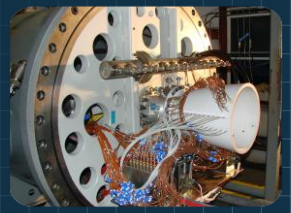
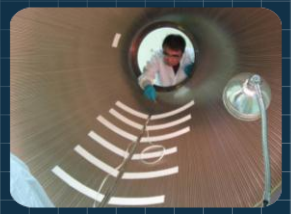
NATIONAL INSTITUTE FOR ROCKET PROPULSION SYSTEMS

NIRPS: A year of Progress and Challenge

Dale Thomas, Ph.D, PE
December 6, 2012

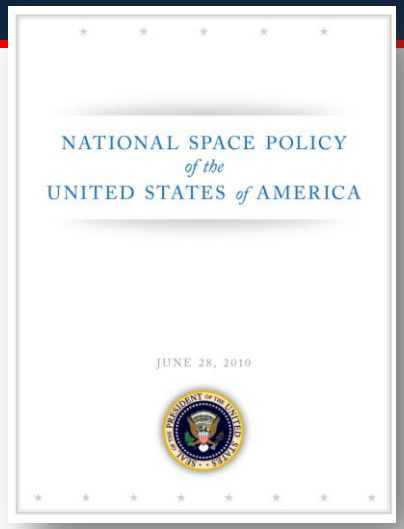
NIRPS First Annual Workshop
Monterey, CA



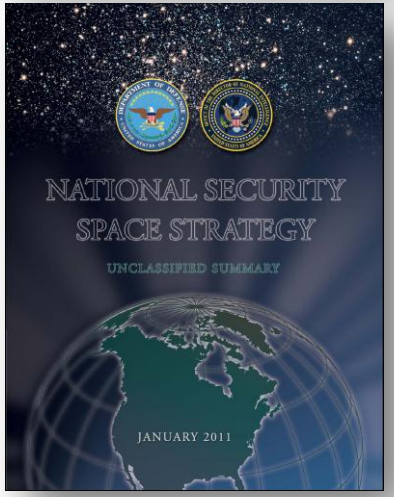





Collaboration: A National Pursuit

"**Departments and agencies shall improve their partnerships through cooperation, collaboration, 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



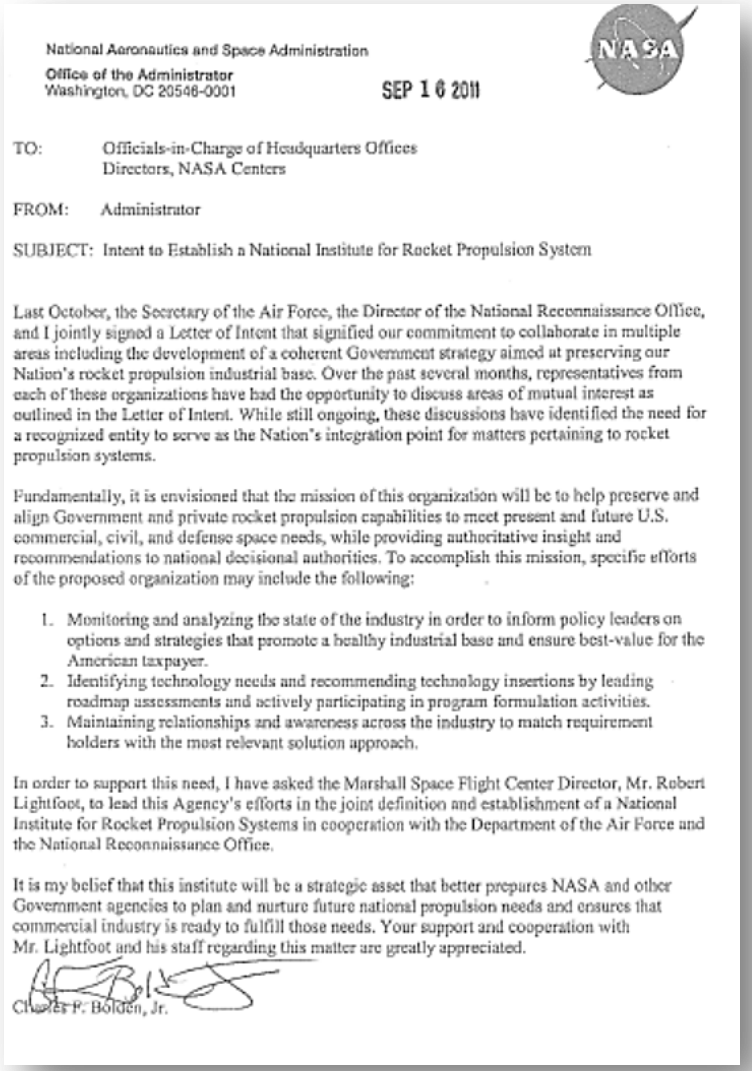
"We seek to foster a U.S. space industrial base that is robust, competitive, flexible, healthy, and delivers reliable space capabilities on time and on budget. DoD and the IC [Intelligence Community], in concert with the civil space sector, **will better manage investments across portfolios to ensure 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

NIRPS: Where we started

- Sept 16, 2011 letter signed by NASA Administrator Bolden authorized creation of NIRPS
- Letter recommended three focus areas
- Established MSFC as NASA lead, in cooperation with Department of the Air Force and the National Reconnaissance Office
- NIRPS is a product priority (Tier 1) as published in the MSFC TIP call for proposals - Attachment 3



