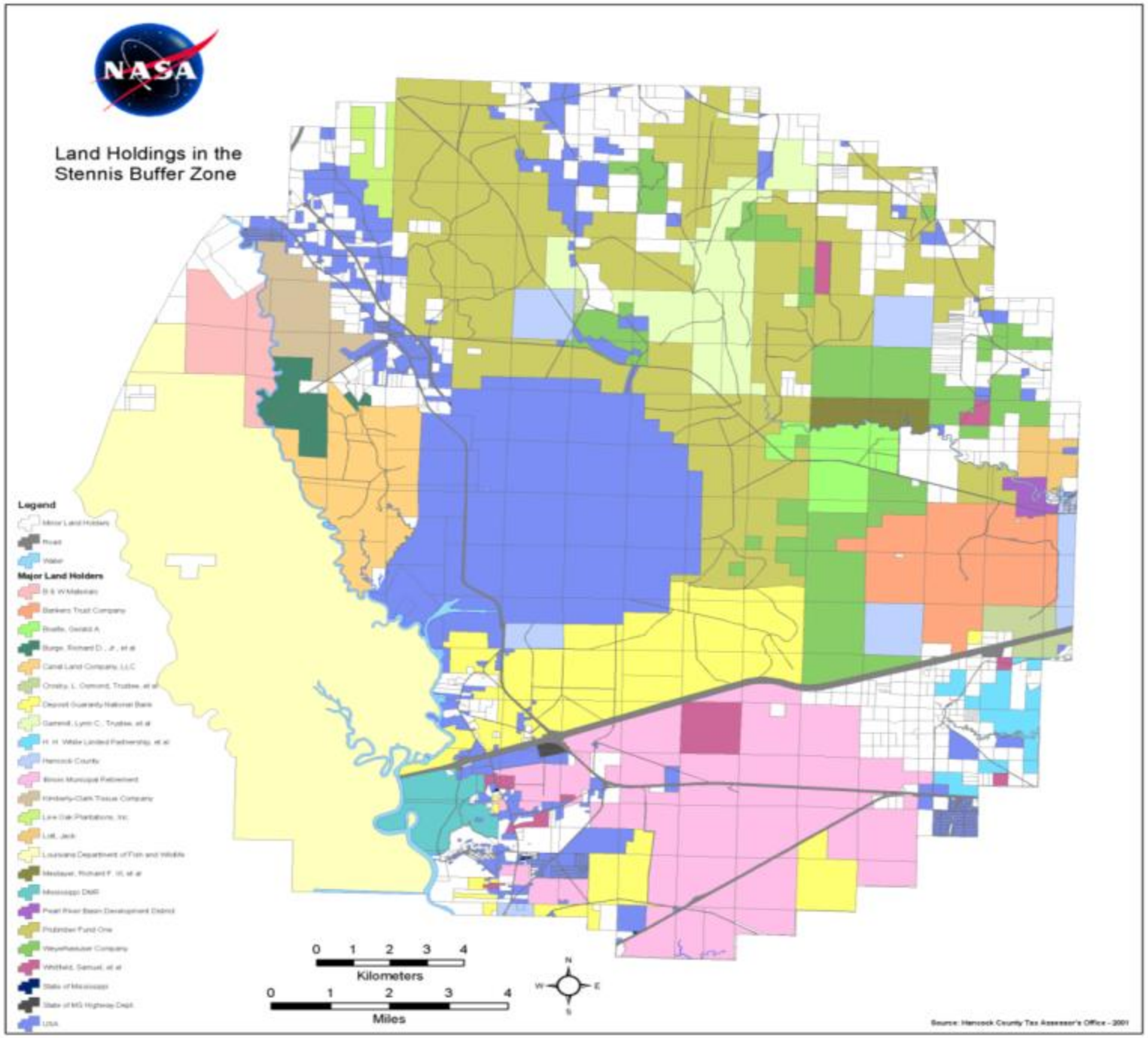
Buffer Zone

13,800 Acre Fee Area

125,000 Acre Buffer Zone



The 7 ½ mile Panama Canal-like lock-and-dam waterway system links the Stennis Space Center test complex to the Pearl River, providing access for delivery of rocket propellants, large rocket components and other materials.


