National Aeronautics and Space Administration

NASA

EXPLORE SCIENCE

2022 Astrophysics Senior Review

Astrophysics Advisory Committee | June ,2022

Eric Smith
Chief Scientist

Rachele Cocks
Program Executive

The Senior Review in Context

What is the Senior Review?

NASA conducts periodic reviews of its operating science missions in order to assess their continued science productivity and whether their operations should be continued through approval of a mission extension.

> The NASA Authorization Act of 2005 (P.L. 109-155) states that "The Administrator shall carry out biennial reviews within each of the Science divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that have exceeded their planned mission life time." The NASA Transition Authorization Act of 2017 (P.L. 115-10) modified the cadence to be triennial reviews.

These reviews of operating missions are NASA's highest form of peer review, as the subject is not a single science investigation, or even a single space mission, but rather a portfolio of operating missions.

> The reviews of operating missions are referred to as Senior Reviews, in recognition of the high level of the peer review.

Senior Review Actions

NASA will use the findings from the Senior Review to:

- Prioritize the operating missions and projects;
- Define an implementation approach to achieve astrophysics strategic objectives;
- Provide programmatic direction to the missions and projects concerned for FY23, FY24 and FY25; and
- Issue initial funding guidelines for FY26 and FY27 (to be revisited in the 2025 Senior Review).

NASA actions resulting from the Senior Review could include:

- Authorizing a mission to pass from its prime phase to extended phase.
- Maintaining the status quo.
- Significantly restructuring a project.
- Deciding to terminate an ongoing science mission.

Missions in the Senior Review

- Chandra X-ray Observatory (Chandra)
- Fermi Gamma-ray Space Telescope (Fermi)
- Hubble Space Telescope (Hubble)
- Neutron Star Interior Composition Explorer (NICER)
- New Horizons
- Nuclear Spectroscopic Telescope Array (NuSTAR)
- Neil Gehrels Swift Observatory (Swift)
- Transiting Exoplanet Survey Satellite (TESS)

New Horizons

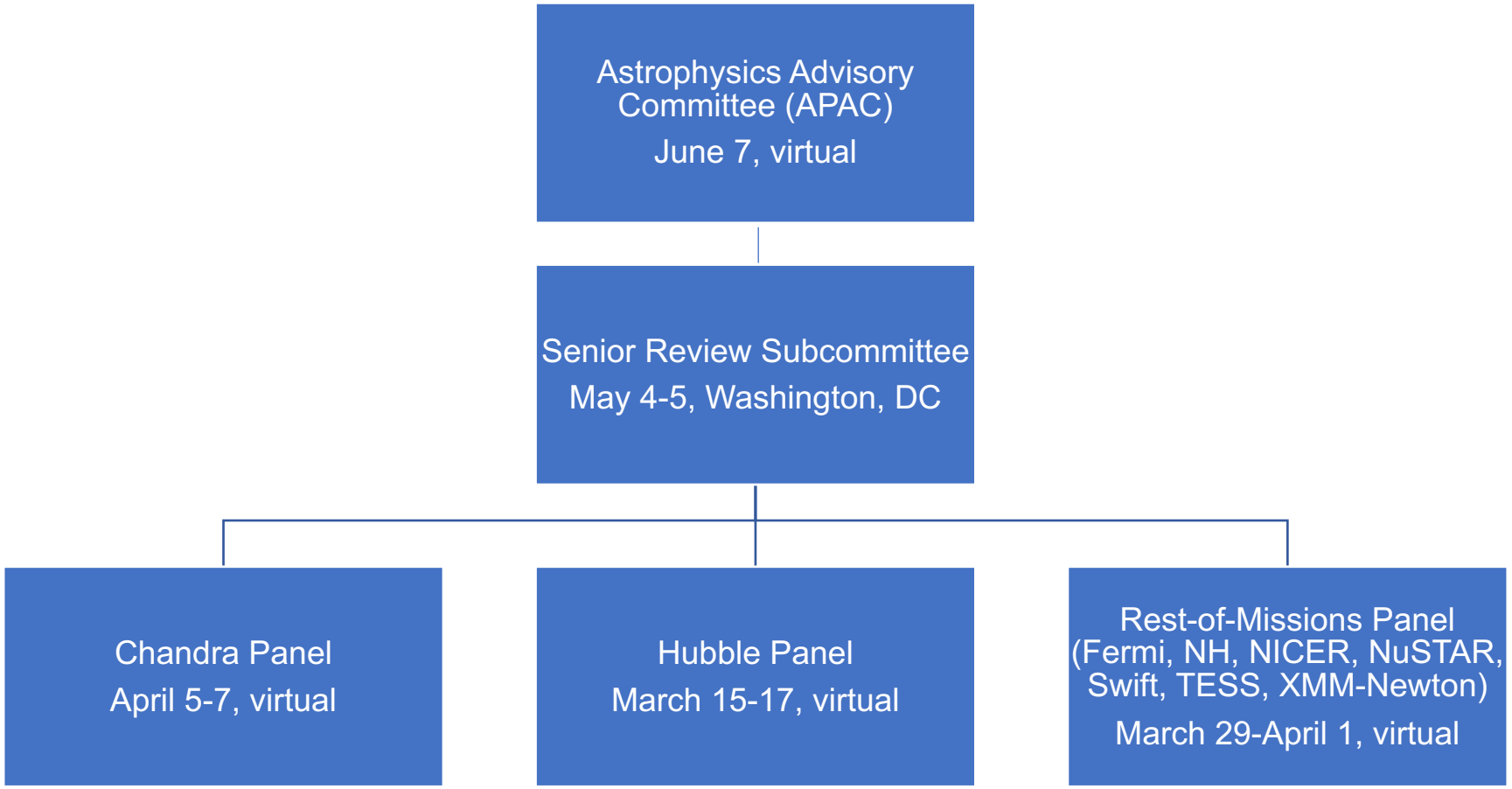
The New Horizons (NH) mission is funded through the Planetary Science Division (PSD) in NASA's Science Mission Directorate. We ask that the panel review the proposed AUGMENTATION of the NH budget for astrophysics science. Cost effectiveness for NH measures the proposed astrophysics additions in their extended mission vs. their AUGMENTION costs only. If the NH mission passes the PSD Senior Review this year, and the RoM panel rates the NH astrophysics highly enough, the Astrophysics Division would consider funding those activities. The remainder of the operating costs for NH are borne by PSD.

