Launching the Future of Science and Exploration
Engineering Directorate Overview
A Briefing to the Marshall Small Business Association

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Abstract

The Marshall Small Business Association (MSBA) serves as a central point of contact to inform and educate small businesses interested in pursuing contracting and subcontracting opportunities at the Marshall Space Flight Center. The MSBA meets quarterly to provide industry with information about how to do business with Marshall and to share specific information about Marshall's mission, which allows private businesses to envision how they might contribute. For the February 19 meeting, the Engineering Directorate will give an overview of its unique capabilities and how it is organized to provide maximum support for the programs and projects resident at Marshall, for example, the Space Shuttle Propulsion Office, Ares Projects Office, and Science and Mission Systems Office. This briefing provides a top-level summary of the work conducted by Marshall's largest organization, while explaining how resources are deployed to perform the volume of work under Marshall's purview.

National Aeronautics and Space Administration

Marshall Space Flight Center
Engineering Directorate Overview
Launching the Future of Science and Exploration

marshall

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Associate Director for Operations
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www.nasa.gov

NASA's Strategic Goals

Retire the SHUTTLE by 2010

Complete the INTERNATIONAL SPACE STATION

Return to THE MOON by 2020

Carry out MISSIONS of SCIENTIFIC DISCOVERY

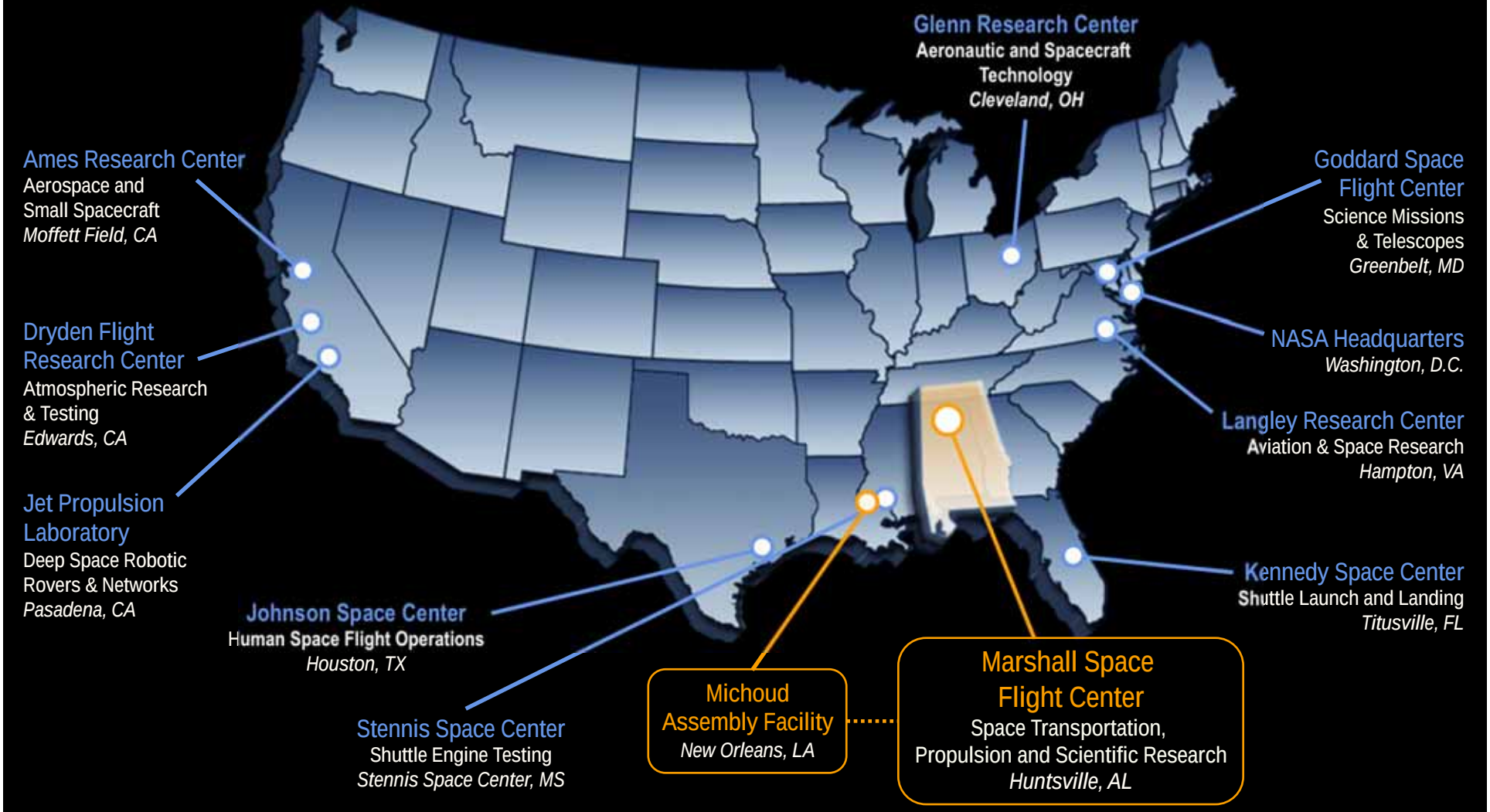
Advance U.S. aeronautics TECHNOLOGY LEADERSHIP

