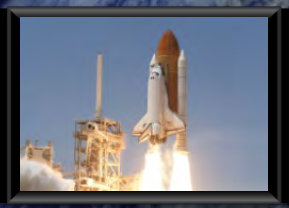
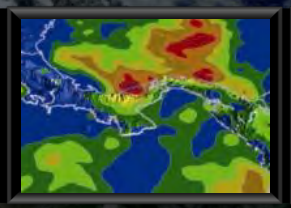
National Aeronautics and Space Administration

# Space Launch System (SLS) Program Overview

## Advanced Development NASA Research Announcement Industry and Academia Day



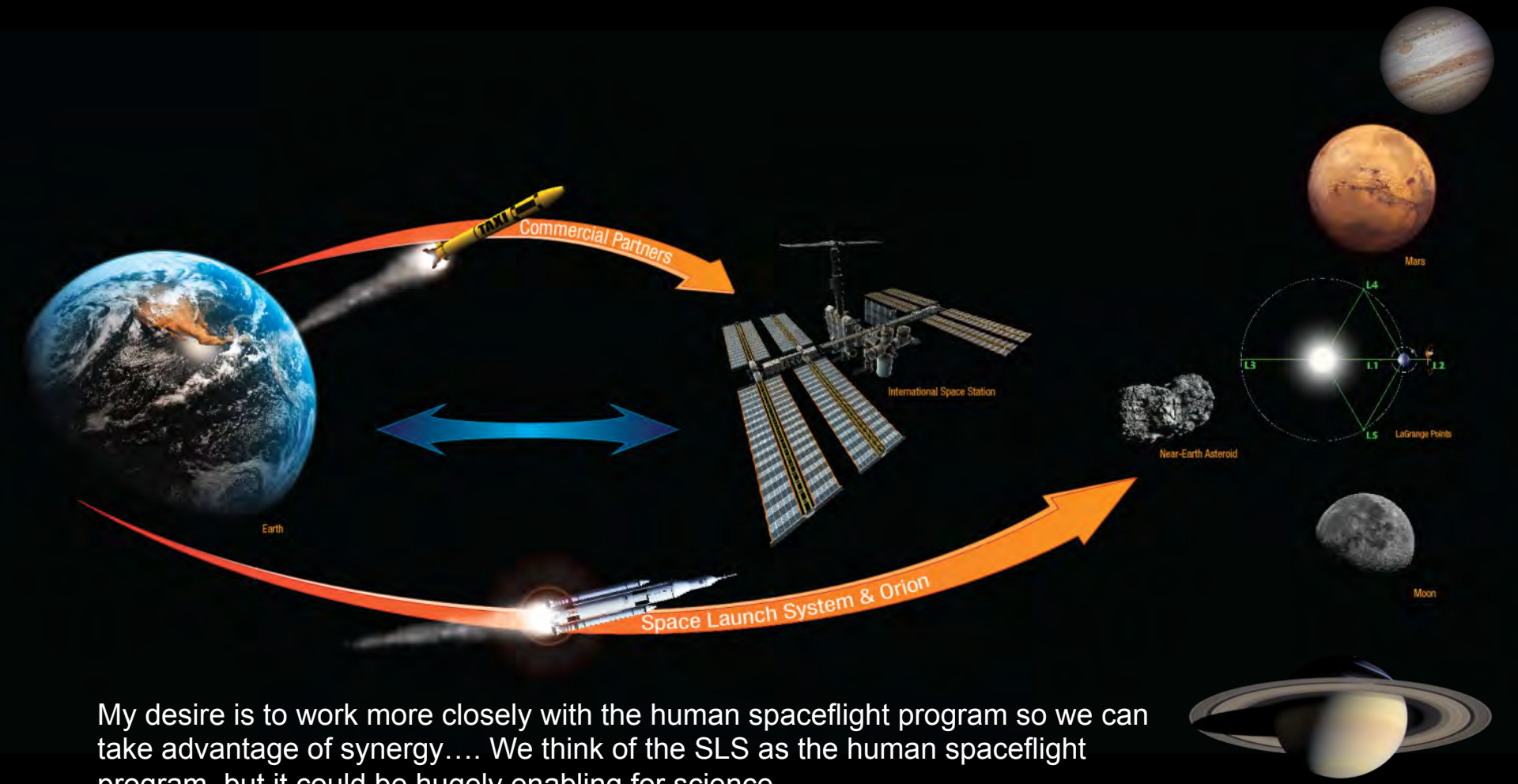





Space Launch System

**Jody Singer, SLS Deputy Program Manager**
**NASA Marshall Space Flight Center**
*February 14, 2012*

# The Future of Exploration




My desire is to work more closely with the human spaceflight program so we can take advantage of synergy…. We think of the SLS as the human spaceflight program, but it could be hugely enabling for science.

*~John Grunsfeld, Associate Administrator*
*NASA Science Mission Directorate*
*Nature, Jan 19, 2012*

# 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)

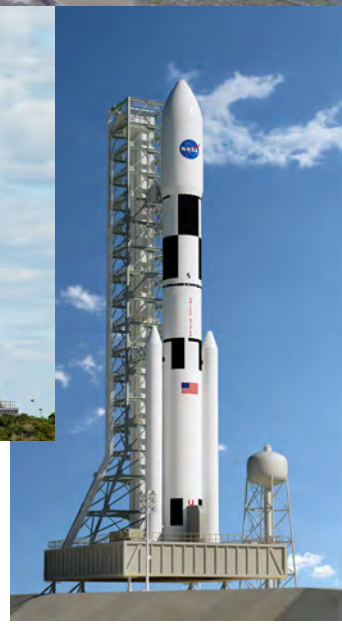
- **The Law authorizes:**
  - Extension of the International Space Station (ISS) until at least 2020
  - Strong support for a commercial space transportation industry
  - **Development of Orion Multi-Purpose Crew Vehicle (MPCV) and heavy lift launch capabilities**
  - A "flexible path" approach to space 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*

***Delivering on the Laws of the Land … and Obeying the Laws of Physics***

# SLS Driving Objectives

- **Safe: Human-Rated**
- **Affordable**
  - Constrained budget environment
  - Maximum use of common elements and existing assets, infrastructure, and workforce
  - Competitive opportunities for affordability on-ramps
- **Sustainable**
  - Initial capability: 70 metric tons (t), 2017–2021
    - Serves as primary transportation for Orion and exploration missions
    - Provides back-up capability for crew/cargo to ISS
  - Evolved capability: 105 t and 130 t, post–2021
    - Offers large volume for science missions and payloads
    - Modular and flexible, right-sized for mission requirements



***SLS First Flight in 2017***

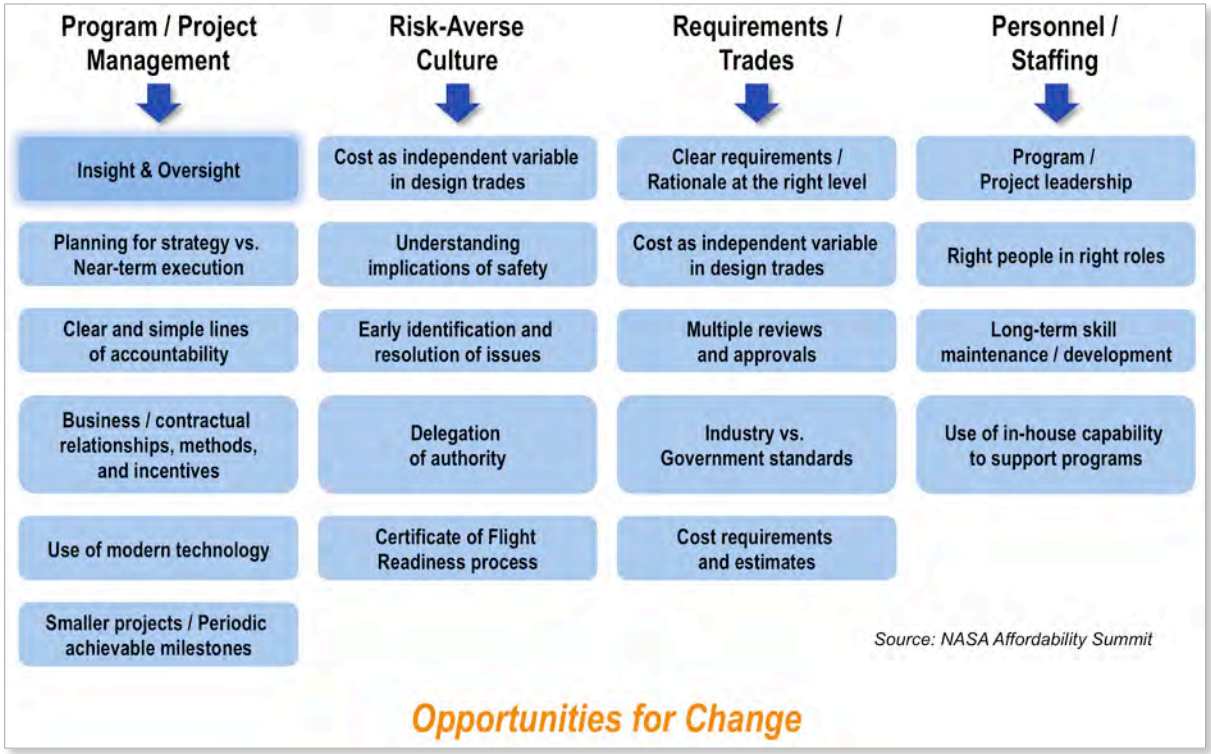
# SLS Advanced Development Tenets

- Utilize an evolutionary development strategy that allows for incremental progress within constrained budgets.
- Incorporate mature technical solutions into SLS program-phased block upgrades.
- Optimize use of common elements and existing assets for a flexible/modular design.

