National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

August 29, 2025

Reply to attn. of: Office of Communications
History and Information Services Division

John Greenwald
Black Vault
27305 W. Live Oak Rd. Suite 1203
Castaic, CA 91384

Re: FOIA Tracking Number 25-00860-F-HQ (Ref: 25-00003-A-OGC)

Dear Mr. Greenwald:

This letter responds to your Freedom of Information Act (FOIA) request to the National Aeronautics and Space Administration (NASA), dated September 22, 2024, that was remanded to the NASA FOIA Office for further processing on May 14, 2025. Your request was assigned the above-referenced tracking number.

Your original request sought the following:

A copy of records (which includes videos/phots), electronic or otherwise, of all briefings about the James Webb telescope and program, made for Congress, to include classified and unclassified briefings on finds made by the program. The timeframe for responsive records was from 2021 through the date of processing.

Consistent with the remanded appeal, we conducted a follow up search of NASA's Office(s) of Legislative and Intergovernmental Affairs (OLIA). NASA's search began on June 20, 2025, and focused on the timeframe of your original request. OLIA identified additional records responsive to your original request.

We reviewed the responsive records under the FOIA to determine whether they may be disclosed to you. NASA considered the foreseeable harm standard when reviewing and applying applicable exemptions to the records. Accordingly, and after careful review, NASA determined that certain information contained therein should be withheld pursuant to 5 U.S.C. § 552 (b)(5) (FOIA Exemption 5). Below is an explanation of the information that has been withheld.

__20__ page(s) are released in full (RIF);[1]

[1] All page counts are approximate numbers.

__4__ page(s) are released in part (RIP);

FOIA Exemption 5

FOIA Exemption 5 protects from disclosure those "inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency." This exemption applies to information which is normally privileged in the civil discovery context. The specific privilege being invoked is explained in more detail below.

Application of Deliberative Process Privilege

One of the frequently invoked FOIA Exemption 5 privileges is the deliberative process privilege. To fall within FOIA's deliberative process privilege, the records must be pre-decisional and deliberative; the records must precede the adoption of an agency policy and include the opinions, recommendations, or deliberations on a legal or policy matter.

In this instance, NASA is withholding under the deliberative process privilege, portions of slides created by NASA to prepare for a Congressional Subcommittee Hearing. The slides are pre-decisional in that they pre-dated the hearing itself, and they are deliberative in that they reflect the evolving, back-and-forth preparations within the agency that is so integral to the Executive Branch decision-making process; more specifically, the development of critical questions, evaluations, and proposals in preparation for a Congressional hearing.

If these pre-decisional, deliberative communications were released to the public, NASA and other Executive Branch employees would be much more cautious in their discussions with each other, and in candidly discussing and providing all pertinent information and viewpoints in a timely manner to agency decision-makers. This lack of candor would also seriously impair the NASA's ability to engage in forthright, internal discussions necessary for efficient and proper agency decision-making, and hearing preparations.

Provisions of the FOIA allow us to recover part of the cost of complying with your request. In this instance, no fees will be assessed.

Appeal

You have the right to appeal the withholdings applied to the newly identified responsive records. Your appeal must be received within 90 days of the date of this response. Please send your appeal to:

Administrator
NASA Headquarters
Executive Secretariat
ATTN: FOIA Appeals
MS 9R17
300 E Street S.W.
Washington, DC 20546

Both the envelope and letter of appeal should be clearly marked, "Appeal under the Freedom of Information Act." You must also include a copy of your initial request, the adverse determination, and any other correspondence with the FOIA office. In order to expedite the appellate process and ensure full consideration of your appeal, your appeal should contain a brief statement of the reasons you believe this initial determination should be reversed. Additional information on submitting an appeal is set forth in the NASA FOIA regulations at 14 C.F.R. § 1206.700.

Assistance and Dispute Resolution Services

If you have any questions, please feel free to contact me electronically at sarah.a.scharf@nasa.gov. For further assistance and to discuss any aspect of your request you may also contact:

Stephanie Fox
FOIA Public Liaison
Freedom of Information Act Office
NASA Headquarters
300 E Street, S.W., 5P32
Washington D.C. 20546
Phone: 202-358-1553
Email: Stephanie.K.Fox@nasa.gov

Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services it offers. The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, Maryland 20740-6001, e-mail at ogis@nara.gov; telephone at 202-741-5770; toll free at 1-877-684-6448; or facsimile at 202-741-5769.

Important: Please note that contacting any agency official including myself, NASA's FOIA Public Liaison, and/or OGIS is not an alternative to filing an administrative appeal and does not stop the 90-day appeal clock.

Sincerely,

Sarah Scharf

Sarah A. Scharf
Principal Agency FOIA Officer
NASA HQ

Enclosures – 40 Pages

Prep Session for HSSTC Space Subcommittee Hearing,

""Unfolding the Universe: Initial Science Results from JWST"

November 15, 2022, 10:30 am

2318 Rayburn House Office Building

WITNESSES

- **Dr. Mark Clampin, Astrophysics Division Director, NASA**
- **Dr. Steven L. Finkelstein, Professor of Astronomy, University of Texas at Austin**
- **Dr. Natalie Batalha, Professor of Astronomy and Astrophysics and Director of Astrobiology, University of California, Santa Cruz**

- Subcommittee Chairs Don Beyer (D-VA) and Ranking Member Brian Babin (R-TX)
- Hybrid Hearing – university witnesses expected to be virtual
- Expected to run under 2:00 hours total.

THEMES

(b)(5) Deliberative Process

[redacted]

MESSAGES?

