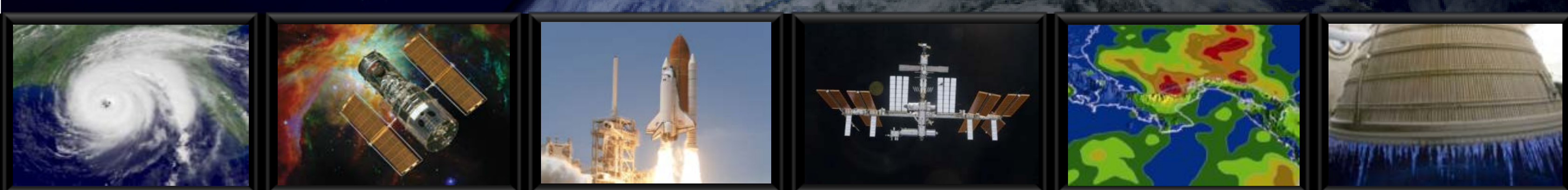
National Aeronautics and Space Administration

Space Launch System (SLS) Program Overview

SLS Industry Day

Marshall Small Business Alliance

Space Launch System



Todd May, Program Manager
NASA Space Launch System Program

September 2011

The NASA Vision

To reach for new heights and reveal the unknown, so that what we do and learn will benefit all humankind.

NASA Strategic Goals

- ✔ *Extend and sustain human activities across the solar system.*
- ✓ Expand scientific understanding of the Earth and the universe in which we live.
- ✓ Create the innovative new space technologies for our exploration, science, and economic future.

  Advance aeronautics research for societal benefit.
- ✓ Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- ✓ Share NASA with the public, educators, and students to provide opportunities to participate in our mission, foster innovation, and contribute to a strong national economy.

SLS Clearly Contributes to NASA's Strategic Goals

SLS and the NASA Authorization Act of 2010

- **The Congress approved and the President signed the National Aeronautics and Space Administration Authorization Act of 2010**
  - Bipartisan support for human exploration beyond low-Earth orbit (LEO)

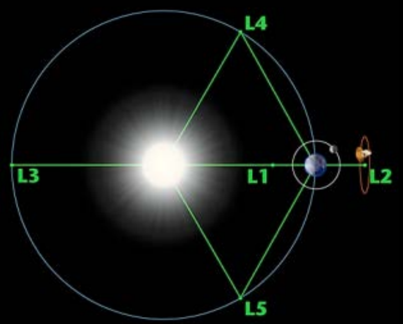
- **The Law authorizes**
  - Extension of the International Space Station (ISS) until at least 2020
  - Strong support for a commercial space transportation industry
  - Development of a Multi-Purpose Crew Vehicle (MPCV) and heavy lift launch capabilities
  - A "flexible path" approach to space exploration, opening up vast opportunities including near-Earth asteroids and Mars
  - New space technology investments to increase the capabilities beyond Earth orbit (BEO)

This rocket is key to implementing the plan laid out by President Obama and Congress in the bipartisan 2010 NASA Authorization Act.
— NASA Administrator Charles Bolden
September 14, 2011

The SLS Acquisition Strategy
Reflects Executive and Legislative Branch Direction and Law

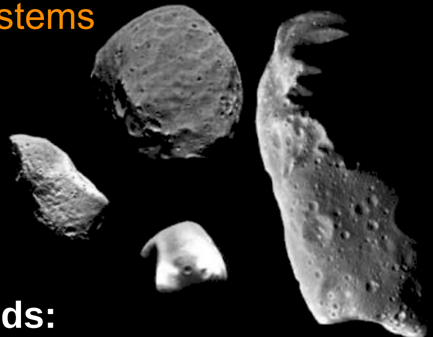
SLS Is a National Asset for Multiple Stakeholders and Partners

SLS Is a National Capability for Exploration Missions



High-Earth Orbit (HEO)/Geosynchronous-Earth Orbit (GEO)/Lagrange Points:
- Microgravity destinations beyond LEO
- Opportunities for construction, fueling, and repair of complex in-space systems
- Excellent locations for advanced space telescopes and Earth observatories

Mars and Its Moons Phobos and Deimos:
- A premier destination for discovery: Is there life beyond Earth? How did Mars evolve?
- True possibility for extended, even permanent, stays
- Significant opportunities for international collaboration
- Technological driver for space systems

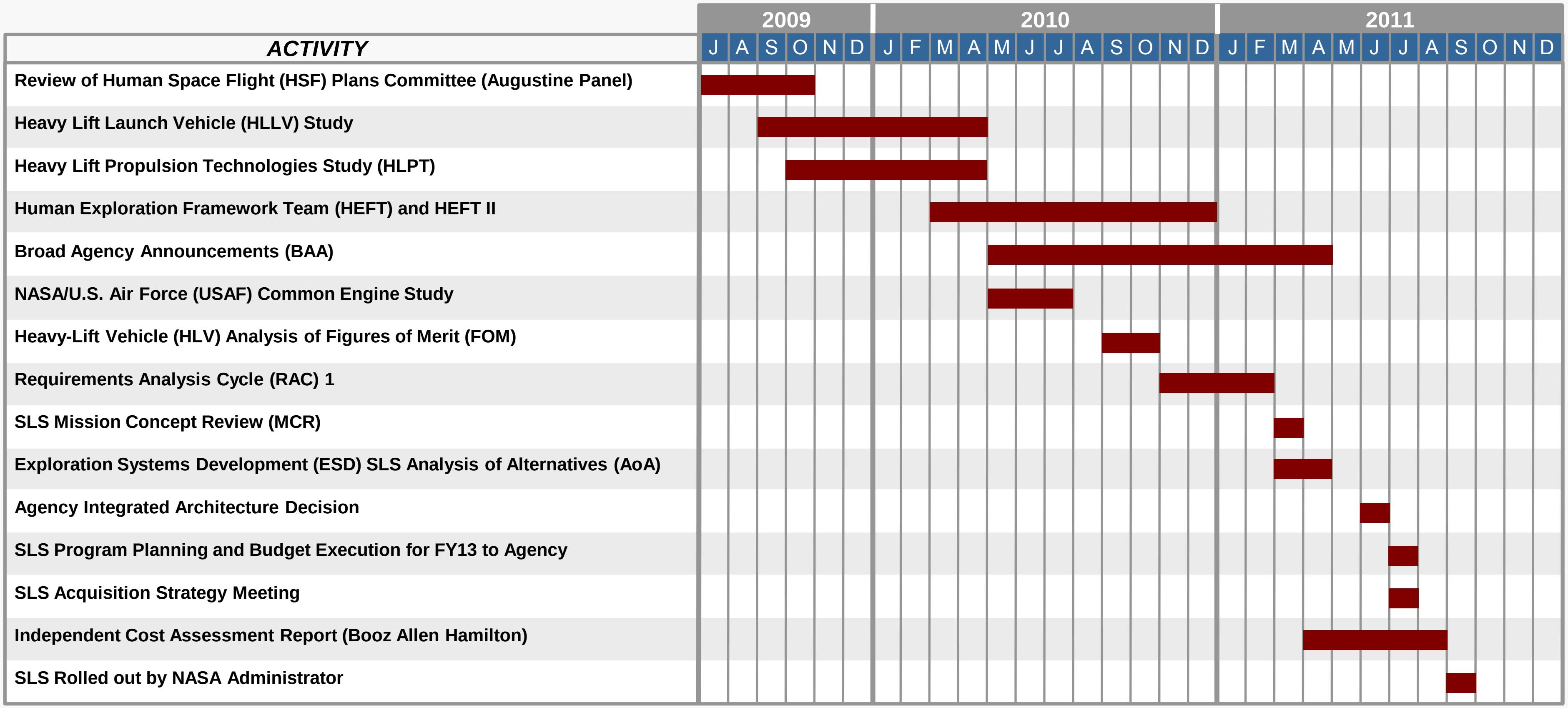


Earth's Moon:
- Witness to the birth of the Earth and inner planets
- Has critical resources to sustain humans
- Significant opportunities for commercial and international collaboration