*Improve Affordability, Reliability, and/or Performance*

# SLS Sustainability Begins with Affordability

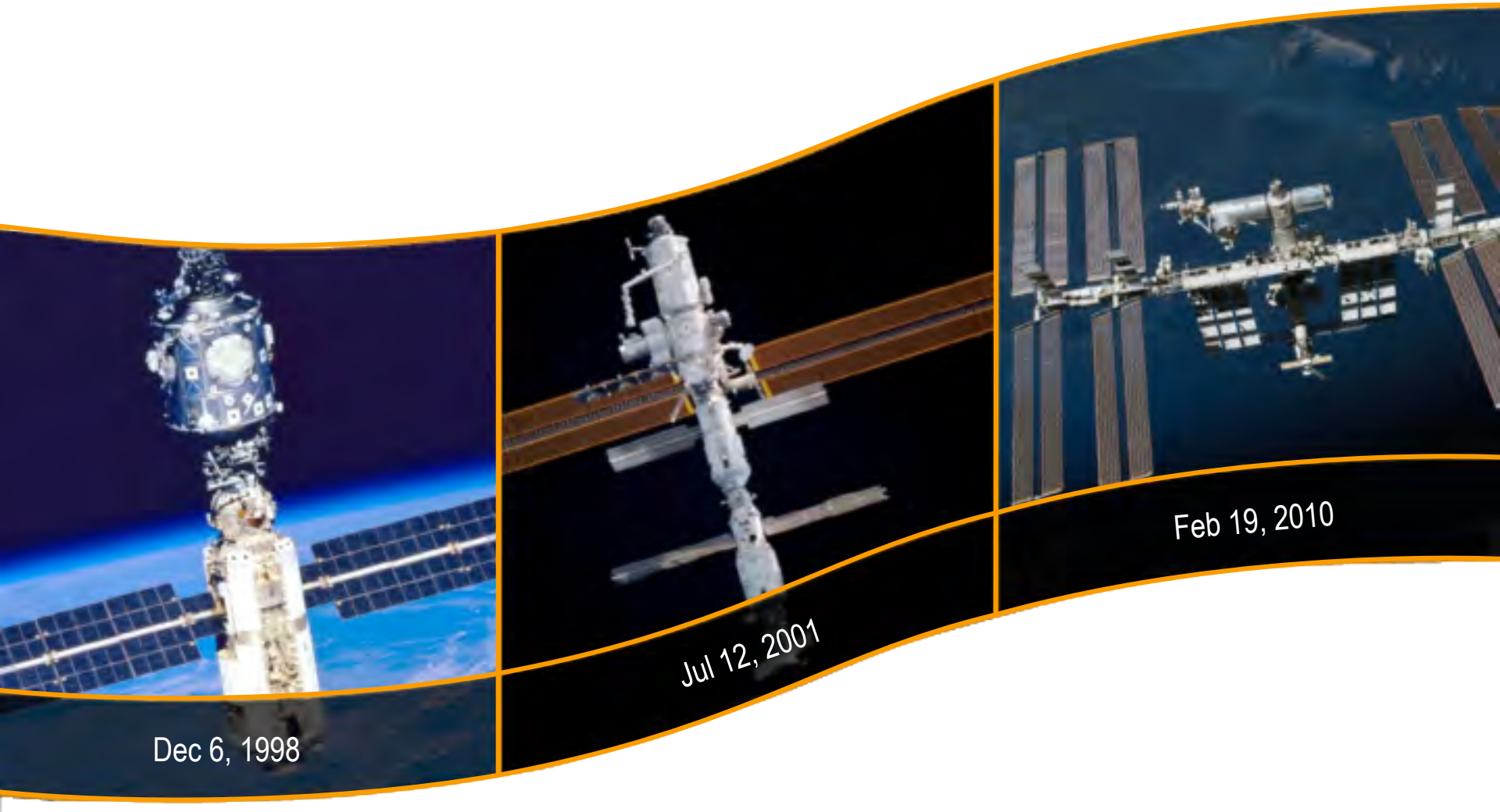
- **Evolvable Development Approach**
  - Manage requirements within constrained, flat budgets.
  - Leverage existing National capabilities, including LOX/$LH_2$ propulsion infrastructure, manufacturing facilities, and launch sites.
  - Infuse new design solutions for affordability.
- **Robust Designs and Margins**
  - Trade performance for cost and schedule.
  - Use heritage hardware and manufacturing solutions.
  - Maintain adequate management reserves controlled at lower levels.




- **Risk-Informed Government Insight/Oversight Model**
  - Insight based on:
    - Historic failures.
    - Industry partner past performance and gaps.
    - Complexity and design challenges.
  - Judicious oversight:
    - Discrete vs. near-continuous oversight.
    - Timely and effective decisions.
- **Right-Sized Documentation and Standards**
  - Up to 80% reduction in the number of Data Requirement (DR) and Program documents from the Ares Projects.
  - Industry practices and tailored NASA standards.
- **Lean, Integrated Teams with Accelerated Decision Making**
  - Simple, clear technical interfaces with contractors.
  - Integrated Systems Engineering & Integration (SE&I) organization.
  - Empowered decision makers at all levels.
  - Fewer Control Boards and streamlined change process.

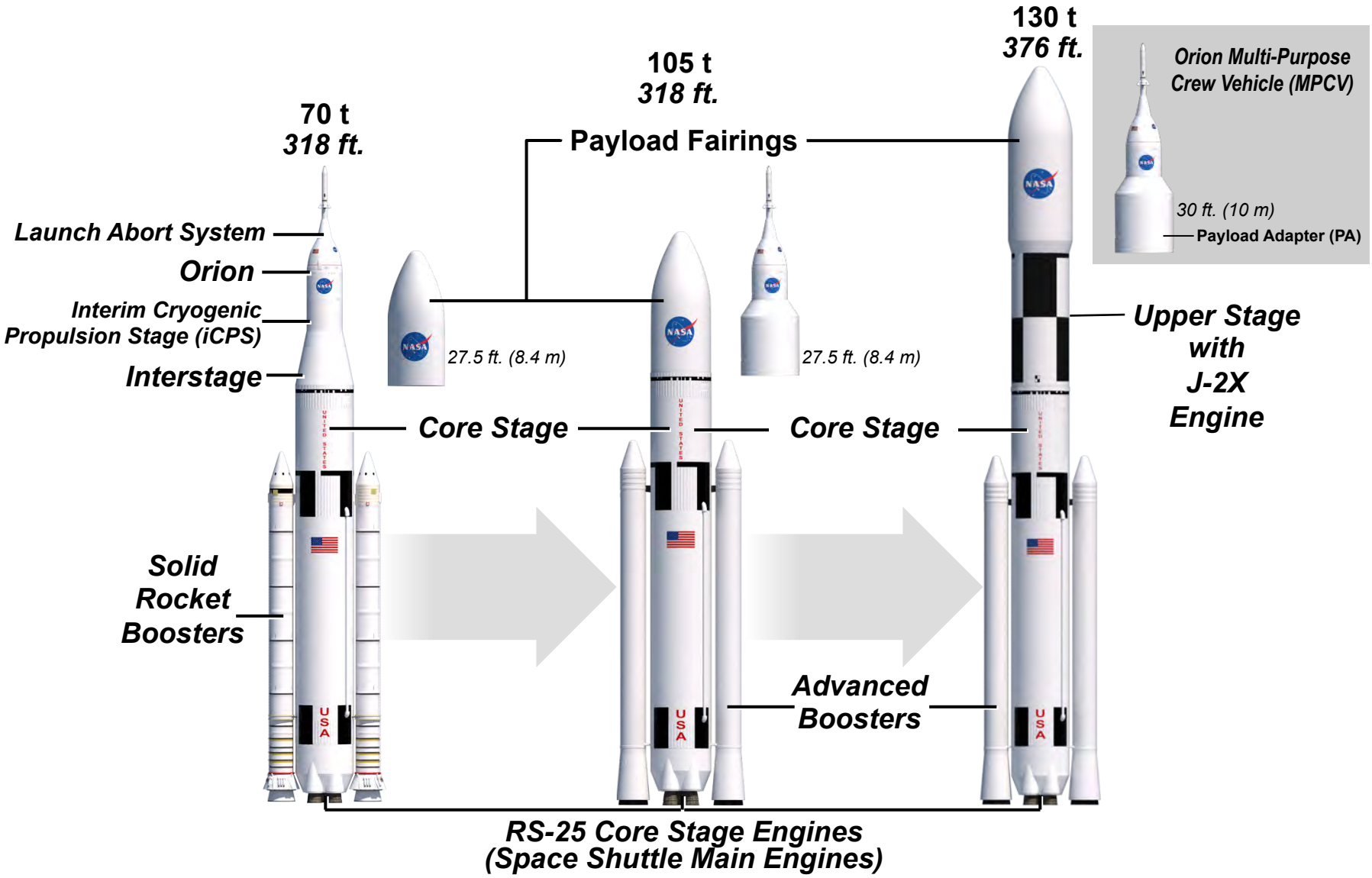
***Affordability: The ability to develop and operate the SLS within the National means, to sustain funding for the Program.***

# Planning Programmatic Content to Deliver Incremental Capability




***Like International Space Station, the SLS is a long-term commitment to America's future in space.***

# SLS Architecture Block Upgrades




## Flexible Capability for Human Exploration and Science Missions

# Advanced Development Summary

**Full and Open Competition**

**Advanced Development NRA**

- Concept Development (Trade Studies and Analyses)
- Propulsion
- Manufacturing, Structures, and Materials
- Avionics and Software

**Goals**

**Advanced Development**

- Support SLS Safety, Affordability, and Sustainability
- Seek out innovative and creative solutions
- Reduce the risk of evolving SLS through block upgrades
- Engage small businesses, academia, and other partners

**Initial Capability**
**2017 – 21**

- Builds on current capabilities
- Engages U.S. workforce and aerospace facilities
- Provides a firm foundation for the human and scientific exploration of space

***Moving Forward from Initial to Evolved Capability***

# Summary

- SLS is a national capability that empowers entirely new human exploration and science missions beyond Earth orbit .
- SLS builds on a solid foundation of experience and current capacities to enable a timely initial capability and evolve to a flexible heavy-lift capability through competitive opportunities.
- The SLS Advanced Development NRA provides opportunities for innovative approaches to improving safety, affordability, reliability, and performance, as well as overall sustainability.
- SLS is partnering with businesses, academia, and other government agencies to make wise choices that yield the best value for the American taxpayers' investment.

