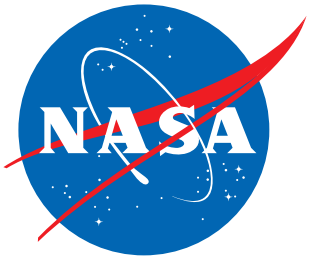
NASA
Office of Inspector General

NASA's Management of ISS Extravehicular Activity Spacesuits

September 30, 2025 **IG-25-012**



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RESULTS IN BRIEF

NASA's Management of ISS Extravehicular Activity Spacesuits

September 30, 2025 IG-25-012 (A-24-14-00-HED)

WHY WE PERFORMED THIS AUDIT

The Extravehicular Mobility Unit (EMU) spacesuits that astronauts wear during spacewalks on the International Space Station (ISS) were designed more than 50 years ago, and the advanced age of their design is causing difficulties for NASA and its spacesuit support contractor—Collins Aerospace (Collins). EMUs protect astronauts from the environment of space and provide them life support capabilities while they conduct science experiments and perform maintenance or upgrades to the ISS. The spacesuits are made of various components that must be maintained and eventually replaced according to pre-determined schedules. NASA contracts with Collins through the Extravehicular Activity Space Operations Contract (ESOC) to perform this maintenance, as well as mission planning and real-time operations support during spacewalks.

NASA awarded ESOC—a cost-plus-award-fee contract—to Collins for $324 million over 5 years in 2010. However, as the operational life of the ISS was extended, so too did NASA's requirement to keep its spacesuits maintained. As of July 2025, ESOC was valued at $1.5 billion through 2027. We previously reported on NASA's spacesuit management in 2017 and 2021, finding that the Agency faced a wide array of risks to sustaining the EMUs, including design inadequacies, health risks, and low inventories of spacesuit life support systems, ultimately leading to NASA's efforts to design and develop next-generation suits to replace the existing EMUs. Specifically, the EMU design flaws have increased the chance of and led to unexpected water in helmets, thermal regulation malfunctions, and astronaut injuries. Given that spacesuits are necessary to meet future ISS maintenance needs until its planned decommissioning in 2030, it is critical that NASA effectively manages the contract performance and subsequent safety risks associated with ESOC.

In this audit, we examined the risks NASA faces through its continued use of the EMU spacesuits and the extent to which the Agency is meeting the cost, schedule, and performance goals for ESOC. To complete this work, we reviewed ESOC documentation and contractor performance evaluation reports. We also interviewed officials from NASA and Collins and issued a survey to over 70 government and contractor individuals involved in spacesuit development and management to gain a wider perspective of the challenges and risks associated with EMU maintenance.

WHAT WE FOUND

Until the ISS's planned decommission at the end of the decade, NASA will continue to require spacewalking capabilities to perform upgrades and corrective and preventative maintenance to the Station. However, Collins' performance on ESOC increases programmatic risks to NASA as it attempts to conduct safe spacewalks outside the ISS and maintain critical EMU life support component inventories. The contractor is experiencing considerable schedule delays, cost overruns, and quality issues that significantly increase the risk to maintaining NASA's spacewalking capability.

Collins attributes delivery delays primarily to challenges with managing its supply chain, citing issues like unreliable suppliers, problems with labor resource retention, and lingering impacts of the COVID-19 pandemic. In addition, parts obsolescence has been an increasingly difficult challenge because suppliers that have historically been in a component's supply chain may no longer produce the required parts or may not even be currently in business. The increased risk

associated with Collins' ineffective management practices and poor performance on ESOC and other NASA contracts led the Agency to write a letter to senior Collins leadership in 2023 outlining various areas of concern and their impact to Agency operations and goals.

