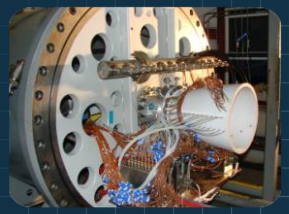
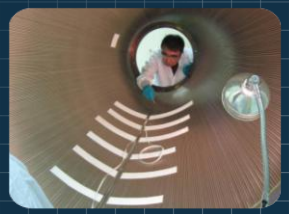
NATIONAL INSTITUTE FOR ROCKET PROPULSION SYSTEMS



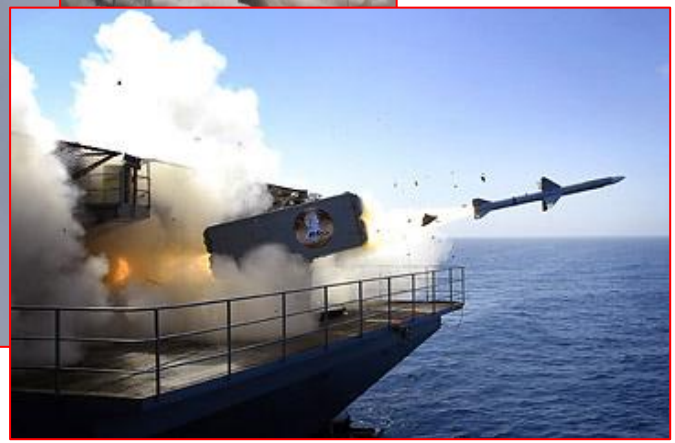

Rocket and Missile Propulsion: Shared Challenges, Shared Solutions

National Defense Industry Association

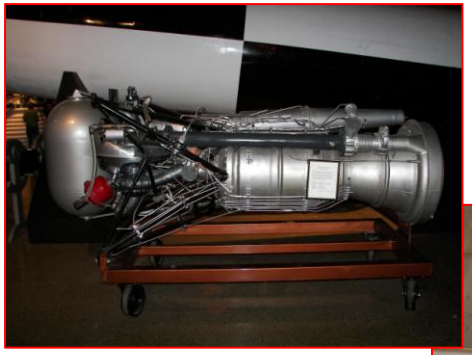
February 16, 2012

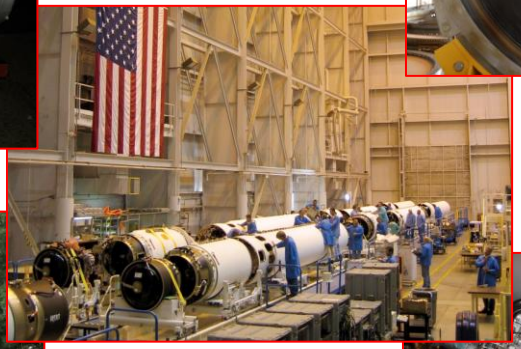
Dale Thomas PhD, PE
Associate Director – Technical
NASA Marshall Space Flight Center

Rockets and Missiles: Critical to our Country



It Really is Rocket Science





A Shared Stake in the Industrial Base

- **"Maintaining our industrial base and a viable highly skilled workforce is essential to DOD."**
  Brig. *Gen. Ole Knudson, PEO Missiles & Space, Army Aviation & Missile Command, Hail to AMC, (12/12/11)*

- "**Anything that NASA does is important to us in terms of the industrial base.** And anything that we do is important to NASA as well."
  Gregory Schulte, Deputy Assistant Secretary of Defense for Space Policy, The National Journal (7/20/11)

- "As constrained DoD budgets become more strained by higher priority programs, **investments in missile research & development and procurement may be more challenged."** *Annual Industrial Capabilities Report To Congress, May 2010, DoD report*