*FOR MORE INFO: WWW.NASA.GOV/SLS*

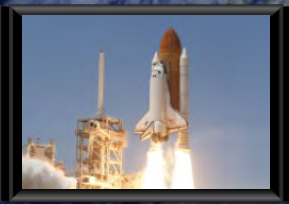
# Advancing the U.S. Legacy of Exploration

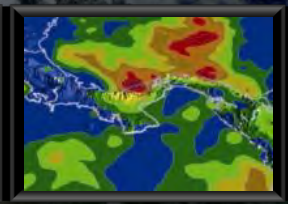
National Aeronautics and Space Administration

# Space Launch System
# NASA Research Announcement
# Advanced Development Office

Space Launch System








Mindy Niedermeyer, Chairperson
Monica Heidelberg, Contracting Officer

*February 14, 2012*

# SLS Advanced Development Office

- **The Space Launch System (SLS) Advanced Development Office is responsible for all aspects of advanced development planning and upgrades for the SLS vehicle.**

- **Mature technical solutions will be provided for an affordable avenue to continue America's journey of discovery by:**

  - Using an evolutionary development strategy, maturing upgrades in parallel with the program until the product reaches acceptable maturity and can be integrated into the vehicle

  - Maturing technologies to be effectively integrated into the SLS Program

  - Working proactively with the Office of Chief Technologist, such that resources are not wasted on duplicative efforts

# United States Government Partnership

- **NASA welcomes the U.S. Air Force (USAF) Space and Missile Systems Center (SMC) Launch & Range Systems Directorate (SMC/LR) as partner on this NASA Research Announcement (NRA).**

- **The NASA/USAF partnership strengthens mutual goals, which include:**
  - Collaborating across agencies for rocket propulsion system development
  - Reducing development and sustainment costs for rocket systems
  - Supporting competitiveness and resilience of the national industrial base

# SLS Advanced Development Office

## Key Tenets

- Use an evolutionary development strategy that allows for incremental progress within constrained budgets.
- Incorporate mature technical solutions into SLS Program-phased block upgrades.
- Optimize use of common elements and existing assets for a flexible/modular design.

***Improve Affordability, Reliability, or Performance.***

# NASA Research Announcement (NRA)

- **An NRA is used to announce research interests in support of NASA's programs.**
- **Offeror submits own Statement of Work (SOW).**
  - More flexibility than a Request for Proposal (RFP), allowing multiple awards for various types of work
  - Not prescriptive in defining the work effort to be proposed
- **An NRA provides for submission of competitive project ideas.**

# NRA – Important Solicitation Sites

- **Offeror should monitor the following locations for this NRA and any amendments issued against it:**
  - Federal Business Opportunities (FBO) (http://www.fedbizopps.gov)
  - NASA Acquisition Internet Service (NAIS) (http://prod.nais.nasa.gov)
  - NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) (http://nspires.nasaprs.com)

# Advanced Development NRA Procurement Schedule

| Activity | Approximate Dates |
|---|---|
| Request for Information (RFI) Issued | Oct 7, 2011 |
| Synopsize Draft NRA and Industry Day | Jan 25, 2012 |
| Issue Draft NRA | Feb 1, 2012 |
| Industry Day | Feb 14, 2012 |
| Offeror Comments/ Questions Due | Mar 1, 2012 |
| Issue NRA | Mar 20, 2012 |
| Proposals Due | May 1, 2012 |
| Award Notice for Provisional Selectees | Aug 13, 2012 |
| Negotiations Complete | Sep 21, 2012 |
| Contract Effectivity/Award | Sep/Oct 2012 |

*Completed Activity*

# NRA NNM12ZPS002N Outline

- **NRA Body**

  Executive Summary

  1.0 – Funding Opportunity Description
  2.0 – Award Information
  3.0 – Eligibility Information
  4.0 – Proposal and Submission Information
  5.0 – Proposal Review Information
  6.0 – Award Administration Information
  7.0 – NASA Contact
  8.0 – Other Information
  9.0 – Concluding Statement
  Appendix A – SLS Advanced Development Technical Information
  Appendix B – SLS Program Launch Vehicle Specification
  Appendix C – SLS Program Concept of Operations (CON OPS) Document
  Appendix D – Acronym List
  Appendix E – Subcontractor Information
  Appendix F – Element of Price Detail for Contracts
  Appendix G – Budget Summary for Grants

- **Model Contract**

  Sections A-I
  Attachment J-2, Data Procurement Document (DPD)

- **Model Grant**

# Executive Summary

- **SLS is seeking proposals that improve affordability, reliability, or performance in the following key technology areas:**
  - Concept development, trades, and analyses
  - Propulsion
  - Manufacturing, structures, and materials
  - Avionics and software
- **SLS seeks proposals in these areas from both Industry and Academia.**

# Executive Summary

## Benefits of including Academia:

- Enable undergraduate and graduate students to directly contribute to agency missions through research and technology development projects.
- Allow NASA and SLS to influence the path of the future workforce.
- Establish synergy with National Institute of Rocket Propulsion Systems (NIRPS).

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# 1.0 – Funding Opportunity Description

- **Funding is not currently available; award is contingent upon the availability of appropriated funds.**
- **Construction of facilities is not an allowed activity.**
- **Participation by non-U.S. organizations and Foreign Governments:**
  - Is limited to the direct purchase of supplies and/or services that do not constitute research
  - Allows foreign nationals to receive payment through a NASA award for the conduct of research while employed by a U.S. organization
- **All information needed to respond to this solicitation is contained in this NRA, *the NASA Guidebook for Proposers, January 2011* and the *NASA Grant and Cooperative Agreement Handbook.***

# 2.0 – Award Information

- **Total anticipated funding available is $40,000,000.**
  - Anticipated Funding split:
    FY2013 Industry $18.5M, Academia $1.5M
    FY2014 Industry $ 8.5M, Academia $1.5M
    FY2015 Industry $ 8.5M, Academia $1.5M
  - Each academic award capped at approximately $250K per year
- **Period of performance is a 12-month base period, with two 1-year options.**
- **Multiple awards are anticipated.**
- **Proposals shall be valid for 12 months to allow for a later award, should the opportunity become available, unless withdrawn by the Offeror prior to award.**

# 3.0 – Eligibility Information

- Other Government agencies, Federally Funded Research Development Centers (FFRDCs), and NASA Centers or their employees may be a supplier, consultant, or subcontractor via separate agreement.
- NASA employees are not permitted to be key personnel or a prime contractor.
- Each Offeror is encouraged to submit only one proposal, which shall describe only one standalone work effort.

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# 4.0 – Proposal and Submission Information

- **This part provides overall guidance for Offerors regarding the SLS Advanced Development NRA.**
  - Purpose and Scope
  - Section 1 – Relevance to NASA's Objectives
  - Section 2 – Intrinsic Merit
  - Section 3 – Price
  - Section 4 – Model Contract (or Model Grant)
  - Additional Proposal Guidance

# 4.0 – Proposal and Submission Information

- **The technical scope of this NRA is defined by the SLS description provided in Appendix A. To be considered within the technical scope of this NRA, proposed work efforts should also be at a maturity level capable of supporting timely implementation into the Block 1A vehicle configuration.**
- **This NRA solicits work efforts within the technical scope (described above) that are either:**
  - Upgrades to the vehicle
  - Studies, analytical tools, or databases that support development of the vehicle

# 4.0 – Proposal and Submission Information

## Section 1 – Relevance to NASA's Objectives

- **Offeror shall describe the relevance and significance of the proposed work effort to the objectives of SLS by:**
  - Describing how the work effort is within the technical scope of this NRA
  - Describing how the work effort improves or influences affordability, reliability, and performance

# 4.0 – Proposal and Submission Information

## Section 2 – Intrinsic Merit

- **Management Approach**
  - Distribution and management of responsibilities and work
  - Teaming, partnering, and subcontracting arrangements
  - Key capabilities, facilities, and equipment
  - Ground rules and assumptions
  - Deviations and exceptions
- **Technical Approach**
  - Technical objectives, methodology, and innovation
  - Upgrade implementation approach
  - Related work experience
  - Current and pending support
  - Bibliography (not evaluated)

# 4.0 – Proposal and Submission Information

## Section 3 – Price

- All cost and workforce summary information shall be complete and be consistent with, and traceable to, lower levels of cost and labor hour detail contained within the proposal.
- Offeror's proposal shall contain a summary of labor hours and other information supporting the proposed price in accordance with Element of Price Detail for Contracts (Appendix F) and Budget Summary for Grants (Appendix G).
- Deviations from Price Section Requirements shall be fully explained and supported.