Schedule for the Senior Review

Senior Review Activities	Date
Final Call for Proposals issued	September 30, 2021
Proposals due	February 11, 2022
Hubble panel meeting (virtual)	March 15, 16, 17, 2022
Rest-of-Missions panel (virtual)	March 29-April 1, 2022
Chandra panel meeting (virtual)	April 5, 6, 7, 2022
Panel reports delivered to Senior Review Subcommittee	April 15, 2022
Senior Review Subcommittee meeting in Washington, D.C.	May 4-5, 2022
Senior Review Subcommittee report delivered to APAC	June 1, 2022
Special APAC meeting	June 7, 2022
NASA Response/Direction to projects	June-July 2022

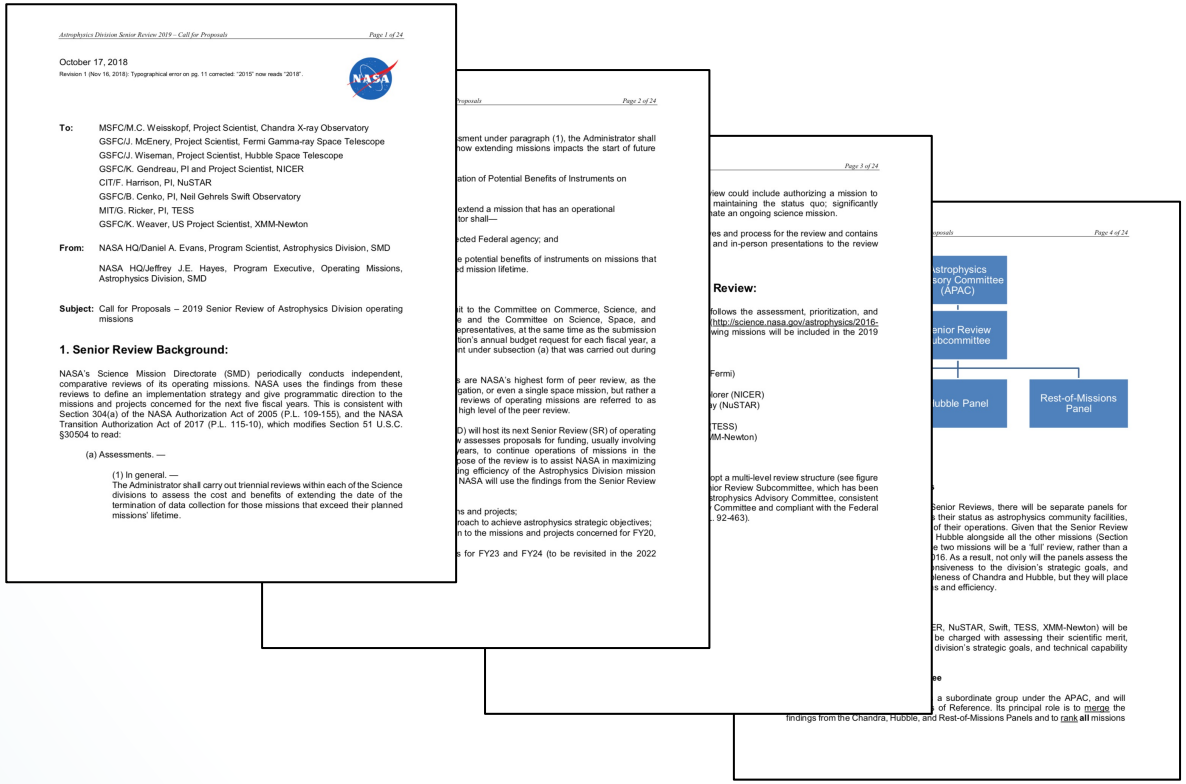
Execution of the 2022 Senior Review

Review Composition and Structure



Proposal Preparation Instructions

Please Refer to the Call for Proposals and Associated Documents



Astrophysics Division Senior Review 2019 – Call for Proposals *Page 1 of 24*

October 17, 2018

Revision 1 (Nov 16, 2018): Typographical error on pg. 11 corrected: "2015" now reads "2016".

