
Evaluation of the Space Weather Follow-On Program’s Progress in Preparing the SWFO-L1 Satellite for Launch and Operations

REPORT NO. OIG-26-008-I

March 5, 2026





March 5, 2026

MEMORANDUM FOR: Dr. Neil A. Jacobs
Under Secretary of Commerce for Oceans and Atmosphere
and NOAA Administrator
National Oceanic and Atmospheric Administration

A handwritten signature in black ink, appearing to read "Arthur L. Scott Jr.".

FROM: Arthur L. Scott Jr.
Assistant Inspector General for Audit and Evaluation

SUBJECT: *Evaluation of the Space Weather Follow-On Program's
Progress in Preparing the SWFO-L1 Satellite for Launch and
Operations*
Report No. OIG-26-008-I

Attached is the final report on our evaluation of the Space Weather Follow-On (SWFO) program's progress in preparing the SWFO-Lagrange 1 satellite for launch and operations. We will post the report on our website per the Inspector General Act of 1978, as amended (5 U.S.C. §§ 404, 420).

Within 60 calendar days, please provide an action plan addressing the report's recommendations, as required by Department Administrative Order 213-5.

We appreciate your staff's cooperation and professionalism during this evaluation.

Attachment





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Evaluation Report OIG-26-008-I

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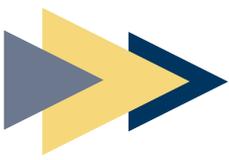
➤ **What We Audited** | Our objective was to assess the Space Weather Follow-On (SWFO) program's progress in preparing the SWFO Lagrange point 1 (L1) satellite for launch and operations.

➤ **Why This Matters** | The National Oceanic and Atmospheric Administration's (NOAA's) National Environmental Satellite, Data, and Information Service (NESDIS) operates satellites that observe space weather. Space weather data, including solar wind measurements and coronal mass ejection (CME) imagery, is critical for NOAA to provide warnings for events that could disrupt communication and navigation systems, like the Global Positioning System, and severely affect commercial power grids.

NESDIS's Office of Space Weather Observations SWFO program is designed to meet NOAA's need for operational solar wind measurements and CME imagery. The program launched its SWFO-L1 satellite on September 24, 2025, and it will orbit the Sun at the Sun-Earth L1, approximately 1 million miles from Earth. This satellite will be able to continuously observe the Sun and space environment outside of Earth's atmospheric effects and will provide measurements of the flow of solar particles before they reach Earth. Sudden increases in solar wind density, speed, and magnetic field strength at the L1 orbit location can indicate the arrival of a CME, and capturing this data can provide up to 60 minutes advanced warning of geomagnetic storm effects on Earth.

➤ **What We Found** | We found that the SWFO program made adequate progress in preparing for launch and operations. However, we also found that the SWFO Program Office did not conduct vibration testing using the actual flight separation system, nor did it receive a formal waiver for this deviation from "Test-As-You-Fly" standards. Further, we identified several observations that highlight areas of concern and opportunities for improvement within the SWFO program and its support of NOAA missions.

➤ **What We Recommend** | We made seven recommendations to NOAA to help decrease the risk of launch failure, prevent unnecessary spending on future rideshare missions, minimize the recurrence of errors in future programs, and avoid potential gaps in space weather data availability. NOAA concurred with our recommendations and is working to implement them.



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Introduction

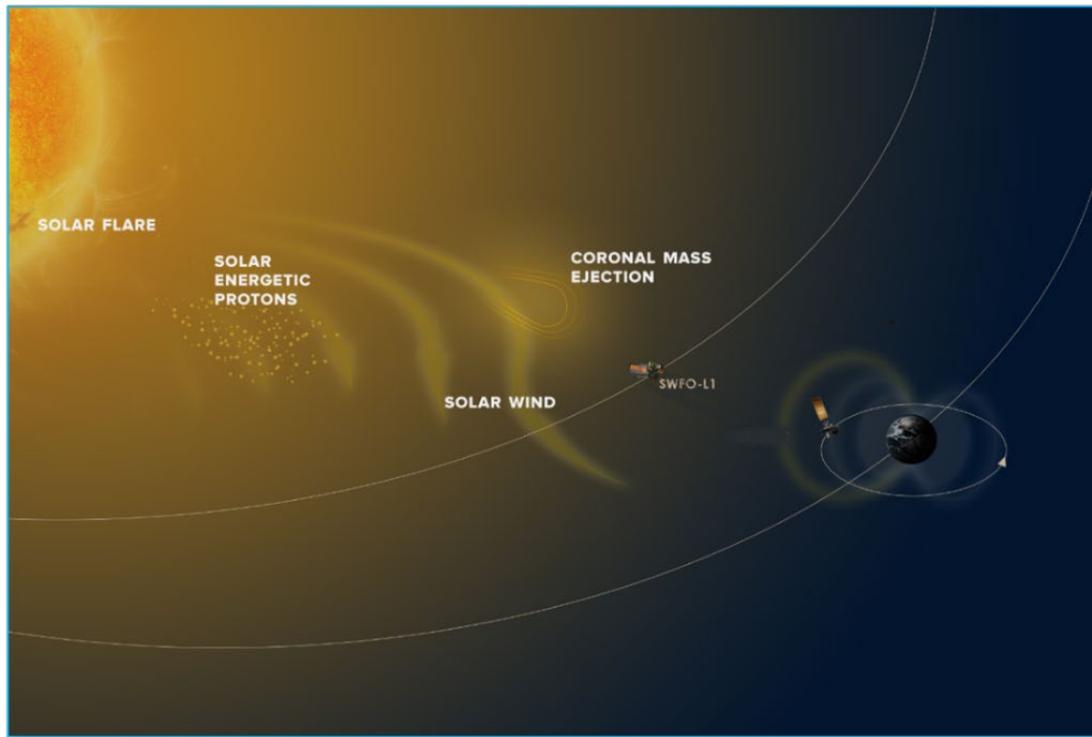
The National Oceanic and Atmospheric Administration's (NOAA's) National Environmental Satellite, Data, and Information Service (NESDIS) operates satellites that observe space weather.¹ Space weather data, including solar wind measurements and coronal mass ejection (CME) imagery, is critical for NOAA to provide warnings for events that could disrupt communication and navigation systems, like the Global Positioning System, and severely affect commercial power grids. NESDIS's satellites collect data that the National Weather Service, scientists across NOAA, the commercial sector, and private citizens use for a wide range of applications.