National Aeronautics and Space Administration
Office of the Administrator
Washington, DC 20546-0001

SEP 16 2011

TO: Officials-in-Charge of Headquarters Offices
Directors, NASA Centers

FROM: Administrator

SUBJECT: Intent to Establish a National Institute for Rocket Propulsion System

Last October, the Secretary of the Air Force, the Director of the National Reconnaissance Office, and I jointly signed a Letter of Intent that signified our commitment to collaborate in multiple areas including the development of a coherent Government strategy aimed at preserving our Nation's rocket propulsion industrial base. Over the past several months, representatives from each of these organizations have had the opportunity to discuss areas of mutual interest as outlined in the Letter of Intent. While still ongoing, these discussions have identified the need for a recognized entity to serve as the Nation's integration point for matters pertaining to rocket propulsion systems.

Fundamentally, it is envisioned that the mission of this organization will be to help preserve and align Government and private rocket propulsion capabilities to meet present and future U.S. commercial, civil, and defense space needs, while providing authoritative insight and recommendations to national decisional authorities. To accomplish this mission, specific efforts of the proposed organization may include the following:

1. Monitoring and analyzing the state of the industry in order to inform policy leaders on options and strategies that promote a healthy industrial base and ensure best-value for the American taxpayer.
2. Identifying technology needs and recommending technology insertions by leading roadmap assessments and actively participating in program formulation activities.
3. Maintaining relationships and awareness across the industry to match requirement holders with the most relevant solution approach.

In order to support this need, I have asked the Marshall Space Flight Center Director, Mr. Robert Lightfoot, to lead this Agency's efforts in the joint definition and establishment of a National Institute for Rocket Propulsion Systems in cooperation with the Department of the Air Force and the National Reconnaissance Office.

It is my belief that this institute will be a strategic asset that better prepares NASA and other Government agencies to plan and nurture future national propulsion needs and ensures that commercial industry is ready to fulfill those needs. Your support and cooperation with Mr. Lightfoot and his staff regarding this matter are greatly appreciated.

Charles F. Bolden, Jr.

Building the Foundation

- Identified key concerns of the propulsion community
- Developed and verified Grand Challenges & allocated primary/secondary responsibilities to NIRPS Strategy Teams
- Developed draft strategies to meet Grand Challenges
- Completed and published assessment for 23 public studies addressing industrial base
- Developed “Propulsion Forum & Needs Assessment” matrix to distinguish NIRPS role relative to other forums
- Established monthly NIRPS Planning Team meeting with government, industry, and academic participation
- Established NIRPS Strategy Teams with broad membership
- Forums Supported: Von Braun Symposium, Space Transportation Policy Workshop, JANNAF Plenary Session, National Defense Industrial Association, Space Trans. Assoc. Breakfast, JPC, SMDC, Marshall Association
- Holding JANNAF/NIRPS Annual Workshop

NIRPS: Charting Our Progress

Outline the 'Grand Challenges'	Outline the 'Plan of Attack' – Problems and Resolution Strategies	National Rocket Propulsion Strategy Requested by OSTP
Von Braun Symposium October 26, 2011	JANNAF December 5-9, 2011	NDAA 1095 February 2012
Progress Against Strategies; Developed consensus on CY2012 Goals	Liquid Engine Collaboration with Air Force	Industry Base Supply Chain TIM
Presentation to HEOMD, March 2012	MIPR from AFRL April 2012	Kennedy Space Center May 2012
NDAA 1095 First Face-to-Face	NIRPS Industrial Base Study Analysis Presented	Initiated procurement with the Chemical Propulsion & Analysis Center (CPIAC)
Washington DC June 2012	Joint Propulsion Conference July 2012	Baltimore, MD August 2012
Drafted FY2013 Goals	Propulsion Industrial Base Health Metrics RFI Released	NDAA 1095 Final Report, Red Team Review, JANNAF/NIRPS Workshop
September 2012	October 2012	November-December 2012

