



SMD/Heliophysics Division

Subject: NASA Response to the 2020 Senior Review for Heliophysics Operating Missions

Background:

The Senior Review for Heliophysics Operating Missions has been conducted typically biennially since the late 1990s.

NASA's Science Mission Directorate (SMD) periodically conducts reviews of Mission Operations and Data Analysis (MO&DA) programs, now on a three-year cycle, to maximize the scientific return from these programs within finite resources. NASA uses the findings from the Senior Review to define an implementation strategy and give programmatic direction to the missions and projects reviewed through the next five fiscal years. The specific findings are used to:

- prioritize continued funding of the operating missions and projects;
- define an implementation approach to achieve heliophysics strategic objectives;
- provide programmatic and budgetary direction to missions and projects for 2021 and 2022; and
- issue initial funding guidelines for 2023, 2024, and 2025 (to be revisited in the 2023 Senior Review).

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:

"...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. "

The 2020 Senior Review panelists were all Regular Government Employees (RGEs) enlisted through agreement with their Agency or non-government employees hired as government consultants. The Senior Review provided a scientific and technical assessment of the Heliophysics Operating Missions, culminating in the final report delivered directly to the Heliophysics Division.

Missions in the 2020 Senior Review for the Heliophysics Division included strategic missions, Principal Investigator-led 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 2020 Senior Review included the following heliophysics missions (in alphabetical order):

- AIM,
- Geotail (JAXA mission),
- GOLD,
- Hinode (JAXA mission),
- IBEX,
- IRIS,
- MMS,
- SDO,
- STEREO,
- THEMIS,
- TIMED,
- Voyager, and
- Wind.

The Solar and Heliospheric Observatory (SOHO) and the Advanced Composition Explorer (ACE) have both been declared national space weather assets by NASA and are therefore omitted from this review. Other operating missions at this time—Parker Solar Probe, Ionospheric Connection Explorer (ICON), Solar Orbiter, and Space Environment Testbeds (SET)-1—are still within their prime mission phase and were not part of this Senior Review.

Operating missions invited to the Senior Review were permitted to propose for one of two types of mission extensions:

1. ***Science investigation proposals*** that presented science objectives that the mission will complete during its extended mission within its in-guide budget.
2. ***Heliophysics System Observatory (HSO) Infrastructure proposals*** that focused on the mission's contribution to the HSO. They may adjust spacecraft orbits/configuration to facilitate synergy with other HSO assets.

Regardless of the type of proposal submitted, each mission needed to meet the following programmatic requirements:

1. Archive all data in NASA archives immediately
2. Archive real-time data as originally downlinked and processed
3. Produce Project Data Management Plan (PDMP), Calibration and Measurement Algorithms Document (CMAD)
4. Present plan for making mission code open source
5. Produce End of Mission Plan verification letter/memo

The charter for this Senior Review was to assess, for each mission separately:

- The scientific benefit of continuation, including but not limited to:

- Completion of previous extended mission science
- Compelling nature of proposed science investigations including cost reasonableness of in-guide science investigation and any proposed over-guide science investigations
- The contribution to the Heliophysics System Observatory, including but not limited to:
 - Usefulness and usability of the archived mission data, code, and accompanying documentation
- The data archiving and software publication strategy and progress, including but not limited to:
 - Completeness of the mission data set in NASA archives
 - Project Data Management Plan (PDMP) and Calibration and Measurement Algorithms Document (CMAD)
 - Plan for open source release of mission-funded code/software

Given the addition of data archive and documentation requirements, the 2020 Heliophysics Senior Review included two panels:

1. Senior Review Panel
2. Data Archiving Subpanel

The 2020 Senior Review was conducted virtually with a Kickoff meeting held on July 20th, Senior Review panels held on August 17-21 and again on August 31 – September 3, with the final report delivered on November 18th.

This, and all previous Heliophysics Senior Review reports, are available at:

<https://science.nasa.gov/heliophysics/resources/senior-review/>

Based on the assessment within the Senior Review report, NASA has made decisions for each of the 13 missions and projects as described below.

NASA Response:

NASA recognizes the significant amount of work that went into the Senior Review process and the diligence of the panels in the execution of their charges. The time and effort invested greatly contributes to the continued success of the Heliophysics System Observatory (HSO) and warrants special recognition in light of the continued public health situation that placed significant stress on the individuals' participation.

The Senior Review report makes clear that all of the projects proposing to the 2020 Senior Review provide scientifically valuable contributions to the HSO and are deserving of continued operations. NASA acknowledges the scientific and programmatic benefit from funding meritorious mission activities; and budget conditions allow accommodation of requested funding increases for the next two Fiscal Years. Specific budget guidance will be provided to each team separately in the next few weeks.

Additionally, the steps each mission must take to satisfy the data archiving and software release requirements will be unique. Each mission shall define tasks necessary to align with the requirements located in the Heliophysics Senior Review 2020 Call For Proposal (Section 5d). NASA will negotiate these tasks and associated funding augmentations, if applicable, separately with each mission by the next PPBE cycle.