NESDIS's Office of Space Weather Observations (SWO) Space Weather Follow-On (SWFO) program is designed to meet NOAA's need for operational solar wind measurements and CME imagery. The program launched its SWFO-L1 satellite on September 24, 2025, and it will orbit the Sun at the Sun-Earth Lagrange point 1 (L1).² From L1, this satellite, called the SWFO-L1, will be able to continuously observe the Sun and space environment outside of Earth's atmospheric effects and will provide measurements of the flow of solar particles before they reach Earth (see figure 1). Sudden increases in solar wind density, speed, and magnetic field strength at the L1 orbit location can indicate the arrival of a CME, and capturing this data can provide up to 60 minutes advanced warning of geomagnetic storm effects on Earth.

¹ Space weather describes the conditions of the space environment due to solar activity. Measurements of solar wind particles, magnetic fields, and CMEs (which are large releases of plasma and magnetic fields from the Sun) increase the accuracy of space weather forecasts and warnings for Earth.

² The orbit location known as L1 is approximately 1 million miles from Earth toward the Sun, and it takes a satellite about 125 days to arrive at L1 after launch. For comparison, NOAA's other major weather satellites, the Geostationary Operational Environmental Satellites and Joint Polar Satellite System, are approximately 22,000 miles and 500 miles from Earth, respectively.

Figure 1. SWFO-L1 at Lagrange Point 1



Source: SWFO program documentation

The SWFO program is a collaboration between NOAA and the National Aeronautics and Space Administration (NASA), each with important and complementary responsibilities in developing, testing, launching, and operating the SWFO-L1 satellite. NOAA provides the funds, manages the program, and operates the satellite after launch. NOAA is also responsible for the acquisition, development, integration, and testing of the ground system, which NOAA will use to control the satellite and collect and process its data. NASA serves as NOAA's acquisition agent for the satellite and launch services. SWFO-L1 is estimated to cost a total of \$693 million over its lifecycle (through fiscal year 2030).

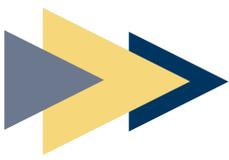
Currently, NOAA and NASA operate three space weather satellites that capture space weather data from the L1 orbital position. These satellites are the Deep Space Climate Observatory, over 10 years old; the Advanced Composition Explorer, over 25 years old; and the Solar and Heliospheric Observatory, almost 30 years old. All three satellites are well beyond their life expectancies. The SWFO-L1 satellite is intended to provide a new source for solar wind measurements and CME imagery before these legacy satellites at L1 stop functioning. SWFO-L1 is designed to operate for 5 years, by which time NOAA intends to launch its next generation of space weather satellites.

In a 2023 audit of the SWFO program, we focused on the early challenges for the SWFO-L1 mission, such as the sharing of a launch vehicle with NASA’s Interstellar Mapping and Acceleration Probe (IMAP).³ This sharing of launch vehicles is referred to as a “rideshare” and presents a unique challenge for NOAA’s mission because the SWFO-L1 satellite must meet the primary satellite’s (IMAP’s) launch schedule.

► Objective

Our objective was to assess the SWFO program’s progress in preparing the SWFO-L1 satellite for launch and operations. Appendix 1 details our scope and methodology.

³ Commerce Office of Inspector General (OIG). March 13, 2023. *Space Weather Follow-On (SWFO) Program: Rideshare Schedule Presents Challenges and Lack of Backup Option Warrants NOAA Attention*, [OIG-23-015-A](#).



Findings and Recommendations

Summary: We found that the SWFO program made adequate progress in preparing for launch and operations. However, we also found that the SWFO Program Office did not conduct vibration testing using the actual flight separation system, nor did it receive a formal waiver for this deviation from “Test-As-You-Fly” (TAYF) standards.

This occurred because NOAA oversight officials, as the mission sponsors, did not provide sufficient oversight to enforce TAYF requirements during vibration testing. As a result, NOAA did not have assurance that the system would not fail during launch and that the government’s interest was adequately protected.

Further, we identified several observations that highlight areas of concern and opportunities for improvement within the SWFO program and its support of NOAA missions. Specifically:

- The SWFO program’s undefined initial design requirements increased costs for the government.
- NOAA and NASA need to ensure accurate cost estimating for the rideshare program.
- The SWFO-L1 flight project did not hold pause and learn (PaL) sessions as planned.
- NOAA lacks policy to ensure the availability of space weather satellite observations.