NIRPS: An Enabler for America's Space Endeavors

Academic Partners

Georgia Institute of Technology

UAHuntsville
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

AUBURN
UNIVERSITY

Commercial Space

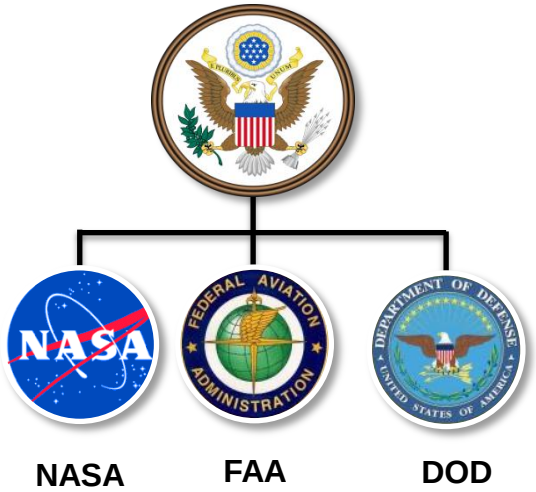
ATK

AEROJET

Pratt & Whitney
A United Technologies Company

USA
United Space Alliance

U.S. Government



NASA FAA DOD

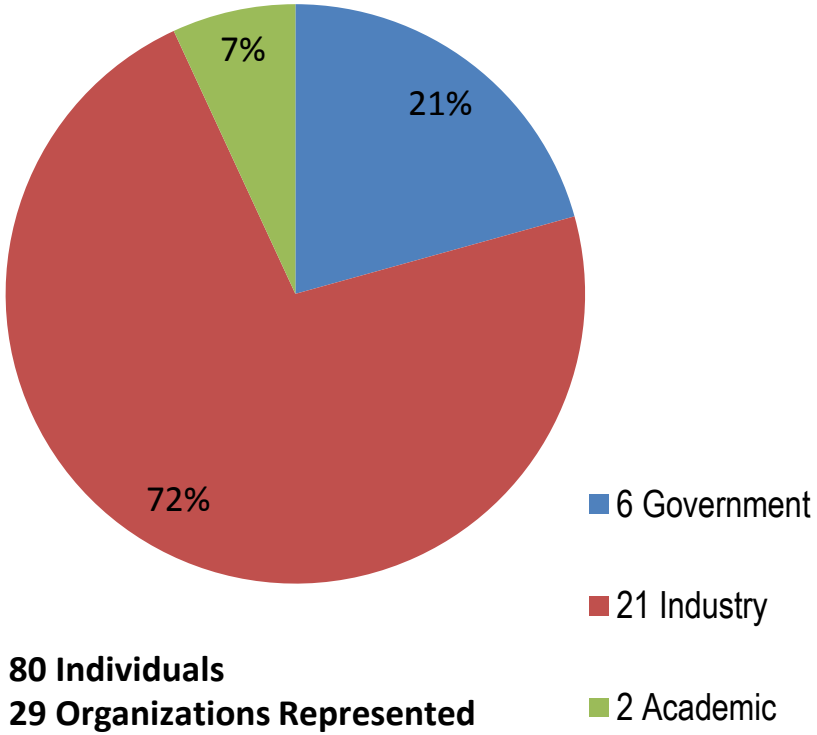
NIRPS

Fostering…

a vibrant rocket propulsion community
that provides reliable and affordable propulsion systems
in support of the nation's defense, civil and commercial needs.

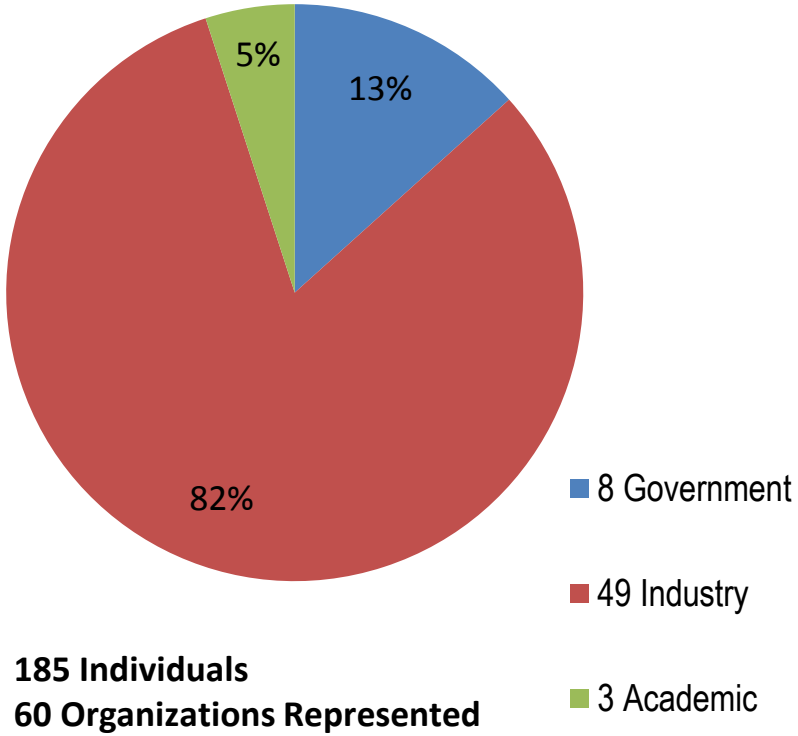
NIRPS: Building a National Capability

November 2011



80 Individuals
29 Organizations Represented

November 2012



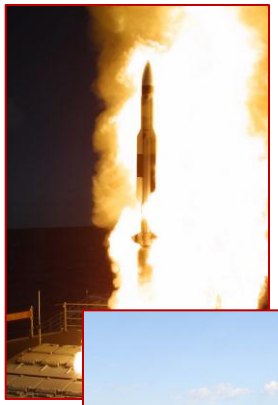
185 Individuals
60 Organizations Represented