For each mission, there are three potential outcomes from this Senior Review:

1. funded for a science investigation (for science investigation proposals);
2. funded for infrastructure operations (for HSO infrastructure proposals or science investigation proposals); or
3. termination.

NASA will work with missions transitioning to HSO Infrastructure to ensure that each mission has:

1. healthy continued operations of the spacecraft and any ground systems;
2. sufficient budget for data validation and necessary support for community interactions; and
3. complete and robust data archiving and software release practices.

Unless otherwise stated, missions must respond to findings identified in the Senior Review report and demonstrate remediation in the next Senior Review.

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

Summary of NASA decisions:

- AIM: Extension approved;
- Geotail (JAXA mission): Extension approved, transition to HSO infrastructure;
- GOLD: First extended mission approved;
- Hinode (JAXA mission): Extension approved;
- IBEX: Extension approved;
- IRIS: Extension approved;
- MMS: Extension approved;
- SDO: Extension approved;
- STEREO: Extension approved;
- THEMIS: Extension approved;
- TIMED: Extension approved;
- Voyager: Extension approved; and
- Wind: Extension approved, transition to HSO infrastructure

Detailed NASA decisions for each mission:

AIM

The AIM mission is approved to continue as an extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. In addition, the AIM mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The AIM mission will be invited to the 2023 Heliophysics Senior Review.

Geotail (JAXA mission)

The Geotail mission is approved to transition to HSO Infrastructure, planning against the current budget guidelines. The Geotail mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The Geotail mission will not be invited to the 2023 Heliophysics Senior Review but will be subject to programmatic review as part of the HSO Infrastructure, contingent on the outcome of any JAXA review.

GOLD

The GOLD mission is approved to continue with its first extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. In addition, the GOLD mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The GOLD mission will be invited to the 2023

Heliophysics Senior Review.

Hinode (JAXA mission)

The Hinode mission is approved to continue as an extended mission, planning against the current budget guidelines. In addition, the Hinode mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The Hinode mission will be invited to the 2023 Heliophysics Senior Review, contingent on the outcome of any JAXA review.

IBEX

The IBEX mission is approved to continue as an extended mission, planning against the current budget guidelines. In addition, the IBEX mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The IBEX mission will be invited to the 2023 Heliophysics Senior Review.

IRIS

The IRIS mission is approved to continue as an extended mission, planning against the current budget guidelines. In addition, the IRIS mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The IRIS mission will be invited to the 2023 Heliophysics Senior Review.

MMS

The MMS mission is approved to continue as an extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. In addition, the MMS mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The MMS mission will be invited to the 2023 Heliophysics Senior Review.

SDO

The SDO mission is approved to continue as an extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. The SDO mission will be invited to the 2023 Heliophysics Senior Review.

STEREO

The STEREO mission is approved to continue as an extended mission, planning against budget guidelines. In addition, the STEREO mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The STEREO mission will be invited to the 2023 Heliophysics Senior Review.

THEMIS

The THEMIS mission is approved to continue as an extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. The THEMIS mission will be invited to the 2023 Heliophysics Senior Review.

TIMED

The TIMED mission is approved to continue as an extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. In addition, the TIMED mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The TIMED mission will be invited to the 2023 Heliophysics Senior Review.

Voyager

The Voyager mission is approved to continue as an extended mission. Specific budget guidance regarding the proposed budget augmentations will be provided separately. In addition, the Voyager mission will be required to develop a plan for meeting the data and code requirements as stated within the Heliophysics Senior Review 2020 Call For Proposals (Section 5d, Data and Management Code Section). Funding requirements associated with the data and code requirements will be negotiated through the budget formulation process. The mission will be invited to the 2023 Heliophysics Senior Review.

Wind

The Wind mission is approved to transition to HSO Infrastructure, planning against the budget guidelines to be negotiated as part of the transition to HSO Infrastructure. The Wind mission will not be invited to the 2023 Heliophysics Senior Review but will be subject to programmatic review as part of the HSO Infrastructure.

Acknowledgement:

NASA acknowledges the assessment from the Senior Review. NASA will implement a plan based on their assessments, subject to budgetary and programmatic considerations.

NASA is exceedingly grateful that these members of the community stepped forward to provide their assessments regarding the NASA Heliophysics operating missions and their proposed work for the next three years.

NASA would like to formally thank the members of the Senior Review Panel and the Data Archive Subpanel for their hard work, dedication, and willingness to commit to the full scope of the task before them given that the process needed to be conducted in a completely virtual environment.

The process of reconciling the breadth of exemplary science made possible by the current suite of heliophysics operating missions with the fiscal reality of constrained budgets made this task both difficult and necessary for the continued success of the Heliophysics System Observatory.

Sincerely,

Nicola Fox
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Fox
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Nicola Fox
Director, Heliophysics Division