Land Holdings in the
Stennis Buffer Zone
Legend
Minor Land Holders
Road
Water
Major Land Holders
B & W Mallonee
Bankers Trust Company
Boatte, Gerald A.
Burge, Richard D., Jr., et al
Camel Land Company, LLC
Crosby, L. Osmond, Trustee, et al
Deposit Guaranty National Bank
Gammill, Lynn C., Trustee, et al
H. H. Wilds Limited Partnership, et al
Hancock County
Illinois Municipal Retirement
Kimberly-Clark Tissue Company
Live Oak Plantations, Inc.
Lott, Jack
Louisiana Department of Fish and Wildlife
Mestayer, Richard F. III, et al
Mississippi DNR
Pearl River Basin Development District
Prudential Fund One
Weyerhaeuser Company
Whitfield, Samuel, et al
State of Mississippi
State of MS Highway Dept
USA
0 1 2 3 4
Kilometers
0 1 2 3 4
Miles
N
W
E
S
Source: Hancock County Tax Assessor's Office - 2001

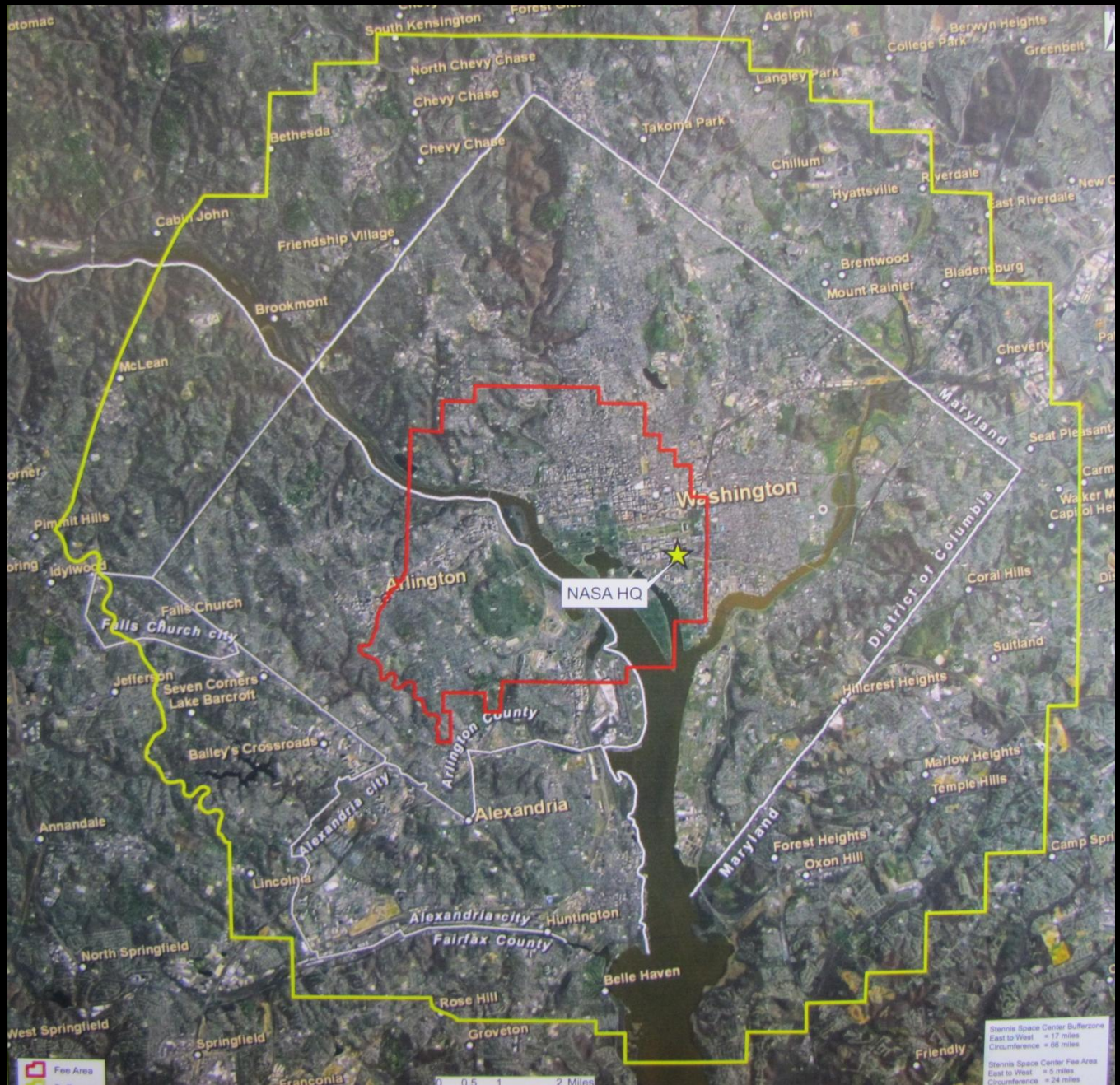
Stennis Space Center Infrastructure Investment