To: MSFC/M.C. Weisskopf, Project Scientist, Chandra X-ray Observatory
GSFC/J. McEnery, Project Scientist, Fermi Gamma-ray Space Telescope
GSFC/J. Wiseman, Project Scientist, Hubble Space Telescope
GSFC/K. Gendreau, PI and Project Scientist, NICER
CIT/F. Harrison, PI, NuSTAR
GSFC/B. Cenko, PI, Neil Gehrels Swift Observatory
MIT/G. Ricker, PI, TESS
GSFC/K. Weaver, US Project Scientist, XMM-Newton

From: NASA HQ/Daniel A. Evans, Program Scientist, Astrophysics Division, SMD
NASA HQ/Jeffrey J.E. Hayes, Program Executive, Operating Missions, Astrophysics Division, SMD

Subject: Call for Proposals – 2019 Senior Review of Astrophysics Division operating missions

1. Senior Review Background:

NASA's Science Mission Directorate (SMD) periodically conducts independent, comparative reviews of its operating missions. NASA uses the findings from these reviews to define an implementation strategy and give programmatic direction to the missions and projects concerned for the next five fiscal years. This is consistent with Section 304(a) of the NASA Authorization Act of 2005 (P.L. 109-155), and the NASA Transition Authorization Act of 2017 (P.L. 115-10), which modifies Section 51 U.S.C. §30504 to read:

(a) Assessments. —

(1) In general. —
The Administrator shall carry out triennial reviews within each of the Science divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that exceed their planned missions' lifetime.

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Rest-of-Missions Panel

https://science.nasa.gov/astrophysics/2022-senior-review-operating-missions

Prioritized Mission Objectives

- For this review, projects are required to submit plans that have a set of Prioritized Mission Objectives (PMOs) for FY23-FY25, with a possible extension to FY26-FY27.
- These PMOs should elucidate the scientific, technical, and/or budgetary priorities for the upcoming three to five-year planning cycle.
- For missions that are primarily driven by GO/GI-type investigations, the PMOs should primarily focus on stewardship and efficiency. Even for these GO/GI-driven missions, however, a project may opt to state as a PMO the expected science return of one or more current or future ‘key projects,’ and/or the expected science return from other discretionary allocations of observing time.

Required Proposal Elements (CfP Section 6)

The proposal should address the following areas specifically and in conjunction with the PMOs identified for the next 3-5 year planning cycle:

1. Scientific Merit
2. Promise of future impact and productivity
3. Progress made toward achieving 2019 PMOs
4. Impact of past scientific results
5. Project's plans to increase the diversity of thought
6. Broad accessibility, usability, and utility of the data
7. Set of PMOs for FY23-FY27
8. Level and quality of observatory stewardship
9. Spacecraft and instrument health and safety

Budget Request Instructions (CfP Section 6)

The proposal should address the following areas specifically and in conjunction with the PMOs identified for the next 3-5 year planning cycle:

In guide (required)	• Budget consistent with NASA-defined levels.
Under-guide (required)	• Budget that would allow for continued operations at a level below in-guide budget. • By identifying such a minimum acceptable funding level, the project is indicating that any further reduction is untenable. • The difference in return (science, technical, spacecraft health and safety, etc.) compared to the in-guideline plan should also be clearly identified. • If a project assesses the in-guide budget to already be the minimum level for continued operations, then this must be explicitly stated in the proposal.
Over-guide (optional)	• Submitted if the proposed in-guide budget poses a significant (self-assessed) risk to the continued operations. • Submitted in cognizance of the tight NASA budget. • The added return from the over-guide versus the in-guideline plan should be clearly identified. • Rest-of-Missions Panel can evaluate none, some, or all of the added return and estimate the budget required for partially funding any proposed increases.

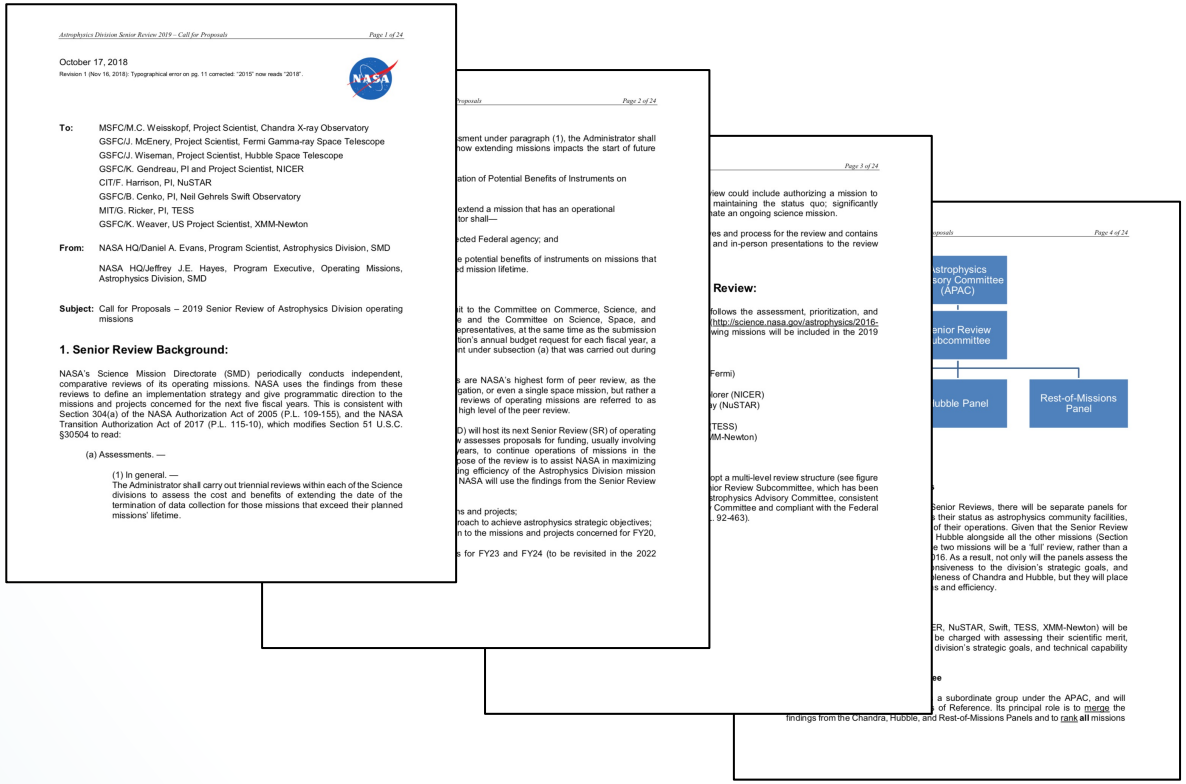
Additional Instructions for Hubble and Chandra