Near-Earth Asteroids:
- Compelling science questions: How did the Solar System form? Where did Earth's water and organics come from?
- Planetary defense: Understanding and mitigating the threat of impact
- Potential for valuable space resources
- Excellent stepping stone for Mars

SLS Is Evolvable and Flexible

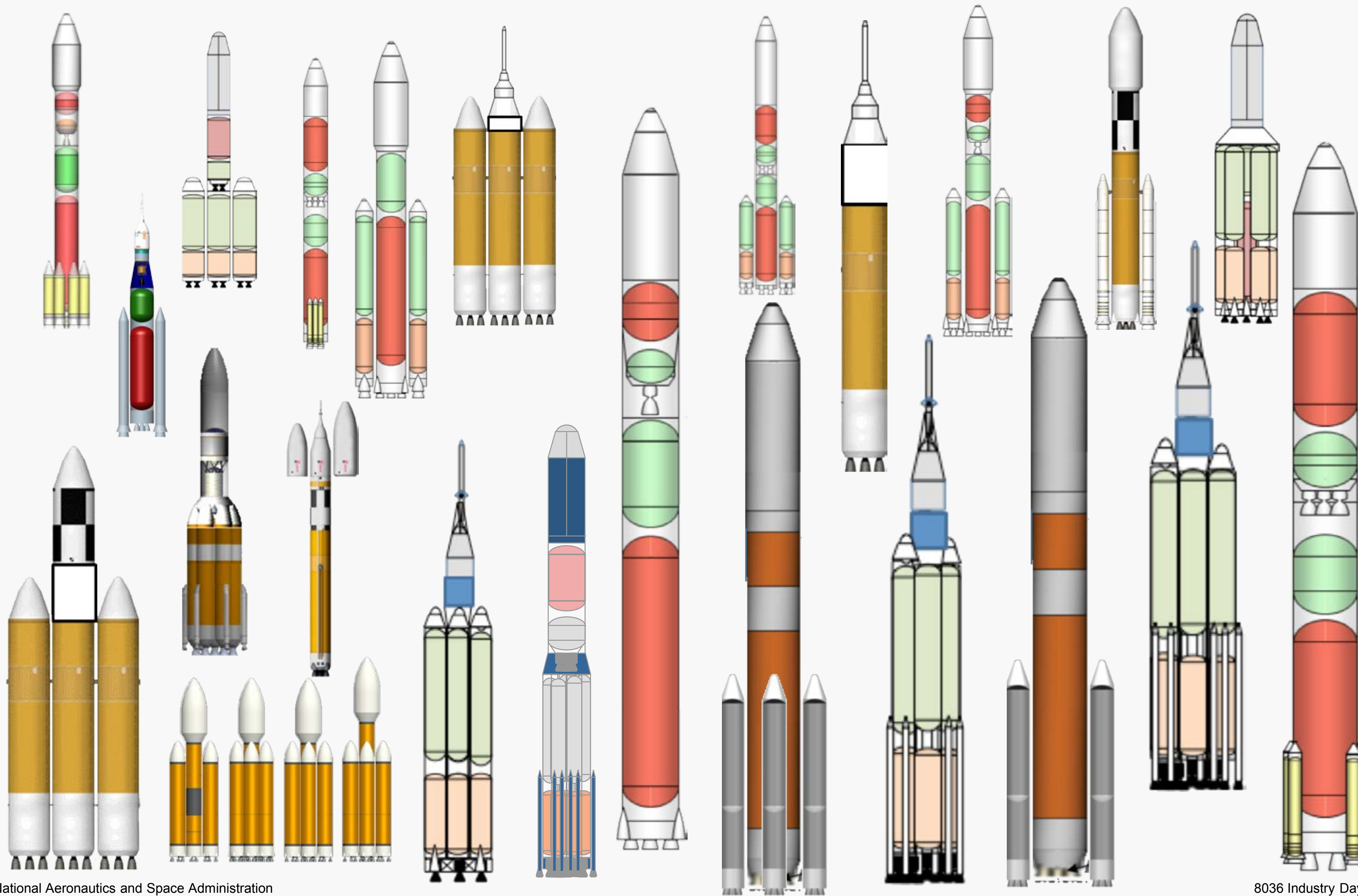
SLS Roadmap: Extensive Engineering and Business Analyses and Planning



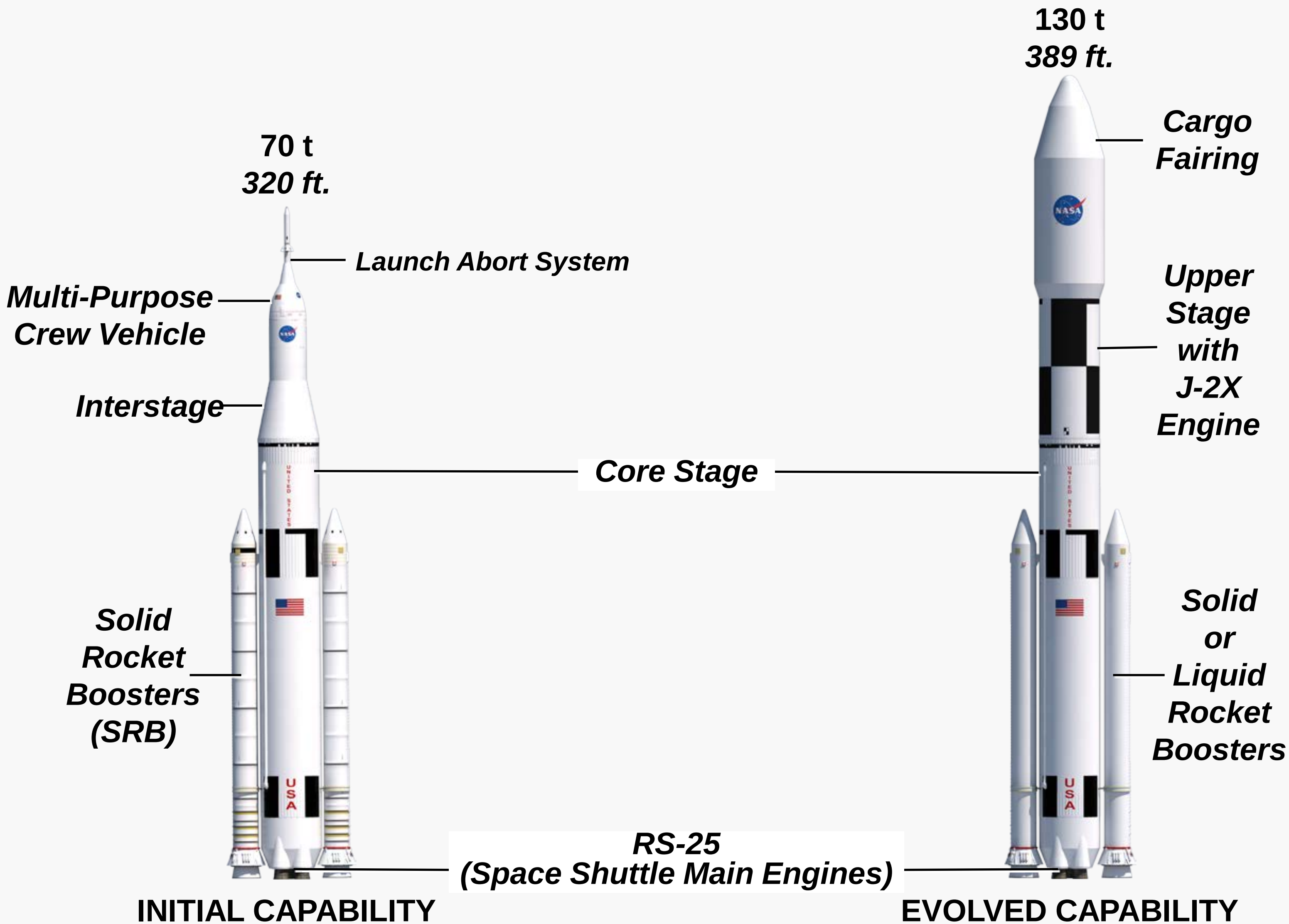
SLS Driving Objectives

- **National Heavy-Lift Capacity**
  - 70 tonnes (t) evolvable to 130 t
  - Serves as primary transportation for MPCV and exploration missions
  - Provides back-up capability for crew/cargo to ISS
  - Offers volume for science missions and payloads of national importance
- **Safe**
  - Loss of Crew: TBR
  - Loss of Mission: TBR
- **Affordable**
  - Constrained budget environment, with no planned escalation
  - Maximum use of common elements and existing assets, infrastructure, and workforce
- **Near-Term Capability**
  - First flight in 2017

