ESD MISSION ROAD MAP

The Way Forward

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Bryant Cramer
Deputy Director
Earth Science Division

What Is The Mission Road Map?

The Backbone of the Mission Road Map is a time-phased series of Mission Concepts responsive to the Decadal Survey:

- The Decadal Survey recommends 15 NASA Missions to be launched between 2010 and 2020
- Must also complete 7 Missions already in Development
- NASA will continue to use the Senior Review Process to maximize the scientific utility of another 14 missions currently on orbit

Three Documents Comprise the Road Map:

- Updated Science Plan
- Program Implementation Plan
- Set of Mission Concepts

Mission Concepts are defined with the Rapid Design Capabilities at GSFC and JPL with assistance from LaRC

Eight Mission Concepts are completed and the rest are in work

Mission Road Map will be completed by September 1, 2007

Road Map Drivers

Mission Concept Definition must proceed far enough to provide:

- Enough detail to get a confident Parametric Estimate of Cost
- Enough detail to get a reasonable Schedule
- Preliminary Assessment of TRLs and any need for a Focused Technology Development Program added to Formulation
- Preliminary Assessment of Overall Risk and any need for a Risk Reduction Phase prior to formally starting the Project

Remain responsive to the Decadal Survey

Address NPOESS De-manifested Climate Sensors:

- NASA/NOAA/OSTP Internal Studies
- NRC Second Study

Maximize the role of International Partnerships

- Keep the CEOS Constellations in mind

Blend present work with the rationale of the Decadal Survey such that the Road Map incorporates the completion of current missions

Getting Started

Establish the Budget to complete work already started:

- Fourteen Operating Missions
- Seven Missions in Development
- Supporting Research, Applied Science, Technology Development, & Outreach

All Mission Concept costs and schedules are entered into a database

A Schedule Tool is Developed to calculate the total ESD budget for any time-phasing of the Mission Concepts

- Enables rapid exploration of budget/schedule relationships that are deemed technically achievable and financially affordable
- More attractive options are carried into the review process to determine which option ultimately becomes the backbone of the Mission Road Map

Explore judicious use of uncosted carry-over to "prime the pump" on long-lead activities

Current Issues

How do we deal with Nunn-McCurdy?

How do we develop accurate Cost Estimates?

What is our Acquisition Strategy – what, and how, do we compete?

How do we incentivize the Field Centers to minimize overruns?

How do we change the way we manage projects to better accommodate interactions with our International and Interagency Partners?

How are we going to resolve our uncosted carry-over?

What is the best way to manage Technology Development?

How can we strengthen Risk Management?

Approach to Issue Resolution

Issues are initially addressed as white papers that are circulated to stakeholders for comment and discussion

White papers are updated to reflect the responses of stakeholders' representatives

Trade studies are quickly performed as required

This process is expected to take less than three months per white paper

A solution is identified by this iterative process

Once a solution is agreed upon, it is incorporated into the Program Implementation Plan

Nunn-McCurdy

Started at the Department of Defense:

- Congress must be notified when the estimated developmental cost exceeds the baselined cost by15%
- At 25% over the baselined cost, the Project goes on “hold” and must be “certified” at a new baseline cost – a process that takes about six months

For NASA, the thresholds are 15% and 30%:

- The Administrator must present the case to Congress

The NPOESS Certification was slow and painful:

- Scientifically insensitive result
- Little technical progress during the review period

We must make a determined effort not to break the 30% Nunn-McCurdy limit

This represents 30% above project reserves (typically about 25-30%)

The Administrator now requires us to keep reserves to cover 70% of all outcomes

Accurate Cost Estimates

The NASA Administrator requires SMD to hold reserves to cover 70% of all modeled financial outcomes for Flight Projects

This is near the historical “most likely” cost

This is based on the S-shaped curve resulting from a Monte Carlo Simulation of the Flight Project’s cost

The HQ Program Assessment and Evaluation Office (PA&E) evaluates all Flight Project budget estimates to determine if the 70% requirement has been met

Clearly we have to meet this requirement with our Mission Concepts

This issue is related to the Nunn-McCurdy Requirement

Whatever solution we development must accommodate BOTH requirements

Budget Normalization

Once a Mission Concept is defined, the initial budget and schedule are further developed:

An experienced budget analyst determines that all of the budget elements are included and that the budget guidelines have been followed

Schedule information is integrated into an abbreviated precedence network of 50-100 tasks

The planner works with the Mission Concept Definition Team to determine the earliest, most likely, and worst case durations for each task

A Monte Carlo Simulation is completed using an appropriate triangular distribution based on the risk characteristics of each Mission Concept

The Monte Carlo schedule results are converted to the corresponding budgets by assuming that all of the schedule variance is contained in Phase C/D

The Project Budget is defined as the 50^{th} percentile

Reserves are added to cover the 70^{th} percentile

Acquisition Strategy

The backbone of the Mission Road Map is a time-phased series of Mission Concepts responsive to the Decadal Survey

NASA prefers to compete wherever possible

If we are to remain responsive to the Decadal Survey, we cannot readily compete the mission but we can compete who will manage the mission

If we expect NASA Field Centers to go head-to-head over these missions, how well will they work together later?

