

The "Senior Review" Process

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Background

As a matter of policy, NASA's Office of Space Science determines the objectives for and actual implementation of its programs on the basis of advice from the science community. Missions are selected either via the "strategic planning" process, which is based on direct science community advice plus independent outside advice from the National Academy of Sciences/National Research Council, or via "mission lines" (e.g. the Explorer, Discovery, New Millennium, or "Living with a Star" programs), where individual missions are selected exclusively via open solicitations and peer review. Research and Analysis investigations (often called "R&A grants") are also selected via open solicitations and peer review.

Space science missions are typically approved for development, launch, and a specific science observation and data analysis period. The "prime phase" observing period depends on the type of mission: recent Explorer or Discovery missions had prime phases of about 2 years, plus a 1-year data analysis period, while major observatories or strategic missions like Cassini or HST have prime phases of 5, 10, even 15 years. However, once that defined goal has been accomplished, and if – as happens for most missions – most of the observing capability is still available, then it is logical that both the mission's science team and the larger science community will advocate an extension for the missions. On the other hand, mission extensions require substantial funds, and these requests compete with the needs for research programs, mission development, and other mission operations needs.

The purpose of this *white paper* is to describe the process for maximizing the scientific return from MO&DA programs within constrained resources. The acronym "MO&DA" encompasses operating missions, data analysis from current and past missions, and supporting science and data archive centers.

Structure of Senior Reviews

At the present time, more than 30 missions are returning science data for four space science themes: Sun-Earth Connection (SEC), Solar System Exploration (SSE), Astronomical Search for Origins (ASO), and Structure and Evolution of the Universe (SEU). Roughly one-half of them have completed the "prime phase" of the science observations for which they were built, and usually request extensions and/or funding increases.

Ideally, a review of requests for MO&DA mission extensions for space science missions should be conducted via a unified process across all space science disciplines. While that is the goal, in practice the space science disciplines – both their constituencies and their processes - have very different histories and patterns. In Planetary sciences, the first assessment of 4 mission MO&DA programs was held in 2001. In Sun-Earth Connection, MO&DA Senior Reviews with full decision-making authority (see below) were held in 1997 and 2001. Astrophysics (including SEU and ASO) has held 6 MO&DA Senior Review between 1998 and 2000; the next review is planned for mid-2002. It is clear that unification of decision-making processes across all space science disciplines will take more effort and time.

The Senior Review, held every two years by an ad hoc panel, complements the standing working groups and other peer reviews by conducting an independent, comparative evaluation of mission research programs. The Senior Review evaluates proposals for continued funding for many missions and programs. **It is the highest level of peer review within the Space Science program.**

Senior Review Panelists

As a matter of principle, panelists for Senior Reviews are selected to be active scientists who have used at least two of the missions or data centers under review. Ideally their interests and expertise should span two or more science

areas and/or wavelength bands. They are expected to serve as experts, rather than as representatives of or advocates for a specific science area or mission or type of investigation.

Each panel is selected on an *ad hoc* basis, with the exception of the chairperson of each review, who is expected to attend the immediately following review for the same panel, in order to provide continuity and to check on implementation of recommendations from the preceding review.

Purpose of each Senior Review:

The purpose of each comparative review is to assist NASA in maximizing the scientific productivity of the Astrophysics (or other discipline) MO&DA Program. Recommendations from the Senior Review will be used by NASA to

- define an implementation strategy;
- give programmatic direction to the missions and programs concerned for the next two years;
- and issue preliminary, tentative guidelines for the following two years (to be reviewed in the next Senior Review, typically in 2 years).

Charter for this Senior Review:

In the following descriptions, "program" may denote a full mission or MO&DA project in the traditional sense, or U.S. participation on a mission led by an international partner, or a multi-mission science data archive. NASA charters the Senior Review panel to:

- (1) In the context of the science goals and objectives described in the Space Science Enterprise Strategic Plan, rank the scientific merits (for science archives, rank the science usefulness) - on a "science per dollar" basis - of the expected returns from the programs reviewed during the following 2 fiscal years
 - (2) Assess the cost efficiency, technology development and dissemination, and education/outreach as secondary evaluation criteria, after science merit.
 - (3) Based on (1) and (2), recommend an implementation strategy for Astrophysics MO&DA for the coming 2 years, and include a mix of
 - continuation of programs "as currently baselined";
 - continuation of programs with either enhancements or reductions to the current baseline;
 - mission extensions beyond the prime mission phase, subject to the "Mission Extension Paradigm" described below; or
 - program terminations.
- (4), (5) and (6): Make preliminary assessments equivalent to (1), (2), and (3) for the subsequent 2 years.