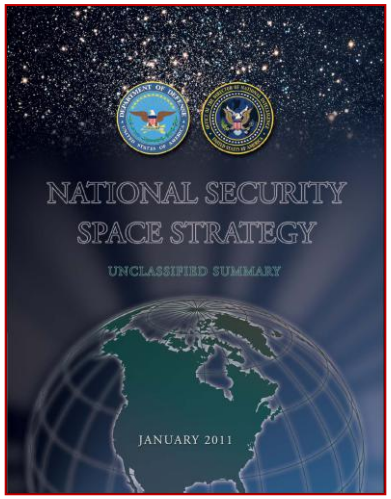
- "The need to move with clear velocity is imperative if we are **to sustain our endangered U.S. space industrial base**, to protect our national security, and to retain our positions as the world leader in humans spaceflight and space exploration."
  Jim Maser, Chairman of Corporate Membership Committee AIAA and President, Pratt & Whitney Rocketdyne. Testimony to Congress (3/30/11)

A Shared Industrial Base Underlies Both DoD & NASA Propulsion Systems

Collaboration: A National Pursuit

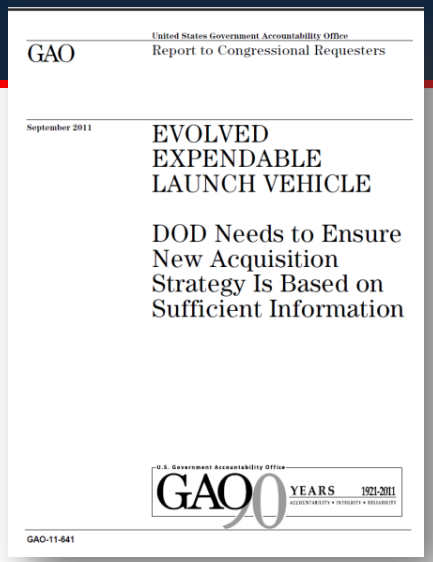
- "**Departments and agencies shall improve their partnerships through cooperation, collaboration, information sharing, and/or alignment of common pursuits.** Departments and agencies shall make their capabilities and expertise available to each other to strengthen our ability to achieve national goals, identify desired outcomes, leverage U.S. capabilities, and develop implementation and response strategies."
National Space Policy June 28, 2010

- "We seek to foster a U.S. space industrial base that is robust, competitive, flexible, healthy, and delivers reliable space capabilities on time and on budget. DoD and the IC [Intelligence Community], in concert with the civil space sector, **will better manage investments across portfolios to ensure the industrial base can sustain those critical technologies and skills that produce the systems we require.**"
National Security Space Strategy (Unclassified Summary) January 2011



National policy guidance directs military and civilian agencies to collaborate

State of the Rocket Propulsion Base


United States Government Accountability Office
GAO
Report to Congressional Requesters

September 2011

EVOLVED EXPENDABLE LAUNCH VEHICLE

DOD Needs to Ensure New Acquisition Strategy Is Based on Sufficient Information

U.S. Government Accountability Office
GAO 90 YEARS 1921-2011
ACCOUNTABILITY • INTEGRITY • RELIABILITY

GAO-11-641

- **More than 40 industrial base studies** and assessments, focused on the challenges facing the propulsion community, have been performed over the past decade.