Derivation of the Grand Challenges

Accomplishments Addressing the Grand Challenges

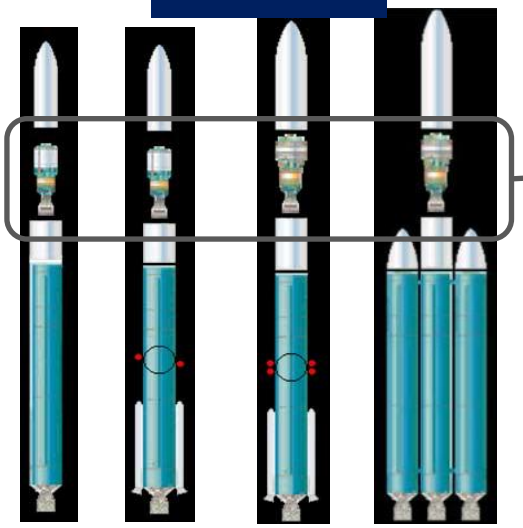
Support competitiveness of IB	Invigorate STEM Pipeline	Develop integrated S&T plan	Reduce development and sustainment costs	Collaborate across agencies	Foster access across the IB
•Developed and approved metrics for determining the health of the US Rocket Propulsion Industrial Base (RPIB) •Released survey to collect data for Industrial Base Health Metrics •Supported NASA Industrial Base Working Group (IBWG) sponsored by NASA HQ •Led MSFC efforts in responding to the Department of Commerce (DoC) "Deep Dive" survey of the US Space Industry	•Supported continued development and university utilization of the MSFC Generalized Fluid System Simulation Program (GFSSP) •Initiated discussions on development of a CUIP/XUIP type entity to support university STEM activities	***•Leading inter-agency task team responding to NDAA 2011 Sec. 1095 action to develop national rocket propulsion strategy***	•Initiated Supply Chain Mapping for Liquid Rocket Engines in cooperation with MSFC Engines Project Office ***• Supported NASA/DoD ammonium perchlorate collaborative procurement***	•Acquired CPIAC Support for Skills & Capabilities directory/web tool ***• Supported negotiations with USAF on AUSEP & AKE collaboration***	• Solutions Facilitator team developing strategies for easier access to US government facilities & expertise •Initiated cross-community skills, capabilities, and subject matter expert directory, and web tool

Addressing the Grand Challenges:
collaborative AP procurement



Addressing the Grand Challenges:
DoD and NASA propulsion collaboration

Delta IV



(Med) (Med+ 4m) (Med+ 5m) (Heavy)

4 m DCSS 5 m DCSS

Space Launch System (SLS)

AUSEP
Near Term Need

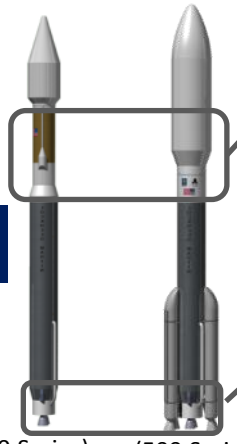
MPCV (with crew)

Cryogenic Propulsion Stage (CPS)

Domestic Hydrocarbon Engine Long Term Need

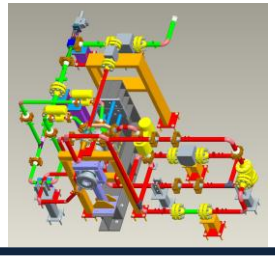
Advanced Liquid Booster

Atlas V



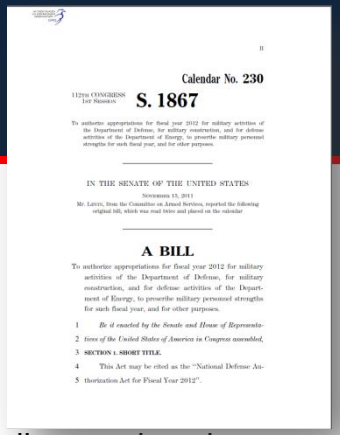
(400 Series) (500 Series)

Atlas V Centaur



Expander Cycle Testbed

Answering a National Need:
NDAA Section 1095



Calendar No. 230

112TH CONGRESS 1ST SESSION **S. 1867**

To authorize appropriations for fiscal year 2012 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe military personnel strengths for such fiscal year, and for other purposes.

IN THE SENATE OF THE UNITED STATES

November 15, 2011

Mr. LEVIN, from the Committee on Armed Services, reported the following original bill, which was read twice and placed on the calendar

A BILL

To authorize appropriations for fiscal year 2012 for military activities of the Department of Defense, for military construction, and for defense activities of the Department of Energy, to prescribe military personnel strengths for such fiscal year, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Defense Authorization Act for Fiscal Year 2012".

(a) SENSE OF THE CONGRESS.-It is the sense of Congress that the sustainment of the solid rocket motor and liquid rocket engine industrial base is a national challenge that spans multiple departments and agencies of the Federal Government and requires the attention of the President.

(b) STRATEGY REQUIRED.

(1) IN GENERAL.-Not later than 180 days after the date of the enactment of this Act, the President shall transmit to the appropriate congressional committees a **national rocket propulsion strategy for the United States**, including-

(A) **a description and assessment** of the effects to programs of the Department of Defense and intelligence community that rely on the solid rocket motor and liquid rocket engine industrial base caused by the end of the Space Shuttle program and termination of the Constellation program;

(B**) a description of the plans** of the President, the Secretary of Defense, the intelligence community, and the Administrator of the National Aeronautics and Space Administration to mitigate the impact of the end of the Space Shuttle program and termination of the Constellation program on the solid rocket motor and liquid rocket engine propulsion industrial base of the United States;

(C) **a consolidated plan** that outlines key decision points for the current and next-generation mission requirements of the United States with respect to tactical and strategic missiles, missile defense interceptors, targets, and satellite and human spaceflight launch vehicles;

(D) **options and recommendations** for synchronizing plans, programs, and budgets for research and development, procurement, operations, and workforce among the appropriate departments and agencies of the Federal Government to strengthen the solid rocket motor and liquid rocket engine propulsion industrial base of the United States; and

(E) any other relevant the President considers necessary

*(2) LONG-TERM ICBM PLAN.- **(DoD only action, Mr. Read leading, with strong support from USAF)***

NIRPS assigned leadership responsibility by OSTP to address the National Rocket Propulsion Strategy