Mission Extension Paradigm:

We assume that the conditions for mission extensions, issued in January 1994, will apply as well in the future. According to these instructions, budgets for mission extensions beyond the prime mission lifetime will support:

- bare-bones mission operation and science operations: Compared to the prime mission phase, a significantly higher risk and lower data collection efficiency will be accepted during any mission extension, and this portion of the MO&DA budget for the extended phase shall have a funding level of roughly one-half of the equivalent portion during the prime mission phase;
- bare-bones data handling, including low-level processing and basic archiving: Compared to the prime mission phase, fewer services will be offered to Guest Observers and Guest Investigators who are assumed to have become more knowledgeable during the mission's prime phase, and this portion of the MO&DA budget for the

extended phase shall also have a funding level of roughly one-half of the equivalent portion during the prime mission phase;

- minimal science data analysis to maintain understanding of the instrument performance, to monitor progress toward accomplishing the objectives of science observations, and to involve the science community in formulating the mission observing program to make the best scientific use of NASA's Astrophysics missions; however, no funds will be available in this "minimal-science analysis mode" for detailed analysis, data fitting, modelling, and interpretation; and
- for science data archive centers: basic, bare-bones operation, including data ingest and validation, distribution of science data and software products, and other value-added services.

If any of these conditions for mission extension should change in the future, then we will, of course, adjust plans accordingly.

Below: Instructions for SR00

NASA will host the next "Senior Review" - a comparative science review of ASO and SEU MO&DA programs - during the summer of 2000. This will be the eighth review of its type for the Office of Space Science. This letter describes the objectives and process for the review, and contains instructions for the submission of proposals and in-person presentations to the review panel.

Relevance to the Space Science Enterprise Strategic Plan:

The Space Science Enterprise Strategic Plan, published in November 1997, represents the results of extensive discussions by the space science community, crystallized into fundamental questions, goals, and science objectives. The goals and objectives contained in this plan will be used as science context for the Senior Review 2000. At the time of this writing, another Strategic Planning process is under way, and partial or full drafts may or may not become available by July 2000. If Strategic Plan documents become available, we will issue announcements to all programs involved.

Review Structure:

To maximize the scientific return from its missions, NASA routinely seeks the advice and counsel of the scientific community. Working groups and user groups deal with NASA's Space Science program by focusing on discipline- or theme-wide, sub-discipline, or mission-specific issues. All proposals for use of missions or data are thoroughly peer-reviewed.

Review Process:

Previous Senior Reviews, as well as standing advisory groups, have recommended that comparative reviews of MO&DA programs occur every two years, and should include all Astrophysics missions, as well as all related projects assisting in the operations and data analysis functions. We had intended to follow this advice; however, Congressional directions make it very clear that we would not be able to move funds among the Hubble Space Telescope (HST), the Chandra X-ray Observatory (CXO), the Space Infrared Telescope Facility (SIRTF) and the cluster of all other Astrophysics MO&DA projects. This Senior Review will therefore assess the science merits of nine astrophysics missions or MO&DA projects (in alphabetical order): 2MASS, CGRO, EUVE, FUSE, HETE II, RXTE, SWAS, VSOP, and XMM (U.S. participation), and the science usefulness of five multi-mission data archive centers: HEASARC, IRSA, NED, Optical/UV SARC, and the astrophysics-related services of NSSDC.

Funding Environment:

At the time of this writing, the FY01-04 budget plans for the nine MO&DA projects and five data archive centers remains unchanged, pending Congressional approval or changes. However, the outlook for additional, unencumbered funds - which would be available for program enhancements or extensions - is still quite unclear. Based on today's knowledge, it appears that very little additional funding, if any, will be available for FY01 and FY02, while approximately \$10M will be available for FY03 and FY04. This profile will benefit missions which seek extensions or additions in the latter two years, but will not benefit those seeking augmentations in the first half of the period under consideration. We hope to be able to clarify the size or size range for these additional, unencumbered funds as a function of fiscal year before the proposal due date.

TABLE 1: Budget Plan for SR00; FY00 values are included as reference

| Fiscal Year | FY00 | FY01 | FY02 | FY03 | FY04 |
|--|------|------|------|------|------|
| Plan for nine Projects + five Archives | | | | | |
| Unencumbered funds | -- | | TBD | TBD | TBD |

Schedule for the Senior Review 2000

The schedule for this review is a compromise between the need for clarification of our funding environment (which will evolve later in 2000) and the need for decisions for the FY01 budget to be announced prior to the start of FY01.

| | |
|--|---------------------|
| Draft Call for Proposals (this message) | Feb. 7, 2000 |
| Call for Proposals issued: | March 1, 2000 |
| Proposals due: | May 1, 2000 |
| Senior Review: | June/July TBD, 2000 |
| Publication of recommendations and instructions to projects: | August 2000 |

Further Information Required for the Senior Review Deliberations:

In order to assist the Senior Review panel members in assessing the usefulness of the five multi-mission science data archives, we will ask selected outside scientists to provide their independent assessments of the content and usefulness of the data archives. They will access the data holdings of each data archive, use the tools provided, and will rate these services as well as the interoperability between data archives which was requested of all archives since early 1999.

