NOAA Response

"A Review of NOAA's Satellite Program: a way forward"

A Presentation to the
NOAA Science Advisory Board

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Outline

- Purpose
- Motivation
- Overview of NOAA's Response
- NOAA Coordination and Views

Purpose

To present and discuss NOAA's response and actions following the SAB's report and recommendations:

A Review of NOAA's Satellite Program: a way forward; November 2012

Motivation

The SATTF report described four primary areas of challenge:

1. Increasing satellite system costs and uncertain fiscal environment
2. Maintaining satellite continuity
3. Balancing requirements push and technology pull
4. Sustaining Partnerships

Overview of NOAA's Response

- Eight Core Recommendations from SAB
  - NOAA accepts all recommendations
  - This briefing will review NOAA's responses
- The SATTF focused on NOAA's long-term satellite architecture
- The SAB joins with input from the Satellite Independent Review Team and other reviews with a short and intermediate-term focus

Recommendation #1
Management Support for Satellites

- Create, at the NOAA leadership level, a stable funding environment and management environment to support satellite activities

Response: Management Support for Satellites

- NOAA concurs with the recommendation
- Administration, DOC and NOAA support for NOAA's satellite program remains strong
- The Administration and Congress continue to give high priority to timely delivery of NOAA's major satellite programs
- Over the course of the past year, significant positive changes have been implemented within DOC, NOAA and NASA to streamline NOAA satellite enterprise governance, oversight and communications
  - Roles, responsibilities, accountabilities and authorities at all levels, line and staff, clarified and documented
  - Oversight and communications processes significantly streamlined and are being regularly implemented
  - Refinements to JPSS governance model have been implemented, more specifically establishing responsibility and authority of the NOAA JPSS Program Director to direct all elements of the JPSS, and integrating the NASA and NOAA systems engineering efforts under a single JPSS Program Chief Systems Engineer

Recommendation #2

Prioritized space-based Observational Requirements

- Establish a prioritized list of threshold space-based observational requirements that maintains high impact capabilities.
  a) Define NOAA core functions and align them with national space policy and agency guidance
  b) Coordinate with all stakeholders (including national and international), with respect to prioritization of requirements and architectural tradeoffs
  c) Update the prioritization process database regularly with current information from subject matter experts

Response
Prioritized space-based Observational Requirements

- NOAA concurs with the recommendation
- NOAA significantly contributed to and will leverage a recently completed OSTP-led Earth Observation Assessment (2012), which provides insight into *national stakeholder observational requirements*
- Similar the OSTP-led effort, NOAA is further implementing a more detailed, NOAA-wide value-chain analysis (from core missions to products/services to data to observing systems), which will provide critical information to support prioritizing NOAA's observing requirements.
  - Information is based on documented impacts of specific data sources to *key NOAA products and services*
  - "NOAA Observing Systems Integrated Analysis II (NOSIA II)" is being conducted for all observing systems used to support NOAA's products and services
    - NOSIA II initial assessment expected in early CY14
  - NESDIS will use the results of both efforts to support the development of a prioritized list of space-based observational requirements
- NOAA continues to work through various communities and forums (e.g. GEOSS, WMO, CEOS) to gain insight into the priorities and plans of our *international stakeholders and partners*

Recommendation #3
Create Chief Systems Engineering Function

- Create a Chief Systems Engineering function within NESDIS to address the end-to-end link from goals, to architectures, to concepts of operation, to individual system development and finally to delivery of the integrated systems across the organization

Response
Create Chief Systems Engineering Function

- NOAA concurs with the recommendation
- NESDIS took immediate action to respond initially to the recommendation, while at the same time developing a strategy to support the longer term needs of the enterprise.
  - NESDIS brought on board a highly qualified leader and systems engineering practitioner in December 2012 as an interim measure to lead a systems architecture team comprised of NOAA, NASA and contracted elements
  - NESDIS has developed a proposed reorganization which includes an Office of Systems Architecture and Advanced Planning. Resource requirements for the office have been identified, and a matrixed staffing approach is currently being used to address near term efforts.
  - In December 2013, a new permanent Director, Systems Engineering, Mr. Marvin LeBlanc, will join the NESDIS Senior Executive team
- The Director, Systems Engineering will:
  - Serve as the end-to-end system architect for NESDIS
  - Analyze observational and data management requirements
  - Allocate and validate the top-level requirements for assessment and implementation
  - Support development of the budget strategy to meet NESDIS mission objectives
  - Lead the technical evaluation of major systems acquisitions programs, and perform strategic planning, risk assessments, contingency planning, and technology assessments
  - Develop policies to ensure the health of operational and future capability