Despite these issues, NASA has limited leverage to incentivize improved performance, partly because NASA lacks an alternative EMU support contractor and partly because award fees have proved to be an ineffective motivator for Collins. Nonetheless, the Agency could more fully utilize award fees to improve accountability. NASA's award fee scores for the highest weighted evaluation criteria do not consistently reflect Collins' actual performance, resulting in higher award fees that may disincentivize performance improvements. NASA's evaluations of Collins' performance—particularly in the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements evaluation category, which has the largest impact on Collins' award fee score—have inflated the amount of award fees earned by Collins despite numerous instances of persistent schedule, cost, and quality problems. While NASA officials believe the overall scores given to Collins are fair based on the contractor's performance over the entire ESOC contract scope, given Collins' ongoing challenges and the increased risk that NASA will be unable to perform critical spacewalks, we question all of the award fees provided to the contractor from fiscal years 2020 through 2024. Finally, we found the contract's award fee plan is based on outdated guidance and does not align with current Federal Acquisition Regulations.

WHAT WE RECOMMENDED

To more effectively hold the Agency's ESOC contractor accountable for contract performance and improve supply chain management for ESOC, we recommended the Associate Administrator for Space Operations Mission Directorate: (1) adjust the ESOC Award Fee Plan to include clear, objective criteria for the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements evaluation category; (2) align definitions in the ESOC Award Fee Plan with Federal Acquisition Regulation guidance; and (3) coordinate with an existing NASA supply chain group (e.g., Supply Chain Risk Management Program) to investigate alternative supply chain management strategies, such as evaluating the feasibility of incorporating the Supply Chain Visibility Data Requirement Deliverable into ESOC to increase visibility into spacesuit supply chains.

We provided a draft of this report to NASA management who concurred with Recommendations 1 and 3 and partially concurred with Recommendation 2. We consider management's comments and described planned actions responsive; therefore, the recommendations are resolved and will be closed upon completion and verification of the proposed corrective actions.

For more information on the NASA Office of Inspector General and to view this and other reports visit https://oig.nasa.gov/.

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Acronyms

CPARS	Contractor Performance Assessment Reporting System
EMU	Extravehicular Mobility Unit
ESOC	Extravehicular Activity Space Operations Contract
EVA	extravehicular activity
FAR	Federal Acquisition Regulation
FY	fiscal year
ISS	International Space Station
OIG	Office of Inspector General
PGS	Pressure Garment System
PLSS	Primary Life Support System

INTRODUCTION

Spacesuits are critical to NASA's operations on the International Space Station (ISS or Station) and its broader goals of returning humans to the Moon and ultimately exploring Mars. Astronauts wear Extravehicular Mobility Unit (EMU) spacesuits to perform extravehicular activities (EVA), also known as spacewalks. After originally being designed in the 1970s for the Space Shuttle Program, the EMUs are now facing issues related to the age of the design. We previously issued two audit reports—in 2017 and 2021—that highlighted the multiple design and health risks associated with the EMUs used by the ISS crew and the ongoing development efforts for new spacesuit technologies.[1] Further, two recent and notable spacesuit incidents—one in which water accumulated in a helmet in 2022 and another where the service and cooling umbilical unit malfunctioned and caused a water leak in 2024—underscore the immense safety risks inherent to these spacewalks.

To maintain and operate the current EMUs for use on the ISS, NASA contracts with Collins Aerospace (Collins) through the Extravehicular Activity Space Operations Contract (ESOC).[2] Awarded in 2010 for $324 million over 5 years, the contract was valued at $1.5 billion as of July 2025 and had been extended through 2027. However, Collins' performance has declined over the past several years, and critical spacesuit components are not being replaced or maintained as needed. In fact, in March 2023, NASA sent a letter to senior leadership at Collins expressing strong dissatisfaction with the contractor's management of multiple NASA contracts, including ESOC. As NASA attempts to maintain its spacewalking capability through 2030, the planned end of the operational life of the ISS, it must ensure that it is not assuming excessive risk with respect to astronaut safety or to the contract's cost and schedule.