Addressing these issues will help decrease the risk of launch failure, prevent unnecessary spending on future rideshare missions, minimize the recurrence of errors in future programs, and avoid potential gaps in space weather data availability. Additionally, while testing with a mock-up was successful and did not impact the schedule, the absence of the actual separation system presents a significant risk to mission assurance. Failure of

the actual separation system could result in mission failure and lead to a gap in space weather coverage.

► **The SWFO Program Made Adequate Progress as It Prepared for Launch and Operations**

SWFO's program plan⁴ and system engineering management plan⁵ required the program to complete a series of satellite-level tests, milestone decision gates, and major technical reviews to monitor performance, ensure the satellite would meet requirements, and therefore, be ready for launch.⁶ Within the time frame of our fieldwork, the program was required to perform various integration and test activities including milestone reviews (Flight Operations Review and Pre-Shipment Review) and major satellite-level tests (vibration testing and thermal vacuum testing).

We observed these reviews, assessed the test results, and found that generally, the program addressed risk items in accordance with policy and completed testing successfully. Additionally, the independent review boards leading the major reviews were generally satisfied with the program's efforts. We did, however, note a concern related to the SWFO-L1 separation system, which is discussed in our next finding.

We also noted that the launch of SWFO-L1, originally planned for October 2024, was delayed three times due to NASA's IMAP mission delays, which were not attributable to the SWFO program. These delays caused the launch date to move from October 2024 to February 2025, then to April 2025, and finally to September 2025. Program personnel indicated that they likely would have needed more resources to meet the original launch date. However, the delays allowed the SWFO program more time to complete integration and test activities, completing them about 8 months before the final launch date. Overall, we concluded that the program made adequate progress and the SWFO-L1 satellite was ready for launch and operations.

In our 2023 audit of the SWFO program, we found that the program should improve its lessons-learned process, improve contract oversight, and update its space weather requirements. This led us to assess the ongoing effectiveness of the SWFO program's corrective actions in response to those findings. Our assessment identified deficiencies

⁴ Commerce, NOAA, and NASA. January 20, 2025. *Space Weather Follow-On Program Plan*.

⁵ Commerce, NOAA, and NASA. October 14, 2021. *Space Weather Follow On Program Systems Engineering Management Plan (SEMP)*.

⁶ NASA. August 3, 2021. *NASA Space Flight Program and Project Management Requirements*.

that, if addressed, would improve future NOAA and NASA programs. These deficiencies are discussed in the following sections.

► **The SWFO Program’s Test Compromises Increased Risk to the SWFO-L1 Satellite**

The Goddard Space Flight Center’s (GSFC’s) engineering rules for space flight systems require that satellites and launch vehicles be tested before launch in the same configuration as they will be flown in space, known as “Test As You Fly” (TAYF).⁷ The rationale for this rule is that TAYF greatly reduces the risk of mission loss. If testing cannot be accomplished in the flight configuration, NASA requires spaceflight programs to request a waiver of the TAYF requirement. When a program seeks a waiver, the process requires GSFC subject matter experts to assess the associated risk to mission success of the test alternatives prior to waiver approval.⁸ The waiver becomes the formal notification and provides the details of the assessment to the GSFC Safety and Mission Assurance Directorate for approval.

GSFC’s engineering rules also govern the flight separation system. A separation system attaches the satellite to its launch vehicle. The system’s purposes are to:

- Maintain attachment throughout launch until the satellite is in space
- Separate the satellite from the launch vehicle once in space

During a program review in May 2024, prior to vibration testing of the SWFO-L1 satellite, GSFC’s independent review team noted that the vibration test plan should include the actual flight separation system instead of a mock-up of the system.⁹ Program personnel told us that the mock-up did not replicate the actual separation system because it was stiffer. As a result, the mock-up would not flex as much during the vibration test.

When the SWFO-L1’s pre-launch vibration test was conducted in June 2024, the program did not use the actual flight separation system because it was unavailable due to conflicting schedules with the launch vehicle provider. Because the SWFO-L1’s vibration test did not use the actual flight separation system, the satellite was not in a TAYF configuration and thus a TAYF waiver was required. The program did not request a TAYF

⁷ GSFC. August 19, 2025. *Rules for the Design, Development, Verification, and Operation of Flight Systems*. Goddard Open Learning Design (GOLD) Rules, 13.

⁸ GSFC. November 5, 2020. *Goddard Procedural Requirement (GPR) 8070.4D*, 5 and 6.

⁹ Ground testing to simulate launch-induced vibration has proven to be vital in developing successful spacecraft programs.

waiver and because of this, the GSFC Safety and Mission Assurance Directorate did not provide a formal assessment and approval for this deviation from the test requirement.

The vibration testing was successfully completed with the mock-up; however, by not using the actual flight separation system for the satellite vibration test and obtaining the required assessment and approvals for the waiver, there was an increased risk that the flight separation system would not work as intended. Failure of the actual separation system could have resulted in mission failure and led to a gap in space weather coverage.

During our discussions, program personnel stated that they believed it was common practice to use the mock-up separation system for this situation but acknowledged the need for a waiver.¹⁰ Because the SWFO-L1 satellite launched in September 2025, it is too late to provide proactive risk mitigation for this satellite. Therefore, NOAA needs to take measures to ensure that future TAYF requirements are fully evaluated either by testing or by analysis.

The NOAA Deputy Under Secretary for Operations and the Assistant Administrator for NESDIS is responsible for the implementation and programmatic direction of satellite development programs. They should have ensured that the program executed the contractual requirement and either performed testing with the actual flight separation system or requested a waiver. Without proper controls in place to ensure that contractual TAYF requirements were fully evaluated either by testing or by analysis as part of the waiver process, NOAA did not have assurance that the services paid for were received and the government's interest was adequately protected.