Pursue PARTNERSHIPS with commercial space sector

Provide critical capabilities to SUPPORT NASA's MISSION

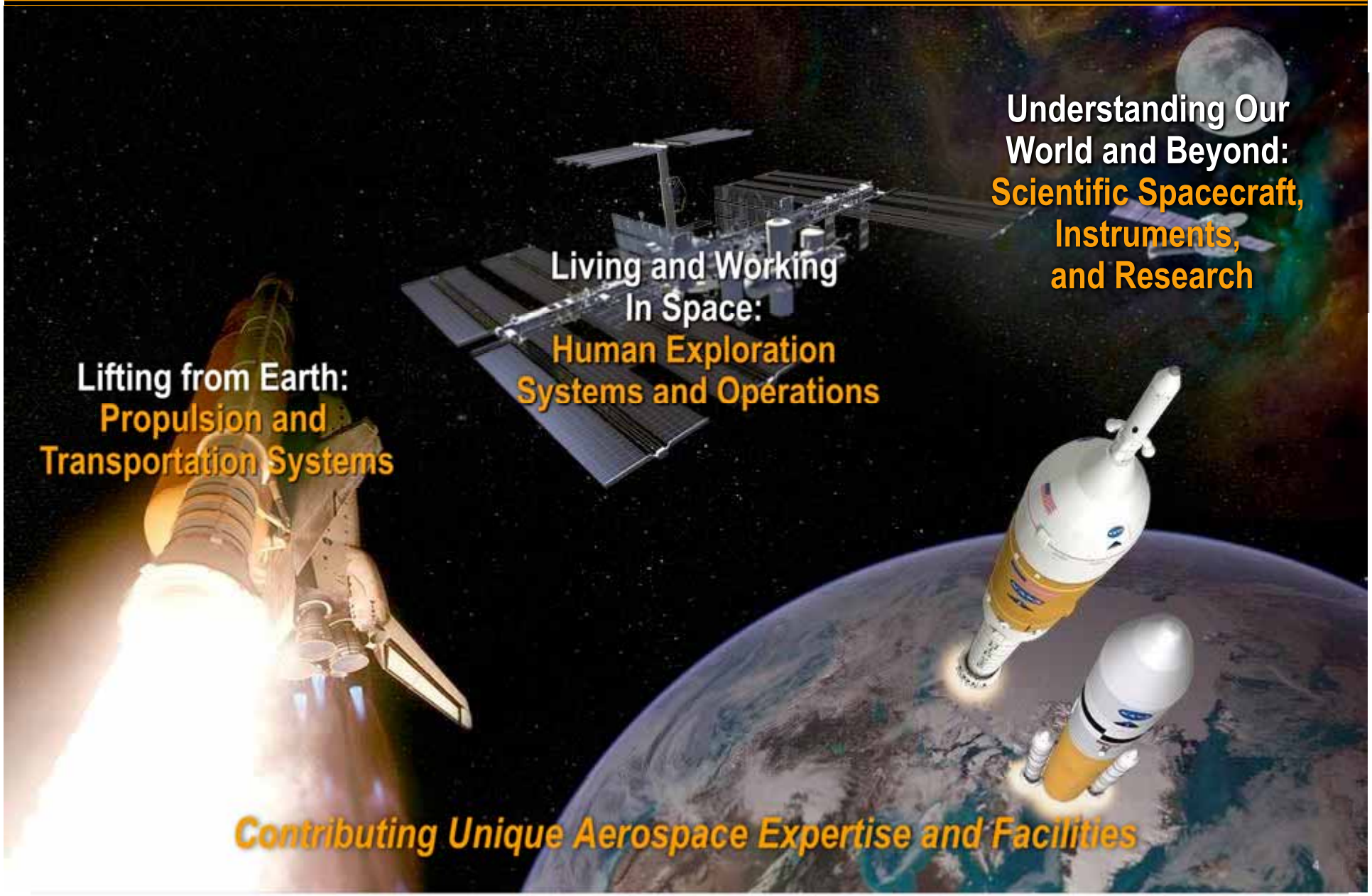
Working with Prime and Support Contractors to Achieve NASA's Goals