In this audit, we examined the risks NASA faces through its continued use of the EMU spacesuits on the ISS. Specifically, we examined the extent to which NASA is meeting cost, schedule, and performance goals for ESOC. Details of the audit's scope and methodology are outlined in Appendix A.

First Demonstration of the EMU Spacesuit Simulating Zero Gravity Operations

This demonstration took place in 1982 at Marshall Space Flight Center's Neutral Buoyancy Simulator. Pictured is NASA astronaut Jerry Ross who wore the spacesuit while preparing to stow a Control Moment Gyroscope on a pallet.

Source: NASA Marshall Star.

[1] NASA Office of Inspector General (OIG), *NASA's Management and Development of Spacesuits* (IG-17-018, April 26, 2017), and NASA OIG, *NASA's Development of Next-Generation Spacesuits* (IG-21-025, August 10, 2021).

[2] NASA originally awarded ESOC to Hamilton Sundstrand, a company created in 1999 as the result of a merger between Hamilton Standard and Sundstrand Corporation. After a 2012 merger, Hamilton Sundstrand became UTC Aerospace Systems, which later became Collins Aerospace following another merger.

Background

Astronauts wear EMUs as protection from the harsh environment of space when exploring outside of a spacecraft like the ISS or a lunar lander. Similar to a spacecraft, spacesuits provide all of the functions necessary to support humans in space, such as life support, waste management, liquid cooling and ventilation, hydration, communications, and astronaut health monitoring.

In the 1970s, Hamilton Standard and ILC Dover began developing a baseline EMU to perform EVAs for the Space Shuttle Program.[3] This EMU made its spacewalk debut during the sixth Shuttle mission in 1983. In 1990, the EMU was enhanced to include improvements to the baseline EMU and designed to be adaptable for future mission needs. As such, when ISS construction began in 1998, the enhanced EMU was able to accommodate the increased number of spacewalks required to assemble, maintain, and repair the Station. Over the past two decades, several updates have been made to the EMU currently in use on the ISS.

International Space Station

Source: NASA.

An orbiting space laboratory that is 356 feet long, approximately the size of a football field, the Station contains exterior trusses for structural support, solar panels that provide power, and radiator panels that dissipate heat. Astronauts from the United States, Europe, Japan, and Canada and cosmonauts from Russia regularly conduct spacewalks outside the ISS for science experiments and to perform maintenance, repairs, and upgrades to the Station.[4] NASA plans to use the EMUs for spacewalks until upgraded replacements—known as next-generation spacesuits—are available.[5] The ISS is scheduled to be decommissioned beginning in 2030.

EMU Design

NASA's EMU is designed to sustain life outside the Station by providing oxygen to breathe and water to drink, removing carbon dioxide, managing the extreme thermal environment, providing appropriate pressure for the body, and providing some protection from debris. The EMU contains two major subsystems: the Pressure Garment System (PGS) and Primary Life Support System (PLSS).

The PGS is the human-shaped portion of the suit that protects the astronaut's body and provides mobility. The PGS includes many interchangeable components for both "soft goods" and "hard goods" that can be used to fit astronauts of various sizes. Soft goods, such as the arm and leg assemblies, gloves, and boots,

[3] The Space Shuttle Program flew missions from 1981 to 2011 and consisted of reusable shuttles that carried crew and cargo to space and back to Earth.