After submission of proposals, members of the Senior Review panel may have further questions or requests for clarification. If that is the case, then identical requests for further information will be sent to all missions/projects prior to the in-person panel review.

Instructions to Proposers:

The written proposal shall contain a science section and a technical/budget section. Proposers are requested to provide fifteen copies of their proposals, printed double-sided on not more than 15 sheets of 8.5 inch x 11 inch paper, with character size not less than 10 points. Approximately one-half of the 15 sheets should be devoted to the science section, the rest to the technical/budget section including any auxiliary information. The panel reviewers will receive only the first 15 sheets of any proposal, and will be asked to base their recommendations on that material. If your institution requires signatures, please place them onto one separate submittal letter; copies of this

submittal letter are not needed and will not be used in the peer review. The Project Name and names of key writers or presenters at the top of the first page will suffice for review purposes.

Instructions for the Science Proposal:

In the science section of a proposal, please describe the science merits of your full program, and - where applicable - the specific contributions of the various instruments within your mission. Include the science insights obtained so far (where appropriate), the science "promise", why it has been important so far, and why this project is needed for the long-term health of the field. The science proposal should list the original science objectives for the mission and (where appropriate) a summary of what has been accomplished so far. The scientific merit of the program is the chief criterion used to determine ranking. Consistent with the relationship to the Space Science Enterprise Strategic Plan described above, past science achievements and proposed science investigations should be linked to those space science goals and objectives which relate to Astrophysics topics.

Instructions for the Technical/Budget Proposal:

NASA intends to transition towards full-cost accounting, including accounting for civil servant salaries. However, at the present time the guidelines for this transition are still being developed and not finalized. Therefore, this year's review will be conducted under the traditional NASA budget principles.

Attachment A contains instructions and the mandatory form for the staffing/budget portion of each proposal. This form will serve as a standard budget summary for all proposals; it is assumed that each proposal will contain further details in a format as determined by each project. For the period under consideration in this Senior Review, FY01 – FY04, two scenarios should be summarized in the mandatory form, and described in the technical/budget proposal: an "In-Guidelines" or Minimal/Bare-Bones Scenario, and a Requested/Optimal Scenario:

- For the "In-Guideline" or Minimal/Bare-Bones Scenario: If the current budget guideline for your project (part of the current NASA operating plan) for any of the fiscal years is larger than zero, then describe a plan which meets that guideline. If the current budget guideline for your project for any of the fiscal years is zero, and you propose operation during that year, then describe a bare-bones scenario at an acceptable risk level. This scenario should indicate to the peer reviewers and to NASA the minimum viable funding level; if less than that level were available, then the project could not continue and should be terminated.
- For the Requested/Optimal Scenario you may describe a staffing/funding level which leads to a higher science return from the project, but still recognizes the very tight fiscal constraints which we will be facing. In other words, the "optimal" scenario should be a carefully considered request, not a "maximal" request. The technical/science description of this scenario should address the added scope and expected benefits compared to the in-guide/minimal scenario. In the case of data archive centers, the Requested/Optimal Scenario could include proposals for the development of new capabilities, new technology enhancements, or collaborative enhancements across programs, centers or disciplines like the National Virtual Observatory concept.

Proposal Submission:

Fifteen sets of copies of the proposal must be received by 5:00 pm EDT on the due dated listed above at :

Senior Review Program Office
Jorge Scientific Corporation
400 Virginia Ave., SW. Suite 700
Washington DC 20024
Tel: 202-554-2775

Panel Review Process:

The Senior Review panel will meet for three days:

Day 1:

Morning: Charter; discussion of conflicts of interest and procedures to minimize their impacts; logistics (writing assignments, etc.), background, comparisons.

Rest of day: Project presentations plus questions and answers (time assignments TBD)

Day 2:

Morning: complete Project Presentations;

Rest of day: Senior Review Panel begins Charter Tasks (1) through (6)

Day 3:

Senior Review Panel completes Charter Tasks (1) through (6)

Presentations to the Review Panel:

During each project presentation to the panel, the project representatives (see next paragraph) should plan on using one-half of the allocated time for their prepared presentation, and reserving one-half for questions and answers:

- Since the reviewers will have read all proposals, the prepared presentation should not try to repeat the content of the written proposal, but instead highlight the most important science topics. You will be asked to describe the top scientific achievements obtained or enabled so far, plus the most promising future observing programs, their objectives, anticipated results, and the significance of those anticipated results;
- The second half of the scheduled time for each project should be reserved for questions from the review panel.