Many Solutions Considered

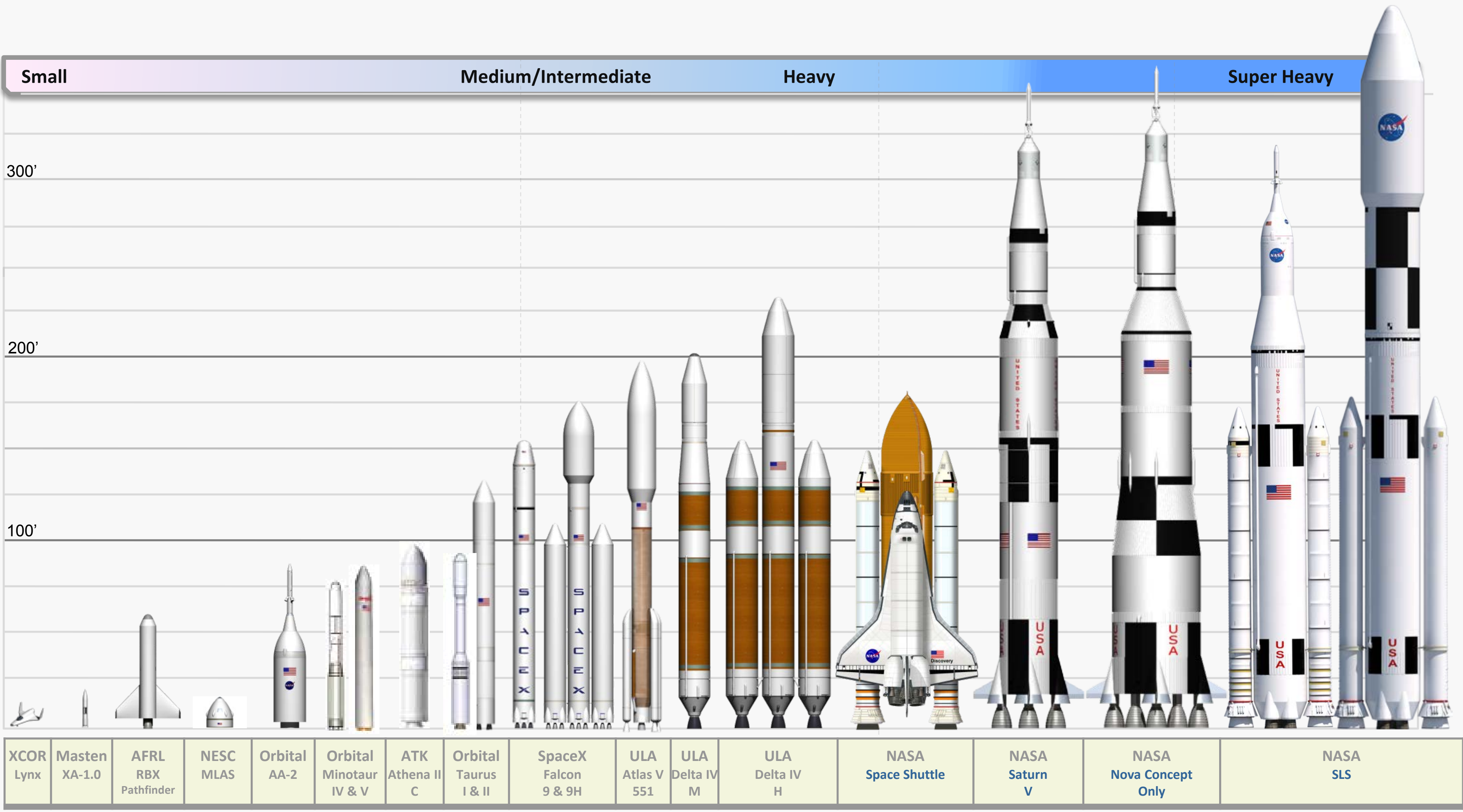


SLS Concept Maximizes Existing U.S. Aerospace Workforce and Capabilities



Leverages Existing Contracts, While Competing the Future

SLS Will Be the Most Capable U.S. Launch Vehicle



Sample of Proposed and Fielded U.S. Systems

SLS Point of Departure (POD) Initial Concept

- **Core Stage**
  - 27.5-foot (8.4-meter) diameter
  - Liquid oxygen/liquid hydrogen (LOX/LH_2) fuel (30 years of U.S. aerospace experience)
  - RS-25 engines (starts with Space Shuttle Main Engine inventory assets)
- **Commonality of Design and Manufacturing between Core Stage and Upper Stage**
  - Same diameter
  - Single facility and contractor
  - Modern manufacturing tooling and techniques
- **Boosters**
  - Initial flights are 5-segment solid rocket boosters (Ares derived)
  - Future flights will use competitively procured boosters, which may be solid or liquid
- **J-2X Upper Stage Engine**
  - Restart capability supports future in-space transfer stages trade studies
  - Metered development effort to support 130 t exploration missions

Vehicle Development and Acquisition Phased to Fit Budget Constraints and Schedule Targets

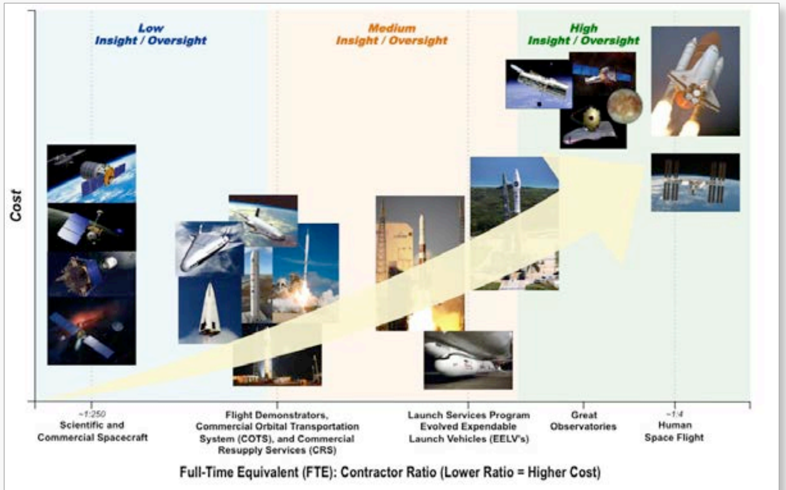
SLS Vehicle Configuration Decision Rationale

- **Maintains U.S. leadership in LOX/LH_2 technology**
  - LOX/LH_2 Core Stage uses RS-25 engines; LOX/LH_2 Upper Stage uses J-2X engine
  - Establishes fixed central design path, with logical use of existing strength in design and modern manufacturing approaches
  - Harnesses existing knowledge base, skills, infrastructure, workforce, and industrial base for existing state-of-the-art systems

