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

- First Saturn-ll Test (4/66)
- Apollo Fire (1/67)
- First Saturn IC test (3/67)
- Lunar Landing (7/69)
- Earth Resources Laboratory (ERL) Transfer (6/70)
- Last Apollo Test (10/70)

Independent NASA Organization - National Space Technology Laboratory (NSTL) Estab. (6/74)

First Space Shuttle Main Engine (SSME) Test (5/75)

Stennis Space Center Estab. (5/88)

Challenger (1/86)

Propulsion Test Lead Center

Mississippi Test Facility

National Space Technology Laboratory

Stennis Space Center

Population / Work Year

- NASA Programs
- NASA Civil Servants

Years: 60, 70, 80, 90, 00
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

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
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.
Stennis Space Center Infrastructure Investment

- **Land**
  - 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
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
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)
B Complex Capabilities

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

B-2 Test of Delta IV Common Booster Core
E-1 Test Stand Capabilities

• **E1 Cell 1**
  - Primarily Designed for Pressure-Fed LO₂/LH₂/RP & Hybrid-Based Test Articles
  - Thrust Loads up to 750K lb\(_f\) (horizontal)

• **E1 Cell 2**
  - Designed for LH₂ Turbopump & Preburner Assembly Testing
  - Thrust Loads up to 60K lb\(_f\)

• **E1 Cell 3**
  - Designed for LO₂ Turbopump & Preburner Assembly Testing
  - Thrust Loads up to 60K lb\(_f\)

**General Pressure Capabilities**
- LO₂/LH₂ ~ 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: LO₂, GOX, JP-8, GH₂
  - Support Gasses: LN₂, GN₂, GHe
  - Thrust Loads up to 60K lbₗ

• E3 Cell 2
  - Vertical Test Cell
  - Propellants: LO₂, H₂O₂, JP-8
  - Support Gasses: LN₂, GN₂, GHe
  - Thrust Loads up to 25K lbₗ
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

<table>
<thead>
<tr>
<th>Test Category</th>
<th>Decreasing Readiness (recommended)</th>
<th>Primary</th>
<th>Secondary</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Stage</td>
<td></td>
<td>B-2 (SSC)</td>
<td>4670</td>
<td>B-1</td>
</tr>
<tr>
<td>Altitude Stage (L, 100k+)</td>
<td></td>
<td>A-3 (SSC)</td>
<td>B2 (PBS)</td>
<td></td>
</tr>
<tr>
<td>Altitude Stage (M, 50k-100k)</td>
<td></td>
<td>B2 (PBS)</td>
<td>A-3</td>
<td></td>
</tr>
<tr>
<td>Altitude Stage (S, &lt;50k)</td>
<td></td>
<td>B2 (PBS)</td>
<td>401</td>
<td>403</td>
</tr>
<tr>
<td>Ambient Engine (L, 100 k+)</td>
<td></td>
<td>A-2 (SSC)</td>
<td>A-1</td>
<td>B-1</td>
</tr>
<tr>
<td>Ambient Engine (M,50k-100k)</td>
<td></td>
<td>E-1 (SSC)</td>
<td>E-2</td>
<td>116</td>
</tr>
<tr>
<td>Ambient Engine (S, &lt;50 k)</td>
<td></td>
<td>E-3 (SSC)</td>
<td>115</td>
<td>301</td>
</tr>
<tr>
<td>Altitude Engine (L, 100 k+)</td>
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<td>A-3 (SSC)</td>
<td>B2 (PBS)</td>
<td>A-2</td>
</tr>
<tr>
<td>Altitude Engine (M, 50k-100k)</td>
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<td>B2 (PBS)</td>
<td>A-3</td>
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<tr>
<td>Altitude Engine (S, &lt; 50k)</td>
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<td>B2 (PBS)</td>
<td>401</td>
<td>403</td>
</tr>
<tr>
<td>Thermal Vacuum Engines/Stages</td>
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<td>B2 (PBS)</td>
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<td></td>
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<tr>
<td>Component**</td>
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<td>E-1 (SSC)</td>
<td>E-2</td>
<td>116</td>
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<tr>
<td>Altitude Hypergolic</td>
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<td>403 (WSTF)</td>
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<td>405</td>
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<tr>
<td>Ambient Hypergolic</td>
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<td>301 (WSTF)</td>
<td>328</td>
<td>402</td>
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<tr>
<td>Ambient Solids</td>
<td></td>
<td>SPTA (MSFC)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 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
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