- ***Land*** - ***138,871*** **Acres**
  - **Fee Area (Fee Simple)** - **13,800 Acres**
  - **Buffer Zone** - **125,071 Acres**

- ***Buildings/Facilities***
  - **Buildings** - **245**
  - **Structures** - **179**
  - **Building space** - **4.39 million sq ft**
  - **Canals** - **8 Miles**
  - **Roads** - **45 Miles**

- ***Population***
  - **Personnel** - **~5200**
  - **Scientists & Engineers** - **~1700**
  - **Federal & State Agencies** - **Over 30**
  - **Technology Companies** - **Over 60**

Stennis Over DC Metro



NASA Centers – Extent Comparison

NASA Stennis Space Center
Core Competencies

- **Rocket Propulsion Testing**
- **Applied Science & Technology**

Rocket Propulsion Test Heritage

First Saturn V rocket engine test firing

April 23, 1966

First Space Shuttle Main Engine test firing
(to achieve ignition)

June 12, 1975

First J-2X engine component test

December 18, 2007

Current/Recent Rocket Propulsion Testing

J-2X engine
294,000 lbs. thrust

RS-68
660,000 lbs. thrust

AJ26
367,000 lbs. thrust

Space Shuttle Main Engine
375,000 lbs. thrust

Commercial Testing

TGV

RS-68

AJ-26

TRW 650K

250K Hybrid

Hydrogen Peroxide

A-3 Test Stand

- 300 feet tall
- Open steel frame structure
- 19-acre site
- Can withstand up to 1 million pounds of thrust
- Able to simulate altitudes up to 100,000 feet by generating steam to create a vacuum

The new A-3 Test Stand will allow engineers to test operating parameters of next generation rocket engines by simulating conditions at different altitudes.

A Complex Capabilities

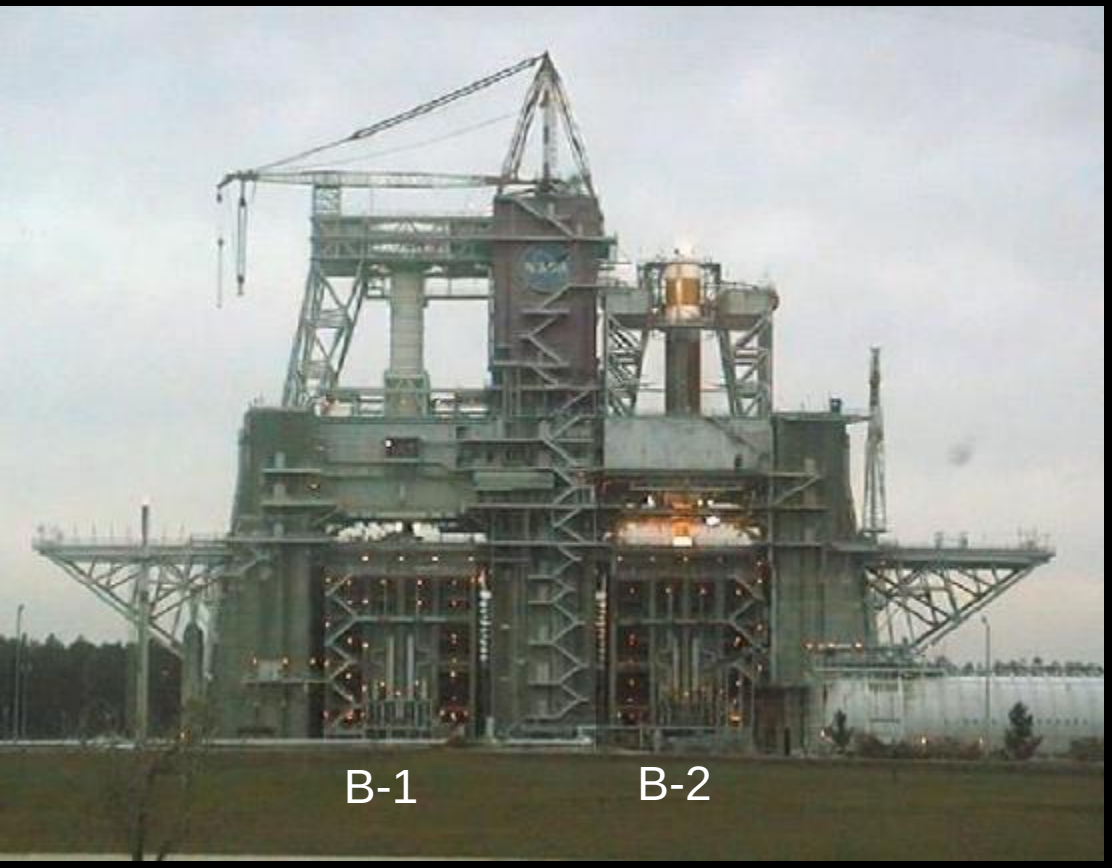
TEST STAND CAPABILITIES:

- Thrust capability of 1.5 M-lb
- Flame Deflector Cooling 220,000 gal/min
- Deluge System 75,000 gal/min
- Data measurement system
- Two derricks – 75 ton and 200 ton
- High-pressure gas distribution systems
- LOX and LH2 propellant supply systems
- Hazardous gas and fire detection systems
- Barge unloading capability (2 LOX, 2 LH)
- Diffuser (A-2)

A-1 Test of SSME

A-1 Test of X-33

B Complex Capabilities



B-2 Test of Delta IV Common Booster Core

TEST STAND CAPABILITIES:

- Thrust capability of 13 M-lb
- Flame Deflector Cooling 330,000 gal/min
- Deluge System 123,000 gal/min
- Data measurement system
- Two derricks – 175 ton and 200 ton
- High-pressure gas distribution systems
- LOX and LH2 propellant supply systems
- Hazardous gas and fire detection systems
- Barge unloading capability (3 LOX, 3 LH)

B-1 Test of Delta IV RS-68 LRE

E-Complex Test Heritage

TGV

250 K Hybrid

IPD

RS-84 Preburner

LOX Hybrid Sounding Rocket

ET Diffuser

Oxidizer Pump

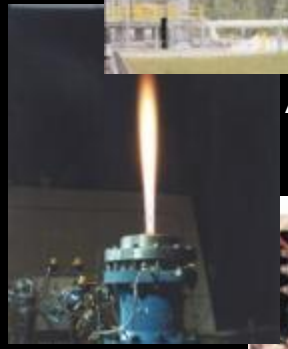
Methane Thruster

A-3 CSGs

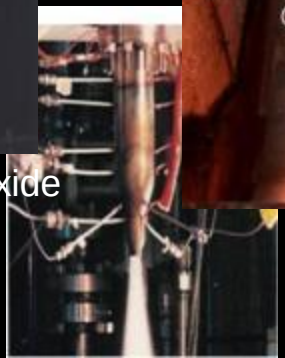
ET Ice Foam Test

TRW 650K

LR-89 Thrust Chamber

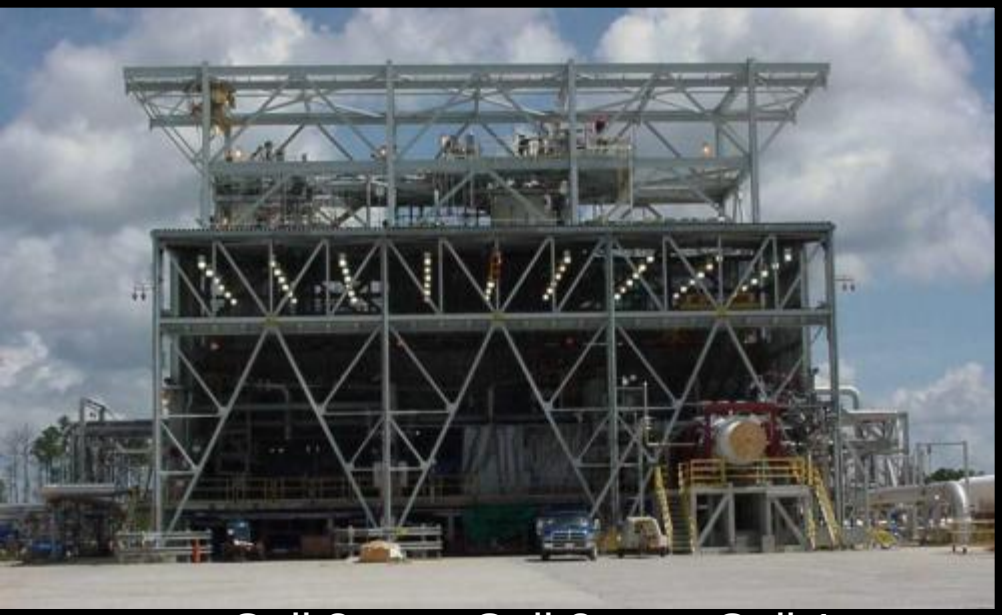


Hydrogen Peroxide Hybrid



AR2-3

E-1 Test Stand Capabilities



Cell 3 Cell 2 Cell 1

- E1 Cell 1
  - Primarily Designed for Pressure-Fed LO_2/LH_2/RP & Hybrid-Based Test Articles
  - Thrust Loads up to 750K lb_f (horizontal)
- E1 Cell 2
  - Designed for LH_2 Turbopump & Preburner Assembly Testing
  - Thrust Loads up to 60K lb_f
- E1 Cell 3
  - Designed for LO_2 Turbopump & Preburner Assembly Testing
  - Thrust Loads up to 60K lb_f

<u>General Pressure Capabilities</u>

- LO_2/LH_2 ~ 8,500 psi
- RP ~ 8500 psi (Ready 1/04)
- GN/GH ~ 15,000 psi
- Ghe ~ 10,000 psi

E-2 Cell 1 Capabilities

- E2 Cell 1