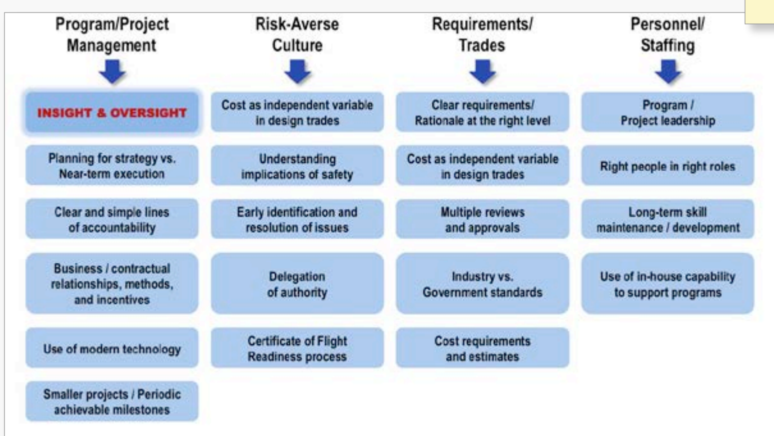
- **Minimizes unique configurations during vehicle development**
  - Evolutionary path to 130 t allows incremental development; thus, progress will be made, even within constrained budgets
  - Allows early flight certification for MPCV
  - May be configured for MPCV or science payloads, providing flexible/modular design and system for varying launch needs
  - Gains synergy, thus reducing design, development, test, and evaluation (DDT&E) costs and schedule by building the Core Stage and Upper Stage in parallel, thereby leveraging common tooling and engine-feed components

Technical Trade Studies and Business Planning Validated Independently

SLS Affordability Tenets



NASA Historical Data



Opportunities for Change

- **Evolvable Development Approach**
  - Manage Within Constrained / Flat Budgets
  - Leverage Existing National Capabilities
  - Infuse New Design Solutions for Affordability
- **Robust Designs and Margins**
  - Performance Traded for Cost and Schedule
- **Risk-Informed Government Insight/Oversight Model**
  - Insight Based On:
    - Historic Failures
    - Industry Partner Past Performance/Gaps
    - Complexity and Design Challenges
  - Judicious Oversight:
    - Discrete Oversight vs. Near Continuous
    - Decisions Made Timely and Effectively
- **Right Sized Documentation and Standards**
  - Reduction in the Number of Program Documents
  - Industry Practices and Tailored NASA Standards
- **Lean, Integrated Teams with Accelerated Decision Making**
  - Simple, Clear Technical Interfaces with Contractor
  - Systems Engineering & Integration (SE&I) Organization
  - Empowered Decision Makers at All Levels

SLS Acquisition Strategy Fully Supports Affordability, Which Is Required for Sustainability

Potential to Build on Heritage Hardware and Facilities

J-2X Test Firing/Space Shuttle Main Engine Testing
Stennis Space Center

Payloads
Goddard Space Flight Center

MPCV Integration
Johnson Space Center

Composite Structures
Glenn Research Center

Ground and Launch Operations
Kennedy Space Center

Physics Based Analysis
Ames Research Center

Manufacturing and Transportation
Michoud Assembly Facility

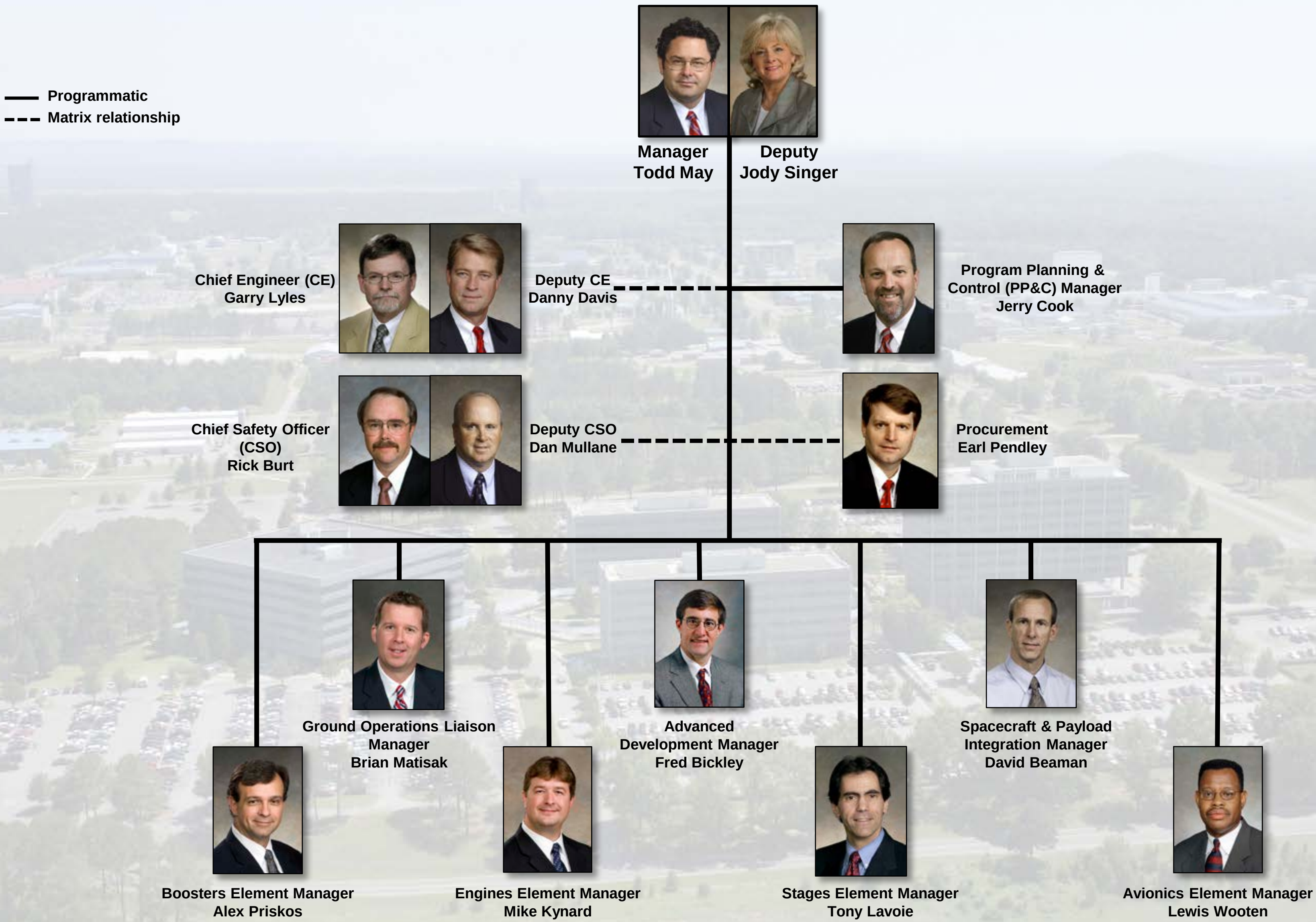
Wind Tunnel Testing
Langley Research Center

Standing Review Team
Jet Propulsion Laboratory

J-2X Upper Stage Engine Injector Firing
Marshall Space Flight Center

Smartly Selecting the Most Efficient Infrastructure

SLS Program Organization at MSFC



Advancing the U.S. Legacy of Human Exploration

Summary

- SLS is a national capability that empowers entirely new exploration missions.
- Program key tenets are *safety, affordability, and sustainability.*
- SLS builds on a solid foundation of experience and current capabilities to enable a fast start and a flexible heavy-lift capacity for missions of national importance.
- The SLS acquisition will help U.S. aerospace industry stay strong as it develops initial capabilities, as well as provide competitive opportunities for advanced technologies for evolvable capabilities.
- The SLS Team has made significant progress and looks forward to working with you to continue America's leadership in space.

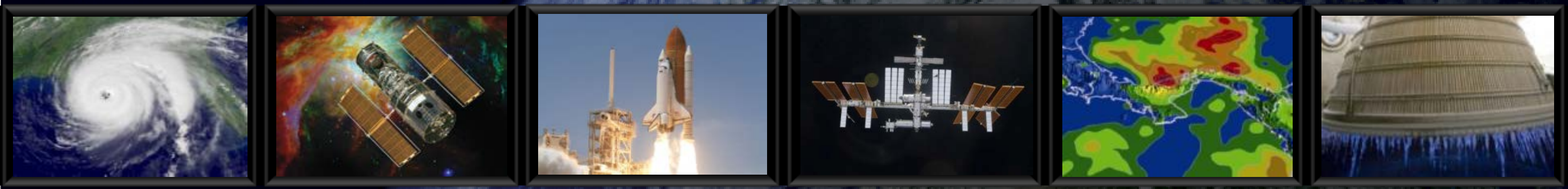
National Aeronautics and Space Administration

Space Launch System (SLS) Program Acquisition Overview

SLS Industry Day

Marshall Small Business Alliance

Space Launch System



Earl Pendley, Manager
Space Transportation Support
Procurement Office
NASA Marshall Space Flight Center

Path to the SLS Acquisition Plan

- The NASA Authorization Act of 2010 (PL 111-267, Oct. 11, 2010) requires that NASA deliver a Space Launch System with at least 70 t of initial capability and 130 t of evolved capability.