# Proposal Page Limits and Formatting:

| REQUIRED CONSTITUENT PARTS OF PROPOSAL (in order of assembly) | WORD COUNT OR PAGE LIMIT | PAGE NUMBERING FORMAT |
|---|---|---|
| Cover Page | 1 page | None |
| Abstract | 200 – 300 words | None |
| Table of Contents | 1 page | Contractor Format |
| Relevance to NASA's Objectives and Intrinsic Merit Sections | 15 pages | 1 – 15 |
| Price Section | As needed | P1 – P# |
| Model Contract/Model Grant: Statement of Work (SOW) | 5 pages | S1 – S5 |
| Model Contract: Data Procurement Document (DPD) | As needed | Contractor Format |
| Model Contract: Work Breakdown Structure (WBS) | 1 page | W1 |

# 4.0 – Proposal and Submission Information

## Additional Guidance:

- Each Offeror is encouraged to submit only one proposal, which shall describe only one standalone work effort.
- Proposed programmatic or business (i.e.: non-technical) work efforts to support the SLS are not within the technical scope for this NRA.
- Industry Offerors should use topics in the Broad Advanced Development area presented in Appendix A, Section 5.0 as guidance for focusing the proposed work into areas of interest that have been identified by the Advanced Development Office.
- Academic Offerors should use topics in the Focused Advanced Development area presented in Appendix A, Section 5.0 as guidance for focusing the proposed work into areas of interest that have been identified by the Advanced Development Office.

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# 5.0 – Proposal Review Information

- **Evaluation Factors** (approximately equal importance)
  - Relevance to NASA's Objectives
  - Intrinsic Merit
  - Price
- **Basis for Award**
  - Based upon the evaluation of the Offeror’s proposal and the Selection Official’s decision

# 5.0 – Proposal Review Information

## Factor 1: Relevance To NASA's Objectives

- Does the proposal meet the technical scope of this NRA?
- How does proposed work effort improve or influence the SLS objectives of affordability, reliability, and performance?

***One Adjectival Rating for Factor 1 (Ex/VG/G/F/P)***
***Based on Consolidated List of Strengths and Weaknesses***

# 5.0 – Proposal Review Information

## Factor 2: Intrinsic Merit

- **Management Approach**
  - Distribution and management of responsibilities and work
  - Teaming, partnering, and subcontracting arrangements
  - Key capabilities, facilities, and equipment
  - Past performance
  - Ground rules and assumptions
  - Deviations and exceptions
  - Clauses B.3 and H.16, SOW, WBS, technical schedule, and detailed description of deliverables
- **Technical Approach**
  - Technical objectives, methodology, and innovation
  - Upgraded implementation approach, if applicable
  - Relationship to past work experience
  - Relationship to current and pending support

***One Adjectival Rating for Factor 2 (Ex/VG/G/F/P)***
***Based on Consolidated List of Strengths and Weaknesses***

## Factor 2: Intrinsic Merit – Past Performance

- Past Performance will be evaluated by:
  - Government evaluation of Past Performance Information Retrieval System (PPIRS), 5-year history
  - Prime contractor and subcontractors
  - Relevant work includes advanced development of aerospace systems, launch systems, or their subsystems

***Lack of relevant past performance will not be evaluated favorably or unfavorably.***

## Factor 2: Intrinsic Merit – Model Contract/Grant Components

- **The Government will evaluate:**
  - Deviations or exceptions to this NRA and the Model Contract/Model Grant, including the DPD
  - Model Contract Clause B.3 – Consideration and Payment and H.16 – Advanced Agreements in Rights in Data
  - Quality and thoroughness of the SOW and WBS as attached to the Model Contract
  - Work effort schedule with technical milestones and the description of deliverables as attached to the Model Contract/Model Grant

# 5.0 – Proposal Review Information

## Factor 3: Price

- **Total Price Proposed will be evaluated for:**
  - Reasonableness
  - Completeness
  - Extent to which the Offeror complied with the expected funding allocations in NRA
- **Contribution of corporate resources will be a consideration in determining reasonableness.**

***Adjectival Rating, in Terms of Cost Confidence for the Price Factor (High/Medium/Low)***

# 5.0 – Proposal Review Information

**Section 1:**
Relevance to NASA's objectives

- Technical scope
- Improves or influences
  - Affordability
  - Reliability
  - Performance

**Section 2 and Section 4: ***
Intrinsic merit

- Management approach
- Technical approach

**Section 3:**
Price

- Reasonableness
- Completeness
- Compliance with funding

**Evaluators**

Findings

*** Only selected portions—Consideration and payment, rights in data, WBS, SOW, and schedule**

# 5.0 – Proposal Review Information

## Voting Board Responsibilities

Findings

1. Assign significance to Findings.
2. Assign adjectives to factors.

| Factor 1 and 2: |
| --- |
| Relevance to NASA objectives and intrinsic merit<br>E, VG, G, F, P |

| Factor 3: |
| --- |
| Price and price confidence<br>H,M,L |

| | |
| --- | --- |
| E | Excellent |
| VG | Very Good |
| G | Good |
| F | Fair |
| P | Poor |
| H | High |
| M | Medium |
| L | Low |

# 5.0 – Proposal Review Information

## Voting Board Responsibilities

Factors assigned ratings

Separate Proposals

**Industry proposals**

**Academic proposals**

# 5.0 – Proposal Review Information (Definitions)

## Types of Findings

| | |
|---|---|
| **Significant Strength** | An aspect of the proposal that greatly enhances the potential for successful contract performance |
| **Strength** | An aspect of the proposal that will have some positive impact on successful contract performance |
| **Weakness** | A flaw in the proposal that increases the risk of unsuccessful contract performance |
| **Significant Weakness** | A flaw that appreciably increases the risk of unsuccessful contract performance |

## Adjectival Ratings based on Findings

| | |
|---|---|
| **Excellent** | A thorough and compelling proposal of exceptional merit that fully responds to the objectives of the NRA as documented by numerous or significant strengths and no significant weaknesses |
| **Very Good** | A competent proposal of high merit that fully responds to the objectives of the NRA, whose strengths fully out-balance any weaknesses and none of those weaknesses constitute fatal flaws |
| **Good** | A competent proposal that represents a credible response to the NRA, whose strengths and weaknesses essentially balance each other |
| **Fair** | A proposal that provides a nominal response to the NRA, but whose weaknesses outweigh any strengths |
| **Poor** | A seriously flawed proposal, having one or more major weaknesses that constitute fatal flaws |

## Confidence Levels for Price Proposal

| | |
|---|---|
| **High** | Indicates that the Government has a very high level of confidence that the Offeror can perform successfully at or below the proposed price |
| **Medium** | Indicates that the Government has a reasonable level of confidence that the Offeror can perform successfully at or below the proposed price |
| **Low** | Indicates that the Government has a marginal level of confidence that the Offeror can perform successfully at or below the proposed price |

# 5.0 – Proposal Review Information

## Partial Awards and Participation with Others

- **NASA may:**
  - Elect to offer selection of only a portion of a proposed work effort.
  - Ask Offerors to team in a joint proposal.
  - Decide to award an effort for less than the full period of the proposal.
    - If accepted, a revised budget and SOW may be required.
    - If declined, the offer of selection may be withdrawn in its entirety.
- **Selection Announcement and Award Dates**
  - No selection announcements are made until funds are approved through the Federal budget process.
  - Offeror may contact, in writing, the Contracting Officer (CO) after 150 days past the proposal submission due date.
  - Offerors *not* selected will be notified and offered a debriefing.
  - NASA reserves the right to subsequently negotiate and make award to Offeror(s) not initially selected.
    - Proposals shall be valid for 12 months to allow for later award.

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# 6.0 – Award Administration Information

- Anticipate ***firm fixed price contracts and grants.***
- Contract awards will be subject to the provisions of the Federal Acquisition Regulations (FAR) and the NASA FAR Supplement (NFS).
- Grants will be subject to the provision of the NASA Grant and Cooperative Agreement Handbook.

# 7.0 – NASA Contact

**All questions shall be submitted in writing within 30 days of the issue date of this draft NRA to the Procurement point of contact:**

Monica Heidelberg
monica.d.heidelberg@nasa.gov

***Please include solicitation number with questions.***

***Questions regarding this Draft NRA will not be answered individually but will be addressed within the issuance of the Final NRA.***

# 8.0 – Other Information

- Announcement of updates/amendments to solicitation will be added as a formal amendment to this NRA.
- It is the responsibility of the prospective proposer to check for updates concerning the program(s) of interest.
- NASA Partnership Office contacts at each Center are listed in the NRA to coordinate with Industry for negotiating Space Act Agreements (SAAs).

# 9.0 – Concluding Statement

- NASA encourages the participation of Industry and Academia in this SLS Advanced Development NRA.