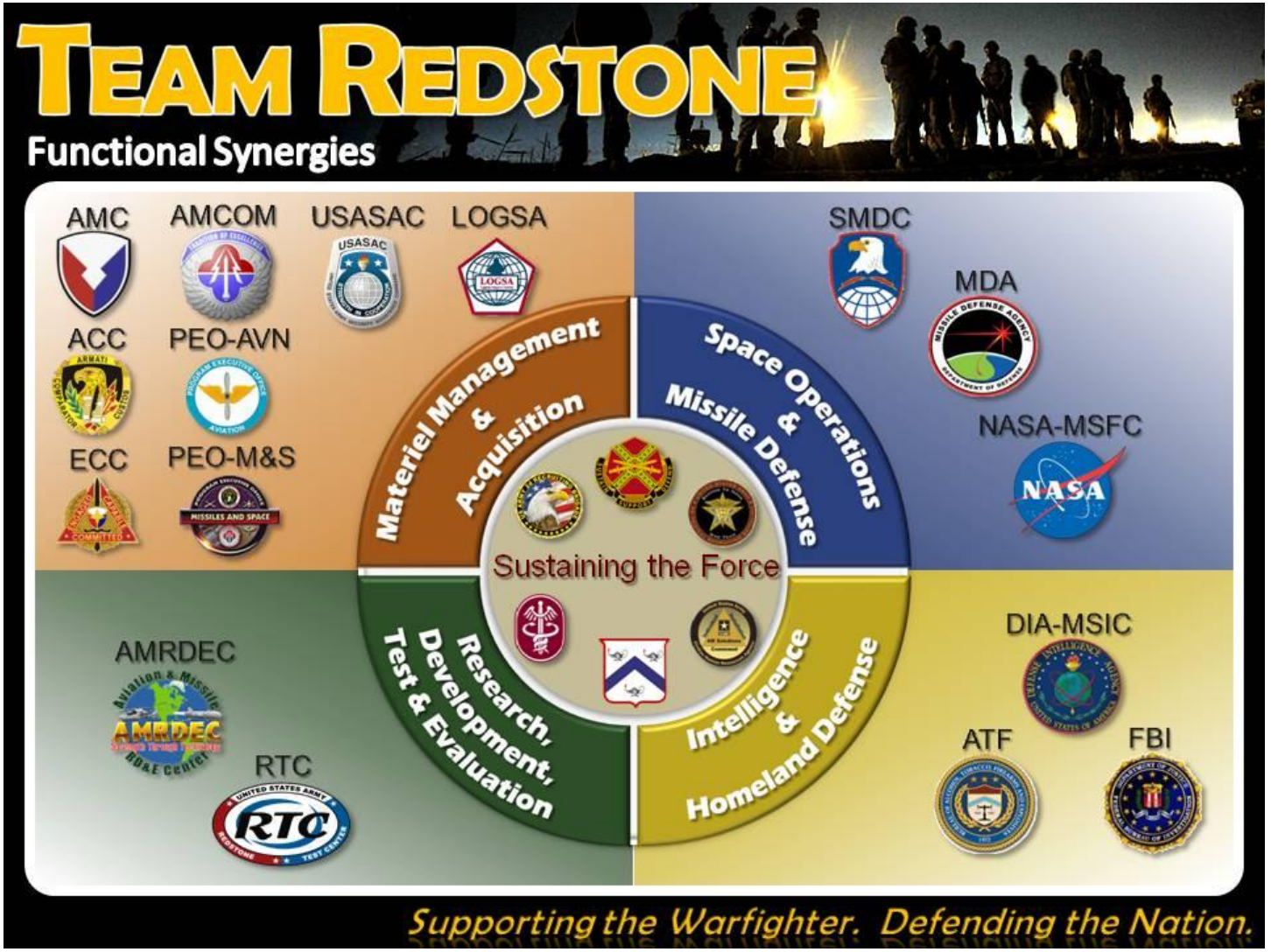
- **Common problematic themes:**
  - Budget constraints require acquisition programs to rely on heritage hardware, leading to a lack of development programs to sustain workforce and suppliers
  - Absence of an integrated science and technology plan for launch technologies
  - Difficulty in obtaining access to government facilities

- **2011 GAO report** highlights the need for better information and government-wide coordination to support DOD EELV acquisition strategy decisions

- **2012 NRC report** on NASA Space Technology Roadmaps and Priorities names "Improved Access to Space" a top technical challenge to all 3 2011 NASA Strategic Plan goals

The Challenges are Known

Recognizing Sustainment/Industrial Base Issues



SLS: Impacts on the Propulsion Base

- **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 NASA Research Announcement (NRA): Full and Open Competition (FOC) in FY12, with award by FY13 (Industry Day on Dec 15, 2011)
    - DDT&E: FOC, with Request for Proposals (RFP) target in FY15
- **Stages**
  - Core/Upper Stage: Justification for Other Than Full and Open Competition (JOFOC) to Boeing, modifying current Ares Upper Stage contract
  - Avionics (Instrument Unit): In-scope modification to existing Ares contract with Boeing; 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**
  - Initial design: Payload Adapter and Fairing design/development in-house through Preliminary Design Review (PDR)
  - FOC to begin in FY13
- **Advanced Development**
  - Broad Agency Announcement (BAA)/NASA Research Announcement (NRA): FOC in FY12
  - Future Core Stage Engine: Separate contract activity in FY12

INITIAL

EVOLVED

An Easy Solution?