Recommendation

1. We recommend that the NOAA Deputy Under Secretary for Operations direct the Assistant Administrator for the National Environmental Satellite, Data, and Information Service take measures to ensure that waivers of TAYF requirements are requested, fully evaluated, and approved as part of the waiver process.

¹⁰ In response to our draft report, NOAA stated that the program subsequently presented an exception to the TAYF rule at the satellite's Pre-Shipments Review in July 2025 and that, while a waiver was not approved, NASA's independent reviewers believed the use of the mock-up separation system did not add risk to the mission.

► Observations to Help NOAA Ensure the Success of Future Missions

The SWFO-L1 is the first space weather satellite in a series of planned missions. During the evaluation, we made several observations intended to help NOAA ensure the success of future missions. The following observations pertain to aspects of contract technical specifications, the tracking of rideshare costs, the collection of lessons learned, and NOAA policy governing the availability of space weather satellite observations.

The SWFO Program Did Not Define Launch Vehicle Separation Requirements at Contract Award, Leading to \$1,225,597 in Increased Costs

When a satellite separates from the launch vehicle, the process can cause the satellite to spin. If the satellite cannot stop spinning, it will not be able to point its instruments, sensors, and solar panels toward the Sun to operate and gather data. As a result, the satellite and mission would be lost.

This spinning can be controlled with reaction wheels or thrusters on the satellite. Reaction wheels stop the spinning by rotating in the opposite direction that the satellite is spinning. If the reaction wheels are too small, thrusters are required to help stop the spinning by firing in the opposite direction. Satellite spinning is measured by a device called an inertial reference unit (IRU). The satellite uses IRU data to stop high rates of spinning with reaction wheels or thrusters.

NASA's best practices for rideshares (defined in agency guidance) at the time of SWFO-L1 satellite contract award stated that it is critical for rideshare programs to overestimate any uncertain design values because portions of the launch environment cannot be defined until later in the primary mission's (in this case, IMAP's) design cycle.¹¹ Overestimating uncertain design values ensures that the rideshare satellite's design is still valid once the uncertain values are determined.

In June 2020 the SWFO program awarded the spacecraft contract; however, the program could not yet define a separation spin rate because the launch vehicle contractor could not yet calculate it. So, the program left this rate undefined in the contract instead of overestimating the rate, despite NASA's best practices for rideshares.

¹¹ NASA. July 6, 2020. *NASA Science Mission Directorate Launch Vehicle Secondary Payload Adapter Rideshare Users Guide*, 4. During SWFO-L1's satellite development, this practice became NASA rideshare policy: NASA. October 1, 2021. *NASA Science Mission Directorate Launch Vehicle Secondary Payload Adapter Rideshare Users Guide with Do No Harm*, 4.

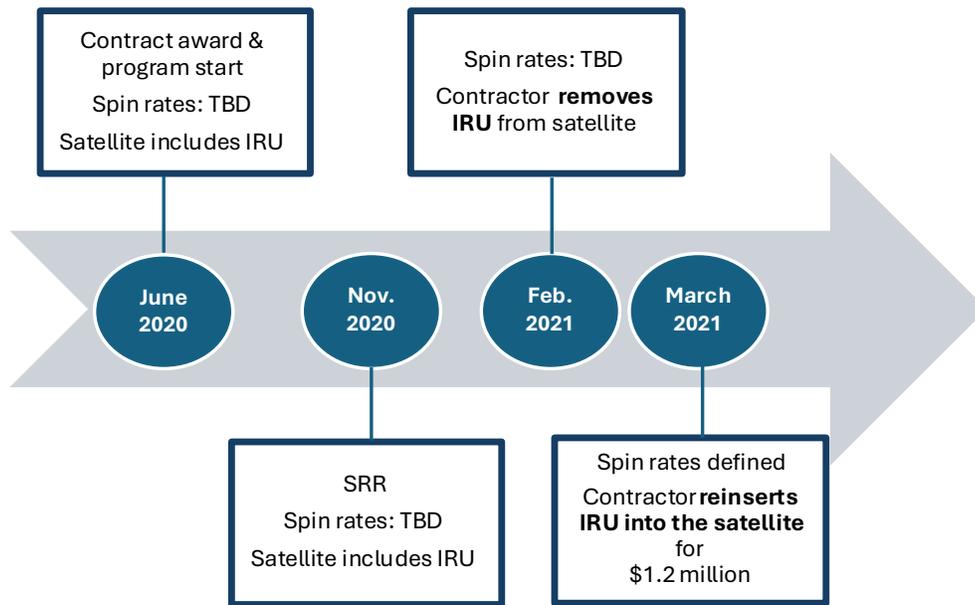
NASA systems engineering policy states that by the time Systems Requirements Review (SRR) occurs, which was November 2020 for SWFO-L1, requirements should be baselined.¹² The policy allows a program to successfully progress past the SRR milestone as long as undefined requirements are clearly identified with an acceptable plan to address them; however, this policy does not take into account NASA's best practices guidance for rideshares. According to that guidance (which is now policy, see footnote 11), the program should have overestimated SWFO-L1's separation spin rate to ensure that the satellite contractor's design accounted for any uncertainty, until the launch vehicle contractor provided the calculated value.