NASA Around the Country



Marshall has a key role in NASA's mission.

Empowering Space Exploration



Exploring in Earth Orbit and Beyond

Safely flying the Shuttle to complete the International Space Station and service the Hubble Space Telescope

Developing innovative propulsion technologies

Engineering avionics, structures, materials, and mechanisms

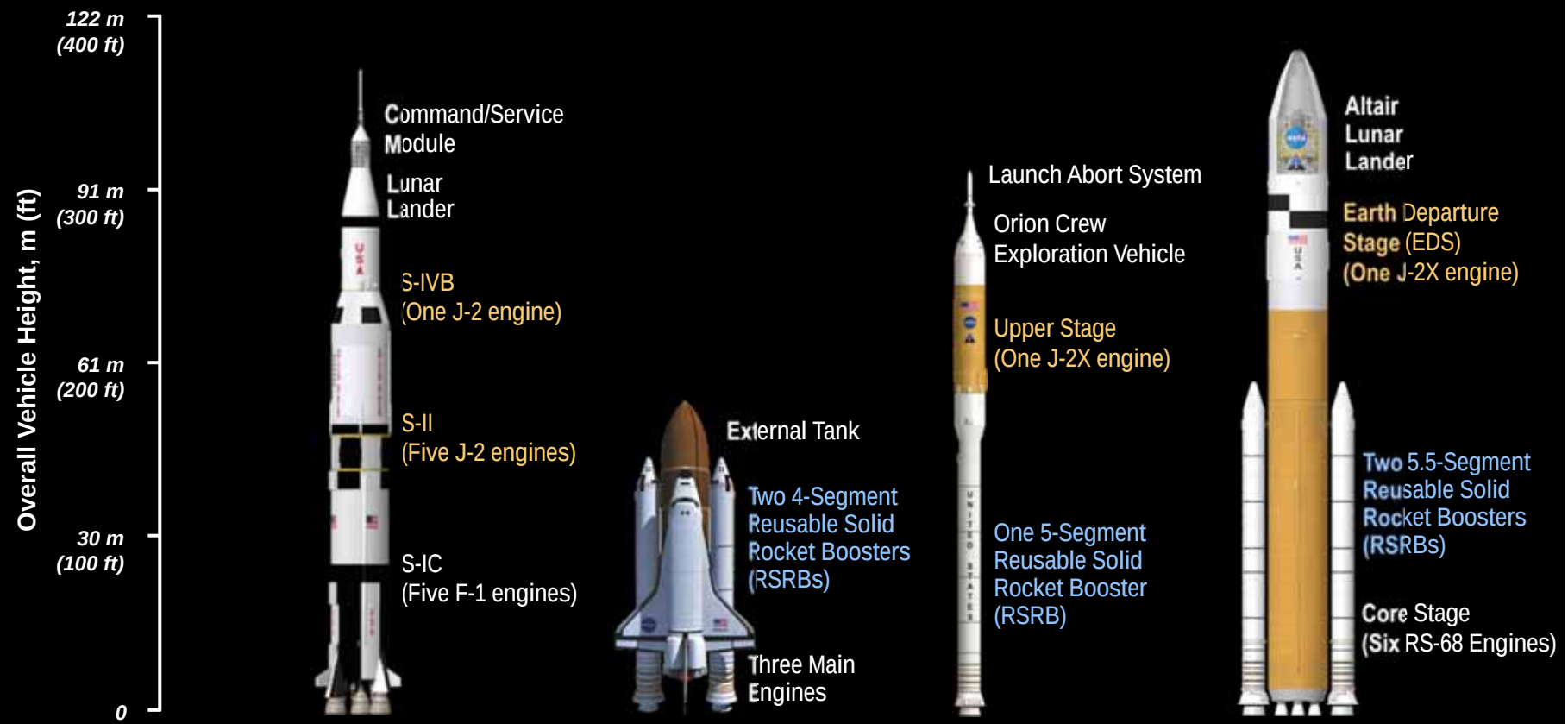
Developing the Ares I crew launch and the Ares V cargo launch vehicle