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  7.0 – NASA Contact
  8.0 – Other Information
  9.0 – Concluding Statement

  Appendix A – SLS Advanced Development Technical Information
  Appendix B – SLS Program Launch Vehicle Specification
  Appendix C – SLS Program CON OPS Document
  Appendix D – Acronym List
  Appendix E – Subcontractor Information
  Appendix F – Element of Price Detail for Contracts
  Appendix G – Budget Summary for Grants

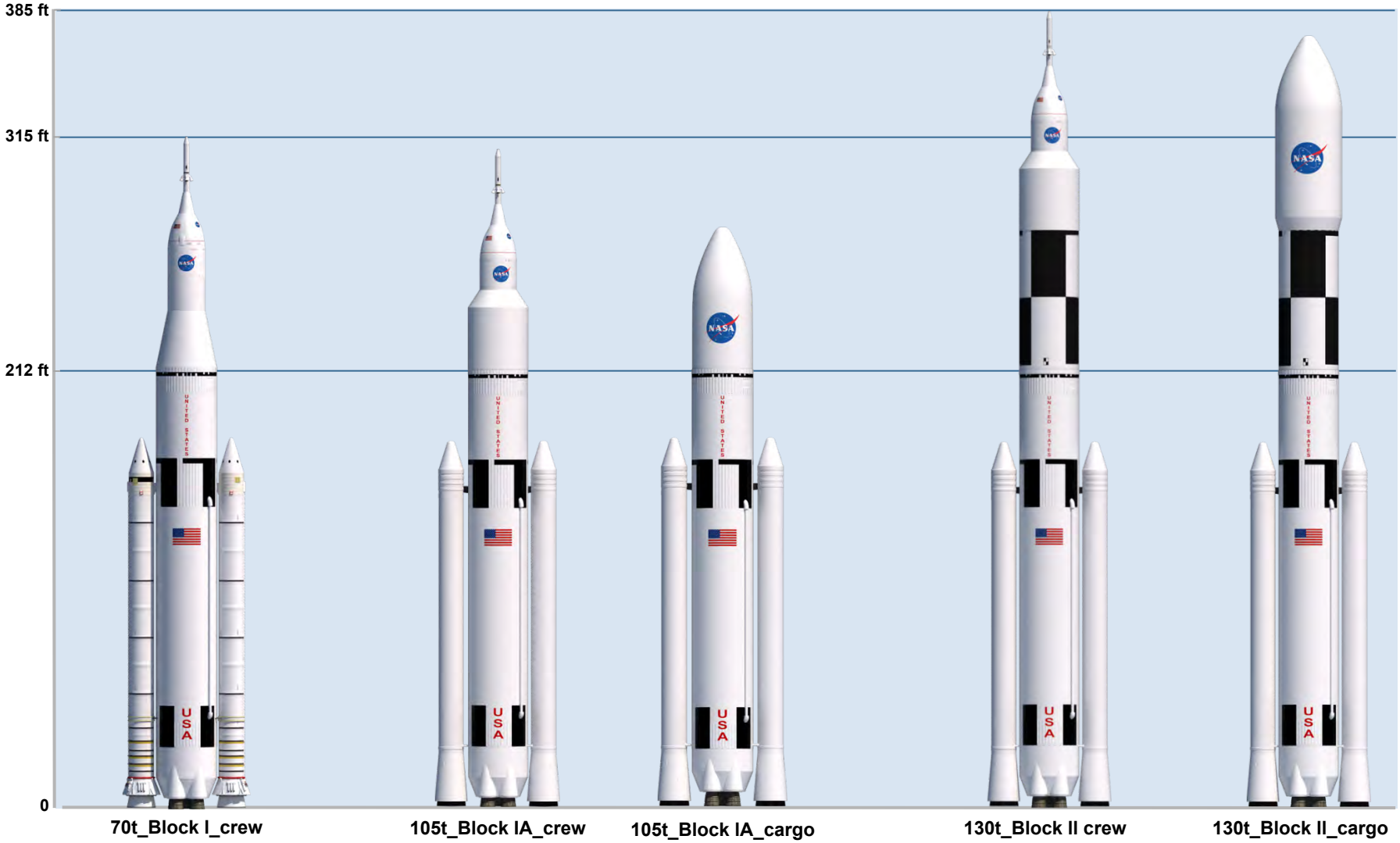
- **Model Contract**

  Sections A-I
  Attachment J-2, DPD

- **Model Grant**

# Appendix A – SLS Technical Information

## SLS Vehicle Configurations



# Appendix A – SLS Technical Information

## Core Stage

- Block 1 core stage uses four RS-25 Space Shuttle Main Engines (SSMEs) and Space Transportation System (STS) Solid Rocket Booster (SRB) Thrust Vector Control (TVC).
- Core stage is designed for thrust takeout of the boosters and structural load path for the upper stage and payload.
- Core stage will be common across Blocks 1, 1A, and 2.

## Booster Stage

- Block 1 booster stage is a metallic 5-segment solid rocket booster (SRBv).
- Blocks 1A and 2 (evolved) booster stage will be either SRB or liquid rocket booster (LRB).
- The Advanced Booster Engineering Demonstration and Risk Reduction (ABEDRR) NRA (NNM12ZPS001N) – which is currently soliciting proposals – is outside the scope of this NRA solicitation.

# Appendix A – SLS Technical Information

## Non-Propulsive Payload Element (NPE)

- Includes a 27.6- or 33-ft diameter shroud and a payload carrier

## Other Elements (SLS Block 1A)

- May use one or more Affordable Upper Stage Engines (AUSE)

## Upper Stage (SLS Block 2)

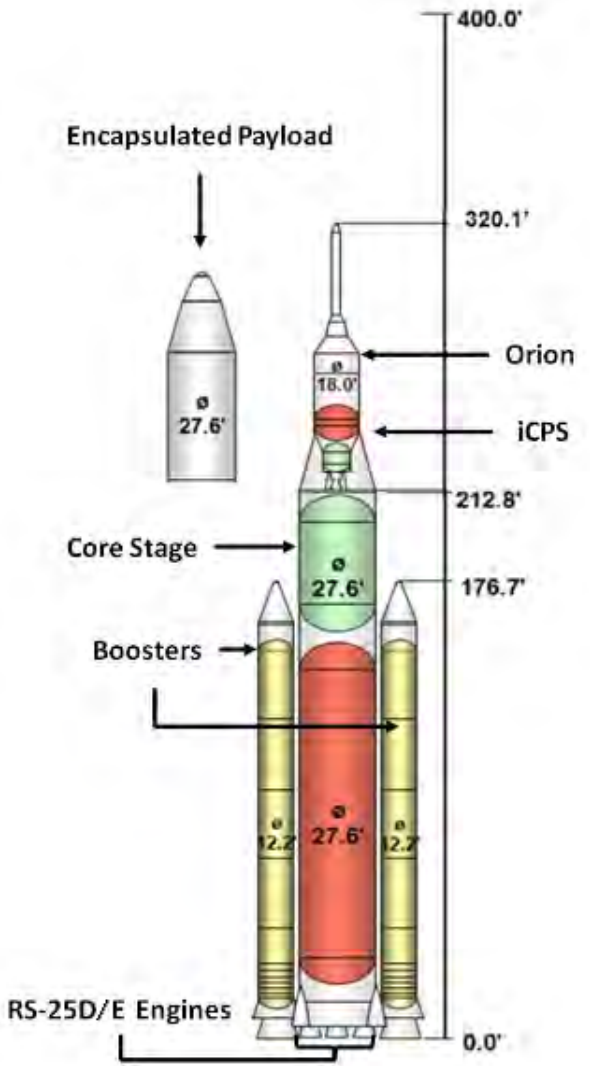
- Adds an $LH_2$/LOX upper stage with one to three J-2X engines

**NOTE:** This NRA does **not** solicit Block 2 upgrades to the vehicle.

# Appendix A – SLS Technical Information

## Block 1 Configuration

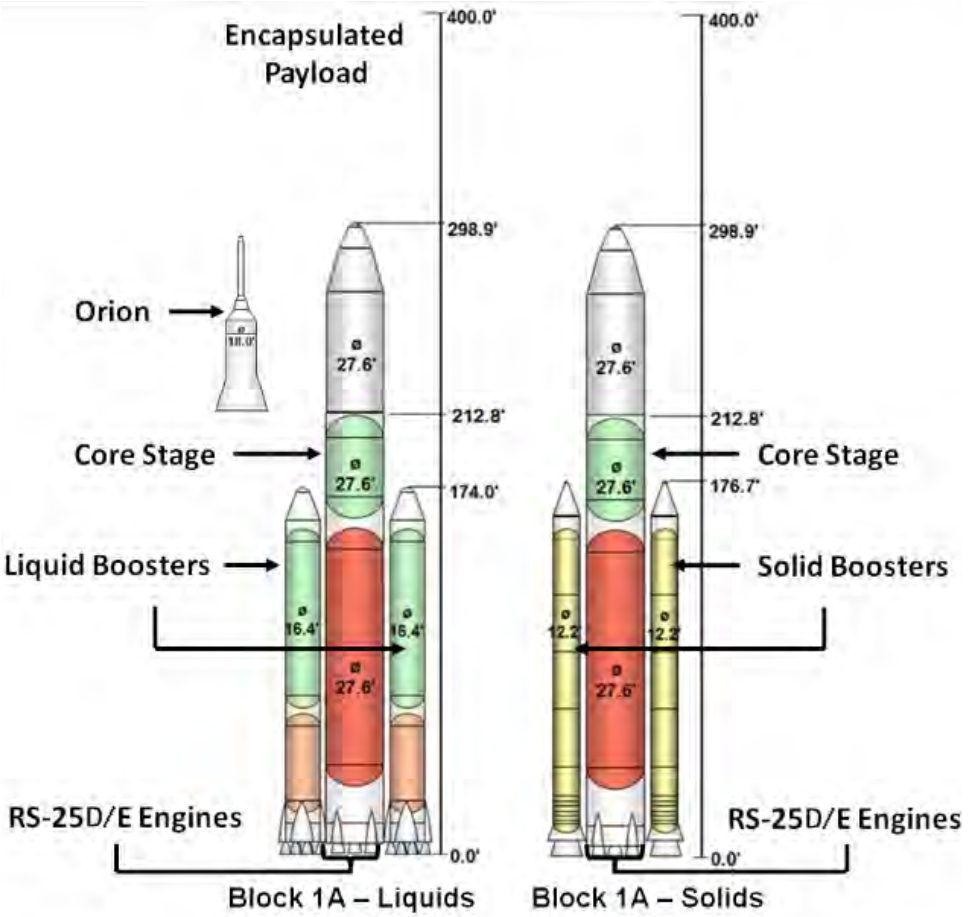
- Block 1 uses two 5-segment expendable SRBv boosters.
- The SRBv solid rocket fuel is polybutadiene acrylonitride (PBAN).
- Core stage will contain four RS-25D engines.
- Core stage will be common across subsequent blocks.
- Booster TVC uses STS SRB heritage hardware.
- Block 1 is capable of carrying an Orion Multi-Purpose Crew Vehicle (MPCV), Orion-MPCV + Interim Cryogenic Propulsion Stage (ICPS), or cargo payload.
- Cargo payloads will be responsible for orbit stabilization.