  - Primarily Designed for Pressure-Fed LO_2/RP1 Based Test Articles
  - Thrust Loads up to 100K lb_f (horizontal)
  - LO_2/RP1 ~ 8500 psia
  - GN/GH ~ 15000 psia
  - Hot GH (6000 psia/1300 F)

- E2 Cell 2
  - Designed for LO_2 /H2O2/RP1 Engine/Stage Test Articles
  - Loads up to 150K lb_f

E-3 Test Stand Capabilities

- E3 Test Stand Capabilities
  - Primarily Designed for Rocket Engine Component & Sub-Scale Engine Development
  - Comprised of Two (2) Test Cells
- E3 Cell 1
  - Horizontal Test Cell
  - Propellants: LO_2, GOX, JP-8, GH_2
  - Support Gasses: LN_2, GN_2, GHe
  - Thrust Loads up to 60K lb_f
- E3 Cell 2
  - Vertical Test Cell
  - Propellants: LO_2, H_2O_2, JP-8
  - Support Gasses: LN_2, GN_2, GHe
  - Thrust Loads up to 25K lb_f

SSC Test Support Facilities

Cryogenic Propellant Storage Facility
Six (6) 100,000 Gallons LOX Barges
Three (3) 240,000 Gallons LH Barges

High Pressure Industrial Water (HPIW)
330,000 gpm

Additional Support

Laboratories
- •Environmental
- •Gas and Material Analysis
- •Measurement Standards and Calibration

Shops

Utilities

Rocket Test Facilities Right Size Study

Capabilities Use Ranking Matrix			
	Decreasing Readiness (recommended) →		
Test Category	Primary	Secondary	3rd
Ambient Stage	B-2 (SSC)	4670	B-1
Altitude Stage (L, 100k+)	A-3 (SSC)	B2 (PBS)	
Altitude Stage (M, 50k-100k)	B2 (PBS)	A-3	
Altitude Stage (S, <50k)	B2 (PBS)	401	403
Ambient Engine (L, 100 k+)	A-2 (SSC)	A-1	B-1
Ambient Engine (M,50k-100k)	E-1 (SSC)	E-2	116
Ambient Engine (S, <50 k)	E-3 (SSC)	115	301
Altitude Engine (L, 100 k+)	A-3 (SSC)	B2 (PBS)	A-2
Altitude Engine (M, 50k-100k)	B2 (PBS)	A-3	
Altitude Engine (S, < 50k)	B2 (PBS)	401	403
Thermal Vacuum Engines/Stages	B2 (PBS)		
Component**	E-1 (SSC)	E-2	116
Altitude Hypergolic	403 (WSTF)	401	405
Ambient Hypergolic	301 (WSTF)	328	402
Ambient Solids	SPTA (MSFC)		