- (b)(5) Deliberative Process

[redacted]

QUESTIONS TO THINK ABOUT

1. (b)(5) Deliberative Process
2.
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5.
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8.
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FURTHER QUESTIONS TO THINK ABOUT

10. (b)(5) Deliberative Process
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EVEN MORE QUESTIONS

20. (b)(5) Deliberative Process
21. [redacted]

National Aeronautics and Space Administration

Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

June 20, 2024

Reply to Attn of: OLIA:AR:vlg

The Honorable Brian Babin
Chairman
Subcommittee on Space and Aeronautics
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Babin:

Please find enclosed NASA's responses to the set of written questions submitted after the March 21, 2024, hearing entitled, *"Advancing Scientific Discovery: Assessing the Status of NASA's Science Mission Directorate."*

We hope the information is useful to you.

Sincerely,

Alicia Brown
Associate Administrator
for Legislative and Intergovernmental Affairs

Enclosure

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

"Advancing Scientific Discovery: Assessing the Status of NASA's Science Mission Directorate"

Dr. Nicola Fox, Associate Administrator, Science Mission Directorate, National Aeronautics and Space Administration

Questions submitted by Chairman Brian Babin

1. **NASA's Fiscal Year 2025 budget justification includes a summary of the 2024 Major Program Annual Report, which identifies three Science Mission Directorate, or SMD, major programs with cost and schedule changes since the 2023 report. The projected development cost of the NASA-Indian Space Research Organisation Synthetic Aperture Radar mission decreased by 2% with no change in the expected launch date. The development cost of the Plankton, Aerosol, Cloud, ocean Ecosystem mission decreased by 3% with no change in the launch date. The projected development cost of the Sentinel-6 mission decreased by 10% with no change in the expected spacecraft B launch date. How did SMD accomplish the development cost reductions achieved by these three missions? Further, what lessons has SMD learned from those cost reductions, and from the success at keeping the missions on schedule, that could be applied to other missions?**

Most missions in the NASA Science portfolio are novel, and the causes of cost or schedule overruns are unique to each project. Since the establishment of the 70% Joint Cost and Schedule Confidence Level (JCL) requirement for major missions in 2009, SMD has confirmed and launched 39 missions. Including James Webb Space Telescope (JWST), these missions have overrun their Phase C/D commitments by a net 4.5% and excluding JWST, these missions have underrun their Phase C/D budget commitments by a net 0.5%. 19 of the 39 missions completed development under their cost commitment.

SMD continues to refine its ability to execute missions within cost commitments by implementing improved management techniques (particularly on large strategic missions) and the use of independent review boards and cost estimates, including JCL estimates.

SMD's approach to managing risk involves providing appropriate levels of unallocated future expenses, which are informed by rigorous risk assessments and cost and schedule reviews at key milestones. We continue to monitor risk and other programmatic changes for each project as well as at the portfolio level.

Questions submitted by Ranking Member Eric Sorensen

1. **The President's Fiscal Year (FY) 2025 budget request for NASA proposes a restructuring of the Earth System Observatory, a set of Earth-focused missions under development that are designed to advance scientific understanding of the Earth's systems and provide key applied science information to guide efforts related to climate change, disaster mitigation, fighting forest fires, and improving real-time agricultural processes. At a March 13 NASA Earth Science townhall, NASA**

administrators noted that the strategy for the Earth System Observatory is to "decouple, partner, and compete."

a. Please elaborate on what the "decouple, partner, and compete" strategy means and how it compares to the existing plans for the Earth System Observatory.

The former architectures of both the Atmosphere Observing System (AOS) and Surface Biology and Geology (SBG) missions within the Earth System Observatory (ESO) featured a tightly-coupled approach combining measurements made from a small number of large satellites, each with multiple instruments. We had also planned to launch all of these satellites within a constrained time window, to maximize overlapping observations on orbit. AOS and SBG were each to be managed as single missions, with multiple components. The large satellites with multiple instruments carried significant risk and concentrated development costs over a small number of years, which drove the need for increased reserves and high annual budget requirements.

"Decouple, partner, and compete" is the philosophy we are executing to adapt to available funding levels while retaining as much mission content in the ESO as possible. "Decouple" means we will now disaggregate both AOS and SBG into smaller projects to be executed independently. This approach reduces cost and schedule risk and annual funding needs, with the trade-off being reduced on-orbit overlap. "Partner" means we will affirm the international partnerships we have already established and pursue new ones to cost-effectively implement science content defined in the original mission architectures. "Compete" means we will accomplish one component of the new AOS architecture as a cost-capped competed mission opportunity to ensure that we acquire the best observation quality within the available budget.

b. Will any of the Earth System Observatory missions be delayed or scaled back in scope from what had previously been planned and announced?

Yes. For AOS, the backscatter lidar capability in the inclined orbit has been removed from the architecture. The radar in the Polar orbit will be the "best available" within the cost cap (competed). The AOS remains largely on schedule. For SBG, the scope is retained but the Visible and Short-Wave Infrared (VSWIR) capability is delayed. The reduced scope, while reducing some science capability, increases the likelihood that the EOS missions will be implemented in the near term, as opposed to indefinitely delayed due to funding constraints.

c. What would be the impacts to Earth science and applications decadal survey priorities?

Throughout the process of aligning ESO mission content with evolving resource targets, NASA has worked to preserve the highest priority science from the "Designated Observables" from the Decadal, while maintaining the competed missions in the Venture and Explorer lines (also a Decadal priority) and protecting partner contributions and commitments.

d. The National Academies is currently conducting the mid-decade assessment of progress on the decadal survey recommendations from the current decadal survey for Earth science and applications from space. Has NASA fully informed the study committee of these changes to the Earth System Observatory?