With this undefined separation spin rate, the spacecraft contractor's design documentation showed that it planned for the SWFO-L1 satellite to use reaction wheels, thrusters, and an IRU to control the undefined rate of separation spin. Shortly after the SRR, in February 2021, the spacecraft contractor performed a trade study and concluded that, for normal levels of separation spin, the IRU was unnecessary and removed it from the design.

Approximately a month after the spacecraft contractor removed the IRU from the design, the launch vehicle contractor defined separation spin rates, and the SWFO program notified the contractor of the updated spin rates (see figure 2). The defined spin rates proved to be much higher than the spacecraft contractor had expected; consequently, the spacecraft contractor then put the IRU back into the design, which resulted in increased costs.

¹² NASA. July 5, 2023. *NASA Systems Engineering Process and Requirements Updated w/Change 2*, 69.

Figure 2. Timeline of Program Events Leading to \$1,225,597 in Increased Costs



Source: Office of Inspector General-derived from SWFO program documentation

As a result of the IRU, the contractor submitted a change proposal that included \$1,225,597 in additional cost to its firm-fixed-price contract to put the IRU back into the spacecraft design to meet the newly defined requirement.¹³ According to program and contractor personnel, the early design was not part of the contract. Therefore, the program accepted the modification to the contract and paid the cost, despite the contractor’s original plan to use reaction wheels, thrusters, and the IRU.

If the program had overestimated the separation spin requirements in accordance with NASA’s best practices guidance, the removal and subsequent re-addition of the IRU into the design, and the related contract modification, would not have occurred.

At least one future NOAA program is considering a rideshare approach to lower launch costs. Updating the SRR success criteria for rideshare missions may prevent similar cost increases for future rideshare programs.

¹³ The SWFO-L1 spacecraft contract value at the time of project start in 2020 was \$96.9 million.

NOAA and NASA Need to Ensure Accurate Cost Estimating for the Rideshare Program

During the SWFO acquisition strategy meeting in 2019, at which NOAA approved the rideshare arrangement for the SWFO-L1 satellite, program representatives told decision-makers that launching as a rideshare would save the government up to \$180 million compared with the cost of a dedicated launch vehicle. At that early stage, program management stated that they believed the program would incur \$5 million to \$10 million in additional costs due to launching the satellite as a rideshare (that is, rideshare costs). However, we found that, even though it would not have changed the decision to launch the satellite as a rideshare, both estimates were significantly inaccurate.

NASA rideshare policy describes how satellite rideshare costs are apportioned between the primary mission and rideshare missions.¹⁴ The policy specifies that a rideshare mission does not pay for the launch vehicle or separation system; however, it must pay for the following:

- All costs associated with building the rideshare satellite and its personnel costs to support the satellite's integration into the launch vehicle
- Mission-unique costs
- Costs that the rideshare mission incurs because of the primary mission's launch delays

The latter two bullets represent the rideshare costs or the additional costs, beyond the satellite procurement costs, that the program would incur because it is a rideshare instead of a primary mission.

We examined the validity of these cost estimates by first assessing the cost for a primary mission to procure a dedicated launch vehicle and then independently reviewing program documentation to collect rideshare cost data incurred by the SWFO program. To assess the potential cost of procuring a launch vehicle dedicated to the SWFO program, we reviewed publicly available NASA launch services contract data. We found 13 applicable contract award announcements since 2014 and assessed the cost against spacecraft mass as well as the actual cost of the launch services contract for the IMAP mission (for which SWFO is a rideshare). Our analysis determined that the estimated costs of a dedicated launch vehicle for the SWFO-L1 satellite were roughly \$94 million.

¹⁴ NASA. October 4, 2019. *Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) Secondary Payloads Rideshare*. NASA Science Mission Directorate Policy SPD-32, 5 and 12.

Next, we collected rideshare cost data from standard reporting documents and early rideshare estimates produced by the program. Our analysis of the data indicated that the rideshare costs incurred by the SWFO program as of April 2024 were \$66.5 million. The costs included \$8.4 million in mission-unique costs¹⁵ and \$58.1 million due to IMAP's three launch delays.

The SWFO program noted that rideshare costs are difficult to estimate but could be made available to inform future rideshare decisions at NOAA and NASA. Program personnel also stated that at the time of the acquisition strategy meeting, when decision-makers compared the costs of a dedicated launch with rideshare cost estimates of \$5 million to \$10 million, choosing a rideshare approach was an easy decision.

We presented our analysis of incurred rideshare costs to the program. In response, the program updated its rideshare cost estimate from the original estimate (that is, \$5 million to \$10 million) to \$51.6 million, grouping the cost estimate into four portions: costs associated with the first, second, and third launch delays, and mission-unique costs. However, the program's estimated costs associated with the second launch delay were different than ours, resulting in a lower estimate. The program did not provide sufficient supporting data for us to understand the differences or validate its estimate for this portion. NASA officials also told us that, under the current rideshare policy, only two other primary missions had rideshares attached. Therefore, little relevant data is available for estimating the total cost of a rideshare.

As a result of this assessment, the SWFO program recognized that it incurred rideshare costs beyond just the mission-unique items that it initially tracked and improved its rideshare cost estimate.

Our estimated launch vehicle costs of approximately \$94 million and the rideshare costs in the range of \$50 million to \$65 million indicate that launching the SWFO-L1 satellite as a rideshare was still a prudent decision. However, the discrepancies in estimated costs highlight the need for NOAA (and NASA) to be cognizant of the accuracy of the projected costs when making critical decisions for future satellite launches. Without accurate collection and reporting of the SWFO program's rideshare cost data, decision-makers cannot balance realistic rideshare cost savings against rideshare risks when planning future programs.