Headquarters leads the study to explore various competitive arrangements and the pros and cons of each arrangement

Incentivizing Field Centers

Overruns in cost and schedule are all too common!

There are multiple causes for this situation:

- The shrinking aerospace industry no longer has the deep bench we enjoyed for many years
- Substantial Field Center involvement in the contractor's activities is now common
- We have become risk averse

If we believe that "failure is not an option" then this Road Map will be unaffordable

The white paper will explore various ways to incentivize the Field Centers to minimize overruns

Accommodating International Partners

International Partnerships are based on a "no exchange of funds"

Consequently, if one partner is late with a scheduled delivery, then the other partner(s) must pay "marching army" costs during the delay

Therefore, the first responsibility of a good partner becomes meeting the schedule

To do this we need to change the management emphasis:

Formulation:

- Plan for sufficient funded slack to anticipate partner problems based on the overall Risk Assessment

Implementation:

- Strategically place funded slack in front of critical milestones and deliveries
- Total funded slack should be 10-12 weeks per year during Phase C/D
- Develop the capability to provide timely "work-arounds" to keep the schedule
- Explore newer schedule management techniques such a "Critical Chain"
- Spend the reserves to keep the schedule

The white paper will develop these notions into specific changes that can be incorporated into the Program Implementation Plan

Uncosted Carry-Over

The Earth Science grants program that is larger than those of the other three divisions combined

The grants average about $300K/year and ESD typically maintains about 1500 active grants

Presently we lack a robust process to manage the costing of these grants and, hence, we have a large uncosted carry-over

The existence of a substantial uncosted carry-over is inhibiting efforts to get new funds, let alone starting new missions

Technology Development

Presently we have a cross-cutting Technology Development Program that spans SMD:

- ESD contributes about $75M annually
- Designed to address technologies that will be useful across Divisions
- Includes the Instrument Incubator Program

We also need a more specific effort focused on individual missions:

- These efforts would get started in Pre-Phase A and run in parallel with Phase A
- Progress tracked through TRL transitions
- Ends with a Technology Readiness Review associated with PDR

The white paper will explore the details of how mission specific technology development efforts might be conducted and how to balance them with the present cross-cutting technology program

Risk Management

Risk Management needs to be Continuous and Aggressive:

NASA routinely practices Continuous Risk Management

Objective is to enhance the process:

- Better definition of Risk Mitigation plans
- Early implementation of Mitigation plans
- Separate budget for Risk Management/Mitigation
- Identified Risk Manager within each Flight Project
- Formal training for the Risk Manager

White paper will explore possible approaches to more aggressive Risk Management and how it might be implemented

Final Products

The development of the Mission road Map consists of three Final Products:

Updated Science Plan including the top-level Mission Schedule and a brief description of each Mission:

Program Implementation Plan (PIP):

- Basic description of how the Mission Road Map will be implemented
- Management Principles of the Implementation
- Incorporates the results of the white papers
- Roles and Responsibilities of the Stakeholders
- Planned International Partnerships
- GEOS/CEOS involvement
- Associated budgets and schedules

Mission Concept Set:

- Mission Concept Definition data
- These will be likely be appendices to the PIP

Review/Coordination

Three Final Documents:

- Updated Science Plan
- Program Implementation Plan
- Mission Concepts

Earth Science Subcommittee will review these documents throughout their development focusing on science issues

The first four mission concepts will be individually reviewed by ad hoc technical peer review teams composed of scientists and engineers from the Earth Science community

A small team of retired program managers (Graybeards) will review the documents focusing on programmatic issues

The Aerospace Corporation will perform an independent cost estimate for each Mission Concept

The Program Assessment and Evaluation Office of NASA Headquarters will review the Program Implementation Plan including all of the Mission Concept budgets and schedules

A Plan for a Plan

Eight Mission Concept Definition Studies were completed in December 2006

The first group of Integrated Mission Studies was completed in January

The second group of Mission Concept Definition Studies started in February and will be completed in June

Budgets and schedules are developed once the Mission Concept Studies are completed

Updated Science Plan available in May

NRC NPOESS Climate Sensor Study results available in July

First draft of the Program Implementation Plan available in August

ESS and Graybeards review these documents as they become available

All three documents available for final review by September 1, 2007

Detailed schedule of this process developed through the Field Centers by the end of March