- **Team Consensus was reached on Primary Test Locations.**
- **Ranking matrix is not a perfect "one size fits all" solution.**
- **Each test program has its own characteristics and the RPT defined processes will be utilized for test assignments.**

NASA Rocket Propulsion Test Program

- Manage NASA's rocket propulsion test assets, activities and resources
- Reduce test costs via efficient utilization of test facilities in support of NASA, Dept. of Defense and commercial partners/customers
- Develop test technologies to improve safety and operational efficiency

Stennis Space Center

Mississippi

Marshall Space Flight Center

Alabama

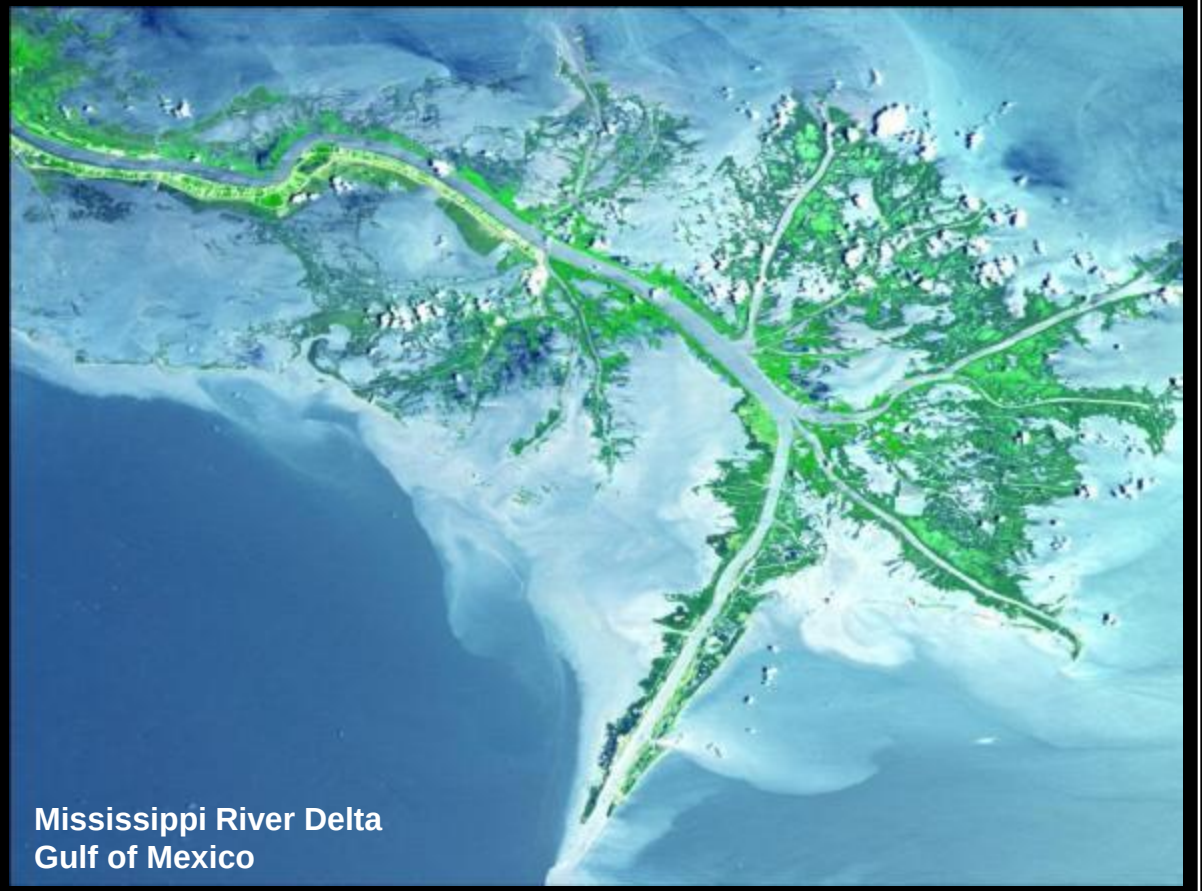
Glenn Research Center – Plum Brook

Ohio

White Sands Test Facility

New Mexico

Applied Science & Technology Project Office (ASTPO)



