

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001



August 5, 2022

Reply to Attn of: SMD/ Director, Astrophysics Division

SUBJECT: NASA Response to the 2022 Astrophysics Senior Review of Operating Missions

Background

The NASA Science Mission Directorate (SMD) conducts comparative reviews of operating missions within each division to maximize the scientific return from these missions within finite resources. The Senior Review, held every three years, assists NASA in maximizing the scientific productivity from its operating missions within a constrained budget. 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.
 - (2) *Considerations.* —

In conducting an assessment under paragraph (1), the Administrator shall consider whether and how extending missions impacts the start of future missions.
- (b) *Consultation and Consideration of Potential Benefits of Instruments on Missions.* —

When deciding whether to extend a mission that has an operational component, the Administrator shall—

 - (1) *consult with any affected Federal agency; and*
 - (2) *take into account the potential benefits of instruments on missions that are beyond their planned mission lifetime.*
- (c) *Reports.* —

The Administrator shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives, at the same time as the submission to Congress of the Administration's annual budget request for each fiscal year, a report detailing any assessment under subsection (a) that was carried out during the previous year.

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.

NASA uses 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, FY27, and FY28 (to be revisited in the 2025 Senior Review).

Missions in the 2022 Astrophysics Senior Review for Astrophysics include strategic missions, Principal Investigator-led Explorers missions, and foreign-led missions in which the U.S. is a minor partner (the NASA Senior Review assesses only U.S. funding for foreign-led missions). The 2022 Astrophysics Senior Review included the following astrophysics missions (in alphabetical order):

- Chandra X-ray Observatory (Chandra);
- Fermi Gamma-ray Space Telescope (Fermi);
- Hubble Space Telescope (Hubble);
- Neil Gehrels Swift Observatory (Swift);
- Neutron Star Interior Composition Explorer (NICER);
- New Horizons (astrophysics investigations only);
- Nuclear Spectroscopic Telescope Array (NuSTAR);
- Transiting Exoplanet Survey Satellite (TESS); and
- X-ray Multi-Mirror Mission-Newton (XMM-Newton) (ESA mission).

The 2022 Astrophysics Senior Review adopted a multi-level review structure, in which three panels (one for Chandra, one for Hubble, and one for the remaining missions) report to a Senior Review Subcommittee, which has been established as a subordinate group to the Astrophysics Advisory Committee, consistent with the Charter of the Astrophysics Advisory Committee and compliant with the Federal Advisory Committee Act (FACA) of 1972 (P.L. 92-463). The Report of the 2022 Senior Review Subcommittee, along with supporting documentation from the review, may be accessed at <https://science.nasa.gov/astrophysics/2022-senior-review-operating-missions/>.

NASA Response

The report of the Senior Review Subcommittee emphasizes that the nine missions in the Senior Review “will continue to enable impactful science in the upcoming five years that directly address NASA strategic science priorities,” and noted that “these missions enable the full suite of astrophysical study from the large-scale distribution of dark and baryonic matter down to the detailed nature of individual stellar or exoplanetary objects.” The Subcommittee also found that “as a fleet, these missions remain more powerful than the sum of their parts, oftentimes combining their individual strengths to tackle science together as a team.” The report of the Senior Review Subcommittee contains

recommendations that NASA continue to operate and support all nine of these missions – eight in Astrophysics, one in Planetary Sciences.

NASA used the prioritized rankings and individual recommendations of the 2022 Senior Review report to make the following decisions for each of the missions in the Senior Review. The missions are presented in alphabetical order.

Summary of NASA decisions

- Chandra X-ray Observatory: extension is approved.
- Fermi Gamma-ray Space Telescope: extension is approved.
- Hubble Space Telescope: extension is approved.
- Neutron Star Interior Composition Explorer: extension is approved.
- New Horizons: astrophysics investigation is recommended.
- Nuclear Spectroscopic Telescope Array: extension is approved.
- Neil Gehrels Swift Observatory: extension is approved.
- Transiting Exoplanet Survey Satellite: extension is approved.
- X-ray Multi-Mirror Mission-Newton (XMM-Newton) (ESA mission): extension is approved.

For all missions, the extension is for FY23-FY25. Although planning guidance and budgets are provided for FY26 and beyond, as part of NASA’s annual budget formulation process, decisions on extensions beyond FY25 will be informed by the 2025 Senior Review.

These decisions are contingent on the Astrophysics Division receiving the funding requested in the FY 2023 President's Budget Request. Additionally, some adjustments will need to be made within the Astrophysics Division budget to accommodate all operating missions.

Detailed NASA decisions for each mission

Chandra X-ray Observatory (Chandra)

The Chandra mission is provided additional funding to preserve operational capabilities and enhance Chandra’s ability to support time-domain science within the budget provided. The guiding principle for the use of the funded overguide should be to maximize the science returns for the community by preserving mission infrastructure while maximizing General Observer program funding. The Chandra mission will be invited to the 2025 Astrophysics Senior Review.

Fermi Gamma-ray Space Telescope (Fermi)

The Fermi mission extension is approved. The Fermi mission will be invited to the 2025 Astrophysics Senior Review.

Hubble Space Telescope (Hubble)

The Hubble mission is directed to implement efficiencies in operational and community outreach support in order to preserve the level of General Observer (GO) funding as much as possible within the FY23 President’s Budget Request. Funding for the NASA Hubble Fellowship Program will be provided external to the Hubble mission, providing budget flexibility to address this direction. The guiding principle should be to maximize

the science returns for the community by preserving mission infrastructure while maximizing GO funding. The Hubble mission will be invited to the 2025 Astrophysics Senior Review.

Neil Gehrels Swift Observatory (Swift)

The Swift mission extension is approved. The Neutron Star Interior Composition Explorer (NICER)/Swift jointly requested funding to improve efficiency and remove redundancy in scheduling coordinated observations is approved and fully funded in the NICER budget. The Swift team is directed to work with NICER and return a plan, including any distribution of the funding between projects. Swift proposal to improve the photometric precision of Swift Ultraviolet Optical Telescope data is also approved. The funding request for Burst Alert Telescope software improvements was not approved. The Swift mission will be invited to the 2025 Astrophysics Senior Review.

Neutron Star Interior Composition Explorer (NICER)

The NICER mission extension is approved. The NICER/Swift jointly requested funding to improve efficiency and remove redundancy in scheduling coordinated observations is approved and fully funded in the NICER budget. The NICER team is directed to work with Swift and return a plan, including any distribution of the funding between projects. The NICER mission will be invited to the 2025 Astrophysics Senior Review.

Nuclear Spectroscopic Telescope Array (NuSTAR)

The NuSTAR mission extension is approved. The budget includes funding for the full suite of NuSTAR overguide requests recommended for implementation in the Senior Review report. The NuSTAR mission will be invited to the 2025 Astrophysics Senior Review.

Transiting Exoplanet Survey Satellite (TESS)

The TESS mission extension is approved. The Senior Review report noted the importance for TESS to follow the path of increasing operational efficiencies for continuing extended missions. Specific direction details to best posture TESS to achieve those efficiencies are still in work. The TESS mission will be invited to the 2025 Astrophysics Senior Review.

X-ray Multi-Mirror Mission-Newton (XMM-Newton) (ESA mission)

The XMM-Newton mission extension is approved with the requested programmer to meet new Science Operations Center requirements and to retire a significant succession planning risk added to its budget. Additional funding to augment the General Observer program was not approved. The XMM-Newton mission will be invited to the 2025 Astrophysics Senior Review.

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