# Appendix A – SLS Technical Information

## Block 1A Configuration

- **Block 1A encompasses replacement of the SRB with a new expendable advanced booster (SRB or LRB).**
  - LRB uses Refined Petroleum (RP-1) propellant.
- **Advanced booster attaches at the same points as the SRBv.**
- **Core stage incorporates the RS-25D or RS-25E engines.**
  - Four engines on the core stage
- **Block 1A uses a $LH_2$/LOX stage that may have one or more AUSEs.**
- **Block 1A is the same height as the Block 1 configuration.**

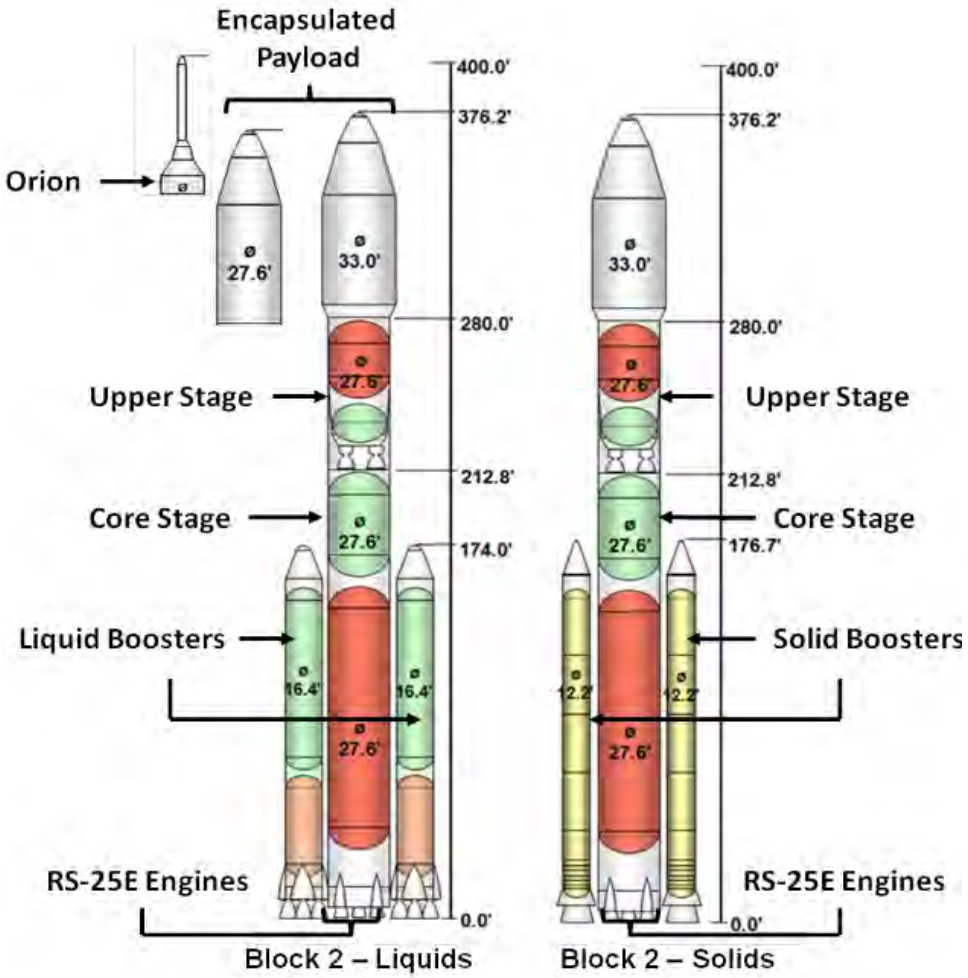


# Appendix A – SLS Technical Information

## Block 2 Configuration

- This upgrade adds an upper stage that derives from the core stage.
- One to three J-2X engines are used on the upper stage.
- The upper stage uses the same propellant as the core stage.

**NOTE:** This NRA does not solicit Block 2 upgrades to the vehicle.



# Appendix A – SLS Technical Information

## Broad Advanced Development Topics include, but are not limited to:

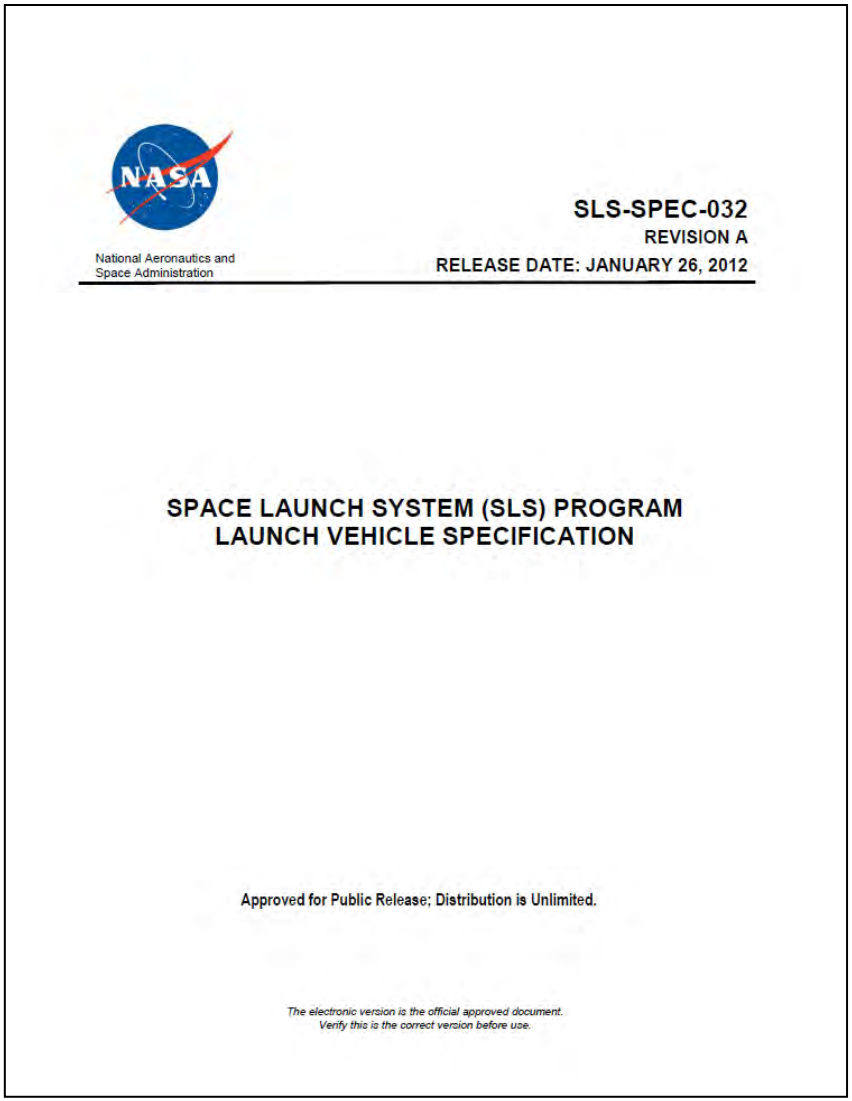
- **Concept Development, Trades, and Analyses:**
  - Support upgrades to the vehicle through systems engineering work efforts.
  - Address work efforts that may include demonstrations, tests, analytical tools.
  - Identify multi-discipline or multi-element aspects of vehicle integration.
  - Improve design tools and design methodologies to facilitate concept development.
  - Conduct high-fidelity trade studies.
- **Propulsion:**
  - Develop advancements in liquid engines, main propulsion systems, solid rocket motors, and their subsystem components.
  - Study and refine AUSE requirements and assess functionality.
  - Reduce both development and operational costs, while increasing system hardware commonality.
  - Mature high-fidelity design tools and design methodologies with accompanying validation data, including prototyping and simulation.
  - Assess use of non-toxic propellants.

# Appendix A – SLS Technical Information

## Broad Advanced Development Topics include, but are not limited to:

- **Manufacturing, Structures and Materials:**
  - Use advanced materials and manufacturing processes in an innovative manner.
  - Develop innovative lightweight structures (metallic or non-metallic).
  - Improve analytical tools to meet damage tolerance requirements and reduce the volume of testing.
  - Expand friction stir weld processes using lightweight alloys.
  - Use digital and virtual methods to reduce the cost of design, manufacturing, and inspection.
  - Address solutions for material obsolescence and environmental compliance.
- **Avionics and Software:**
  - Improve vehicle robustness with sustainable avionics, sensors, power, and software subsystems for real-time fault detection and mission recovery.
  - Upgrade avionics modules to improve navigation, telemetry, redundancy, simplified check-out, and ground support equipment.
  - Enable avionics modernization through technology maturation tasks.
  - Use advanced flight computers and simulations to enable and verify expanded vehicle guidance, fault detection, and mission recovery.
  - Evolve STS legacy steering and control subsystems into sustainable, safer, and greener alternatives.