- The President's FY12 Budget Request includes funding for SLS.

- The FY11 Appropriation Act includes funding for SLS.

- NASA selected an architecture in June 2011 to meet the Authorization Act.

- NASA conducted an Agency-level SLS Acquisition Strategy meeting in July 2011.

- NASA conducted Procurement Strategy Meetings in mid-September 2011.

This rocket is key to implementing the plan laid out by President Obama and Congress in the bipartisan 2010 NASA Authorization Act.
— NASA Administrator Charles Bolden
September 14, 2011

SLS Acquisition Strategy Fulfills Legislative and Executive Branch Direction and Law

Key SLS Requirements

- **Affordability**
  - Flat annual budget profile
  - Existing contracts and assets used for initial capability
    - Significant hardware investments maximized
    - Significant portions of the supply chain in place
    - Work can begin earlier, engaging the U.S. aerospace workforce
    - Less design, development, test, and evaluation (DDT&E) risk and costs
    - Contract types to move to more objective incentive structures
- **Performance Margin**
  - Initial near-term capability of 70 t, evolvable to 130 t
  - Modular flexible architecture that may be configured for mission needs
  - Significant National capability
- **Evolvable**
  - Competitions for technology infusions and vehicle upgrades for future capability

SLS Will Be Safe, Affordable, and Sustainable

SLS Procurements

- **Boosters**
  - 5-segment Solid Rocket Booster in-scope modification to existing Ares contract with ATK for initial flights through 2021
  - Advanced Boosters
    - Engineering demonstration and risk reduction via NRA: Full and Open Competition later this year
    - DDT&E: Full and Open Competition
- **Stages**
  - Core/Upper Stage: Justification for Other Than Full and Open Competition (JOFOC) to Boeing, modifying current Ares Upper Stage contract
  - Avionics
    - Instrument Unit Avionics: In-scope modification to existing Ares contract with Boeing; to be consolidated with Stages contract to Boeing
- **Engines**
  - Core Stage Engine: RS-25 JOFOC to existing Space Shuttle contract with Pratt & Whitney Rocketdyne (PWR)
  - Upper Stage Engine: J-2X in-scope modification to existing Ares contract with PWR
- **Spacecraft and Payload adapter and Fairing**
  - Full and Open Competition to begin in FY13
- **Advanced Development**
  - Broad Agency Announcement (BAA)/NASA Research Announcement (NRA): Full and Open Competition
  - Future Core Stage Engine: Separate contract activity to be held in the future

Delivers Near-Term Initial Capabilities and Spurs Competition for Evolved Capabilities

SLS Small Business Goals

- **The NASA MSFC Small Business Specialist is performing a NASA Policy Directive 5000.2C uniform methodology assessment for the appropriate SLS requirements:**
  - Stages
  - Engines
  - Advanced Booster
- **Subcontracting plan goals for existing contracts will be updated via negotiations.**
- **For incentive fee contracts, an incentive fee applicable to a small business utilization performance-type of measurement will be explored.**
  - Mentor/Protégé Program will be included
- **SLS will provide topics to the Small Business Innovation Research (SBIR) Program.**
  - Link to the NASA SBIR website will be listed on all solicitations
    - http://sbir.gsfc.nasa.gov/SBIR/SBIR.html

Targeting Robust Small Business Partnerships Through Various Channels

SLS Acquisition Summary

- **The SLS acquisition strategy is consistent with Legislative and Executive branch direction.**

- **The acquisition strategy meets key SLS requirements of *safety, affordability, and evolvable performance.***

- **SLS will continue to work closely with NASA's Office of Small Business Programs to maximize opportunities for all parts of the Agency's socio-economic programs.**

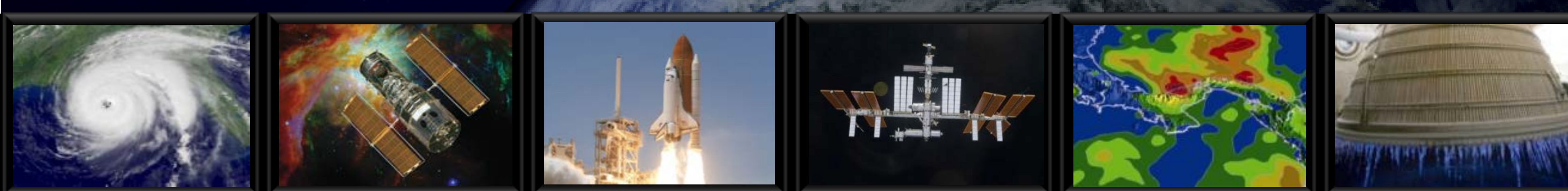
- **Competitive actions will have specific and detailed Industry Days in the future.**

- **Contact information: Earl Pendley**
  - Phone: 256-544-2949
  - email: george.e.pendley@nasa.gov

Space Launch System (SLS) Program
Boosters Element Overview

SLS Industry Day

Marshall Small Business Alliance



Space Launch System

Alex Priskos, Manager
Boosters Element
NASA Space Launch System Program
September 2011

Boosters Element Overview

- **Acquisition approach directly supports U.S. human space exploration**
  - Based on extensive engineering and business analyses and planning, leading to the optimum solution for NASA's requirements for safety, affordability, and sustainability
  - Delivers an initial 70 t lift capability in 2017, using the existing Ares contract for the 5-Segment Solid Rocket Booster (SRBV) for the first two flights, while spurring competition for advanced boosters for evolved capability

- **Boosters are a major Space Launch System element, providing high thrust for liftoff**
  - 70 t lift capacity = two SRBVs, three Core Stage Engines (RS-25)
  - 130 t lift capacity = two Advanced Boosters, five Core Stage Engines, three J-2X Upper Stage Engines

- **Advanced Boosters for evolved capability will be:**
  - The largest and highest performing booster system ever produced
  - Determined by a competitive procurement, which will establish the best configuration for a safe, affordable, and reliable U.S. Space Launch System

Delivering a National Capability in the Shortest Amount of Time, While Leveraging Research and Development Investments for the Most Affordable Solution

Three-Phase Booster Development Approach

1. Booster Fly Out for early flights through 2021

- Scope: Build 2 SRBV Flight Sets
- Date: In progress
- Capability: Initial 70–100 t
- Contract: Modification to existing Ares contract with ATK

2. Advanced Booster Engineering Demonstration & Risk Reduction

- Scope: Award contracts
- Date: RFP targeted for Winter 2011; award targeted for Fall 2012
- Capability: Leading to 130 t
- Contract: NASA Research Announcement (NRA): Demonstrating Specific Technologies and Affordability Risk Reduction for Advanced Boosters
  - Liquid Rocket Boosters or Solid Rocket Boosters

3. Advanced Booster Design, Development, Test, and Evaluation (DDT&E)

- Scope: Follow-on procurement for DDT&E of a new booster
- Date: RFP target is FY15
- Capability: Evolved at 130 t
- Contract: Full and Open Competition (Liquids or Solids)

Starting Where We Are and Competing the Future

Advanced Booster Engineering Demonstration and Risk Reduction: Target Areas

- Acquisition will identify and mitigate risk at the Element and System Levels
- Target area risk reduction focusing on
  - Affordability
  - Performance
  - Reliability
- NASA has identified POTENTIAL target areas for risk mitigation:

Liquid Rocket Boosters	Solid Rocket Boosters
• Large Component Fabrication (Nozzle and Turbopump)	• Non-Destructive Evaluation (NDE) of Composite Structures
• Oxygen-Rich Technologies	• Composite Case Structural Test
• Rocket Propellant (RP) Combustion Performance and Stability	• Propellant Formulations (HTPB, HTPE, NEPE)
Interface Attach Point Methods to SLS Core Stage	

- Competition via NASA Research Announcement (NRA)
- Target areas will evolve and expand based on knowledge obtained through specific industry day briefings, draft NRA, etc.
- Offerors may propose other risk areas not identified in NRA.