1. An additional section, entitled “Project’s Perspective on Operations and Efficiency” must be included. This section shall include:
   a. An assessment of the current efficiency of science and mission operations, to include metrics where appropriate.
   b. A discussion of any plans to further improve the efficiency of science and mission operations over the next three to five years.
   c. A discussion of how funds are presently used, to include FTE counts in each key functional area.
   d. A description and justification of the management and decision processes that the project uses to apply the funding it receives to maximize science quality, observational efficiency, and return on investment.

2. The scientific and the technical/management/budget sections combined should not exceed 40 pages (including figures, figure captions, tables, and other graphics). Not included in the page limit are the appendices.

Charge to the Review Panels

Please Refer to the Call for Proposals and Associated Documents



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Astrophysics Advisory Committee (APAC)

Senior Review Subcommittee

Hubble Panel

Rest-of-Missions Panel

https://science.nasa.gov/astrophysics/2022-senior-review-operating-missions

RoM Review Criteria (CfP Section 8)

Criterion A: Scientific Merit (50% weighting)

Factor A-1:	Overall scientific strength and impact of the mission.
Factor A-2:	Expected scientific output and science productivity given the costs over the requested funding period.
Factor A-3:	Quality of data collection, archiving, distribution, and usability.

RoM Review Criteria (CfP Section 8)

Criterion B: Relevance and Responsiveness (25% weighting)

Factor B-1:	Relevance to research objectives and focus areas described in the SMD Science Plan and the 2020 Astrophysics Decadal Survey.
Factor B-2:	Relevance to NASA's core value of Inclusion and alignment to SMD Science Plan Strategy 4.1. Specifically, the quality of plans and likelihood of success for nurturing the diversity of thought and background represented, a diverse community and an inclusive environment.
Factor B-3:	Progress made toward achieving PMOs in the 2019 Senior Review proposal (for missions included in the 2019 SR). Performance of addressing any findings in the 2019 Senior Review (for missions included in the 2019 SR).

RoM Review Criteria (CfP Section 8)

Criterion C: Technical Capability and Cost Reasonableness (25% weighting)

Factor C-1:	Overall operating cost and cost efficiency of the mission's operating model for proposed scientific goals.
Factor C-2:	Health of the spacecraft and instruments, and suitability of the mission's operating model (e.g., governance, science team, instrument team, inclusion, diversity of thought and backgrounds represented) to maximize its scientific return.

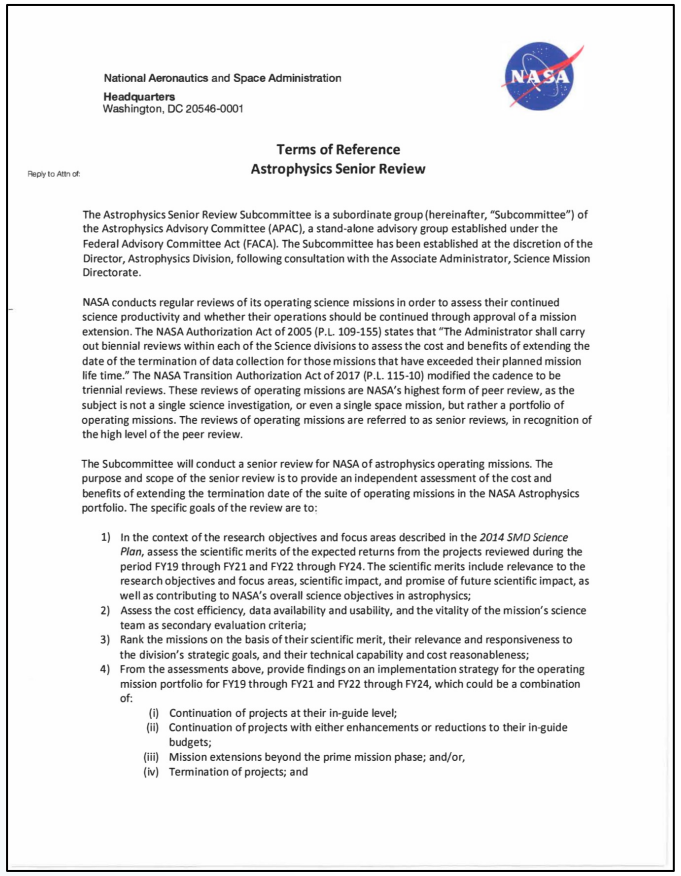
Additional Requested Findings (CfP Section 8)

The Chandra and Hubble panels are additionally requested to **specifically** provide findings that address the following areas:

1. *The science productivity and cost effectiveness of the observatory, and its associated operations center and infrastructure in enabling new science, archival research, and theoretical studies.*
2. *The efficiency of the science and mission operations processes and identify any obvious technical obstacles to achieving the observatory's science objectives in the next five years.*
3. *The overall quality of observatory stewardship, and the usage of the allocated funds, in light of overall limited financial resources, to maximize science quality, observational efficiency, and return on investment.*
4. *Notable aspects that would enhance the science return of the mission within its available resources.*
5. *If the HRC is never recovered, is Chandra still worth operating?* [Chandra panel only]

Senior Review Subcommittee

Please Refer to the Terms of Reference



National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001

Reply to Attn of:

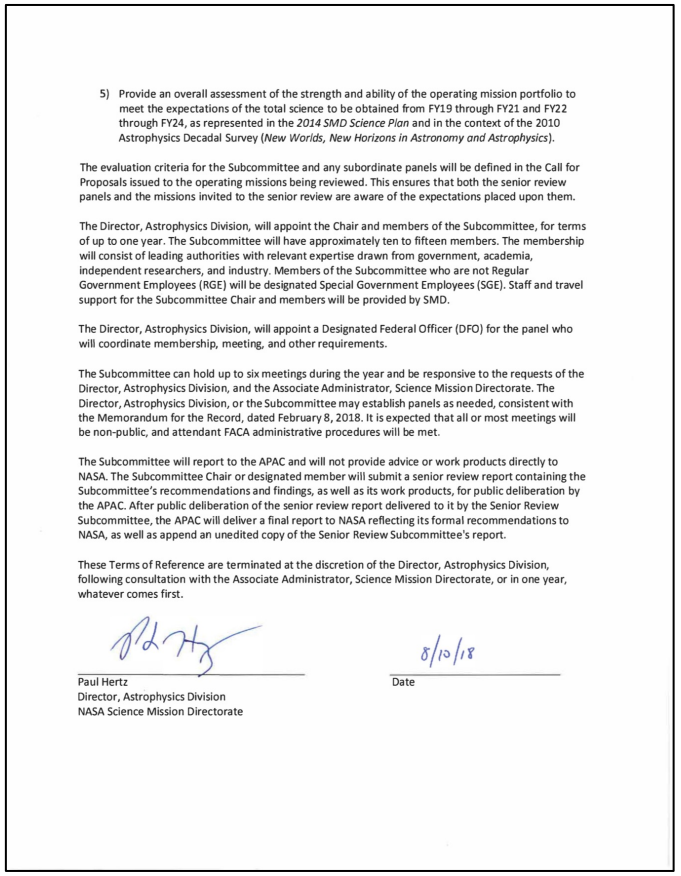
Terms of Reference
Astrophysics Senior Review

The Astrophysics Senior Review Subcommittee is a subordinate group (hereinafter, "Subcommittee") of the Astrophysics Advisory Committee (APAC), a stand-alone advisory group established under the Federal Advisory Committee Act (FACA). The Subcommittee has been established at the discretion of the Director, Astrophysics Division, following consultation with the Associate Administrator, Science Mission Directorate.

NASA conducts regular reviews of its operating science missions in order to assess their continued science productivity and whether their operations should be continued through approval of a mission extension. The NASA Authorization Act of 2005 (P.L. 109-155) states that "The Administrator shall carry out biennial reviews within each of the Science divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that have exceeded their planned mission life time." The NASA Transition Authorization Act of 2017 (P.L. 115-10) modified the cadence to be triennial reviews. These reviews of operating missions are NASA's highest form of peer review, as the subject is not a single science investigation, or even a single space mission, but rather a portfolio of operating missions. The reviews of operating missions are referred to as senior reviews, in recognition of the high level of the peer review.

The Subcommittee will conduct a senior review for NASA of astrophysics operating missions. The purpose and scope of the senior review is to provide an independent assessment of the cost and benefits of extending the termination date of the suite of operating missions in the NASA Astrophysics portfolio. The specific goals of the review are to:

1) In the context of the research objectives and focus areas described in the *2014 SMD Science Plan*, assess the scientific merits of the expected returns from the projects reviewed during the period FY19 through FY21 and FY22 through FY24. The scientific merits include relevance to the research objectives and focus areas, scientific impact, and promise of future scientific impact, as well as contributing to NASA's overall science objectives in astrophysics;
2) Assess the cost efficiency, data availability and usability, and the vitality of the mission's science team as secondary evaluation criteria;
3) Rank the missions on the basis of their scientific merit, their relevance and responsiveness to the division's strategic goals, and their technical capability and cost reasonableness;
4) From the assessments above, provide findings on an implementation strategy for the operating mission portfolio for FY19 through FY21 and FY22 through FY24, which could be a combination of:
   (i) Continuation of projects at their in-guide level;
   (ii) Continuation of projects with either enhancements or reductions to their in-guide budgets;
   (iii) Mission extensions beyond the prime mission phase; and/or,
   (iv) Termination of projects; and



5) Provide an overall assessment of the strength and ability of the operating mission portfolio to meet the expectations of the total science to be obtained from FY19 through FY21 and FY22 through FY24, as represented in the *2014 SMD Science Plan* and in the context of the 2010 Astrophysics Decadal Survey (*New Worlds, New Horizons in Astronomy and Astrophysics*).

The evaluation criteria for the Subcommittee and any subordinate panels will be defined in the Call for Proposals issued to the operating missions being reviewed. This ensures that both the senior review panels and the missions invited to the senior review are aware of the expectations placed upon them.