Yes. NASA has kept the National Academies, international partners, and community stakeholders as informed as possible, within the constraints of the budget process, as our strategy to execute these missions continues to evolve during formulation. The mid-decade assessment was nearly complete at the time of the FY 2025 budget request roll-out, so the full impacts of these adjustments may not be reflected in the mid-term report. However, NASA briefed the National Academies Committee on Earth Science and Applications from Space on the NASA Earth Science FY25 budget request, including these changes to the ESO.

e. How will NASA implement the new strategy for the Earth System Observatory, including the approach and timeline?

NASA met the budget target by reducing synchronization to maintain the majority of the technical content. The updated timelines for the decoupled missions are as follows:

- GRACE-Continuity continues unaffected with a planned LRD of December 2028
- SBG-TIR – Deliver to ASI partner November 2027, LRD FY 2029
- SBG-VSWIR – LRD NET FY 2032
- AOS-Sky – directed mission, passive instrument suite, LRD NET 2030
- HAWCsat – CSA partner, planned co-manifest with AOS-Sky
- AOS-Cloud (New competed radar mission), Community Announcement released on April 19, 2024, anticipated launch FY 2031
- PMM – JAXA partner, LRD 2029
- AOS-Storm – Smallsat to host CNES Radiometer, planned co-manifest with PMM
- CALIGOLA – ASI LIDAR mission, NASA detector suite, LRD NET 2029

These timelines are contingent on full funding of the FY 2025 President's Budget request for Earth Science Systematic Missions.

2. The explanatory statement accompanying the FY2024 minibus appropriations law allocated $10 million for NASA to set up a project office at NASA Goddard and begin work maturing the technologies and concept for the next astrophysics great observatory, which has been called the Habitable Worlds Observatory. What will NASA accomplish on the Habitable Worlds Observatory in FY2024, and what will be accomplished in FY2025 under the requested budget?

In FY 2024, NASA will make progress in maturing technologies relevant to a potential future Habitable Worlds Observatory (HWO) mission, including the following steps:

1. Create a Project Office at the Goddard Space Flight Center, with the initial goal of consolidating and developing a technology investment roadmap.
2. Continue work with Science, Technology, Architecture Review Team (START) and its working groups to conduct science trades that will inform the goals and objectives for a potential future HWO.
3. Initiate development of the software models (i.e., integrated modeling) to predict system level performance of the Observatory at the picometer level of precision.
4. Begin developing the government technology testbeds to provide our academic and commercial partners a gold standard to test their technologies.
5. Develop a mentorship program for early-career scientists and engineers to increase access to careers and fields that are relevant to the study of habitable worlds.
6. Issue calls for precursor science & technology that must be developed for a potential future HWO mission to succeed.
7. Initiate a solicitation to industry for technology development.

In addition to continuation of the above activities, the major objective for FY 2025 is to initiate significant industry participation in technology maturation activities in support of a potential future Habitable Worlds Observatory. This will be achieved via a Research Opportunities in Space and Earth Science (ROSES) Announcement of Opportunity call initiated in FY 2024, with awards to be made in FY 2025.

3. **The NASA Authorization Act of 2022, enacted as part of the CHIPS and Science law, set a goal for NASA to dedicate at least 10% of the funding for each of NASA's science divisions to research and analysis programs by FY2025. Does NASA's FY2025 budget request meet this goal?**

NASA's Science Mission Directorate's budget request for FY 2025 exceeds 10% of funding for research and analysis programs. Each NASA science division's budget for research and analysis programs, as a percentage of division budget, is:

- Earth Science Division 15%
- Planetary Science Division 11%
- Astrophysics Division 16%
- Heliophysics Division 19%
- Biological and Physical Science Division 11%

Additionally, our FY 2025 budget calls for consistent investments in research and analysis programs through FY 2029.

4. **The President's FY2025 budget request for NASA proposes the cancellation of the development of the Geospace Dynamics Constellation (GDC), a mission under development and a priority recommendation of the last decadal survey in heliophysics. GDC is going to provide crucial measurements of the extreme variability of conditions in near-Earth space, which will improve our space weather**

and space situational awareness models. In 2022, NASA charged an independent review board to assess the scientific, technical, and management plans for GDC.

a. Did the 2022 IRB recommend cancellation of GDC?

The 2022 IRB did not recommend cancellation of GDC. Please note that the GDC IRB was not tasked to provide a recommendation on whether the project should be cancelled, nor was the GDC IRB tasked with prioritization of GDC within current budgets. It was chartered to assess the programmatic readiness, management approach, and structure of the science team to maximize the science return.

b. Did the 2022 IRB find that GDC would satisfy the science priorities recommended by the decadal survey for the mission?

Yes, the IRB concluded that NASA's planned implementation of GDC addresses the primary recommendations from the 2013-2022 Decadal Survey for Solar and Space Physics.

c. What will be the scientific impact, if Congress were to accept NASA's proposal to cancel GDC?

The proposed cancellation of GDC enables support for other priority science missions that would likely need to be canceled or delayed if GDC were implemented. The cancellation of GDC would, however, prevent NASA from making advances in our scientific understanding of Earth's upper atmosphere and its interaction with the local space environment, as recommended by the 2013-2022 Decadal Survey.

d. In the last two budget requests, NASA proposed significant cuts to GDC to implement a "pause" in the mission's development. What is the rationale for cancelling the mission as proposed in the FY2025 budget proposal?

The GDC IRB found that the FY2023 budget profile did not support the current Launch Readiness Date (LRD) and that delays to 2032 or later would "expose NASA to uncertainty and risks" that are likely to require additional funds. The combination of increased costs and decreasing budgets led to the conclusion that GDC should be proposed for cancellation. The tightly constrained budget environment due in part to the Fiscal Responsibility Act of 2023 made it infeasible to continue funding the mission.

e. NASA also stated in the last two budget requests that the reductions to GDC were to accommodate other priorities, including Mars Sample Return. How does NASA make choices among high-priority decadal missions in its different disciplines?