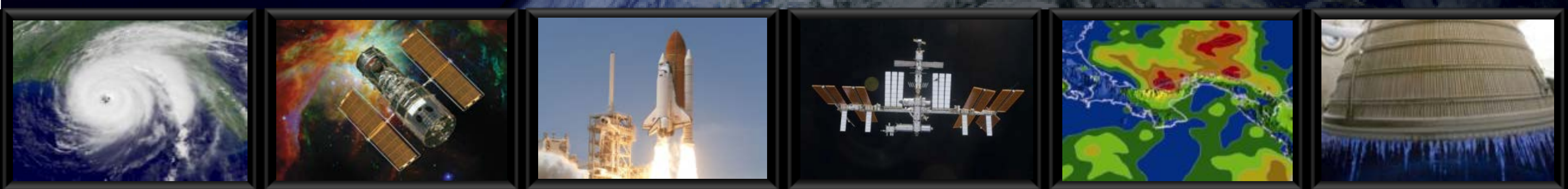
NASA Will Hold a Separate Industry Day for NASA Research Announcements

National Aeronautics and Space Administration

Space Launch System (SLS) Program
Stages and Avionics Elements Overview

SLS Industry Day

Marshall Small Business Alliance



Space Launch System

Tony Lavoie, Manager
Stages Element
NASA Space Launch System Program
September 2011

Stages Element Overview

- **Acquisition approach directly supports human space exploration.**
  - Based on extensive engineering and business analyses and planning, leading to the optimum solution for NASA's requirements for safety, affordability, and sustainability
  - Delivers an initial 70 t lift capability in 2017, by modifying existing Ares contract with Boeing for the Core and Upper Stages, which use cryogenic LOX/LH_2 fuel
  - Includes Instrument Unit Avionics, modifying existing Ares contract with Boeing
  - Consolidates Stages and Instrument Unit Avionics contract

- **Common Core Stage and Upper Stage supports affordability and sustainability.**
  - Maximizes existing workforce, infrastructure, and contracts
  - Leverages efficiencies in design, development, tooling, and processes
  - Drives production toward common element responsibility and contractor

- **Stages Element will integrate Core Stage and Upper Stage Engines to deliver a complete stage ready for launch processing at the Kennedy Space Center.**

Core Stage Is on the Program's Critical Path to First Flight in 2017

Stages Element Requirements

- **Core Stage**
  - Accommodates LOX/ LH_2 cryogenic tanks to provide propellant to three to five Core Stage Engines (RS-25)
  - Accommodates three to five RS-25 engines
  - Delivers a 70 t initial lift capability, with three Core Stage Engines
- **Upper Stage**
  - Accommodates LOX/LH_2 cryogenic tanks to provide propellant to J-2X engines
  - Accommodates one to three J-2X Upper Stage Engines
  - Delivers a 130 t evolved lift capability, with three Core Stage Engines (RS-25)
- **Avionics Suite**
  - Provides all system-level command and control functions for the launch vehicle
  - Provides all data distribution and communications
  - Provides power to the Core Stage and Upper Stage
- **Mission support for applicable phases**
  - Stages sustaining engineering support
  - Stages launch support
  - Stages launch processing support at the launch site
- **Michoud Assembly Facility (MAF) will be utilized**

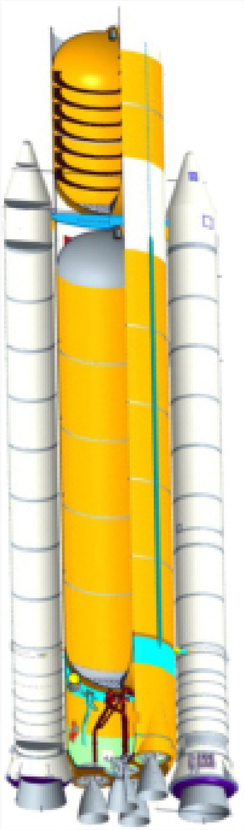
Acquisition Strategy Is a Single Prime Contractor to Design, Develop, Manufacture, and Deliver SLS Stages

Core Stage Description

- **Flexible design can be configured for the mission**
  - 27.5-ft-diameter (8.4m) tank provides propellant for three to five RS-25 engines, depending on mission needs
  - Will be designed once for all mission types

- **Key interfaces**
  - Boosters attach near the top of the booster
  - Payload mounts to the top of the Core Stage for initial capability launches
  - Upper Stage mounts above the Core Stage for heavy-lift missions and large-sized payloads

- **Includes the Main Propulsion System (MPS)**

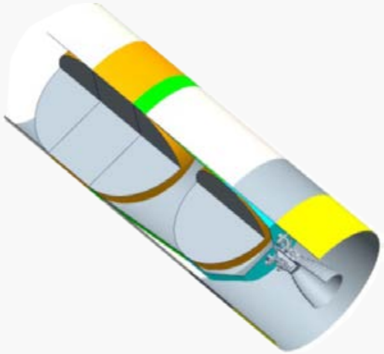


Core Stage

Backbone of the Space Launch System

Upper Stage Description

- **Upper Stage required for missions with heavier lift requirements**
  - 27.5-ft-diameter (8.4m) cryogenic stage of the same diameter as the Core Stage
  - Houses one to three J-2X Upper Stage Engines, depending on mission needs
  - Activated during flight after the Core Stage and Boosters are depleted and expended



Upper Stage

Evolved Capability for Heavier Lift Payload Requirements

National Aeronautics and Space Administration

Space Launch System (SLS) Program
Engines Element Overview

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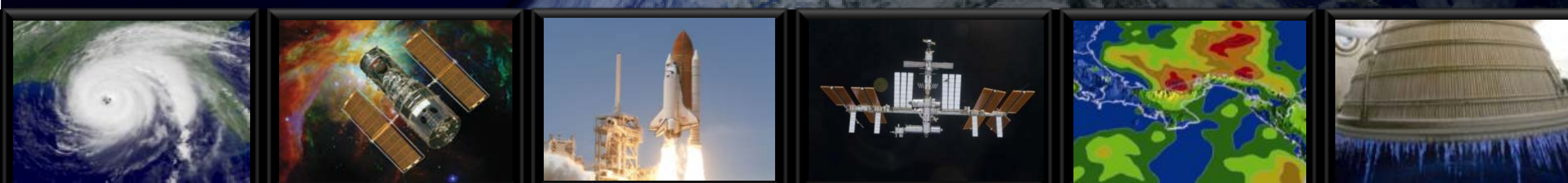


Mike Kynard, Manager
Engines Element
NASA Space Launch System Program
September 2011

Engines Element Overview

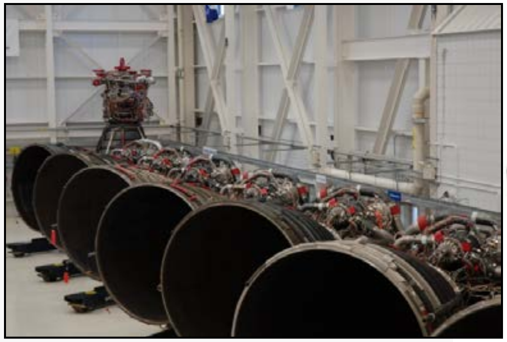
- **Acquisition approach directly supports U.S. human space exploration**
  - Based on extensive engineering and business analyses and planning, leading to the optimum solution for NASA's requirements for safety, affordability, and sustainability
  - Delivers an initial 70 t lift capability in 2017, using the existing Space Shuttle Main Engine (SSME, RS-25) contract with Pratt & Whitney Rocketdyne (PWR) for the Core Stage Engine, while modifying the exiting Ares contract with PWR for the J-2X Upper Stage Engine for evolved 130 t capability