Designing the Upper Stage and Integrating the Ares I Stack In House

First test flight is scheduled for 2009

Opening the Door to Discovery

Building on Proven Systems and Experience Base



Saturn V	Space Shuttle	Ares I	Ares V
1967–1972	*1981–Present*	*First Flight 2015*	*First Flight 2020*
Height: 110.9 m (364 ft)	Height: 56.1 m (184.2 ft)	Height: 99.1 m (325 ft)	Height: 116.2 m (381.1 ft)
Payload Capability: 44.9 metric tons (99,000 lbs) to TLI 118.8 metric tons (262,000 lbs) to LEO	Payload Capability: 25.0 mT (55,000 lbs) to LEO	Payload Capability: 25.5 mT (56,200 lbs) to LEO	Payload Capability: 187.7 mT (413,800 lbs) to LEO 71.1 mT (156,700 lbs) to TLI with Ares I 62.8 mT (138,500 lbs) direct to TLI

mT – metric tons
TLI – Trans-Lunar Injection
LEO – Low Earth Orbit

Making Possible Off-Planet Operations

Life Support and Science

- Producing Clean Air and Recycling Water
- Managing Science Operations Around-the-Clock
- Making Science Experimentation Possible in Space

Future Systems

- Providing Exploration Life Support Systems and Radiation Hardened Electronics
- Developing Altair Lunar Lander Systems
- Utilizing Lunar Resources

Payload Operations Center

Lunar Resources

Environmental Control & Life Support

Altair Lunar Lander

Working in Space

Helping Crews Survive and Thrive in Space

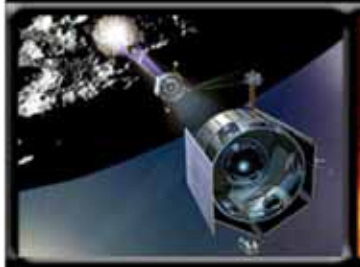
Supporting the Range of Science Missions

Earth Science:

- Monitoring the Environment
- Accurately Predicting Weather
- Researching Hurricane Activities

Space Science:

- Preparing for crewed missions to the Moon with robotic precursor spacecraft
- Learning about Earth's planetary neighborhood
- Discovering secrets of the cosmos