# Appendix B – SLS Launch Vehicle Specification



National Aeronautics and Space Administration

**SLS-SPEC-032**
**REVISION A**
**RELEASE DATE: JANUARY 26, 2012**

**SPACE LAUNCH SYSTEM (SLS) PROGRAM**
**LAUNCH VEHICLE SPECIFICATION**

**Approved for Public Release; Distribution is Unlimited.**

*The electronic version is the official approved document.*
*Verify this is the correct version before use.*

# Appendix C – SLS Program CON OPS Document

National Aeronautics and Space Administration

SLS-PLAN-020
BASELINE
RELEASE DATE: OCTOBER 27, 2011

SPACE LAUNCH SYSTEM (SLS) PROGRAM
CONCEPT OF OPERATIONS (CON OPS) DOCUMENT

Approved for Public Release; Distribution is Unlimited.
*The electronic version is the official approved document.*
*Verify this is the correct version before use.*

# Appendix D – Acronym List

| | |
|---|---|
| ADN | ammonium dinitramide |
| BEO | beyond Earth orbit |
| BOE | Basis of Estimate |
| CAGE | Contractor and Government Entity |
| CAI | compression after impact |
| CAS | cost accounting standards |
| CASB | Cost Accounting Standards Board |
| CD ROM | compact disk read-only memory |
| CFD | computational fluid dynamics |
| CFR | Code of Federal Regulations |
| CON OPS | concept of operations |
| COR | Contracting Officer's Representative |
| CPU | central processing unit |
| CTN | Communications and Tracking Network |
| DPD | Data Procurement Document |
| DRD | Data Requirements Document |
| DUNS | Data Universal Numbering System |
| DFRC | Dryden Flight Research Center |
| EAR | Export Control Regulations |
| EP | equivalent people |
| ETR | Eastern Test Range |
| FAR | Federal Acquisition Regulations |
| FBO | Federal Business Opportunities |
| FFRDC | Federally Funded Research and Development Center |
| GAO | General Accounting Office |
| GNC | guidance, navigation, and control |
| GPGPU | General Purpose Graphics Processing Unit |
| GPU | graphical processing unit |
| GRC | Glenn Research Center |
| GSDO | Ground Systems Development and Operations Program |
| GSFC | Goddard Space Flight Center |
| HAN | hydroxylammonium nitrate |
| HAT | Human Architecture Team |
| HEO | Human Exploration and Operations Directorate |
| HNF | hydrazinium nitroformate |
| HSPD | Homeland Security Presidential Directive |
| ICPS | interim cryogenic propulsion stage |
| ISS | International Space Station |
| IT | information technology |
| ITAR | International Traffic in Arms Regulations |
| JPL | Jet Propulsion Laboratory |
| JSC | Johnson Space Center |
| KSC | Kennedy Space Center |
| LaRC | Langley Research Center |
| LEO | low Earth orbit |
| $LH_2$ | liquid hydrogen |
| $LO_2$ | liquid oxygen |
| LRB | liquid rocket booster |
| MPCV | multi-purpose crew vehicle |
| MSFC | Marshall Space Flight Center |
| NAIS | NASA Acquisition Internet Service |
| NASA | National Aeronautics and Space Administration |
| NDE | non-destructive evaluation |
| NFS | NASA FAR Supplement |
| NIMA | National Imaging and Mapping |
| NOI | Notice of Intent |
| NPE | non-propulsive payload element |
| NRA | NASA Research Announcement |
| NSPIRES | NASA Solicitation and Proposal Integrated Review and Evaluation |
| ODC | Other Direct Cost |
| PC | personal computer |
| PEG | powered explicit guidance |
| PI | principal investigator |
| PPIRS | Past Performance Information Retrieval System |
| RANS/LES | Reynolds-averaged Navier-Stokes/large eddy simulation |
| RINU | redundant inertial navigation unit |
| SAA | Space Act Agreement |
| SHE | safety, health, and environmental |
| SIL | System Integration Laboratory |
| SLS | Space Launch System Program |
| SOW | Statement of Work |
| SRB | solid rocket booster |
| SRBv | solid rocket booster (five-segment) |
| SRBA | Sponsored Research Business Activity |
| SSC | Stennis Space Center |
| STEM | science, technology, engineering, and mathematics |
| STS | Space Transportation System |
| TPS | Thermal Protection System |
| TRL | technology readiness level |
| TVC | thrust vector control |
| WBS | Work Breakdown Structure |

# Appendix E – Subcontractor Information

## SUBCONTRACTOR INFORMATION

1. COMPANY NAME: _____
   ADDRESS: _____
   _____

   POINT OF CONTACT/PHONE NUMBER _____

   CONTRACT VALUE: _____ TYPE OF CONTRACT: _____

   BRIEF DESCRIPTION OF WORK: _____
   _____

2. COMPANY NAME: _____
   ADDRESS: _____
   _____

   POINT OF CONTACT/PHONE NUMBER _____

   CONTRACT VALUE: _____ TYPE OF CONTRACT: _____

   BRIEF DESCRIPTION OF WORK: _____
   _____

3. COMPANY NAME: _____
   ADDRESS: _____
   _____

   POINT OF CONTACT/PHONE NUMBER _____

   CONTRACT VALUE: _____ TYPE OF CONTRACT: _____

   BRIEF DESCRIPTION OF WORK: _____
   _____

# Appendix F – Element of Price Detail for Contracts

## Element of Price Detail for Contracts

| | ($K) | Base | Opt 1 | Opt 2 | Total |
|---|---|---|---|---|---|
| 1. | Direct Labor Hours | | | | |
| | Program Administration<br>Engineering<br>Manufacturing<br>Subcontract | | | | |
| | Total Hours | | | | |
| | | | | | |
| 2. | Direct Labor Cost | | | | |
| | Program Administration<br>Engineering<br>Manufacturing | | | | |
| | Total Direct labor Cost | | | | |
| | | | | | |
| 3. | Indirect Labor Cost | | | | |
| | | | | | |
| 4. | Sub Total Labor | | | | |
| | | | | | |
| 5. | Non-Labor | | | | |
| a.<br>b.<br>c. | Material<br>Subcontracts<br>Other Direct Cost | | | | |
| | Total Non-Labor | | | | |
| | | | | | |
| 6. | Sub Total Labor and Non Labor | | | | |
| | | | | | |
| 7. | General & Administrative | | | | |
| | | | | | |
| 8. | Total Cost | | | | |
| | | | | | |
| 9. | Profit/Fee | | | | |
| | | | | | |
| 10. | Less Proposed Corporate Resources (if any) | | | | |
| | | | | | |
| 11. | Total Cost and Profit | | | | |
| | | | | | |
| 12. | Proposed Space Act Agreement Cost | | | | |
| | | | | | |
| 13. | Total Project Price | | | | |

# Appendix G – Budget Summary for Grants

**Budget Summary for Grants**

**PERIOD OF PERFORMANCE: FROM_____TO_____**

| | **COST** |
|---|---|
| 1. DIRECT LABOR (salaries, wages, fringe benefits) | $_____ |
| 2. OTHER DIRECT COSTS: | |
| a. Subcontracts | $_____ |
| b. Consultants | $_____ |
| c. Equipment | $_____ |
| d. Supplies | $_____ |
| e. Travel | $_____ |
| f. Other | $_____ |
| 3. INDIRECT COSTS_____%_____ | $_____ |
| 4. OTHER APPLICABLE COSTS | $_____ |
| 5. SUBTOTAL-ESTIMATED COST | $_____ |
| 6. LESS PROPOSED COST SHARING (if any) | $( _____ ) |
| 7. TOTAL ESTIMATED COST | **$**_____ |

# NRA NNM12ZPS002N Outline

- **NRA Body**
  Executive Summary
  1.0 – Funding Opportunity Description
  2.0 – Award Information
  3.0 – Eligibility Information
  4.0 – Proposal and Submission Information
  5.0 – Proposal Review Information
  6.0 – Award Administration Information
  7.0 – NASA Contact
  8.0 – Other Information
  9.0 – Concluding Statement
  Appendix A – SLS Advanced Development Technical Information
  Appendix B – SLS Program Launch Vehicle Specification
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  Appendix D – Acronym List
  Appendix E – Subcontractor Information
  Appendix F – Element of Price Detail for Contracts
  Appendix G – Budget Summary for Grants
- **Model Contract**
  Sections A-I
  Attachment J-2, DPD
- **Model Grant**

# NRA Model Contract

## Section 4 – Model Contract (if applicable)

- Model contract
- Contract terms and conditions
- Statement of Work (SOW)
- Data Procurement Document (DPD)
- Work Breakdown Structure (WBS)
- Meeting and review requirements

- Also, if selected for award:
  - Subcontract Plan
  - Safety, Health, and Environmental (SHE) Plan
  - Organizational Conflict of Interests Avoidance Plan
  - Information Technology (IT) Security Management Plan

# NRA Model Contract

## Clause B.3, Consideration and Payment

- Milestone payment schedule (Kickoff; Final Report – required)
- Changes/additions to the milestone payment schedule – may be proposed by Offeror

## Section G – Government Furnished Property Clauses – incorporated at contract award, as appropriate

## Clause H.5, Key Personnel and Facilities

- To be proposed by Offeror
- Modification required if change

## Clause H.12, Representations, Certifications, and Other Statements of Offeror

- If any significant changes to the representations and certifications, the Contractor shall notify the CO in writing as soon as the condition is known.