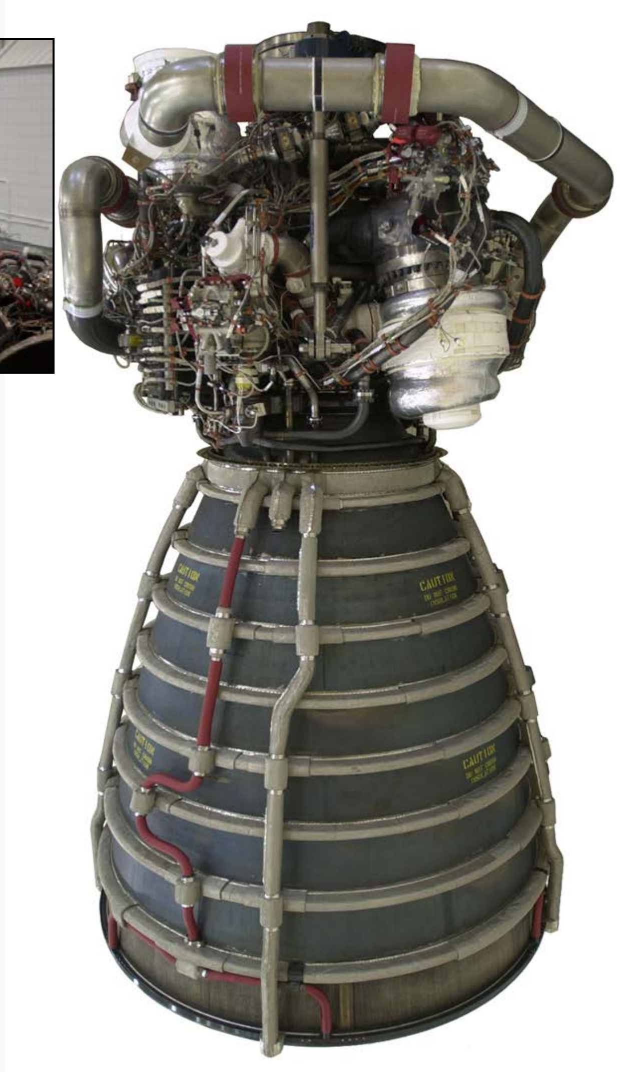
- **Delivering Core Stage Engine and initial flight sets, as well as the Upper Stage Engine**
  - Core Stage Engine: 15 available Space Shuttle Main Engines (RS-25)
  - Upper Stage Engine: J-2X leverages development and certification effort in process

- **Approach**
  - Perform engine assembly and acceptance testing at Stennis Space Center (SSC)
  - Integrate with Core Stage and Upper Stage at Michoud Assembly Facility (MAF)
  - Integrate existing engine interfaces to stage designs
  - Resolution of existing design to SLS requirements: safe, affordable, and sustainable

Supports U.S. Aerospace State of the Art in LOX/LH_2 Engine Experience, Technologies, and Infrastructure

RS-25 Engine





- **High Performance System**
  - 492k-lb nominal thrust
  - 453-sec specific impulse (Isp)
- **Operational Capability**
  - ~ 67 to 109% throttle range
- **Mature design, manufacturing and operational knowledge base**
  - >1,200,000 seconds hot-fire time
  - Catastrophic failure risk = 1 in 1,956 starts
- **Human rated**
- **Significant U.S. investment in SSME capabilities**
- **Available Assets**
  - 15 Flight Engines
  - 2 Development Engines
  - Additional spare Line Replaceable Units (LRU)
- **Adaptations**
  - New Controller – Use J-2X Controller
  - Evaluate component spares and possible limited refurbishment
  - Acceptance testing under SLS launch conditions

J-2X Engine

- **Vacuum Thrust**
  - Nominal = 294k
  - *Open-loop control*
- **Mixture Ratio**
  - Nominal = 5.5
  - *Open-loop control*
- **Secondary Mode Operation**
  - Thrust = ~82%
  - Mixture Ratio = 4.5
- **Health & Status Monitoring**
  - Data Collection for Post-Flight Analysis
  - Engine Failure Notification

Operational Life = 4 starts and 1,750 sec (post-delivery)

- **Minimum Vacuum Isp = 448 sec**
- **Weight & Size**
  - 5535 lbm (NTE)
  - 120” D X 185” L
- **Altitude Start & Orbital Re-Start**
  - Start at > 100,000 ft.
  - Second start after 2-hr to 5-day on-orbit loiter

J-2X Engine Development Is Past the Critical Design Review and Hardware Is in Testing

National Aeronautics and Space Administration

Space Launch System (SLS) Program Spacecraft and Payload Integration Office Overview

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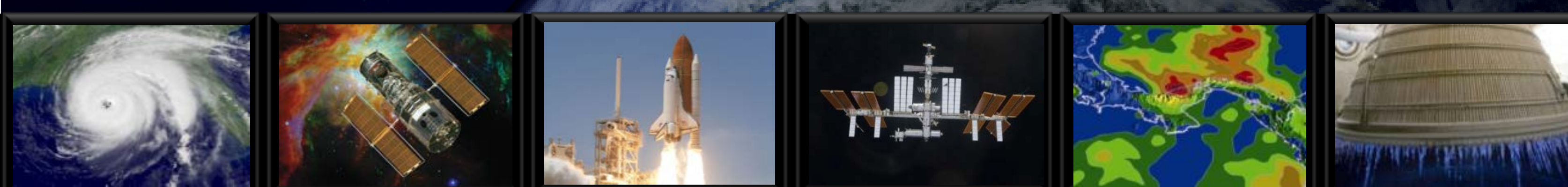
Space Launch System



Craig McArthur, Deputy Manager
Spacecraft & Payload Integration Office
NASA Space Launch System

September 2011

Spacecraft & Payload Integration Overview

- **Acquisition approach directly supports U.S. human space exploration**
  - Is based on extensive engineering and business analyses and planning, leading to the optimum solution for NASA's requirements for safety, affordability, and sustainability
  - Full and Open Competition to Begin in FY13 for spacecraft adapter
- **Manages all aspects of Spacecraft and Payload integration with the launch vehicle**
  - Solicits and pursues planned and potential SLS customers
    - Multi-Purpose Crew Vehicle (MPCV)
    - Scientific missions
    - Propulsive requirements
    - Cargo payloads
  - Defines and verifies customer requirements and interfaces
  - Develops or modifies hardware to accommodate payloads
  - Qualifies and certifies flight readiness of all flight hardware
  - Manufactures all hardware required for the SLS vehicle to accommodate spacecraft and payloads
  - Performs operational planning and hardware mission management for specific missions

Responsible for Accommodating all SLS Payloads

Spacecraft & Payload Integration Development Approach

- **In-house requirements up to the transition point will be fulfilled by a combination of civil servant and support contractor resources**
  - Support contractors will be utilized through existing Center contracting mechanisms.
- **Requirements definition will occur during in-house phase sufficient to allow for development of procurement packages for outsourced requirements**
  - The scheduled need date for the item(s) will dictate when a procurement is initiated.
  - The size and complexity of requirements will dictate the lead-time for procurement.
- **Spacecraft and Payload Adapters**
  - MSFC in-house design for MPCV adapter through Preliminary Design Review
  - Make/Buy decision for critical design and development will dictate scope of future competition

- **Payload Fairing**
  - Competitive acquisition cycles to be announced in the future in time to support first need
  - Anticipated phased approach with maximum competition

Developing Payload Interfaces and Modular Protective Shrouds Configurable for Science Instruments, Equipment, and Cargo