NIRPS: Capability Sustainment Beyond the Gate

Scope:

National
Multi-organizational
Multi-sector

Purpose:

NIRPS will help preserve and align government and private rocket propulsion capabilities to meet present and future US commercial, civil, and defense needs, while providing insight and recommendations to National decisional authorities

Tri-faceted approach:

- **Stewardship:** Formulate and recommend National Policy options and strategies that promote a healthy industrial base
- **Technology:** Identify technology needs and recommend technology insertions
- **Solutions facilitator:** Maintain relationships and awareness across the Government and industry to align available capacity with emerging demand

A Jointly Created and Sponsored Institute Providing Coherent Policy Recommendations to National Decision Authorities

Planning Team

All Sectors of the Propulsion Community are Engaged in NIRPS Formulation Efforts

Grand Challenges

Lack of integrated space strategies across Government Agencies and Departments

Lack of multi-Agency vision

Lack of defined space missions

Lack of predictable long-term funding

Frequent program starts & cancellations

Aging work force

Shuttle retirement

Lack of sustained technology development

Uncertainty in future needs

Industrial base decline

Fewer engineers have technology development experience

Overcapacity of production capability

Overall decline in aerospace engineer demand

Rising supplier costs

Difficulty in access to government facilities

Large solid rocket motor industrial base decline

Systems infrastructure, supply chain, & skill base challenges

Loss of competitiveness in the global market

Attacking the Issues

Grand Challenge	Stewardship Dr. Jamie Neidert AMRDEC	Technology Dr. George Schmidt NASA-GRC	Solutions Facilitator Dr. Tom Brown NASA-MSFC
Support the competitiveness and resilience of the industrial base	Primary	Secondary	Secondary
Invigorate the STEM pipeline	Primary	Secondary	Secondary
Develop and implement an integrated science & technology plan for propulsion systems.	Secondary	Primary	Secondary
Reduce development and sustainment costs for missile and rocket systems	Secondary	Primary	Secondary
Collaborate across agencies for missile and rocket propulsion system development	Secondary	Secondary	Primary
Foster access to facilities and expertise across Government, industry, and academia	Secondary	Secondary	Primary

NIRPS will address open needs and coordinate across the domains

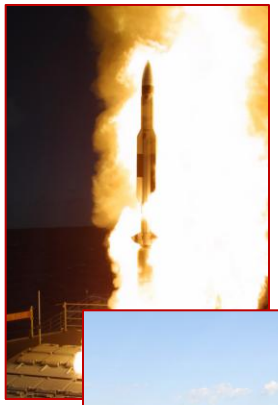
Forum Assessment

National Needs / Forums	Forum for Collaboration (Technical Exchange/ Teaming/ Partnership)	STEM	Technology Roadmap Assessments	Recurring Industrial Base Assessments (Corporations, Faciliites, Infrastructure, Obsolence)	Access to Engineering Resources to Address Problems	Coordination and Synchronization of Government Investments	Scenario Analysis (in Support of Acquisition Strategy)	Policy Analysis and Recommendation
Associations/Councils								
JANNAF	Primary	Contributing	Contributing	Not Addressed	Not Addressed	Not Addressed	Not Addressed	Not Addressed
AIAA	Primary	Contributing	Not Addressed	Not Addressed	Not Addressed	Not Addressed	Not Addressed	Contributing
AIA	Contributing	Not Addressed	Not Addressed	Contributing	Not Addressed	Not Addressed	Not Addressed	Primary
NDIA	Contributing	Not Addressed	Not Addressed	Not Addressed	Not Addressed	Not Addressed	Not Addressed	Contributing
SIBC	Not Addressed	Not Addressed	Not Addressed	Primary	Not Addressed	Not Addressed	Not Addressed	Primary
Sponsored Programs								
RP21 (IHPRPT)	Contributing	Contributing	Primary	Not Addressed	Not Addressed	Primary	Not Addressed	Not Addressed
NRPTA	Primary	Not Addressed	Not Addressed	Not Addressed	Primary	Primary	Not Addressed	Not Addressed
XUIP (CUIP)	Not Addressed	Primary	Not Addressed	Not Addressed	Contributing	Not Addressed	Not Addressed	Not Addressed