# NRA Model Contract

## Clause H.14, Evaluation of Subcontracting Plan

- This clause only applies to Offerors who submit a proposal totaling $650,000 or greater and who are selected for award.
- Offeror's independent assessment of small business subcontracting opportunities will be evaluated.
- Coordination is performed with MSFC Office of Small Business.

## Clause H.16, Advanced Agreement in Rights in Data

- Agreement will be proposed by Offeror.
- Clause will contain Contractor and Subcontractor Unlimited Rights, Limited Rights, and Restricted Rights.
- This clause constitutes an advanced agreement between the Government and Contractor regarding the interpretation of Clause 52.227-14, Rights in Data – General, Alternates I and II.

# NRA Model Contract

## Section I – Listed as full text:

- Rights in Data – General (52.227-14) (DEC 2007)
- Additional Data Requirements (52.227-16) (JUN 1987)
- Payments Under Fixed-Price Research and Development Contracts (52.232-2) (APR 1984)
- Limitation on Withholding of Payments (52.232-9) (APR 1984)
- Changes – Fixed Price (52.243-1) (AUG 1987) – Alternate V (APR 1984)
- Termination for Convenience of the Government (Fixed-Price) (52.249-2) (MAY 2004)
- Default (Fixed-Price Research and Development) (52.249-9) (APR 1984)
- NFS 1852.204-76, Security Requirements for Unclassified Information Technology Resources
- NFS 1852.237-72, Access to Sensitive Information
- NFS 1852.237-73, Release of Sensitive Information

# NRA Model Contract

## Section J – List of Attachments, as provided by NASA

- Attachment J-2, Data Procurement Document/ Data Requirements

### Key Concepts

- Offeror can propose additions, modifications, or deletions to DPD.
- Selected offeror(s) shall provided Alternate SHE Plan no later than 30 days after award.
- Key deliverables are “Monthly Progress Reports” and “Final Scientific and Technical Report.”

## List of Attachments, as proposed by Offeror

- With initial submission
  - Attachment J-1, Statement of Work (SOW)
  - Attachment J-3, Work Breakdown Structure (WBS)

# NRA Data Procurement Document (DPD)

## Data Requirements List (DRL)

| DRD | DATA TYPE | TITLE | OPR |
|---|---|---|---|
| CD-XXCD-OELL | 3 | On-Site Employee Location Listing | PS12 |
| CD-XXCD-LTR | 3 | Technology Reports | ED10 |
| MA-XXMA-MPR | 3 | Monthly Progress Report | XP70 |
| MA-XXMA-FSTR | 3 | Final Scientific and Technical Report | XP70 |
| SA-XXSA-ASHE | 2 | Alternate (Off-Site) SHE Plan | AS10/QD12 |
| SA-XXSA-MSR | 3 | Mishap and Safety Statistics Reports | QD12 |

**Type 3:** Data shall be delivered by contactor as required by the contract and do not require NASA approval. However, to be a satisfactory delivery, the data shall satisfy all applicable contractual requirements and be submitted on time.

**Type 2:** Contractor shall submit data with the plan for review. NASA reserves a time-limited right to disapprove in writing any issues and interim changes to those issues.

# NRA Model Contract

## Statement of Work (SOW)

- Offeror shall submit a detailed SOW that includes a schedule with technical milestones, and a detailed description of deliverables (other than those in the DPD).
- Offeror shall submit a detailed schedule of all work items to be undertaken. This schedule shall outline the dependencies of work items and critical path. All long lead items and facility schedule conflicts shall be identified.

## Data Procurement Document (DPD)

- Offeror shall provide rationale for any addition or deletion taken to the model DPD and show all exceptions in a redline version as part of the proposal submittal.

## Work Breakdown Structure (WBS)

- Offeror shall submit a WBS at a sufficient level to facilitate a complete evaluation and understanding of the work responsibilities and distribution.

# Documents Required IF SELECTED for Award

- Detailed WBS and BOEs required for negotiations
- Attachment J-4, Subcontracting Plan
- Attachment J-5, Alternate Safety, Health, and Environmental (SHE) Plan
- Attachment J-6, Organizational Conflict of Interest Avoidance Plan
- Attachment J-7, IT Security Management Plan

# NRA Model Grant

## Section 4 – Model Grant (if applicable)

- Model Grant
- General Provisions, Special Conditions, and Additional Terms
- Required Publication and Reports
- Statement of Work

# NRA Model Grant

## General Provisions – Incorporated by Reference

1260.22 – Technical Publications and Reports

- Required listing will be located as an Exhibit to the Model Grant.

1260.24 – Termination and Enforcement

1260.25 – Change in Principal Investigator (PI) or Scope

- Offeror proposes PI.
- Change requires modification.

1260.28 – Patent Rights

1260.30 – Rights in Data

1260.37 – Safety

- Offeror shall comply with all applicable federal, state, and local laws relating to safety.

# NRA Model Grant

## Special Conditions – Listed as full text

1260.52 – Multiple Year Grant or Cooperative Agreement
1260.56 – Withholding

## Additional Terms

1260.35 – Investigation Requirements

### Statement of Work (SOW)

- Offeror shall submit a detailed SOW, including a detailed description of deliverables and a schedule with technical milestones.
- Offeror shall submit a detailed schedule of all work items to be undertaken. This schedule shall outline the dependencies of work items and critical path. All long lead items and facility schedule conflicts shall be identified.

# Changes to Document

- Additional details on Block configurations (Appendix A)
- NASA/USAF partnership and potential funding changes

# Precedence

**The posted NRA takes precedence over any discrepancies or inconsistencies noted between this presentation and the NRA.**

**This Industry Day presentation will be publicly available within 48 hours at www.nasa.gov/sls.**

# NRA NNM12ZPS002N

**Offeror shall submit proposal package to Monica Heidelberg at:**

NASA
George C. Marshall Space Flight Center
Attn: Monica Heidelberg/PS42
MSFC, AL 35812

- 1 original plus 10 paper copies
- 2 digital copies
- Digital copies shall be provided on a virus-free CD ROM in PC format and shall be readable by Microsoft Office Word 2007 edition and Microsoft Office Excel 2007 edition.

**The Offeror is advised that proposal submittal will not be made via NSPIRES or email.**

# Questions?


# Back-up

# 4.0 – Proposal and Submission Information

## Section 2 – Intrinsic Merit: Management Approach

- **Distribution and Management of Responsibilities and Work**
  - Offeror shall describe plans and processes for distribution and management of responsibilities and work for ensuring a coordinated effort.
- **Teaming, Partnering, and Subcontracting Arrangements**
  - Offeror shall describe teaming arrangements employed to complete the work effort.
- **Key Capabilities, Facilities, and Equipment**
  - Offeror shall identify key capabilities, facilities, and any major equipment that will be required.
- **Ground Rules and Assumptions**
  - Offeror shall describe all ground rules and assumptions.
- **Deviations and Exceptions**
  - Offeror shall identify any deviations or exceptions relevant to this NRA and Model Contract/Model Grant, including the Data Procurement Document (DPD). Rationale for these deviations shall be included.

# 4.0 – Proposal and Submission Information

## Section 2 – Intrinsic Merit: Technical Approach

- **Technical Objectives, Methodology, and Innovation**
  - Offeror shall provide a description of the technical objectives and methodology proposed to accomplish the work effort. Offeror shall explain how the work effort uses innovation to accomplish the proposed objectives and measures against the present state of knowledge.
- **Upgrade Implementation Approach**
  - Offeror shall, if an upgrade to the vehicle is proposed, describe how the work effort will be integrated and phased into the specific SLS system or elements that it affects, and discuss the impact of implementation on other systems, subsystems, interfaces, or operations.
  - If the proposed work effort is not an upgrade to the vehicle (i.e.: studies, analytical tools, databases), then an implementation approach is not required.

## Section 2 – Intrinsic Merit: Technical Approach

- **Related Work Experience**
  - Offeror shall describe related work experience and how that experience will be used in the proposed work effort.
- **Current and Pending Support**
  - Offeror shall indicate if the same, or similar, work effort is currently funded or being submitted to any other ongoing Government solicitation. Offeror shall not submit a work effort that is significantly similar to a previously awarded or currently funded NASA, or other Governmental agency, solicitation.
  - Offeror shall provide information for all ongoing and pending projects and proposals that involve (commitments greater than 10 percent) the proposing PI or key personnel.
- **Bibliography**
  - All references and citations given in any previous sections of the proposal shall be provided using easily understood, standard abbreviations for journals and complete names for books.

# NRA Model Contract

| DRD | TITLE | DESCRIPTION |
|---|---|---|
| CD-XXCD-OELL | On-Site Employee Location Listing | Assist in conducting floor checks. |
| CD-XXCD-LTR | Technology Reports | Provide invention, discovery, improvement/innovation information or possible patentable data. |
| MA-XXMA-MPR | Monthly Progress Report | Used to assess problems, issues, and risks toward meeting the cost, technical, and schedule requirements. |
| MA-XXMA-FSTR | Final Scientific and Technical Report | Provide results of contract effort with recommendations and conclusions. |
| SA-XXSA-ASHE | Alternate (Off-Site) SHE Plan | Execute a signed agreement conforming compliance with OSHA, EPA, and State Environmental Management and DOT regulations, as well as use of MSFC 8715.1 as the contractor ‘s SHE program while performing contract work. |
| SA-XXSA-MSR | Mishap and Safety Statistics Reports | Provide initial and follow-up reporting of mishaps, close calls, serious non-occupational injuries or illness and contractor quarterly safety metrics for off-site contractors . |