SMD strives to maintain balance between all divisions and science disciplines to ensure that each division makes progress against their respective Decadal Surveys within budgetary constraints. NASA does not consider any one division to be higher priority than any other. Programmatic factors specific to individual missions and the specifics of budgetary constraints will influence the choices made during the budget process. Significant budget constraints required NASA to make difficult choices across the entirety of SMD including to Mars Sample Return.

5. **Mr. Scott states in his prepared testimony that "[Deep Space Network] antennas are currently operating at capacity and are oversubscribed—meaning more time is requested by missions than the network's current capacity can provide—with demand exceeding supply at times by as much as 40 percent" and also that, "even with needed upgrades, it is possible that NASA may not be able to receive all the future missions' data that could advance our understanding of the universe and our place in it."**
    a. **How do the constraints on the DSN impact the scientific return of NASA's deep space missions?**

NASA provides operational communications and navigation (C&N) services to an array of science and exploration missions which depend on those services to be successful. NASA missions can be designed to last ten or more years, and often are extended beyond their planned operational mission period in order to continue to return invaluable science data and capitalize on investment. For example, missions such as Voyager 1 and 2 and the Hubble Space Telescope are tremendous science assets utilized by the scientific community and revered by the public. Further, NASA must actively understand the landscape of future science and exploration missions to determine the C&N capabilities that will be required and plan appropriately to meet those needs. Future missions are expected to produce much higher amounts of data while employing novel mission designs, such as swarms of collaborating spacecraft. These demands will change how services are delivered to meet the overall set of mission C&N requirements.

As reported by the NASA Inspector General, demand for DSN support to NASA science missions has increased faster than the capacity of the network. The DSN team has established a strong working relationship with NASA's mission teams that has enabled NASA to ensure that critical science mandatory for achievement of mission objectives is fully supported in the nominal network schedule. Demand projections developed in 2023 suggested an exceedance of the DSN capacity by as much as 40 percent at times during the next four to five years (the "contention period" mentioned in the OIG report).

Based on these projections and lessons learned from Artemis I, NASA has embarked on several activities to address the capacity and reliability challenges for DSN. In addition to completing upgrades to the DSN, implementing Lunar Exploration Ground Sites (LEGS), and exploring options to offload demand from DSN, the Space Communications and Navigation (SCaN) Program has created a DSN prioritization working group that is specifically focused on ensuring science return concurrent with Artemis mission operations. Efforts of this team, which includes members from Exploration Systems Development Mission Directorate (ESDMD), Science Mission Directorate (SMD), and Space Operations Mission Directorate (SOMD), have already resulted in an improved understanding of the Artemis mission requirements and proposed approaches to scheduling during nominal and contingency operations intended to protect NASA science and exploration needs. The work from this team is ongoing and NASA will iterate DSN demand projections to assess the recommendations from the DSN prioritization working group.

b. How does NASA ensure that the requirements of the science missions are well-understood and taken into account by the Space Operations Mission Directorate when planning for future DSN services?

NASA's SMD and SOMD have a common interest in ensuring the provision of SCaN Program C&N services meets mission needs now and into the future. Coordination occurs between SMD and SOMD's SCaN, such that each party has a common understanding of the objectives, outcomes, and mechanisms of that coordination, as well as a common understanding of the services being provisioned to missions and the associated cost implications.

SMD and SCaN independently conduct respective long-range planning for this purpose. SMD strategic planning is tied to science objectives and guiding documentation such as the SMD Science Plan, the advice provided through the various advisory bodies within NASA and the National Academies, and the Decadal Surveys. SCaN has responsibility for the management and operation of the existing networks and the evolution of the C&N architecture and services over time. Communication between the two organizations ensures that the SCaN network roadmap is responsive to mission needs.

The primary mechanisms for the exchange of requirements, technology needs and development, as well as network implementation and status are through the SCaN Board of Directors (BOD), and technical working groups as needed. SMD provides to SCaN appropriate information on mission forecasts, upcoming announcements of opportunity, and insight into mission requirements that are relevant to C&N (e.g., data rate capability, unique navigation requirements). Implementation solutions for C&N service are determined by SCaN, which provides to SMD appropriate information on the network roadmap and time-phased capability of the networks. SCaN also keeps SMD apprised of trends in radio frequency (RF) spectrum policy that have the potential to impact NASA missions.

c. What is the maturity level of deep space optical communications capabilities under development by NASA, and what are NASA's plans and timelines regarding the potential future use of optical communications technologies to meet some or all of the demands that only the DSN can meet today?

For the Deep Space Optical Communications (DSOC) experiment, NASA expects to reach Technology Readiness Level (TRL) 7 maturity level in the fall of 2024, pending successful completion of DSOC's final Level 1 requirement of its first year of operations. On April 8, 2024, DSOC successfully demonstrated optical downlinks of 6.25 Megabits per second (Mbps), 20.8 Mbps, and 25 Mbps from a distance of more than 1.5 Astronomical Units (1 AU, an Astronomical Unit, is the distance from the Sun to Earth's orbit, or about 93 million miles), including receiving 30 Megabytes of Psyche spacecraft telemetry. The 25 Mbps link at >1.5 AU substantially exceeds the Level 1 requirement target, and meets the third of four Level 1 mission requirements. The remaining Level 1 requirement of the first year of operation is currently expected to be met in October 2024.

NASA is exploring the possible future use of optical communications technologies to support deep space missions, though this technology is still in the demonstration phase, at this point.