The Director, Astrophysics Division, will appoint the Chair and members of the Subcommittee, for terms of up to one year. The Subcommittee will have approximately ten to fifteen members. The membership will consist of leading authorities with relevant expertise drawn from government, academia, independent researchers, and industry. Members of the Subcommittee who are not Regular Government Employees (RGE) will be designated Special Government Employees (SGE). Staff and travel support for the Subcommittee Chair and members will be provided by SMD.

The Director, Astrophysics Division, will appoint a Designated Federal Officer (DFO) for the panel who will coordinate membership, meeting, and other requirements.

The Subcommittee can hold up to six meetings during the year and be responsive to the requests of the Director, Astrophysics Division, and the Associate Administrator, Science Mission Directorate. The Director, Astrophysics Division, or the Subcommittee may establish panels as needed, consistent with the Memorandum for the Record, dated February 8, 2018. It is expected that all or most meetings will be non-public, and attendant FACA administrative procedures will be met.

The Subcommittee will report to the APAC and will not provide advice or work products directly to NASA. The Subcommittee Chair or designated member will submit a senior review report containing the Subcommittee's recommendations and findings, as well as its work products, for public deliberation by the APAC. After public deliberation of the senior review report delivered to it by the Senior Review Subcommittee, the APAC will deliver a final report to NASA reflecting its formal recommendations to NASA, as well as append an unedited copy of the Senior Review Subcommittee's report.

These Terms of Reference are terminated at the discretion of the Director, Astrophysics Division, following consultation with the Associate Administrator, Science Mission Directorate, or in one year, whatever comes first.