¹⁵ SWFO-L1's mission-unique rideshare costs include funds paid to the NASA Launch Services Program from fiscal years 2021 through 2025 for costs associated with the SWFO-L1 satellite-specific payload processing facility and launch site integration.

The SWFO-L1 Flight Project Did Not Hold PaL Sessions as Planned

The *SWFO Program Plan* states that “to elicit and capture lessons learned on a regular basis, projects will hold a PaL session after completing project-level milestone reviews.”¹⁶ The milestone reviews identified in the program plan are the SRR, Preliminary Design Review (PDR), Critical Design Review (CDR), and System Integration Review (SIR). The plan also echoes higher-level NASA policy by stating that SWFO Knowledge Management will ensure that “new knowledge generated is appropriately documented and shared within the project, [GSFC Flight Projects] Directorate, GSFC, NESDIS, and across NASA.”¹⁷ Lessons are shared beyond the project (or program) through representatives who facilitate PaL sessions and share any relevant lessons through NASA’s knowledge management personnel.

Our 2023 audit of the SWFO program found that the SWFO-L1 flight project failed to conduct the required PaL sessions after SRR, PDR, and CDR.¹⁸ To address this finding, the program stated that it would update its *SWFO Program Plan* and designate a new knowledge management officer to ensure that these activities were accomplished.

Despite these plans for corrective action, we found that the SWFO-L1 flight project again did not conduct a required PaL session after its SIR milestone in January 2024. SWFO program management personnel told us that they had communicated lessons learned with NOAA’s Office of Space Weather leading up to the January 2024 SWFO-L1 satellite SIR. Based on this and two earlier ad hoc PaL sessions, management stated that they felt that lessons learned had been adequately communicated within the program and the post-SIR PaL was unnecessary. Program officials also noted that, although they did not conduct the required post-SIR PaL session, they did present some lessons learned during the SIR.

We reviewed the lessons learned presented during the SIR and found that 10 out of 11 lessons learned could be applicable beyond the SWFO program. However, without a facilitated PaL session, these lessons learned were never shared beyond the program.

The program did not have another standard method to ensure that lessons learned were shared with NASA when PaL sessions were not held. In addition, the NESDIS Systems Architecture and Engineering (SAE) group is responsible for overseeing knowledge management activities across NESDIS programs, including the SWFO program. However,

¹⁶ NASA and NOAA. January 20, 2025. *Space Weather Follow-On Program Plan*. SWFO-MGMT-PLAN-0012 Rev A, 30.

¹⁷ NASA. December 16, 2019. *NASA Knowledge Policy for Programs and Projects*, NASA Policy Directive 7120.6A, section 1.a.(1)(a), 1.

¹⁸ Commerce OIG, *Space Weather Follow-On (SWFO) Program: Rideshare Schedule Presents Challenges and Lack of Backup Option Warrants NOAA Attention*, 7.

the SAE group did not ensure that the SWFO program held the required PaL session after SIR.

The SWFO program attempted to improve management control over this process by adding a knowledge management officer position to its *SWFO Program Plan*. The plan describes the roles of the position, including “organizing PaL sessions following milestones, immediately after they happen.”¹⁹ Based on our review, we concluded that program staff and the person designated as the SWFO program knowledge management officer did not have a clear understanding of the roles and responsibilities defined in that plan, despite this position being added to the program plan.

Without following a structured approach to capturing lessons learned, the program risks missing key learning opportunities that could help address technical challenges. Additionally, these PaL sessions would allow NASA to retain lessons learned and ensure that future NOAA and NASA programs, including future space weather missions, can benefit from lessons learned.

The *SWFO Program Plan* specifies several future launch-related knowledge management requirements including consolidating end-of-project lessons learned, conducting a PaL session after launch, and submitting a lesson learned report to NASA within 60 days of launch. These requirements should be followed to ensure that lessons learned are shared with NOAA and NASA to benefit other programs.

NOAA Lacks Policy to Ensure the Availability of Space Weather Satellite Observations

Enacted on October 21, 2020, the Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act (PROSWIFT Act) calls for the United States to prepare and protect against the social and economic impacts of space weather phenomena (like CMEs).²⁰ Space weather phenomena pose a significant threat to ground-based and space-based critical infrastructure, modern technological systems, and humans working in space. The act directs NOAA to develop options to build and deploy space-based observational capabilities that may improve space weather measurements and observations. It also directs NOAA to secure reliable backup capability for observations necessary for space weather forecasts.²¹ The SWFO program is part of

¹⁹ NASA and NOAA, *Space Weather Follow-On Program Plan*, 30.

²⁰ See PROSWIFT Act, Pub. L. No. 116-181 (2020).

²¹ For example, NOAA built two compact coronagraphs to maintain continuous coverage of detecting CMEs with one installed on the Geostationary Operational Environmental Satellites-19 satellite and another on the SWFO-L1 satellite.

NOAA's plan to address the PROSWIFT Act requirements related to improving space weather observations.

Additionally, NOAA supports two primary mission essential functions of the Department, and space weather measurements and observations are important to both.²² Specifically, NOAA is responsible for collecting and providing critical intelligence data, imagery, and other essential information from NOAA-controlled satellites and for providing meteorological forecasts to protect the nation's critical infrastructure.