Needs Assessment

	Forum for Collaboration (Technical Exchange/ Teaming/ Partnership)	STEM	Technology Roadmap Assessments	Recurring Industrial Base Assessments (Corporations, Faciliites, Infrastructure,	Access to Engineering Resources to Address Problems	Coordination and Synchronization of Government Investments	Scenario Analysis (in Support of Acquisition Strategy)	Policy Analysis and Recommendation
Aggregate Assessment	Well Addressed	Slightly Addressed	Moderately Addressed	Slightly Addressed	Slightly Addressed	Slightly Addressed	Not Addressed	Moderately Addressed

Many uses – One commodity

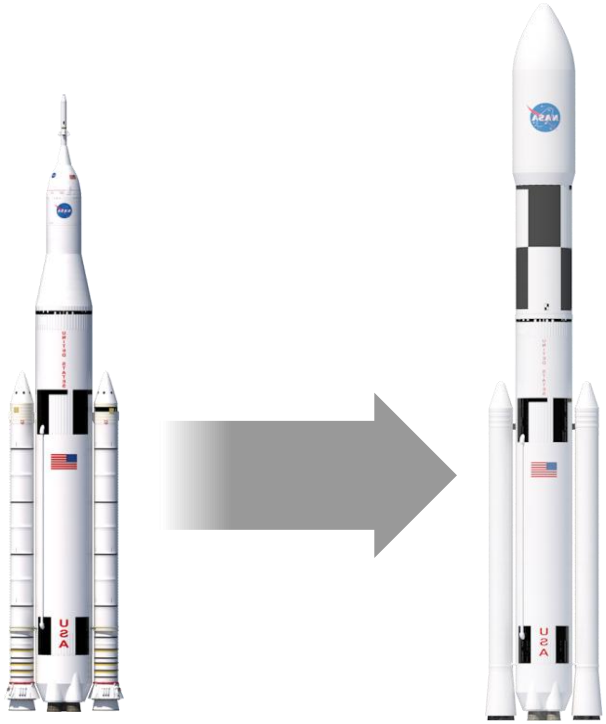


Additional NIRPS Value-Added Insight

National Defense Authorization Act for Fiscal 2012
National Rocket Propulsion Strategy