Questions submitted by Full Committee Ranking Member Zoe Lofgren

1. **The President's Fiscal Year (FY) 2025 budget request for NASA proposes a $27.2 million (40%) cut to the budget for the operations of the Chandra X-ray Observatory and to begin shutting down the mission. Chandra is the most powerful X-ray telescope in space right now, and it has enabled us to answer fundamental questions about the origins and evolution of the universe. NASA's 2022 Senior Review ranked Chandra, along with the Hubble Space Telescope, in the top tier of operating astrophysics missions for its continued scientific value, and NASA approved Chandra for extended operations through FY2025 and for participation in the 2025 Senior Review.**

    a. **What is the rationale for reversing the decisions based on the recommendations of the 2022 Senior Review and ending Chandra early?**

The primary rationale is that Chandra mission operations cannot be sustained at the previous level of funding in light of FY 2025 budget constraints. These reductions are required to maintain a balanced Astrophysics portfolio. Chandra has been operating for twenty-five years and reliance on its continued performance represents an increased risk moving forward. FY 2025 budget constraints are such that the recommendations made in the last Senior Review, during a different budget climate, cannot be followed beyond FY 2024.

    b. **Has NASA sought independent scientific input to inform its proposal to end Chandra operations sooner than planned?**

A Mini-Senior Review will be commissioned during FY 2024 to solicit community input on alternative operational scenarios for Chandra and Hubble that could provide more cost-effective science operation models for each mission. With a combined operational cost of $188M, the Mini-Senior Review will address potential cost savings that could be achieved via consolidation of Hubble and Webb science operations. The Mini-Senior Review will investigate options for a streamlined operational model for Chandra.

    c. **What are the research questions in astrophysics that can only be addressed by Chandra?**

Chandra is a large area X-ray telescope, so it primarily addresses Astrophysics problems that require deep x-ray imaging capabilities and high angular resolution.

    d. **Is NASA currently pursuing development of a mission that would match or exceed Chandra's capabilities to address the gap that would be left, were the agency's proposal to end the mission be accepted?**

The Budget proposes to start orderly mission drawdown to minimal operations, not to end the mission. The agency is attempting to identify a lower-cost operations concept for the current stage of Chandra's extended mission.

Additionally, NASA is currently reviewing proposals for a Probe-Class ($1B) mission recommended by the Decadal Review. The Probe mission proposals are for X-Ray or Far-Infrared missions. In addition, a Medium-Class Explorers (MIDEX) call in FY 2027 also presents the opportunity to propose a mission that would meet or exceed the current capabilities

of Chandra. NASA is partnering with the European Space Agency to develop an X-ray mission known as NewAthena that could exceed the capabilities of Chandra.

e. Are international space agencies operating, or pursuing the development of, a mission that would match or exceed Chandra's capabilities?

NASA is partnering with the European Space Agency to develop an X-ray mission known as NewAthena that could exceed the capabilities of Chandra. This mission will be adopted by ESA in 2027 and NASA will initiate Phase A development once adoption has occurred. NASA has already developed an X-ray sensor for this mission.

f. What would be the impact on the U.S. x-ray astrophysics and astronomy research community should the Chandra mission end early? How many U.S. researchers would be affected?

NASA is attempting to identify an alternative operations concept for the Chandra mission that would allow research to continue at this stage of the extended mission.

It should be noted that the Agency also operates the following operational x-ray missions: IXPE, NICER, XMM, XRISM, NuSTAR and SWIFT. Science funding for these missions, combined with other Research Opportunities in Space and Earth Science (ROSES) research programs provide a total of ~$28M.

g. What would be the implications for the United States' global standing in x-ray astronomy should the proposal to end the Chandra mission be adopted?

The Agency is attempting to identify a lower-cost alternative for Chandra's continued operation, consistent with the reduced funding for Chandra proposed in the President's Budget, while also maintaining a balanced Astrophysics portfolio.

It should be noted that the Agency also operates the following operational x-ray missions: IXPE, NICER, XMM, XRISM, NuSTAR and SWIFT. Science funding for these missions, combined with other ROSES research programs provide a total of ~$28M. The U.S. X-ray community remains well-funded and has access to numerous X-ray science missions, together with opportunities for new missions in the future.

Questions submitted by Rep. Mike Garcia

1. **During the hearing you asserted that had NASA continued to spend at FY23 levels for the Mars Sample Return program, such spending would have resulted in an Antideficiency Act violation, and you committed to providing detailed evidence to support that claim. Please provide any relevant information for the record.**

In July 2023, the Senate Appropriations Committee marked up and reported, S. 2321, the FY 2024 Commerce, Justice, Science Appropriations bill, and accompanying report (Senate Report 118-62). Senate Report 118-62 included language funding the Mars Sample Return (MSR) Program at not less than $300.0 million, $522.0 million below the FY 2023 enacted level and $649.3 million below the President's Budget Request (PBR).

The table below shows the monthly costs for MSR during FY 2023. This shows that the project was costing an average of $82.0 million per month during the last quarter of FY 2023. Had this level been sustained during FY 2024, the project would have costed $984.0 million during FY 2024. The project had $327.0M of uncosted funding from prior years available as of October 1, 2023. Therefore, MSR would have required over $650 million in FY 2024 funding to support monthly costs at this rate and appropriate carryover into FY 2025, exceeding the Senate mark of not less than $300.0 million by at least $350.0 million.