We found that NOAA has launch policies for polar and geostationary orbits that identify launch cadence and availability for its satellites in these orbits. These policies ensure availability of critical satellite data by prescribing a process to mitigate or identify alternate approaches in the event of development issues or malfunctions while in orbit. However, NOAA is planning future space weather satellite operations, but it does not have a policy that defines capabilities and ensures availability of satellite observations from space weather-related orbits. This policy would include:

- Capabilities needed for space weather observations
- Actions to be taken to mitigate the loss of critical observations
- Number of satellites needed in the constellation at each orbital location to maintain availability, which impacts the timeliness of the next satellite launch

NOAA is still defining the necessary space weather observations and satellite constellations needed to meet the PROSWIFT Act requirements. Based on the importance of space weather data to the nation's critical infrastructure as described in the PROSWIFT Act and the existing launch policies for polar and geostationary orbits, we suggest that NOAA develop a framework that identifies the necessary launch cadence for space weather satellites beyond SWFO-L1.

²² These are mandated, agency-level functions that need to be continuous or resumed within 12 hours after an event that impacts the nation's continuity of operations and maintained for up to 30 days or until normal operations can be resumed.

Recommendations

We recommend that the NOAA Deputy Under Secretary for Operations direct the Assistant Administrator for the National Environmental Satellite, Data, and Information Service to consider taking the following actions for future programs:

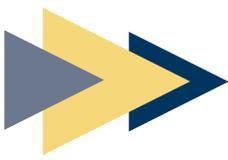
2. Update the SRR success criteria for rideshare missions to ensure that plans for disposition of any undefined requirement include an overestimated value for the requirement.
3. Update the rideshare cost estimate for SWFO-L1 to support decision-making for future rideshare programs.
4. Update policies to ensure that rideshare costs are tracked accurately.
5. Conduct PaL sessions after completing project-level milestone reviews to elicit and capture lessons learned on a routine basis and in accordance with program plans.
6. Ensure that the NESDIS SAE group develops a management control to provide reasonable assurance that programs under its purview execute their knowledge management responsibilities.
7. Define the necessary space weather observations and satellite capabilities to ensure the continuity of satellite operations to meet PROSWIFT Act requirements.



Summary of NOAA's Response and OIG Comments

On February 6, 2026, we received NOAA's response to our draft report. In its response to our draft report, NOAA concurred with all our recommendations and described actions it has taken, or will take, to address them. NOAA also provided technical comments on the draft report. We considered those comments and revised the report where appropriate.

NOAA's complete response is included in this report as appendix 2. We are pleased that NOAA concurs with our recommendations and look forward to reviewing its corrective action plan.



Appendix 1. Scope and Methodology

Our objective was to assess the SWFO program’s progress in preparing the SWFO-L1 satellite for launch and operations. To meet our objective, we reviewed SWFO-L1 satellite environmental testing, planning for integration onto the launch vehicle as a rideshare, and operational readiness reviews. We also reviewed the extent to which NOAA had policies governing the launch of space weather satellites. Additionally, we compared the program management of risk, cost, and schedule against programmatic plans.

To evaluate the program’s preparation for launch and operations, we:

- Attended program review meetings and analyzed program test documents, requirements waivers, and contract records
- Assessed these program documents against NOAA and NASA requirements to identify any disconnects and narrowed our focus to a couple of issues related to the program’s planning for launch vehicle separation that led to both additional risk and cost
- Interviewed program management, engineers, and the spacecraft contractor at their worksite to better understand their perspective on potential deficiencies with the separation system hardware and circumstances leading to a contract change proposal that led to increased costs for the government on the satellite contract

To evaluate the program’s cost, schedule, and knowledge management controls for adequacy and effectiveness, we:

- Reviewed routine program reporting documentation to assess cost and schedule reporting against requirements described in the *SWFO Program Plan*
- Used these documents to identify actual rideshare costs incurred by the program and compared them with the early estimates the program provided to higher-level decision-makers
- Reviewed the program’s performance of knowledge management activities for recent program milestones to assess continued compliance with corrective actions from our 2023 SWFO audit. To support these activities, we interviewed NOAA and NASA program management to understand how the SWFO program’s management controls were implemented and to seek further perspective on any disconnects we identified between policy and the program’s actual activities.

To assess NOAA's space weather-related launch planning, we:

- Reviewed the PROSWIFT Act to understand the requirements for essential functions and space weather observations
- Compared those requirements to SWFO-L1 and Space Weather Next L1 capabilities and launch planning dates
- Reviewed NESDIS geostationary and polar launch policies to understand the process described for launch cadence and to ensure availability of critical satellite data in the geostationary and polar orbits
- Interviewed the former SWO Director and NOAA's Assistant Administrator for the National Environmental Satellite, Data, and Information Service to understand mission capabilities, launch dates, geostationary and polar launch policies, and why there was no space weather policy

We assessed the internal controls that were significant to our objective by interviewing NOAA and NASA personnel and reviewing policies and procedures.

We identified weaknesses in internal controls related to knowledge management activities and the oversight of testing, as noted in the Findings and Recommendations section of this report.

We did not rely on computer-processed data to support our findings, conclusions, and recommendations. Although we could not independently verify the reliability of all the information we collected, we compared it with other available supporting documents to determine data consistency and reasonableness. We found the data to be sufficiently reliable to support our findings and conclusions.

We conducted our evaluation from June 2024 through December 2025 under the authority of the Inspector General Act of 1978, as amended (5 U.S.C. §§ 401-424), and Department Organization Order 10-13, as amended October 21, 2020.