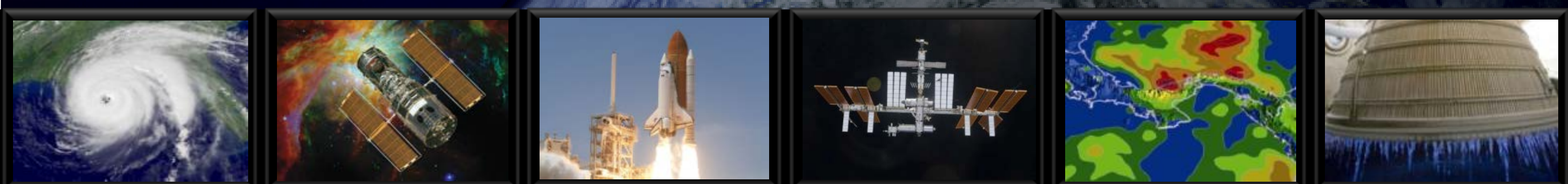
National Aeronautics and Space Administration

Space Launch System (SLS) Program Advanced Development Overview

SLS Industry Day

Marshall Small Business Alliance

Space Launch System



Fred Bickley, Manager
Advanced Development Office
NASA Space Launch System Program

September 2011

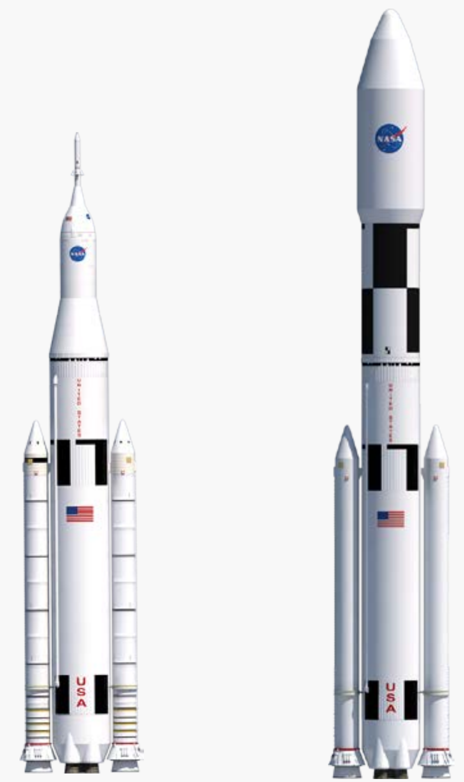
Advanced Development Overview

♦ **Flexibility to achieve initial operating capability (70 t) quickly (2017)**

♦ **Ability to develop evolutionary designs and block configuration upgrades to improve affordability, increase safety and reliability, and increase performance (130 t)**

♦ **Engaging both industry and academia in the following Technology Areas (including, but not limited to):**

- Block upgrades or concept development
- Advanced development in propulsion
- Advanced development in manufacturing/ structures/materials
- Advanced development in avionics/software



INITIAL CAPABILITY **EVOLVED CAPABILITY**

Further Details Will Be Available by the End of 2011 at an SLS Advanced Development Industry Day

Advanced Development Schedule

Activity	Date
Overall SLS Industry Day	*September 29, 2011*
Advanced Development Industry Day	*NLT December 2011*
Anticipated Contract Award	*NLT August 2012*

- **Anticipate multiple Firm-Fixed Price (FFP) Contracts, Grants, and Cooperative Agreements**
- **Anticipated Period of Performance: 1-year base, with potential for options**

Seeking the Most Affordable, Innovative Solutions for the Challenges of Exploration Beyond Earth Orbit

Advanced Booster Engineering Demonstration and Risk Reduction: Target Areas

- Acquisition will identify and mitigate risk at the Element and System Levels
- Target area risk reduction focusing on:
  - Affordability
  - Performance
  - Reliability
- NASA has identified POTENTIAL target areas for risk mitigation:

Liquid Rocket Boosters	Solid Rocket Boosters
• Large Component Fabrication (Nozzle and Turbopump)	• Non-Destructive Evaluation (NDE) of Composite Structures
• Oxygen-Rich Technologies	• Composite Case Structural Test
• Rocket Propellant (RP) Combustion Performance and Stability	• Propellant Formulations (HTPB, HTPE, NEPE)
Interface Attach Point Methods to SLS Core Stage	

- Competition via NASA Research Announcement (NRA)
- Target areas will evolve and expand based on knowledge obtained through specific industry day briefings, draft NRA, etc.
- Offerors may propose other risk areas not identified in NRA.

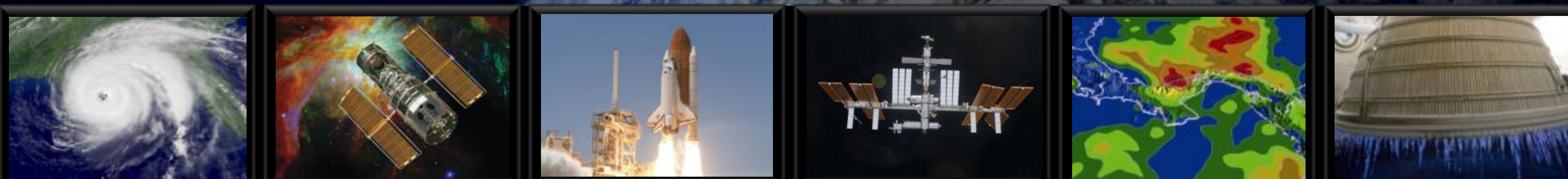
NASA Will Hold a Separate Industry Day for NASA Research Announcements

Michoud Assembly Facility (MAF) Update

SLS Industry Day

Marshall Small Business Alliance

Space Launch System



Steve Doering, Director
Michoud Assembly Facility

September 2011

Michoud Assembly Facility Supports SLS

- **MAF Background**
  - Unique manufacturing capabilities perfectly suited for SLS manufacturing
    - Delivered large-scale structures for NASA's Apollo and Shuttle Programs
    - Manufacturing the Orion Multi-Purpose Crew Vehicle's primary structure
  - Site comprises 832 acres with over 2M square feet of manufacturing space (43 acres under one roof) and 900k square feet of office space
  - Conveniently located and accessible
    - Deep-water port, Gulf of Mexico waterway, multiple Mississippi River ports
    - Less than 5 miles from intermodal rail stations and Class-One rails
    - Less than 1 mile from interstate highway
    - Lakefront Airport that accommodates dual-wheel cargo craft

- **Significant State of Louisiana investment in manufacturing capability**

- **MAF Transformation**
  - Over the last 24 months, updated from single project to multi-project facility to support NASA projects/programs and new commercial tenants
  - Reduced operating costs to NASA with:
    - Implementation of shared services and broader tenant base
    - Commercial and non-NASA Government access to available excess capacity

One-of-a-Kind Infrastructure Asset

Innovative New Business Model

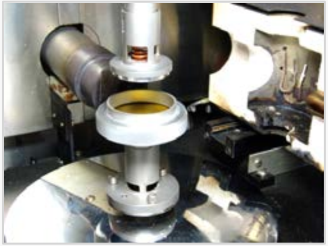
- **Multiple NASA Programs**
  - Space Shuttle External Tank (retired)
  - Ares Upper Stage (transitioned)
  - Orion MPCV
- **Commercial and Gov't. Tenants**
  - Lockheed Martin
  - Blade Dynamics
  - B-K Manufacturing
  - Long Branch Production Company
  - BP
  - DNV
  - USDA
  - U.S. Coast Guard
- **Contractual Mechanisms**
  - Space Act Agreement
  - Enhanced Use Leasing
- **Turn-Key Manufacturing**
  - Infrastructure
  - Laboratories
  - Equipment
  - Support
- **Focus on Growth**
  - Pricing Model
  - Marketing for New Tenants
  - Facility Improvements

mafspace.msfc.nasa.gov

MAF Is Ready to Support America's New Heavy-Lift Launch Vehicle

- **MAF team is working with the SLS Stages Element**
  - Manufacturing Core Stage and Upper Stage
  - Manufacturing Instrument Ring
  - Integrating engines with Core and Upper Stages

- **Commercialization strategy of leasing available excess capacity will continue**



- **Suppliers and subcontractors to SLS elements located at MAF have the opportunity to collocate with their prime contractor customer**
  - Utilize the same world-class infrastructure, equipment, and services
  - Significantly reduce logistics cost and delivery time by sharing common space
  - Potentially qualify for State of Louisiana economic development incentives

Targeting Small Business Industry Day at MAF in Early November

For More Information

www.nasa.gov/sls