LCROSS

HINODE

Discovery/
New Frontiers

Lightning
Research

JWST/
Marshall XRCF

Hurricane
Research

Delivering Systems that Expand Knowledge and Improve Life on Earth

Marshall Space Flight Center

Engineering Directorate

Dan Dumbacher, Director
Chris Singer, Deputy Director
Garry Lyles, Assoc Dir, Tech Mgt
Steve Miley, Assoc Dir, Operations

Resource Management Office
Terry Hopper

Engineering Programs & Systems Office
Pam Caruso (act)

Advanced Concepts Office
Reggie Alexander

Chief Engineers Office
Paul McConnaughey

Space Systems Department
Steve Pearson

Spacecraft & Vehicle Systems Department
Preston Jones

Propulsion Systems Department
Tom Williams

Mission Operations Laboratory
Jay Onken

Materials & Processes Laboratory
Ralph Carruth

Test Laboratory
Rick Burt

Crosscutting Capabilities for Marshall's Product Lines

Engineering Directorate Capabilities

Advanced Concepts

- Concept Definition, Integration, & Analysis
  - Earth-to-Orbit Transportation
  - In-Space Transportation
  - Planetary Surface Systems
- Mission Analysis
- Architecture Analysis
- Technology Assessments

Space Systems

- Systems Engineering & Integration
- Avionics
- Software
- Electrical Integration
- Mechanical Systems
- Fabrication & Assembly Services
- Environmental Control & Life Support Systems

Spacecraft & Vehicle Systems

- Systems Engineering & Integration
- Tank/Structures Design
- Loads & Dynamics
- Mechanisms
- Terrestrial & Space Environments
- Induced Environments
- Modeling & Simulation
- Guidance, Navigation, & Control

Propulsion Systems

- Propulsion Engineering
- Liquids & Solids
- Component Design
- Fluid Systems Design & Analysis
- Computational Fluid Mechanics
- In-Space Propulsion
- Nuclear Propulsion

Organized for Mission Success

Engineering Directorate Capabilities *(continued)*

Mission Operations

- Operations Concepts
- Ground Systems
  - Design Development
  - Certification
  - Operation
- Flight Operations
  - Mission Design
  - Crew Procedures & Timelines
  - Flight Controller Cert.
  - On-board Facility Ops

Materials & Processes

- Metallics
- Composites
- Ceramics
- Environmental Effects
- Fracture & Failure Analysis
- NDE & Tribology
- Chemistry & Combustion Research

Test Lab

- Propulsion Testing
- Structural Testing
- Thermal Vacuum
- Shock & Vibration
- Acoustic
- Experimental Fluids Test & Development
- Advanced Instrumentation Application

Organized for Mission Success

Engineering Directorate Capabilities *(continued)*

Resource Management Office

- Business Operations
- IT Resources
- Administrative Support
- Fiscal Accountability
- Business Processes
- Workforce & Resource Planning

Programs & Systems Office

- Integrated Engineering Tools
- Streamlined Processes
- Engineering Technical Standards Program
- Innovative Partnerships
- Technology Transfer

Chief Engineers Office

- Focal Point for Technical Excellence & Authority
- Cross-cutting Technical Leadership
- Senior Network of Systems Engineers
- Reps in Programs & Projects Supported