NDAA Sec. 1095: Background

- Many previous studies and reports, and results are still valid. Six key needs are:
  - Competiveness and resilience of the propulsion industrial base
  - An integrated science and technology plan
  - Better collaboration across agencies for propulsion systems development
  - Better and easier access to government facilities and expertise
  - Revitalized Science, Technology, Engineering and Mathematics (STEM) pipeline
  - Reduction of development and sustainment cost for propulsion components and systems
- Rocket propulsion is a key subsystem used to provide a necessary capability.
  - i.e. space launch, munitions delivery, etc.
- Rocket propulsion has evolved since the 1940s, but it remains a highly specialized field that relies significantly upon experience and heritage.
  - Some areas not fully understood and small perturbations have unintended results.
  - Aging of the workforce is a significant issue, with regard to maintaining safety and mission assurance.
  - Industry consolidation has reduced the number of companies serving the same market.

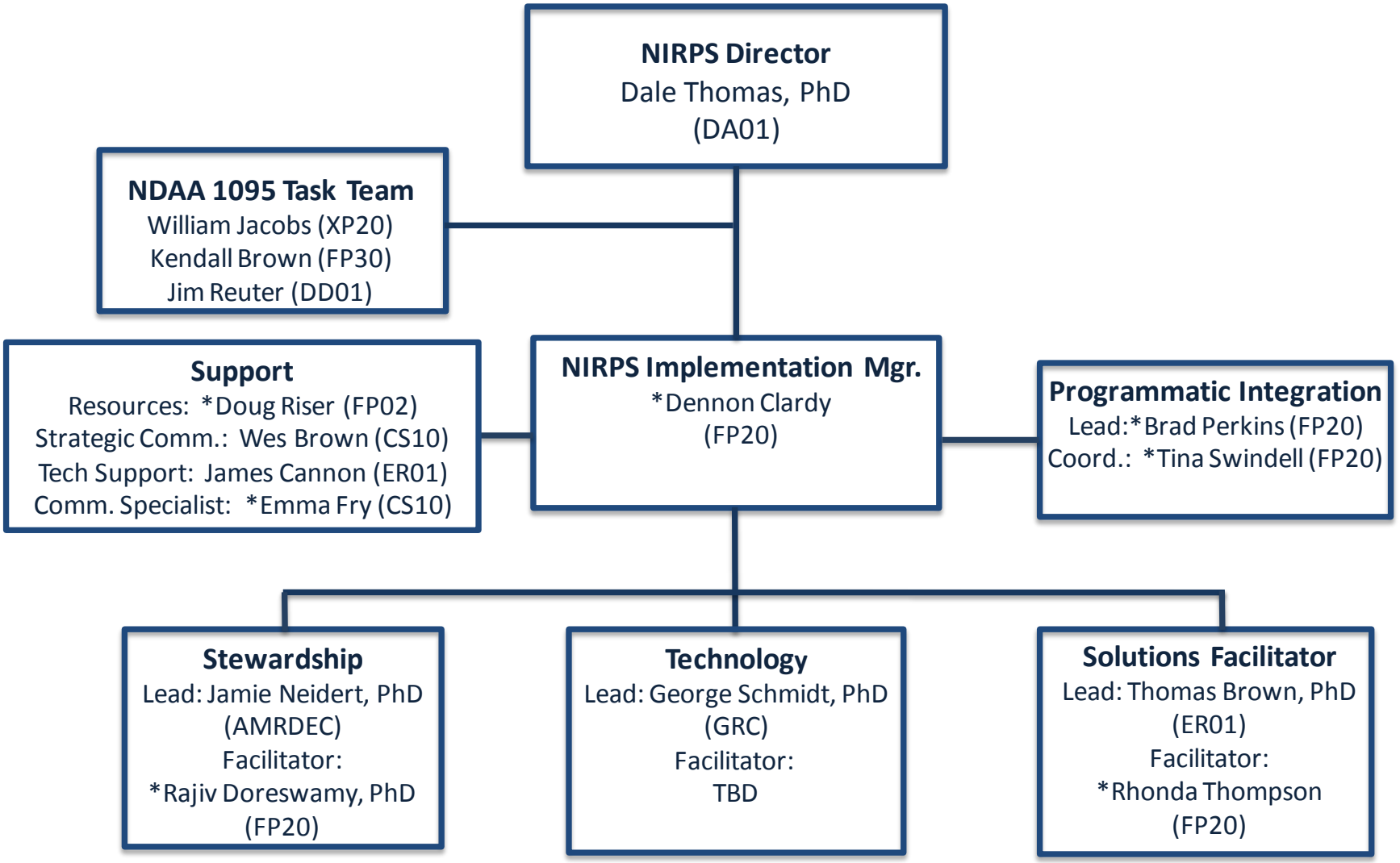
Senior Steering Group

Name	Org	Title
Dr. Dale Thomas	MSFC/DA01	Associate Center Director, MSFC
Mr. Roger (Scott) Correll	AFPEO/SL	Program Executive Officer for Space Launch
Mr. Brett Lambert	DASD(MIBP)	Deputy Assistant Secretary of Defense (Manufacturing and Industrial Base Policy)
Mr. Rich McKinney	SAF/SP	Deputy Under Secretary of the Air Force for Space Programs
Maj Gen William Chambers	SAF/A-10	Assistant Chief of Staff, Strategic Deterrence and Nuclear Integration
Maj Gen Martin Whelan	AFSPC	A5 Director of Requirements
Brig Gen Daryl Hauck	AFPEO/SS	Program Executive Officer for Strategic Systems