We conducted this evaluation in accordance with *Quality Standards for Inspection and Evaluation* (December 2020) issued by the Council of the Inspectors General on Integrity and Efficiency. Those standards require that the evidence must sufficiently and appropriately support evaluation findings and provide a reasonable basis for conclusions and recommendations related to the objectives. We believe that the evidence obtained provides a reasonable basis for our findings, conclusions, and recommendations based on our review objectives.



Appendix 2.

NOAA's response to our draft report begins on the next page.



UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary of Commerce
for Oceans and Atmosphere
Washington, D.C. 20230

February 6, 2026

MEMORANDUM FOR: Kevin D. Ryan
Director of Engineering, Cybersecurity, and Systems
performing the duties of Assistant Inspector General for Audit
and Evaluation
Office of Inspector General
U.S. Department of Commerce

FROM: Dr. Neil Jacobs 
Under Secretary of Commerce for Oceans and
Atmosphere and NOAA Administrator

SUBJECT: Draft Report Response: Evaluation of the Space Weather
Follow-On
Program's Progress in Preparing the SWFO-L1 Satellite for
Launch and Operations.
Report No. 2024-493

The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) is pleased to submit the attached draft report response to the Office of Inspector General's draft report: Evaluation of the Space Weather Follow-On Program's Progress in Preparing the SWFO-L1 Satellite for Launch and Operations.

If you have questions, please contact Mia Forgy, Director, Audit and Information Management Office at Mia.Forgy@noaa.gov.

THE ADMINISTRATOR



Department of Commerce
National Oceanic and Atmospheric Administration
Draft Report Response to
Department of Commerce Office of Inspector General's
Evaluation of the Space Weather Follow-On Program's Progress in Preparing the SWFO-L1
Satellite for Launch and Operations
(2024-493, December, 2025)

General Report Comments

The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) appreciates the opportunity to review the Department of Commerce Office of Inspector General's (DOC OIG) report on Evaluation of the Space Weather Follow-On Program's Progress in Preparing the SWFO-L1 Satellite for Launch and Operations.

NOAA Response to Recommendations -

The draft report made 7 recommendations pertaining to NOAA.

We recommend that the NOAA Deputy Under Secretary for Operations direct the Assistant Administrator for the National Environmental Satellite, Data, and Information Service to consider taking the following actions for future programs:

Recommendation 1: Take measures to ensure that waivers to test as you fly (TAYF) requirements are requested, fully evaluated, and approved as part of the waiver process.

Agency Response:

We concur with the recommendation. Going forward, all future Office of Space Weather Observations (SWO) projects will document accordingly and comply with the waiver process.

Recommendation 2: Update the SRR success criteria for rideshare missions to ensure that plans for disposition of any undefined requirement include an overestimated value for the requirement.

Agency Response:

We concur with this recommendation. We will evaluate Systems Requirements Review (SRR) success criteria for rideshare missions to ensure that plans for disposition of any undefined requirements include an overestimated value for the requirement and document accordingly. In addition, updates to the SRR success criteria will be considered and documented for rideshare missions.

Recommendation 3: Update the rideshare cost estimate for SWFO-L1 to support decision-making for future rideshare programs.

Agency Response:

We concur with this recommendation. The SWFO Program will document final costs associated with the SWFO-L1 mission and distinguish between nominal rideshare planned costs (mission specifics) and costs associated with primary mission launch delay that are required to be absorbed by the rideshare if a delay occurs (like the four (4) IMAP delays).

Department of Commerce
National Oceanic and Atmospheric Administration
Draft Report Response to
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(2024-493, December, 2025)

Recommendation 4: Update policies to ensure that rideshare costs are tracked accurately.

Agency Response:

We concur with this recommendation. All SWFO costs are very accurately tracked; however, moving forward the SWFO will provide additional detail and context related to costs to avoid any confusion at the project level.

Recommendation 5: Conduct PaL sessions after completing project-level milestone reviews to elicit and capture lessons learned on a routine basis and in accordance with program plans.

Agency Response:

We concur with this recommendation. Going forward, all future projects will document all pause and learn (PaL) sessions and distinguish between project-level milestone held PaLs and normal agenda item PaLs (which are now standard in all agendas), which the SWFO Program implemented after the original SWFO Program audit.

Recommendation 6: Ensure that the NESDIS Systems Architecture and Engineering (SAE) group develop management controls to provide reasonable assurance that programs under its purview execute their knowledge management responsibilities.

Agency Response:

We concur with this recommendation. The Office of Space Weather Observations (SWO), including Space Weather Follow-on (SWFO), will follow a Knowledge Management approach derived from NASA Policy Directive (NPD) 7120.6A "Knowledge Policy for Programs and Projects w/Change 1." Neither SWO nor the SWFO program are under the purview of NESDIS SAE from a management perspective.

Recommendation 7: Define the necessary space-weather observations and satellite capabilities to ensure the continuity of satellite operations to meet PROSWIFT Act requirements.

Agency Response:

We concur with this recommendation. NOAA space weather observations and system capabilities are documented in NESDIS-REQ-4500.3 "Space Weather Next Program Objectives." This document provides detailed requirements to drive NOAA acquisition programs and budget requests to ensure the continuity of all NOAA space weather satellite observing needs. The documents provide a complete list of "High Availability Products (HAP)" requirements upon which a system architecture has been determined and from which a reasonable launch policy can be developed. Although launch policies exist for the NESDIS LEO and GEO programs, NESDIS should develop a launch and product continuity policy to meet space weather observing requirements.

REPORT

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