FY 2023	Monthly Cost
October	$ 60,076,798
November	$ 48,051,908
December	$ 60,530,612
January	$ 61,139,578
February	$ 51,080,567
March	$ 22,126,940
April	$ 104,630,254
May	$ 78,782,653
June	$ 82,599,805
July	$ 77,526,697
August	$ 81,568,111
September	$ 87,652,544

During the period of the extended FY 2024 Continuing Resolution (CR), NASA planned available funding prudently to the most conservative funding level within the anticipated FY 2024 constraints as directed in Section 110 of the FY 2024 Further Continuing Appropriations and Extensions Act (P.L. 118-22), including the not less than $300.0 million level for MSR as stipulated in Senate Report 118-62.

If NASA had expended more on MSR during the period of the FY 2024 CR than the level ultimately specified in an enacted FY 2024 appropriation, NASA would have been required to deobligate funds in excess of the amount appropriated for MSR or reduce an equivalent amount from other Planetary Science projects, causing significant damage and programmatic disruption to projects such as Europa Clipper, NEO Surveyor, and Dragonfly. In order to protect against such an outcome, SMD directed the MSR project to plan to a not less than $300.0 million FY 2024 budget during the period of the extended FY 2024 CR. NASA believes this to have been the most responsible path forward for MSR, given the uncertainty in both the MSR mission architecture and FY 2024 funding constraints.

2. **In NASA's FY21 budget request, the Dragonfly mission was estimated to launch NET April 2026 with a projected FY25 request of $208.9 million. Yet your FY25 budget request asks for $434.6 million and a new launch date of NET July 2028. Why has the cost of this project more than doubled and experienced continued delays? Will NASA implement an Independent Review Board?**

On April 16, 2024, NASA confirmed the Dragonfly mission with a total lifecycle cost of $3.35 billion and a launch date of July 2028. This reflects a cost increase of about two times the proposed formulation and development cost and a delay of more than two years from when the mission was originally selected in 2019.

The New Frontiers Announcement of Opportunity under which Dragonfly was selected set a cost cap of $850 million in FY 2015 dollars, and covered Phases A-D of the life cycle (i.e., excluding operations) and excluded the costs of the launch vehicle and associated nuclear services as well as mission directorate held cost reserves. As proposed, the Dragonfly mission met this cost cap requirement and had an initial cost for Phases A-D of approximately $1 billion in real year dollars. The current estimate for those phases within the $3.35 billion Agency Baseline Commitment is approximately $2.1 billion. That is the basis for the statement that the cost is twice what it was at selection.

Since mission selection in 2019, NASA has changed the targeted launch date several times due to budgetary constraints. The cumulative impact of these early NASA-directed replans, and another after the Preliminary Design Review (PDR), are responsible for nearly two thirds of the increase in Phase A-D costs. The Dragonfly project also conducted an in-depth design iteration prior to PDR. The increased costs of that, combined with COVID-driven increases in labor rates and the costs of parts and materials, are responsible for the balance of the increase in Phase A-D costs.

Separate from the Phase A-D costs, NASA also provided additional funding to support the acquisition of a heavy-lift launch vehicle. The greater energy provided by such a vehicle enables a shorter cruise phase to Titan, offsetting the schedule impacts of prior launch delays and allowing the science to be returned in the timeframe originally proposed.

An Independent Review Board (IRB) will not be needed given that the mission successfully passed all of the success criteria of its Preliminary Design Review in early 2023 and has a credible path forward.

Questions submitted by Rep. Jennifer McClellan

1. **The Science Mission Directorate Bridge Program aims to develop partnerships between NASA Centers and institutions that have been historically under-resourced—including Minority Serving Institutions, Community Colleges, and Tribal Colleges and Universities. Dr. Fox, could you provide an update on the status of the Bridge Program and some of its outcomes?**

A call for seed funding proposals to develop new partnerships between NASA Centers and under-resourced institutions was included in NASA Science Mission Directorate's annual omnibus solicitation for basic and applied research, Research Opportunities in Space and Earth Science (ROSES) 2023. A total of 86 proposals were received by this year's closing date of March 29, 2024, the first 40 of which have been peer reviewed. The other 46 proposals are currently undergoing review, with anticipated selections to be made in late June 2024.

Thus far, a total of 24 partnerships have been selected for two-year funding awards with a total contract value of $7.6M. Additional funding is planned for the final selectees later this year. All selected proposals were led by investigators at under-resourced institutions, and seven NASA Centers are involved in new Bridge Program partnerships these institutions. Cohort-building and mentor training activities are underway for faculty and NASA partners, and student research experiences are planned to begin in summer 2024.

Questions submitted by Rep. Summer Lee

1. **NASA's CLPS program has moved forward with two missions so far this year. The agency assumed risk in moving forward with new contracting methods and enabling new companies to participate in our nation's space program, and I applaud the efforts made to date. I look forward to future CLPS missions, including the one to deliver the VIPER rover which will demonstrate ground-breaking science that could change the economics of future space science and exploration. In light of cuts made to the Planetary Science portfolio within the Science Mission Directorate in the final FY24 appropriations act, can you please update us on NASA's progress and plans for the VIPER mission, including its method of delivery to Moon via a CLPS delivery service contract?**

Since a 2023 replan, VIPER has continued to face technical and supply chain challenges that have consumed funded cost and schedule, including late delivery of subsystems and hardware by vendors; out-of-specification printed wiring board and connectors; and failures in the drill engineering unit during testing. The CLPS-provided lunar delivery of VIPER also has increased schedule uncertainty in the wake of Astrobotic's Peregrine Mission 1 failure to land on the Moon. As a result of ongoing technical and supply chain challenges, NASA requested the VIPER project to provide a plan for a potential 2025 IOC. The project has estimated that the associated costs of this delay could result in exceeding the original ABC development cost estimate by more than 30 percent, requiring a rebaseline of the project. To assess the viability of the project given these likely cost and schedule increases and impacts on upcoming CLPS deliveries and other areas of the LDEP portfolio, NASA is finalizing the results of a Continuation/Termination Review for VIPER.