RADM Terry Benedict	Navy SSP	Director, Strategic Systems Programs
Dr. David Burns	MDA	MDA Director of Science and Technology
Mr. Greg Hulcher	AT&L/S&TS/SW	Director for Strategic Warfare
Mr. Gil Klinger	AT&L/SIO	Deputy Assistant Secretary of Defense for Space and Intelligence
Mr. Barry Pike	Army	Deputy PEO, Missiles and Space
Mr. Jim Norman	NASA/HQ	Assistant Associate Administrator for Launch Services
Dr. George Schmidt	GRC/R000	Deputy Director for Research & Technology
Mr. Jeff Hanley	JSC/AB111	Human Exploration Development Support Office Director
Mr.Brian Muirhead	JPL/1010	Chief Engineer, JPL Executive Council
Mr. Mike Kelly	FAA	Chief Engineer, Office of Commercial Space Transportation
Maj Gen Susan Mashiko	NRO	Deputy Director, National Reconnaissance Office
Dr. Ronald Jost	AT&L/DASD	Deputy Assistant Secretary of Defense, C3&Cyber

NDAA 1095 Accomplishments/Status

- **Team gathered and summarized data**
  - Defined Rocket Propulsion Industry Base and the Desired End State
  - Formed 6 integration categories
  - Drew on SRM and LRE 2011 Studies, Dept. of Commerce 2010 survey
- **Senior Steering Group (SSG) has held seven meetings with Inter Agency Task Team to provide guidance to the team**
- **Team held two Face-to-Face Workshops**
  - Army, Air Force, Navy, MDA, OSD, NASA, and FAA were all represented
- **Briefings to OSTP conducted on June 26th and Sept 25th**
  - Interim report completed and released to OSTP
- **Final draft released for organizational coordination.**
- **Delivery of final report to OSTP scheduled for December 13**

NIRPS Execution Team



* Indicates NIRPS Core Team

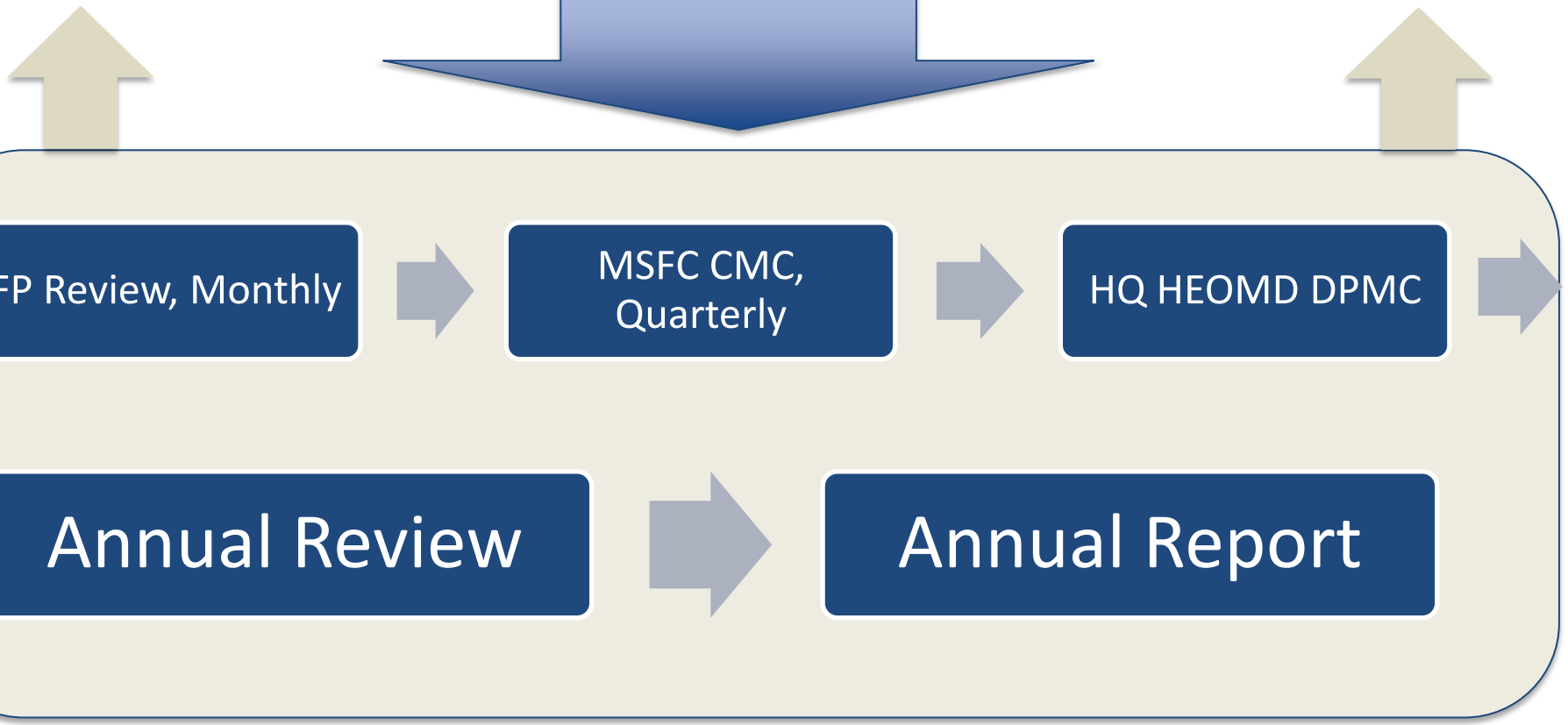
Grand Challenges Allocation to Strategy Teams