To minimize the burden on projects, no more than a total of three persons may represent any one of the projects. The Program Scientists should work with their respective Project Scientists to determine the best participation of Project, science center (where appropriate) and user community (where appropriate), in both the written proposal and oral presentation to the Senior Review Panel.

Attachments:

A - Mandatory Format for Staffing/Budget Page

B - Explanation of the four budget break-down categories used in Attachment A



ATTACHMENT A: Required Format for Staffing/Budget Page

Please use the following format to show, for each project:

I. FY00 Actual MO&DA Plan (where applicable)

II. FY01 - FY04 "In-Guidelines" or Minimal/Bare-Bones Scenario:

Describe how your project breaks down by staff and cost, MEETING CURRENT GUIDELINES FOR FY01 through FY04.

(a) If the current budget guideline for your project (part of the current NASA operating plan) for any of the fiscal years is larger than zero, state "In-guide" in the third row of the table.

(b) If the current budget guideline for your project (part of the current NASA operating plan) for any of the fiscal years is zero, and you propose operation during that year, then state "minimal" in the third row of the table, and list a bare-bones scenario below.

III. FY01 - FY04 Requested/Optimal Scenario

If you request funding different from the guideline or minimal scenario, show breakdown by staff and cost for your request.

**** FORMS – Use Courier 9 pt ****

Project Name: _____

I. FY00 Actual Staffing and Budget Level

| Function | FY00 Actual | |
|-----------------------------|-------------|--------------|
| | Staff (FTE) | Budget (\$k) |
| 1. Development | | |
| 2. Mission Operations | | |
| 3. Science Center Functions | | |
| 4. Science Data Analysis | | |
| TOTAL | | |

II. "In-Guidelines" or Minimal/Bare-Bones Scenario

| In-Guide/Minimal | FY01 | FY02 | FY03 | FY04 |
|------------------|-------------|-------------|-------------|-------------|
| Function | # Budget | # Budget | # Budget | # Budget |
| | (FTE) (\$k) | (FTE) (\$k) | (FTE) (\$k) | (FTE) (\$k) |

In-Guide or Minimal?

| | | | | | |
|-----------------------|--|--|--|--|--|
| 1. Development | | | | | |
| 2. Mission Ops | | | | | |
| 3. Science Ctr Fncts | | | | | |
| 4. Science Data Anal. | | | | | |
| TOTAL | | | | | |

III. Requested/Optimal Scenario

| Request | FY01 | FY02 | FY03 | FY04 |
|----------|-------------|-------------|-------------|-------------|
| Function | # Budget | # Budget | # Budget | # Budget |
| | (FTE) (\$k) | (FTE) (\$k) | (FTE) (\$k) | (FTE) (\$k) |

| | | | | |
|-----------------------|--|--|--|--|
| 1. Development | | | | |
| 2. Mission Ops | | | | |
| 3. Science Ctr Fncts | | | | |
| 4. Science Data Anal. | | | | |
| TOTAL | | | | |

Attachment B

Definitions of Four-Way Breakdown for Space Science MO&DA Programs:

NOTE: This Four-Way Breakdown is identical to that specified for the Spring 1998 Program Operating Plan (POP) guidelines to all NASA MO&DA programs at all NASA Centers.

1. Development

- Instrument Development for future instrument replacements
- Astronaut training for servicing missions
- Development of MO&DA elements for "Great Observatory" class missions prior to launch
- Development of multi-user ground segments for planetary missions
- Development of post-lanauach flight software and ground systems.
- For science data archive centers: development of new capabilities, software tools, technology enhancements, improved services, etc.

2. Mission Operations: "Control Center" functions including:

- Prepass and postpass tracking operations
- Spacecraft commanding and telemetry operations, including radiometric data
- Health and performance monitoring of the spacecraft, instruments, and ground system
- Spacecraft trajectory or orbit, and attitude planning and determination
- Mission analysis and planning tool development
- Scheduling of shared facilities - voice and data links
- Project management and accounting functions (include education and public outreach, if executed by Project staff)

3. Sequence Generation, Science Planning & Data Processing: "Science Center" functions including:

- Science events planning, integration, and optimization
- Science and engineering activity integration
- Resource constraints analysis (spacecraft power, data storage, telemetry rates, TDRSS, DSN, etc.)
- Activity request conflicts resolution
- Instrument and observation performance analysis
- Mission science center; services for guest observers/guest investigators
- Science teams products for science data processing
- Generation of quick-look and common pool data sets
- Standard data processing
- Mission data archiving (performed by mission science center)
- Multi-mission data archive centers

4. Science Data Analysis: Science functions

- Customized Data Processing
- Science data calibration/physical unit conversion
- Data products distribution to co-investigators for analysis
- Analysis activities
- Writing and editing documentation
- Presentation and publication of scientific results
- Data archiving (performed by PI teams)
- Education and public outreach (if executed by science teams or outside scientists)