Organized for Mission Success

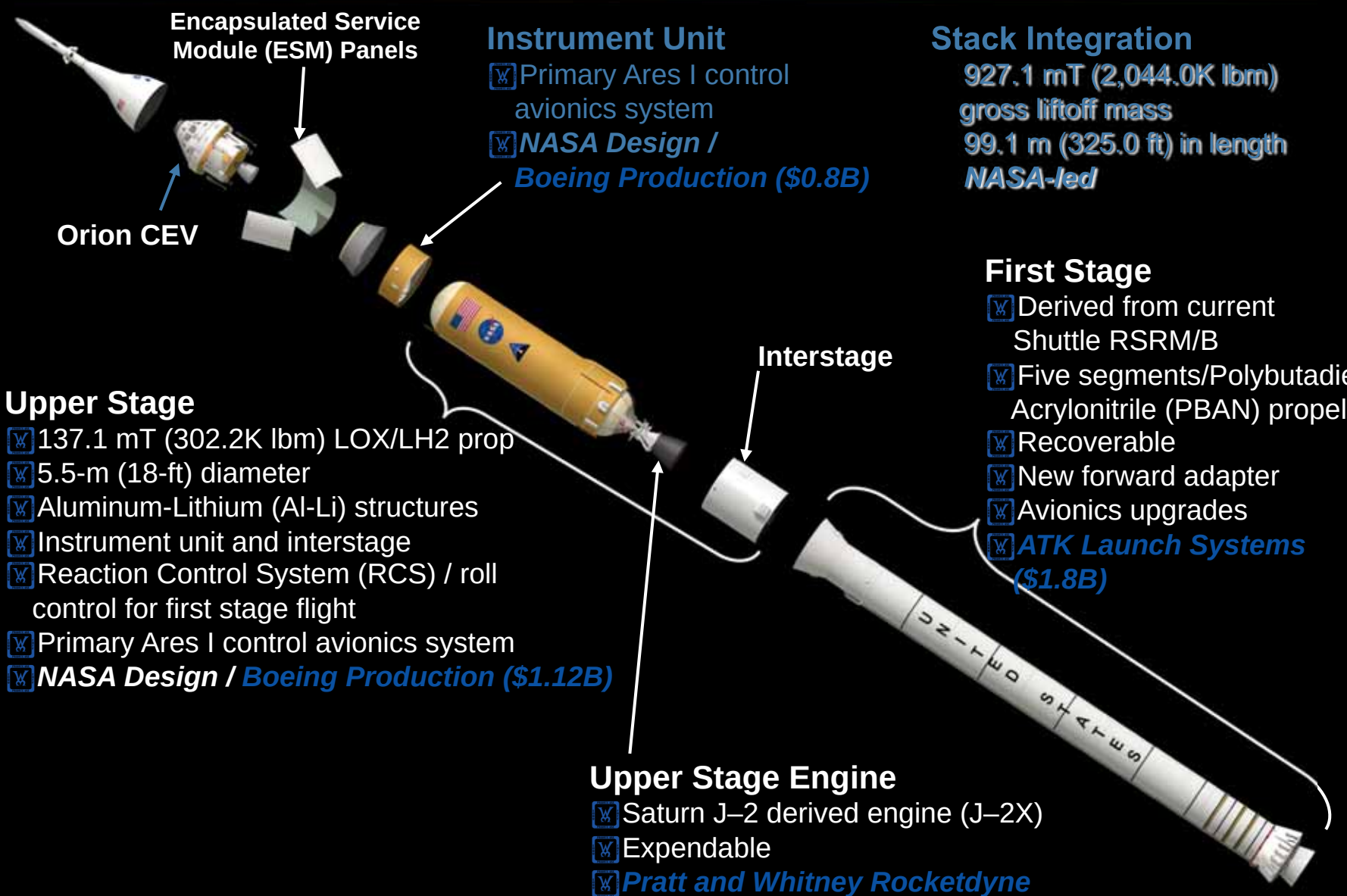
For More Information

Marshall Space Flight Center
www.nasa.gov/centers/marshall

Doing Business With Marshall
http://ec.msfc.nasa.gov/msfc/doin_bus.html

Backup

Ares I Elements



Instrument Unit
- Primary Ares I control avionics system
- ***NASA Design / Boeing Production ($0.8B)***

Stack Integration

927.1 mT (2,044.0K lbm) gross liftoff mass
99.1 m (325.0 ft) in length
NASA-led

First Stage
- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- ***ATK Launch Systems ($1.8B)***

Upper Stage
- 137.1 mT (302.2K lbm) LOX/LH2 prop
- 5.5-m (18-ft) diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- ***NASA Design / Boeing Production ($1.12B)***

Upper Stage Engine
- Saturn J–2 derived engine (J–2X)
- Expendable
- ***Pratt and Whitney Rocketdyne ($1.2B)***

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