Following Astrobotic Technology's Peregrine Mission-1 (PM-1), Astrobotic conducted a Failure Review Board (FRB) on Peregrine and will soon brief NASA on the results. NASA expects Astrobotic to apply corrective actions from the PM-1 Failure Review Board to the Griffin lander. After incorporating any necessary actions, along the findings of the Continuation/Termination review, NASA will inform Congress with an update and plans for both VIPER and the Griffin lander.

National Aeronautics and
Space Administration

Hold for Release Until
Presented by Witnesses

November 16, 2022

Committee on Science, Space,
and Technology

United States House of Representatives

Statement by:

Dr. Mark Clampin, Division Director, Astrophysics Division, Science Mission Directorate
National Aeronautics and Space Administration

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Statement of

Dr. Mark Clampin, Astrophysics Division Director
Science Mission Directorate

National Aeronautics and Space Administration

before the
Committee on Science, Space, and Technology
U.S. House of Representatives

INTRODUCTION

My name is Mark Clampin, and I am the Director of the Astrophysics Division of NASA's Science Mission Directorate. As one of the many people who have worked on the James Webb Space Telescope (JWST) over the years, I could not be happier to join you this morning to share some tantalizing science NASA and our partners at the European and Canadian Space Agencies are set to explore using JWST: about the earliest, most distant light we can see; how galaxies form and evolve; the lifecycle of stars; and planetary systems and the origin of life.

I know many of you were excited to see us come together with our partners and audiences around the world for JWST's major milestones so far – from launch, provided by the European Space Agency and Arianespace, to the first images rollout events at NASA's Goddard Space Flight Center, here on the Hill, and at the Space Telescope Science Institute in Baltimore, which operates the telescope. The anticipation of what the world's premier space science observatory might deliver is beginning to come to fruition. In just the first few months of using its amazing American, Canadian, and European instruments: a Near-Infrared Camera, Near-Infrared Spectrograph, Mid-Infrared Instrument, and Fine Guidance Sensor and Near Infrared Imager and Slitless Spectrograph; we already have myriad results showing that JWST will dramatically advance our understanding of the universe. As is always true with NASA science, our need to explore further only deepens with each new discovery.

The End of the Dark Ages: First Light and Reionization

NASA's JWST is already setting this stage with new discoveries that were previously beyond our reach. In one of its very first full-color images, the observatory delivered the deepest and sharpest infrared image of the distant universe so far. JWST's First Deep Field was galaxy cluster SMACS 0723, an image teeming with thousands of galaxies – including the faintest objects ever observed in the infrared. The combined mass of this cluster of galaxies acts as a gravitational lens, magnifying more distant, background galaxies, including some seen when the universe was much less than a billion years old.

Within this first deep field, scientists have already identified the most distant globular clusters ever seen. These clusters are dense groups that contain millions of stars, some of which may be the first and oldest stars in the universe. We are now seeing the details of the earliest phase of star formation, advancing immediately beyond what was possible with previous Hubble Space Telescope (HST) imaging.

New results also point to some of the most distant galaxies ever observed, using only a few days' observation time. Some likely date back to nearly 350 million years after the Big Bang. And while the distances of these early sources still need to be confirmed, astronomers have been surprised to find that many of these early galaxies are extremely compact and bright. This brightness poses a serious science question for us: What was more common in the early universe – many large, low-mass stars, or fewer, blazingly bright stars?

Assembly of Galaxies

JWST is also already offering insights about how galaxies form and evolve over time. One surprising discovery was a cluster of massive galaxies in the process of forming around an extremely red quasar, a powerfully active galactic nucleus that existed 11.5 billion years ago. JWST's extremely sensitive instruments allowed simultaneous spectroscopic measurement of a wide enough area to show how the quasar and a cluster of at least three galaxies around it, in an area likely full of dark matter, interact in what is one of the densest known areas of galaxy formation in the early universe.

JWST is revealing new perspectives on previously studied targets, thanks to its infrared instruments' ability to peer through dust. The Cartwheel Galaxy, a large pink, speckled galaxy resembling a wheel, is the result of a high-speed intergalactic collision, and now sports two rings — a bright inner ring and a surrounding, colorful ring. JWST has been able to uncover how the expanding rings drive star formation, as well as peer at hydrocarbons, silicates, and other compounds in the dust in the spokes of the wheel.

The Birth of Stars and Protoplanetary Systems

The Pillars of Creation, famously imaged by HST in 1995, is a region where many new stars are forming within dense clouds of gas and dust. But JWST can help us understand how many emerging stars can be found there with much more precision. Its newest view of the Pillars of Creation will help researchers revamp models. Over time, we will begin to better understand how stars form and burst out of these dusty pillars over millions of years. JWST's ability to observe and quantify gas and dust also helps us understand the properties of this rapidly changing area in sharper detail than ever.

Astronomers studying Wolf-Rayet stars have also recently discovered the best evidence yet that the huge amounts of gas pushed into space by these powerful late-stage stars produce carbon-rich dust. And the dust shells that JWST can spot tell us that this dust can remain in the hostile environment between stars and supply material for future stars and planets.

The Tarantula Nebula is the largest and brightest star-forming region near our Milky Way, and it is home to the hottest, most massive stars known. The nebula has a similar type of chemical composition as the gigantic star-forming regions observed when the cosmos was only a few billion years old and star formation was at its peak. JWST is providing astronomers the opportunity to compare and contrast star formation in the Nebula with that of distant galaxies from the actual era of peak star formation, called "cosmic noon."