Response

Create Chief Systems Engineering Function

Systems Architecture and Advanced Planning near term efforts have included:

- Applying enterprise systems engineering perspective across all major developments to support critical needs/milestones
- Developed a baseline framework for a Quality Management System with process owners identified across the organization
- Satellite Enterprise integrated risk management approach defined and implemented
  - » Risk Management Procedures incorporated within QMS
  - » Active risk management now underway across enterprise
- Established current ground architecture baseline to enable ongoing analysis of improvements for enterprise ground system; successfully vetted by independent review

Underway:

- Refining requirements definition process -- using archive requirements and Polar Free Flyer transition as pathfinders -- to improve traceability to stakeholders, requirements prioritization and linkage to program implementation
- Updating current flight architecture baseline and understanding of requirements, including priorities, to enable FY14 analysis of alternatives studies

Recommendation #4
Cost-capped Enterprise Ground System

- Develop a cost-capped implementation plan for a NOAA Enterprise Ground System building on the recently completed study and analysis of alternatives

Response
Cost-capped Enterprise Ground System

- NOAA concurs with the recommendation
- NESDIS is progressing with plans to transition to enterprise ground services, currently utilizing a team of NOAA, NASA and contract personnel in the near term, and with a proposed reorganization which includes an Office of Satellite Ground Services in the long term. Efforts include:
  - Defining a service-based architecture which includes mission management; product ingest; product generation; product distribution; and archive
  - Phased transition to common ground services to support currently planned and future missions
  - In December 2013, Steven Peterson will join NESDIS Senior Executive team as the Director, Satellite Ground Services

Response
Cost-capped Enterprise Ground System

Satellite Ground Services: Near Term Efforts have included

- Baselining a Technical Reference Model across key information technology capabilities (e.g. storage, security, network) to ensure commonality and consistency across NESDIS satellite and data management programs
- Conducting network engineering analysis to determine feasibility of leveraging NOAA Network Common Services to support GOES-R and JPSS programs at reduced cost
  - Includes use of common network services and trusted internet connection transport services
  - GOES-R will execute phased implementation plan over FY13 and FY14
  - JPSS will execute with J-1 at backup facility for continuity of operations
- Conducting feasibility study and cost analysis to determine options to centralize Product Distribution (PD) to external customers
  - Reduces costs by decreasing infrastructure requirements, reducing interfaces and streamlining operations
  - GOES-R will execute as part of GOES-R launch schedule
- Developed Draft Common Ground Target Architecture Concept of Operations/Vision Document

Response
Cost-capped Enterprise Ground System

Satellite Ground Services: Currently underway

- Feasibility study and cost analysis for GOES-R and JPSS data compression
- Developing framework for common algorithm architecture and standardized product data formats
- Feasibility study and cost analysis of replacing disparate legacy PD systems with a centralized PD
- Defining and developing CG Level 0 and Level 1 requirements, the to-be NESDIS CG System architecture, a transition plan for migration to the target state, and an OSGS Common Service Catalog
- Developing Organizational Structure, Governance, and Business Model with detailed breakdown of functions to be performed by or coordinated with OSGS and Transition Plan

Recommendation #5
Integrated Master Schedule

- Develop an integrated master schedule addressing the entire satellite system architecture, including identification of the critical path(s)

Response
Integrated Master Schedule

- A top-level Integrated Master Schedule (IMS) has been developed across the entire NESDIS satellite and ground system architecture for development and operations management awareness, monitoring, and decision-making at the enterprise level
  - The top-level IMS is under configuration control and soon to be available on a monthly update cycle within the maturing NESDIS Quality Management System (QMS) such that the entire organization priorities are communicated and aligned
  - Updates and progress of the top-level IMS will be communicated to NESDIS Directors through the Monthly Status Reviews
- Program development is delegated to specific Program Management Offices, and notably specific satellite acquisition is performed through NASA, so individual program IMSs are used to track development and critical paths
  - For programs comprising multiple satellite missions, e.g. GOES-R and JPSS, the critical path is tracked within the program IMS
  - All other programs are uncoupled, so an enterprise-wide critical path across the satellite system architecture is not meaningful
- As NESDIS transitions to an enterprise ground architecture, an IMS is being developed to track resources and conflicts across the ground development and operations to ensure that program and operational milestones are met
  - The enterprise ground schedule is incorporating updates from the recent partial USG shutdown as programs evaluate impacts