Paul Hertz
Director, Astrophysics Division
NASA Science Mission Directorate

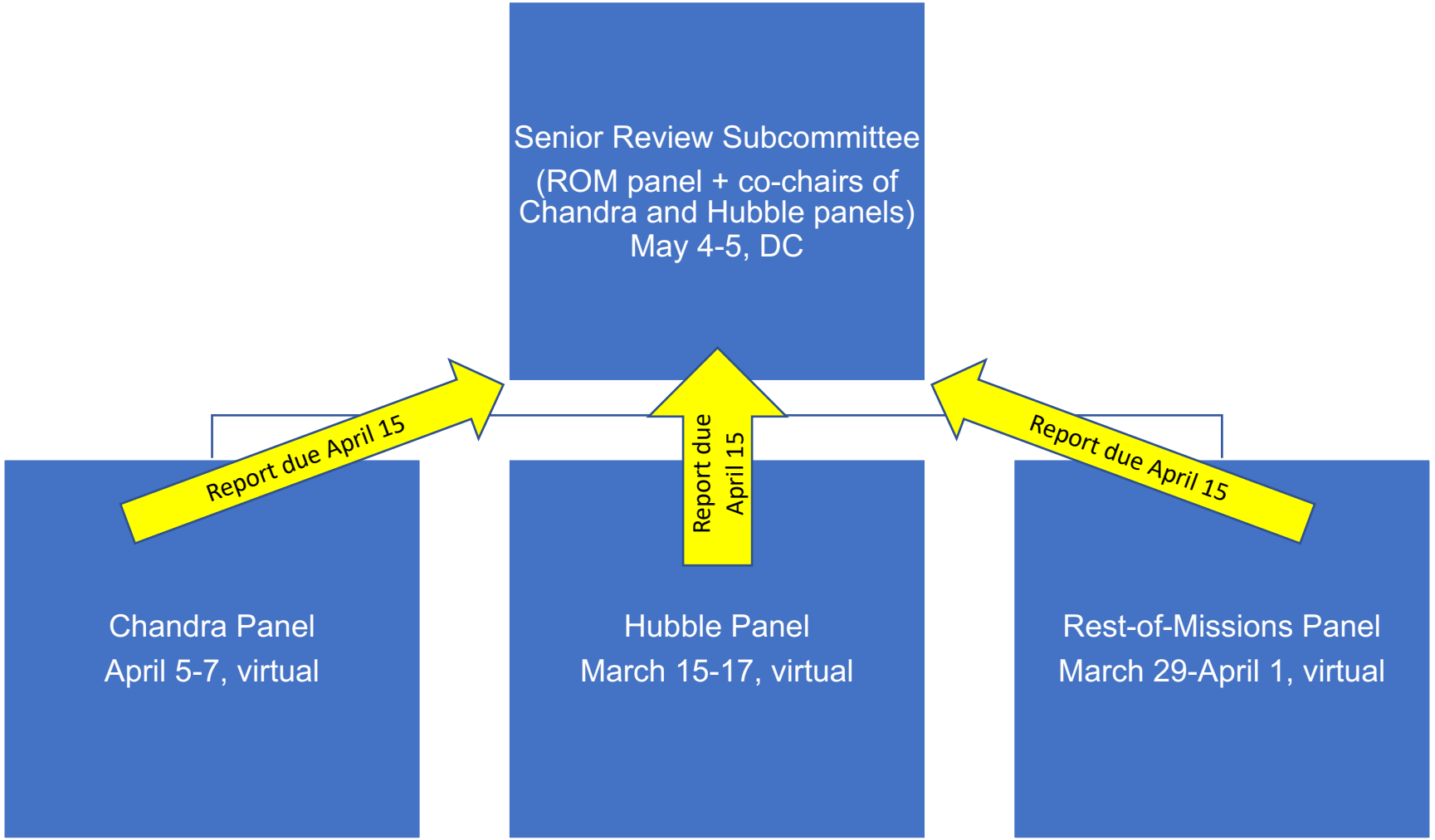
8/10/18
Date

https://science.nasa.gov/astrophysics/2022-senior-review-operating-missions/

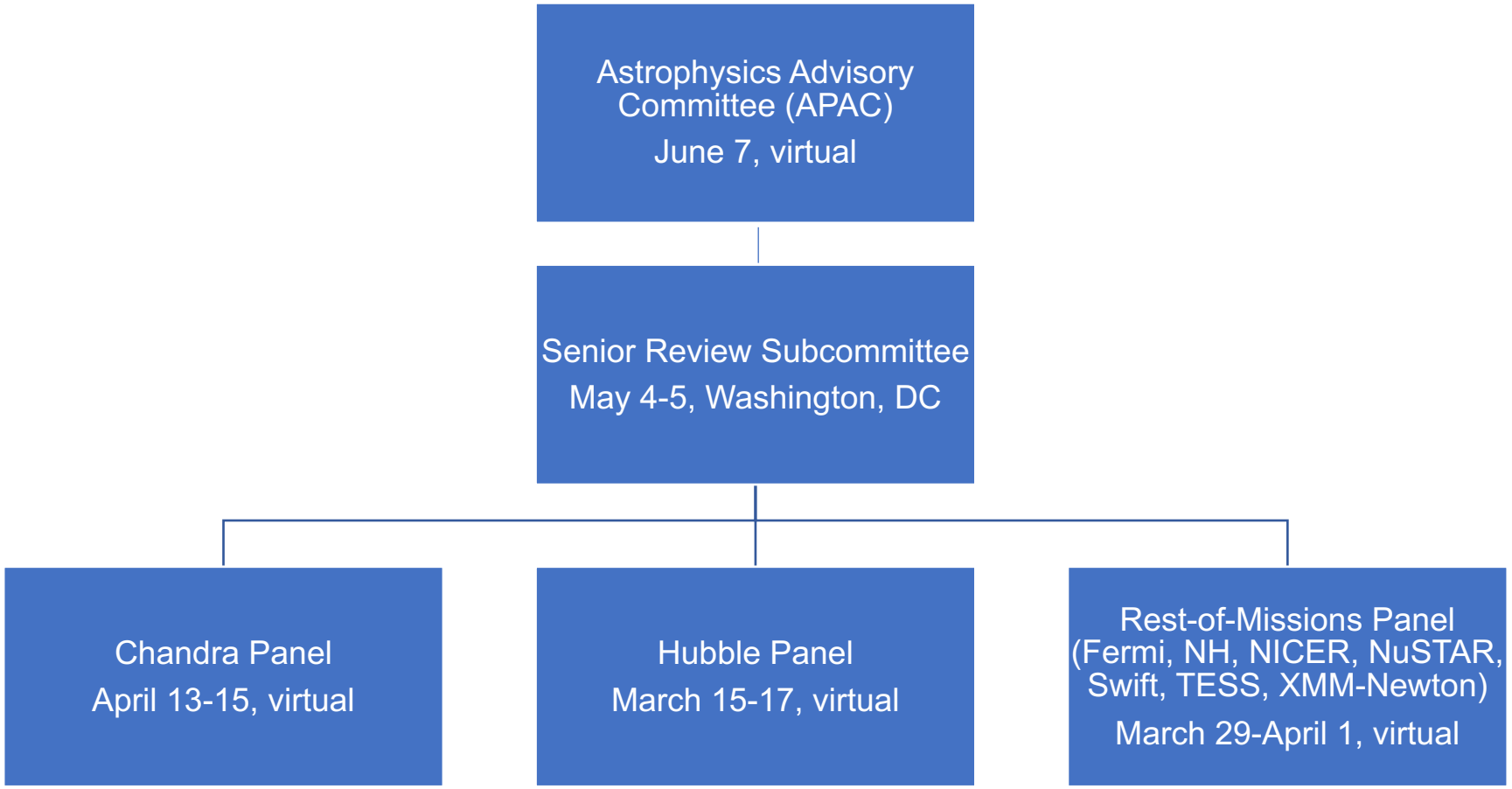
SR Subcomm. Panel Members

Name	Institution
John O'Meara (chair)	Keck Observatory
Marcel Agüeros	Columbia Univ.
Supriya Chakrabarti	U. Mass Lowell
Eric Charles	Stanford Univ.
Kelle Cruz	Hunter College
Daryl Haggard	McGill Univ [Chandra panel co-chair]
Erin Hicks	Univ. of Alaska
William Jones	Princeton Univ [Chandra panel co-chair]
Jeyhan Kartaltepe	Rochester Inst. of Tech.
Priyamvada Natarajan	Yale Univ. [Hubble panel co-chair]
Tommaso Treu	UCLA [Hubble panel co-chair]
David Weinberg	Ohio State Univ.

Review Composition and Structure



Review Composition and Structure



Products Available to the SR Subcommittee

The following input products will be made available to the Senior Review Subcommittee:

- All 2022 Senior Review proposals.
- 2019 Senior Review proposals (for those projects included in the 2019 SR)
- Copies of presentations and Q&A responses from each mission to the Rest-of-Missions, Chandra, and Hubble panels.
- Final reports from the Rest-of-Missions, Chandra, and Hubble panels, which contain detailed assessments of each mission, together with adjectival assessments (Excellent through Poor) for each review criterion.

SR Subcommittee Charge

Principally using the input products, and in the context of the research objectives and focus areas described in the SMD Science Plan, the Subcommittee shall:

1. **Provide an overall narrative assessment of the scientific merits of the expected returns from the projects reviewed during the period FY23 through FY27** (individual mission assessments are not, per se, required, given the detailed reports provided to the Senior Review Subcommittee by the Rest-of-Missions, Chandra, and Hubble). The scientific merits include relevance to the research objectives and focus areas, scientific impact, and promise of future scientific impact, as well as contributing to NASA's overall science objectives in astrophysics.