Planetary Systems and the Origin of Life

Excitingly, JWST's unmatched infrared sensitivity is also revealing new hints about worlds outside our solar system. JWST confirmed the first clear evidence of carbon dioxide in the atmosphere of a planet called WASP-39 b. The planet's discovery, reported in 2011, was made based on ground-based detections of the subtle, periodic dimming of light from its host star as the planet transits in front of the star, and previous observations from NASA's HST and the Spitzer Space Telescope revealed the

presence of water vapor, sodium, and potassium in the planet's atmosphere. JWST has studied WASP-39 b's atmosphere in unprecedented detail, offering evidence that this powerful observatory may also be able to detect and measure carbon dioxide in the thinner atmospheres of smaller rocky planets.

JWST also captured the distinct signature of water in the atmosphere of a hot, puffy gas giant planet called WASP-96 b. While HST has analyzed many exoplanet atmospheres over the past two decades, capturing the first clear detection of water in 2013, JWST's immediate and more detailed observations hint at the significant role the telescope will play in the search for potentially habitable planets in coming years. JWST's powerful new view of this planet also showed evidence of haze and clouds that previous studies of this planet did not detect.

A true highlight of our early research is JWST's ability to take a direct image of a planet outside our solar system. Taking direct images of exoplanets is challenging because stars are so much brighter than planets. HIP 65426 b is an exoplanet discovered in 2017 using the SPHERE instrument from the European Southern Observatory's Very Large Telescope. HIP 65426 b is more than 10,000 times fainter than its host star in the near-infrared, and a few thousand times fainter in the mid-infrared. JWST was able to image such a dim object so early in its mission, thanks to the coronagraphs on its instruments, which served to suppress the light of the host star – a capability that points toward exciting new observations of other worlds in the future.

Closer to home, JWST images of Jupiter have been able to showcase several levels of its auroras and clouds, from high-altitude auroras above to the northern and southern poles to swirling hazes and deeper main clouds. Streaks and spots identified in JWST data likely reflect convective storms. Wider field images capture Jupiter's faint rings and tiny nearby moons. Planetary scientists are already working out what these new data mean for Jupiter's chemistry and atmosphere.

JSWT's first image of Neptune captured the clearest view of this distant planet's rings in more than 30 years. Some of these rings had not been detected since NASA's Voyager 2 first observed Neptune during its flyby in 1989, along with Neptune's dust band. High-quality images show a vortex at Neptune's southern pole and more subtly suggest other weather activity. JWST also imaged Neptune's highly reflective icy moon Triton, with plans to image this system again in the coming year.

Conclusion

Since it began observations, JWST has simply been amazing. We have been very pleased with its better-than-expected performance and observations. We are managing the observatory in such a way that we expect it to provide dramatic scientific surprises for many years to come. But we at NASA are far from satisfied with what we have learned, insofar as it tells us there is infinitely more to learn from the heavens. We continue to learn from observations gained from missions like Hubble, Chandra, TESS, and IXPE, among many others. In the future, you should expect great things from the Roman Space Telescope, COSI, GUSTO, and the missions we build toward in response to the 2020 Astrophysics Decadal Survey. In just a few years, I hope you will invite us back to see the first results of Roman's massive infrared survey so we can discuss how these systems can provide complementary observations to target future JWST missions. We will, as always, be prepared to share with you and the public everything that we and the scientific community are able to find with these complementary assets.

Mr. Chairman, we would be happy to respond to any questions you or the other Members of the Subcommittee may have.

From:	Crary, Carolyn D. (HQ-VA030)
To:	Hone, Marc (HQ-VA000); Ghee, Ladonna E. (HQ-VA030)
Cc:	Rowe, Andrew (HQ-VA000)
Subject:	FW: [EXTERNAL] SST: Hearing Thank You - Advancing Scientific Discovery: Assessing the Status of NASA's Science Mission Directorate
Date:	Friday, June 21, 2024 10:46:08 AM
Attachments:	HSSTC Fox 03.21.24 QFRs.pdf **Attacment: Duplicate (14pp)**

For your files.

From: Rowe, Andrew (HQ-VA000) <andrew.rowe@nasa.gov>
Sent: Thursday, June 20, 2024 5:04 PM
To: Scales, Charlie <Charlie.Scales@mail.house.gov>
Cc: Blevins, Brent <Brent.Blevins@mail.house.gov>; Whitney, Pamela <Pamela.Whitney@mail.house.gov>
Subject: RE: [EXTERNAL] SST: Hearing Thank You - Advancing Scientific Discovery: Assessing the Status of NASA's Science Mission Directorate

Charlie – letter and QFR responses attached.

From: Scales, Charlie <Charlie.Scales@mail.house.gov>
Sent: Monday, April 8, 2024 12:46 PM
To: Rowe, Andrew (HQ-VA000) <andrew.rowe@nasa.gov>
Cc: Blevins, Brent <Brent.Blevins@mail.house.gov>; Whitney, Pamela <Pamela.Whitney@mail.house.gov>
Subject: [EXTERNAL] SST: Hearing Thank You - Advancing Scientific Discovery: Assessing the Status of NASA's Science Mission Directorate

Good Afternoon,

Please find attached a thank you letter from Chairman Babin to Dr. Fox for her appearance at the Space and Aeronautics Subcommittee Hearing titled, "*Advancing Scientific Discovery: Assessing the Status of NASA's Science Mission Directorate*." The attached letter also includes a transcript of the hearing and Member questions for the record (QFRs). Please submit any desired corrections to the transcript and QFR responses by Monday, April 22, 2024.

Please let me know if you have any questions.

Thank you,

Charlie Scales
Policy Assistant
House Science, Space, and Technology Committee
(202) 465-5014