Recommendation #6
Overarching Risk Management Plan

- Develop a tailored overarching risk-management plan consistent with alternative architectural decisions to ensure a sustainable future satellite program

Response
Overarching Risk Management Plan

- Enterprise risk management has been established across NEDSIS to ensure proper identification, mitigation, and tracking of risks and issues
- The Enterprise Risk Matrix is maintained by the NESDIS Chief Systems Engineer and incorporates top risks raised by the development and operations programs as well as risks identified by Systems Engineering that cross program boundaries
- Risks are updated and discussed monthly as part of the NESDIS Monthly Status Review with subsequent discussion with the NOAA Risk Officer as part of the monthly NOAA Program Management Council
- A formal Risk Management Plan providing NESDIS-wide guidance and procedural requirements is in formal review for inclusion in the NESDIS QMS

Recommendation #7
Gap Mitigation

- Create a plan and a process for developing innovative and contingency options to mitigate gaps and potential reductions in capability and capacity
- Establish a small, agile team to create the plan and process
- Capitalize on technology developments across all sectors, e.g., industry, academia, national labs and other agencies
- Consult other innovative organizations with space architecture experience; for example, DoD's Operationally Responsive Space (ORS) office provides one model for rapid response and lower capability alternatives, especially for observational reconstitution in the case of single instrument failures
- Balance Technology Readiness Levels (TRL) with the criticality of the measurements

Response
Gap Mitigation

- In October 2013, NOAA hired Riverside, Inc. to conduct an independent study and recommend ideas for NOAA to reduce the impact of a potential gap in afternoon polar-orbiting satellite data on NWS products and services
- Riverside completed its study in February 2014, identifying 12 high-merit ideas and 17 recommendations for NOAA actions
- NOAA accepted most of Riverside's ideas and recommendations and is now executing FY 2013 Sandy Supplemental / Disaster Relief Funds to mitigate impacts of a gap in critical data on the prediction of future natural disasters through:
  - Improved use of observations from satellite and non-satellite sources
  - NWP data assimilation and modeling science and infrastructure
  - Strengthening domestic and international partnerships
- In addition to this effort, NESDIS and the JPSS program continues work to minimize the likelihood of a gap in satellite coverage by maintaining the JPSS-1 schedule, accelerating the JPSS-2 schedule, and examining options for a possible satellite gap filler mission

Recommendation #8
Analysis of Alternatives

- **Given the ten year timeline required to develop new satellite systems conduct an analysis of alternatives, starting in FY2013, considering cost, performance, risk and resiliency, and assessing trade space vs. requirements for at least the following approaches:**
  - **Continue JPSS and GOES architecture,**
  - **Pursue new multi-sensor satellites,**
  - **Establish a hybrid of current polar and geostationary satellites,**
  - **Investigate a federated architecture with defined missions for individual partners, and**
  - **Develop a new distributed architecture.**

- *Note: Bold text in original. This was identified by the SATTF as the central recommendation.*

Response
Analysis of Alternatives

- Specific Analysis of Alternative (AoA) plans are being refined and formulated with all programs and the strengthened NESDIS Systems Architecture Team with oversight by the Deputy Assistant Administrator, Systems
- The AoAs have four key architectural objectives
  - Increase robustness
  - Reduce risk
  - Reduce cost
  - Reduce development schedules
- The AoAs include:
  - Improvements to the Polar architecture, which includes JPSS and beyond
  - Risk management of the current GOES-R architecture
  - Evaluation of other instruments, satellites, hybrid, acquisition, and partnership approaches
- Initial results of the AoAs are expected to inform decisions for the final FY15 budget decisions and FY16 budget formulation
  - Efforts will continue through-out FY14 to more fully evaluate the architectural options to then enable specific program formulation for implementation

Questions?

Many thanks the SAB and SATTF for their dedicated service and helpful advice