2. **Provide an overall narrative assessment of the cost efficiency, data availability and usability, and the vitality of the projects** (individual mission assessments are not, per se, required, given the detailed reports provided to the Senior Review Subcommittee by the Rest-of-Missions, Chandra, and Hubble).

SR Subcommittee Charge

Principally using the input products, and in the context of the research objectives and focus areas described in the SMD Science Plan, the Subcommittee shall:

3. **Rank the missions** on the basis of their scientific merit, their relevance and responsiveness to the division's strategic goals, and their technical capability and cost reasonableness.

4. **From the assessments above, provide findings on an implementation strategy** for the operating mission portfolio for FY23 through FY27, which could be a combination of:
   a. Continuation of projects at their in-guide level;
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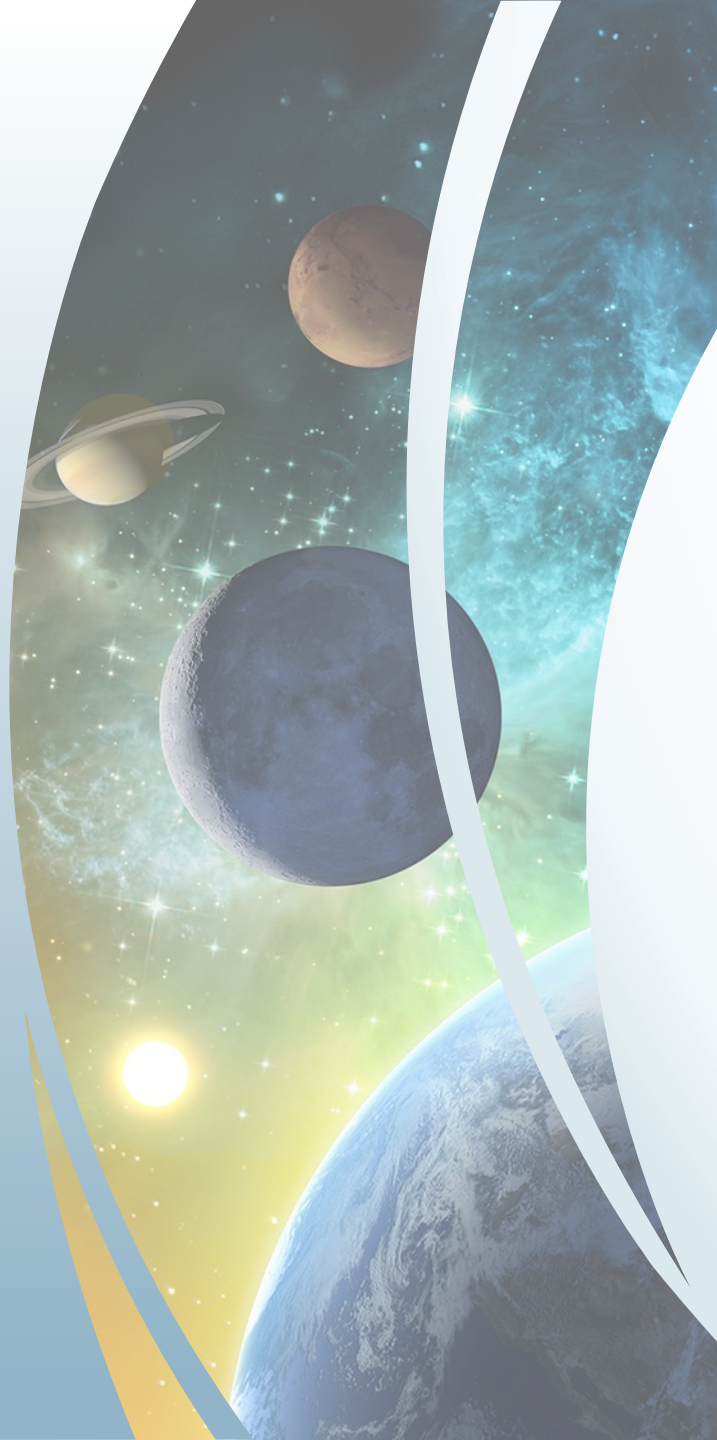
   c. Mission extensions beyond the prime mission phase; and/or,
   d. Termination of projects.

SR Subcommittee Charge

Principally using the input products, and in the context of the research objectives and focus areas described in the SMD Science Plan, the Subcommittee shall:

5. **Provide an overall assessment of the strength and ability of the operating mission portfolio** to meet the expectations of the total science to be obtained from FY23 through FY27, as represented in the SMD Science Plan and in the context of the 2020 Astrophysics Decadal Survey (Pathways to Discovery in Astronomy and Astrophysics for the 2020s).



Reference Links

Senior Review Call for Proposals

https://science.nasa.gov/astrophysics/2022-senior-review-operating-missions

SMD Science Plan

https://science.nasa.gov/science-red/s3fs-public/atoms/files/2020-2024_Science.pdf

Pathways to Discovery (Decadal Survey)

https://www.nap.edu/catalog/26141/pathways-to-discovery-in-astronomy-and-astrophysics-for-the-2020s

NASA Science Policy Document 41 (SPD41)

https://science.nasa.gov/science-red/s3fs-public/atoms/files/Scientific%20Information%20policy%20SPD-41.pdf