Grand Challenge	Stewardship	Technology	Solutions Facilitator
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**

NASA Governance Model

NIRPS Products: Accomplishments/Planning, Resources/Metrics

Team Meetings w/ Focused Stakeholders, GAS Meeting (Core), Steering Team Meeting (Core+), Planning Team Meeting (All Stakeholders), Conferences, Symposiums, Workshops



NIRPS CY12 Primary Goals

NIRPS CY12 PRIMARY GOALS				
Category	**Goal**	**9/28/2012**	**Current**	**EOY (Projected)**
NIRPS Strategic Development	Articulate National Charter	**Y**	**Y**	**G**
	Establish Governing Body	**Y**	**Y**	**Y**
	Develop 5 year plan	**G**	**G**	**G**
NIRPS Outreach & Inclusion	Establish reporting mechanisms consistent with governance model	**Y**	**Y**	**Y**
	Formalize Partnerships with other government agencies	**Y**	**Y**	**Y**
	Investigate and address FACA requirements	**B**	**B**	**B**
	Hold Workshop/Annual Meeting	**G**	**G**	**B**
	Sponsor Publications	**G**	**G**	**B**
	Enhance Web Presence	**G**	**G**	**B**
NIRPS Strategies Implementation	Develop strategies to address the Grand Challenges	**G**	**G**	**B**
	Conduct Propulsion Studies Assessment	**G**	**G**	**B**
	Develop of a series of metrics to measure health of the industrial base	**Y**	**Y**	**G**
	Understand ramifications of declining Industrial Base on the ability to maintain DoD & NASA propulsion current needs	**Y**	**Y**	**G**
	Ease access to government skills/capabilities	**Y**	**Y**	**G**
	Demonstrate cooperative efforts across multiple agencies	**G**	**G**	**G**
	Use existing roadmaps from government agencies to create an integrated propulsion roadmap	**Y**	**Y**	**G**
	Identify demonstrator / workhorse assets that provide infrastructure and accessibility for an affordable technology transition bridge	**Y**	**Y**	**Y**
NDAA 1095	Support DA 1095: National Rocket Propulsion Strategy	**G**	**G**	**B**

Legend

B	Completed
G	In Progress
Y	Have started; known challenges exist
R	Not started; challenges being identified

20121031VERSION

Red Team Scope and Objectives

Scope

The Red Team Review was a *self-imposed* one year check point for NIRPS activities.

The Red Team evaluated the accomplishments, assessed the planned activities, identified weaknesses, and recommended appropriate changes for forward planning.

Objectives

- Assess the current status and plans for NIRPS in terms of appropriateness, clarity, and potential impact in addressing the Grand Challenges facing the Propulsion Community on a national, strategic level
- Assess the adequacy of resources, plans and organizational approach being applied to the formulation/implementation of NIRPS
- Assess the adequacy of the engagement of stakeholders from MSFC, NASA, other Government Agencies, Industry and Academia
- Assess the clarity and appropriateness of the overall vision and end-state for NIRPS

NIRPS Red Team

Membership

- Chair: Alex Priskos, Manager, Booster Office, Space Launch System
- Garry Lyles, Chief Engineer, Space Launch System
- Preston Jones, Deputy Director, MSFC Engineering Directorate
- Steve Doering, Director, MSFC Center Operations
- Jih-Fen Lei, Director of Research and Technology, Glenn Research Center

Focus Areas

- NIRPS Strategy Development
- NIRPS Organization
- NIRPS Goals and Major Accomplishments for CY12
- NIRPS Collaboration and Partnerships
- Goals for FY13
- Resources
- Strategic Operating Plan
- 2012 National Defense Authorization Act Section 1095

Red Team Recommendations

Simplify and focus objectives

- Prioritize activities in both task sets to ensure the most important/highest leveraging tasks receive the appropriate resources
- Develop an integral connectivity between NIRPS and the 1095 Study; performance on 1095 is critical; 1095 steering committee could potentially become strong advocates for NIRPS

Define the value proposition

- What organizations or entities can NIRPS most effectively assist
  - Consider how NIRPS can assist/engage all propulsion related Government Program Executive Offices (PEO's usually *have* problems and budget)

Align ultimate construct of organization with desired outcome

- What is the desired end state in 3-5 years
- Establish structure to NIRPS committees/stewardship teams with various levels of membership
  - Current structure and membership of the various NIRPS committees appears ad hoc
  - Consider tiered membership; define areas of collaboration, and decision authority
  - Consider evaluating various organization models and define the desired end state of NIRPS in 3-5 years

Develop a process to utilize the NASA Administrator (NIRPS Chartering Authority) as an advocate

- Frequency should likely be more than annual
- Consider how NIRPS function is related to Multi-Agency Forums that includes participation from the NASA Administrator

Consider establishing credibility early through current opportunities

- Possibly manage the Academic Contract Management Task within the SLS Advanced Development NRA

External Red Team

- **NIRPS is developing the plan for a non-NASA Red Team to be held in CY 13**

- **Overarching goal is for feedback and course correction, from a "national" perspective**

- **Issues to be addressed**
  - Membership of Red Team and organizations represented
  - Red Team Chair
  - Role of industry and academia
  - Scope and Terms of Reference
  - Date and location
  - Action item response and closure