SLS Advanced Booster Procurement

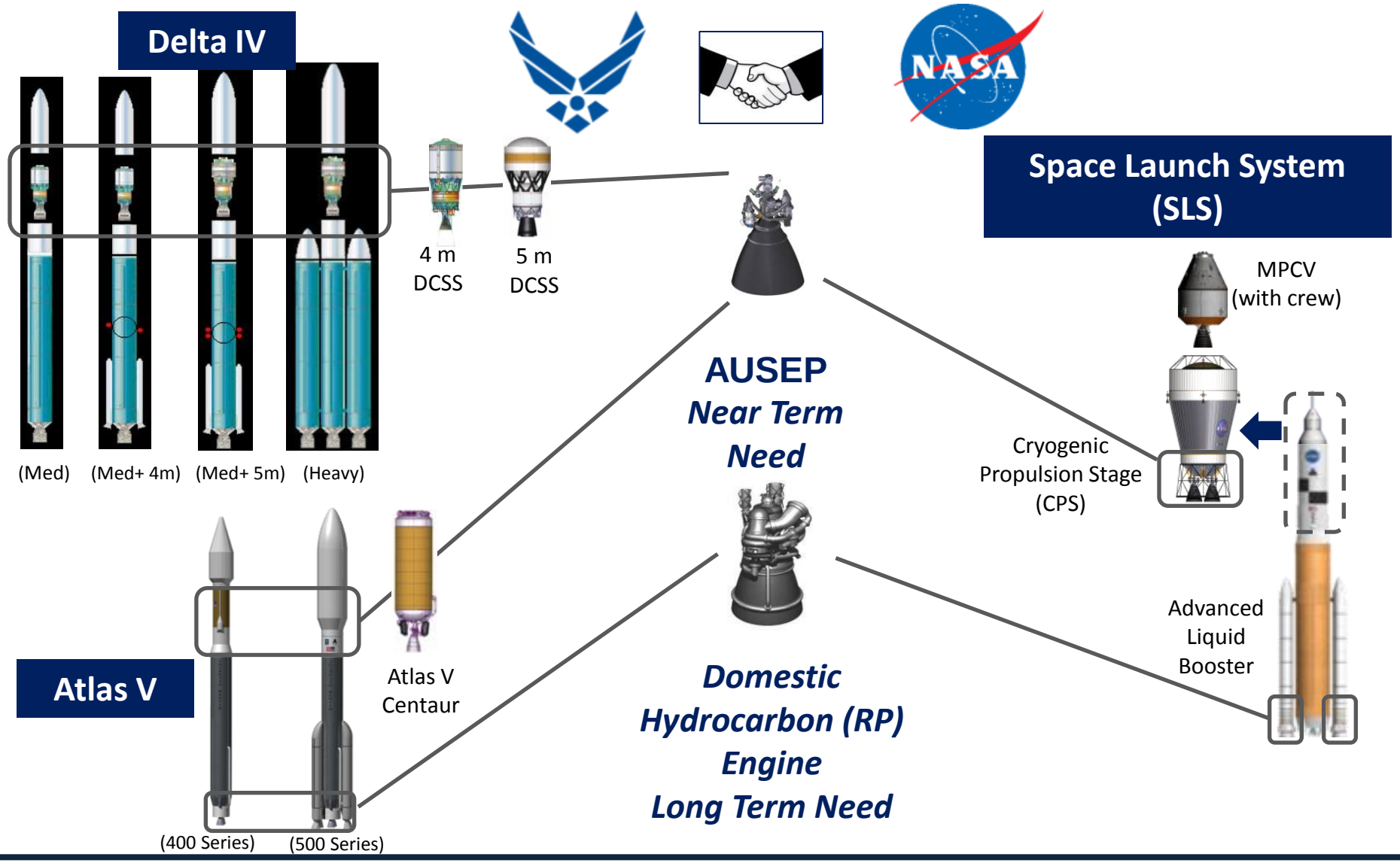
SLS Advanced Development NRA to NIRPS Grand Challenges