Mississippi River Delta
Gulf of Mexico

Responsibilities include

- Management of the Gulf of Mexico Initiative for NASA Headquarters
- Federal co-lead of the Gulf of Mexico Alliance, a regional collaboration of the 5 US Gulf states and 13 federal agencies
- Conducting scientific research that addresses the needs of the Gulf of Mexico region

ASTPO Objectives

- Use NASA assets to understand and monitor the natural and anthropogenic processes affecting the Gulf of Mexico region.
- Demonstrate ways NASA capabilities can help local, state, and federal decision makers.
- Conduct projects in partnership with those decision-making organizations so they can apply this technology.
- Promote sustainable use of the region’s resources.

Stennis Management Boards

- Cooperative NASA/Agency Management Policy
  - Executive Council - NASA Chaired
    - Operations Review Steering Committee-Rotating Chairperson
  - Emergency Management Council
  - Joint Management Council
  - Security Council
  - Safety Council
  - Environmental Working Group
  - Interagency Training Council
  - Higher Education Policy Board
  - Federal Women's Program Council
  - Telecommunications Council
  - Joint Master Planning Board

Stennis Cooperative Agreements

- Center for Higher Learning
  - Employees can obtain advanced degrees in:
    - Management, Science, Computer Science & Engineering
- State of Mississippi and Louisiana
  - Technology Transfer
  - Mutual Aid (emergency response)
  - Natural Disaster

Stennis Agreements Process

- SSC - Space Center and Multiple Agency Laboratory Facility
- Full Base Operating Cost Sharing
  - Buildings and Grounds Maintenance
  - Base Infrastructure Operations
    - Utility Systems Operations
    - Telecommunications Systems Operations
    - Environmental Operations
    - Security, Food Services, Medical/Wellness, etc.
- Full Recovery of Demand Services
  - Scientific, Technical and Programmatic Support

Stennis Agreements Process (Cont'd)

- Interagency Agreements
  - Top Level Agreements Between NASA and Federal Agency
  - Executed at HQ NASA and Federal Agency Level
  - Establishes Overall Agreement to Locate and/or Conduct Agency Operations at SSC
  - Implemented by Local Agreements
    - Space Act Agreement
    - Use Permit
    - Host-Tenant Agreement

Area 9

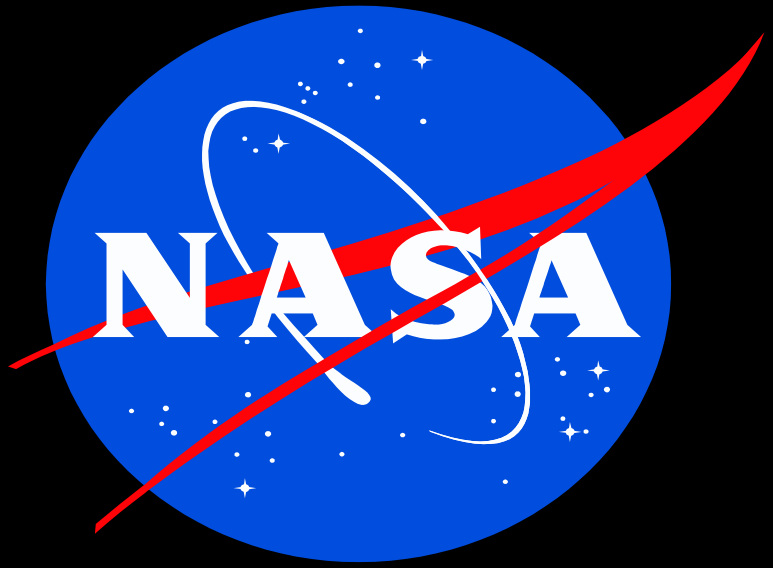
Rolls-Royce

CNMOC

NOAA

EPA

SBT-22



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