Looking Forward: Challenges and Opportunities

FY 2013 will be a year of consolidation and execution

Pivot from organizational formulation to adding real value to the Propulsion Community

Strategic Needs

- Formalize agreements with other US Government Agencies
- Determine Interim and End States of NIRPS
- Respond and react to NDAA Sec. 1095 Outcomes
- Develop STEM Strategy and execution plan
- Effectively Communicate the value and accomplishments of NIRPS across the Agency, Government and Propulsion Community

Execution Priorities

- Use NIRPS Metrics and DoC data to develop a "State of the Propulsion Industry" report/dashboard
- Develop Supply Chain Mapping and Analyses capabilities to inform SLS and other major architecture decisions
- Complete initial Integrated Propulsion Science and Technology Roadmap in conjunction with IHPRPT (RP21)
- Build initial collaborative capability across the Propulsion Ecosystem and ease access to NASA facilities, skills and personnel

Challenges

- Effective integration and Coordination with other Government Agencies
- Continued Active engagement with Industry and Academia
- Building an Efficient and Responsive Governance System for a growing Institute

Looking Forward: Proposed NIRPS FY13 Goals

Grand Challenges	FY13 Goals	Team
1. Support the Competetiveness and resilience of the industrial Base	1.1 Develop Supply Chain Analysis for SLS Architecture Decisions.	Stewardship
	1.2 Develop Metrics to Determine Health of Industrial Base.	Stewardship
2. Invigorate the STEM pipeline	2.1 Provide engineering students with practical experience utilizing propulsion design and analysis tools and methodologies.	Solutions Facilitator
3. Develop and integrate a science and technology plan for propulsion systems	3.1 Use existing roadmaps to identify opportunities for collaborations and leveraging of complimentary activities.	Technology
4. Reduce development and sustainment costs for missiles and rocket systems	4.1 Conduct a study/survey of low cost technology test beds and/or other methods for transitioning propulsion component /sub-system technologies through the TRL valley of death (TRL 4-6).	Technology
5. Collaborate across agencies for missile and rocket propulsion system development	5.1 Develop initial community of interest capability.	Solutions Facilitator
	5.2 Establish a Cross-Cutting Collaborative Solutions Team that executes tasks of cross community interest, stimulating potential follow-on collaborations.	Solutions Facilitator
6. Foster access to facilities and expertise across Government, industry, and academia	6.1 Develop initial Propulsion Skills and Capabilities Directory & Web Tool.	Solutions Facilitator
	6.2 Complete study of mechanisms for potential pass through process to ease access to cross government skills and capabilities.	Solutions Facilitator
Integrated Goals		
Integrated Goals	IG.1 Develop operational model defining management concepts, operating principles and framework, and high-level goals including a concept of management oversight for periodic evaluation.	Integrated
	IG.2 Develop a comprehensive Strategic Communications Plan that addresses external and internal stakeholders, interactive websites, and outreach planning for public, STEM, and Agency/Industry engagement.	Integrated
	IG.3 Establish a National Charter	Integrated

Looking Forward: Notional Strategic Operational

Collaborative Engagement

Collaborative effort, "Executive Committee" Approves Operating Plan

- Formulation
- Mutually beneficial, shared products and analyses

Chartered Forum

Forum with signed charter and defined by MOUs/LOAs

- Stronger/defined governance model
- Stronger collaboration and integration

Operational Institute

Formal Institute (Virtual)

- Formal governance structure
- Stronger Integration with Academia and Industry
- JANNAF-like Funding Model

Execution

a) Integrated Planning & Synchronization- Some, mainly for mutually beneficial near-term strategic decisions
b) Budget Integration- Very Limited
c) Industrial Base Assessments- some Integration, most likely of (a)
d) Team Leadership Level- GS-14/15 and OS-5/6
e) Contractor & Academia Involvement- Mostly Contractors, in support Roles

Execution

a) Integrated Planning & Synchronization- Some, multi-year planning
b) Budget Integration- Very Limited
c) Industrial Base Assessments- Recurring IB and SCM assessments
d) Team Leadership Level- GS-15 and OS-6
e) Contractor & Academia Involvement- Regular Meetings with Both

Execution

a) Integrated Planning & Synchronization- Routine
b) Budget Integration- High-Level Integration and Assessment
c) Industrial Base Assessments- Recurring IB and SCM Assessments, with funded risk-mitigation
d) Team Leadership Level- SES and OS-7/8
e) Contractor & Academia Involvement- Regular Meetings with Both, Both in Co-Lead Roles for STEM Activities

NIRPS: Summary

- In the past 14 months NIRPS has gone from an idea on a sheet of paper to a working organization, performing tasks of national scale
- NIRPS is beginning to establish itself among the Propulsion Community
  - Need is recognized for a coordination and integration function across the US Government's propulsion activities
- NIRPS acts as a collaboration agent – serves as a catalyst and multi-agency facilitator
- NIRPS is leading a high-priority Government-wide task
  - 2012 Defense Authorization Act, Sec 1095; Develop National Rocket Propulsion Strategy
- Beginning to perform in accordance with Grand Challenges
- Performing to an Executable plan, adjusting to to Center and Agency priorities
- Challenges remain to building a sustainable Institute
  - Effective integration and Coordination with other Government Agencies
  - Continued Active engagement with Industry and Academia
  - Building an Efficient and Responsive Governance System for a growing Institute