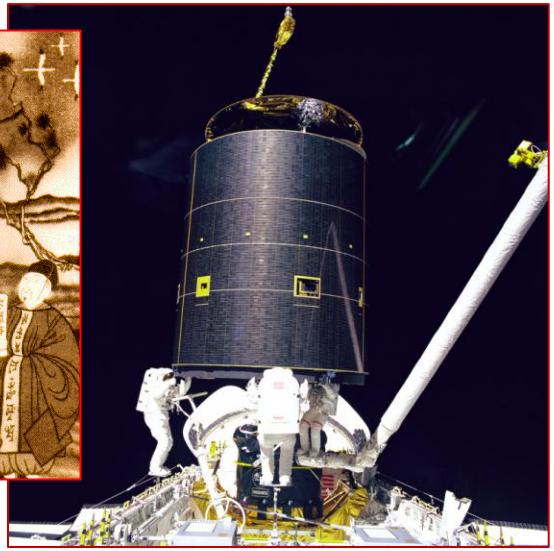
INITIAL CAPABILITY, 2017–21

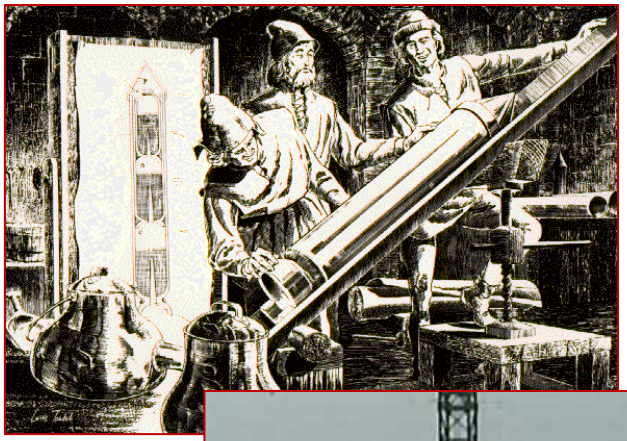
EVOLVED CAPABILITY, Post-2021

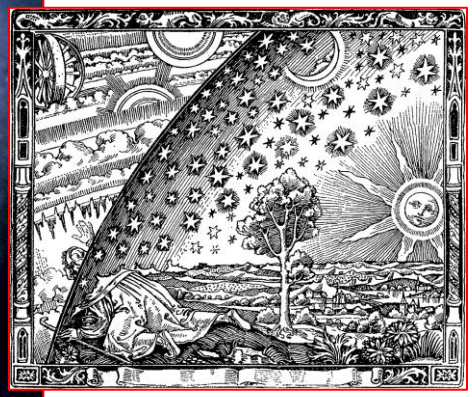
Near-term Partnership Opportunities



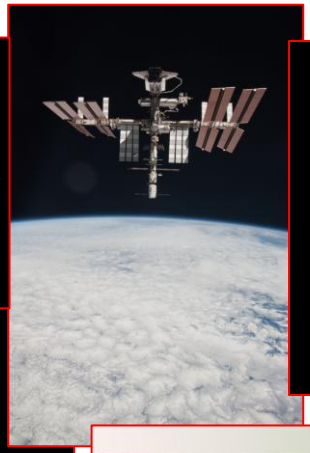
Rocketry and Reality

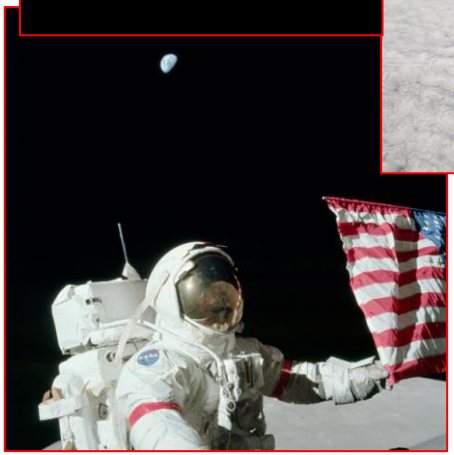


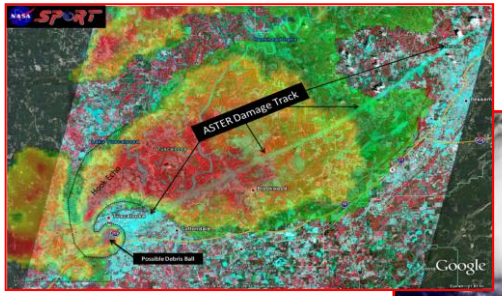


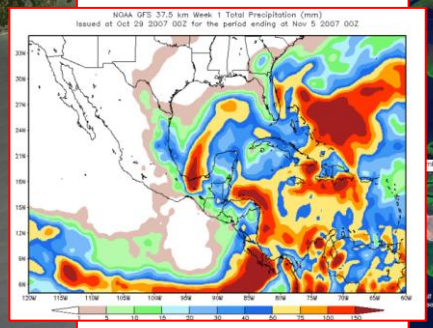


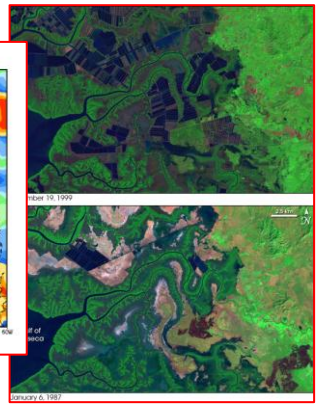
Rockets: closer to our lives than we realize



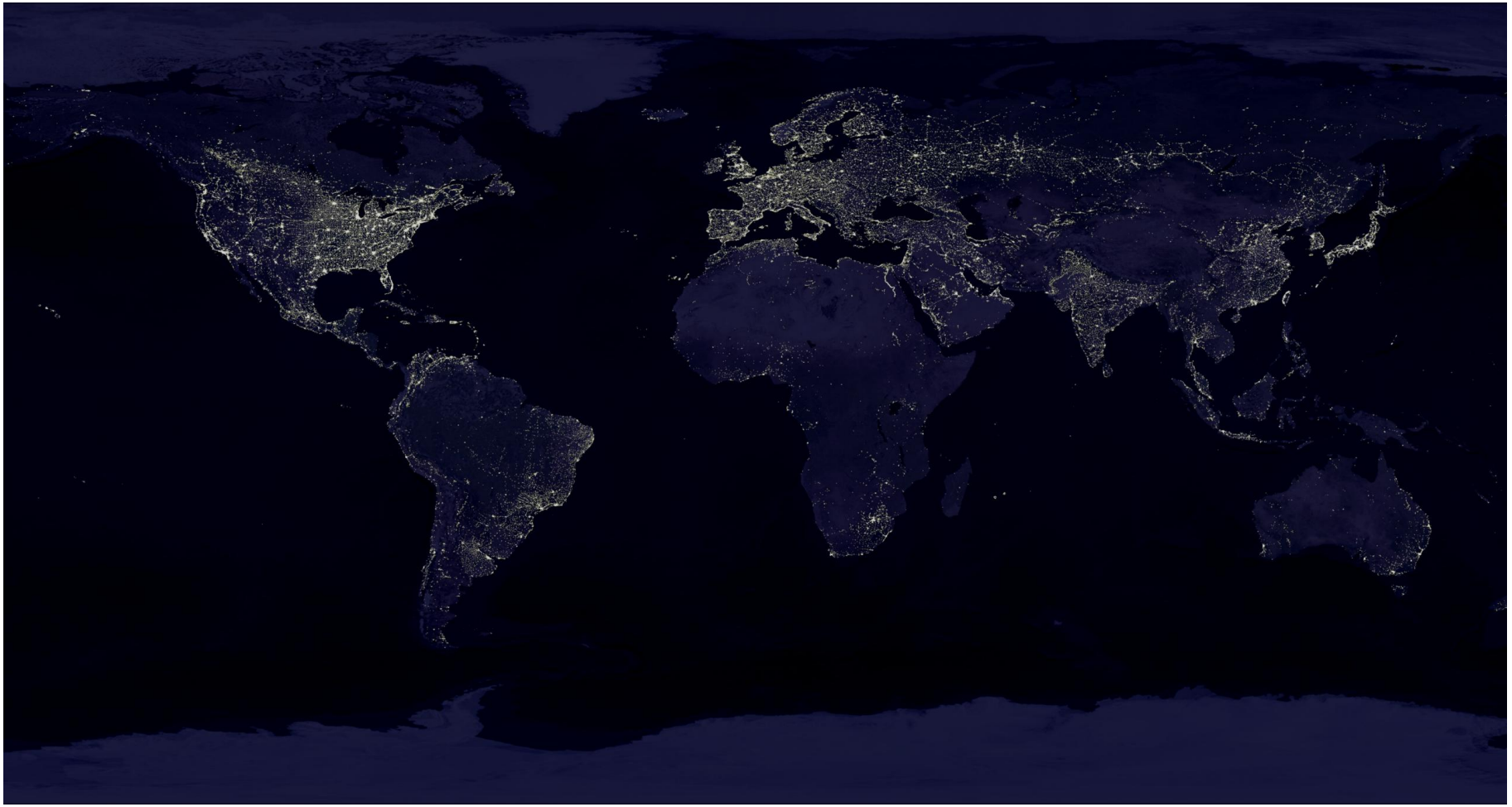








Thank-you and good evening



This incredible picture was brought to you by rocket propulsion