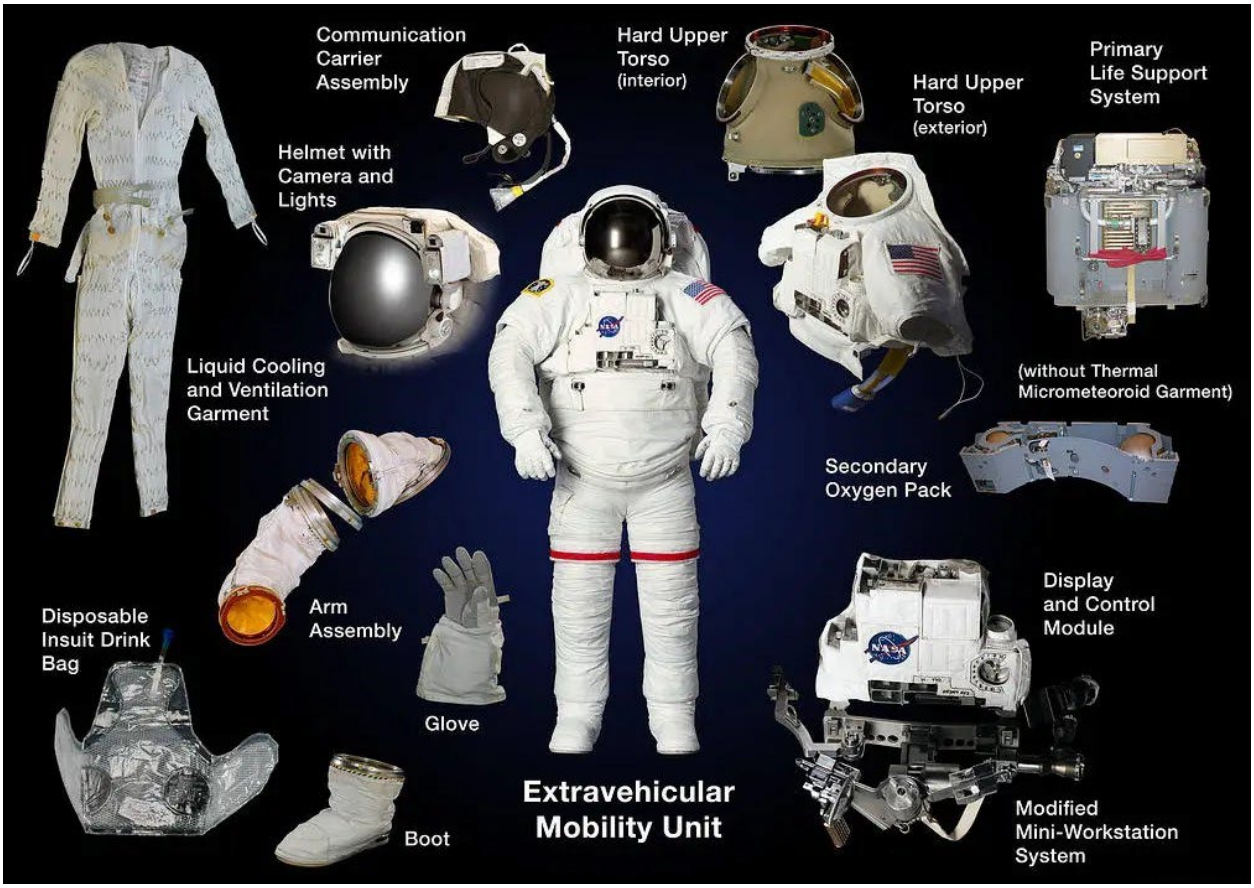
[4] Cosmonauts use Russian-made Orlan spacesuits when conducting spacewalks. Astronauts from the other international partners use NASA's EMU.

[5] Next-generation spacesuits will be built by commercial providers, used for ISS and Artemis missions, and tailored for the ISS and lunar environments. In comparison to EMUs, the new suits will be equipped with upgraded life support systems and tools, as well as new technologies that will make the suits less bulky, allowing the astronauts to move more freely and efficiently. NASA is planning for these spacesuits to be available for the Artemis III mission, currently scheduled for mid-2027.

are manufactured in different sizes, while hard goods, such as the Hard Upper Torso, can be assembled for each mission in different variations using spare components to accommodate fit needs.

The PLSS provides the astronaut's life support while performing a spacewalk. This backpack-like structure includes a highly compressed set of technologies to perform a variety of functions, such as providing breathable air and battery power for the electrical functions, removing carbon dioxide and humidity, and maintaining the astronaut's body temperature. See Figure 1 for the EMU's primary components.

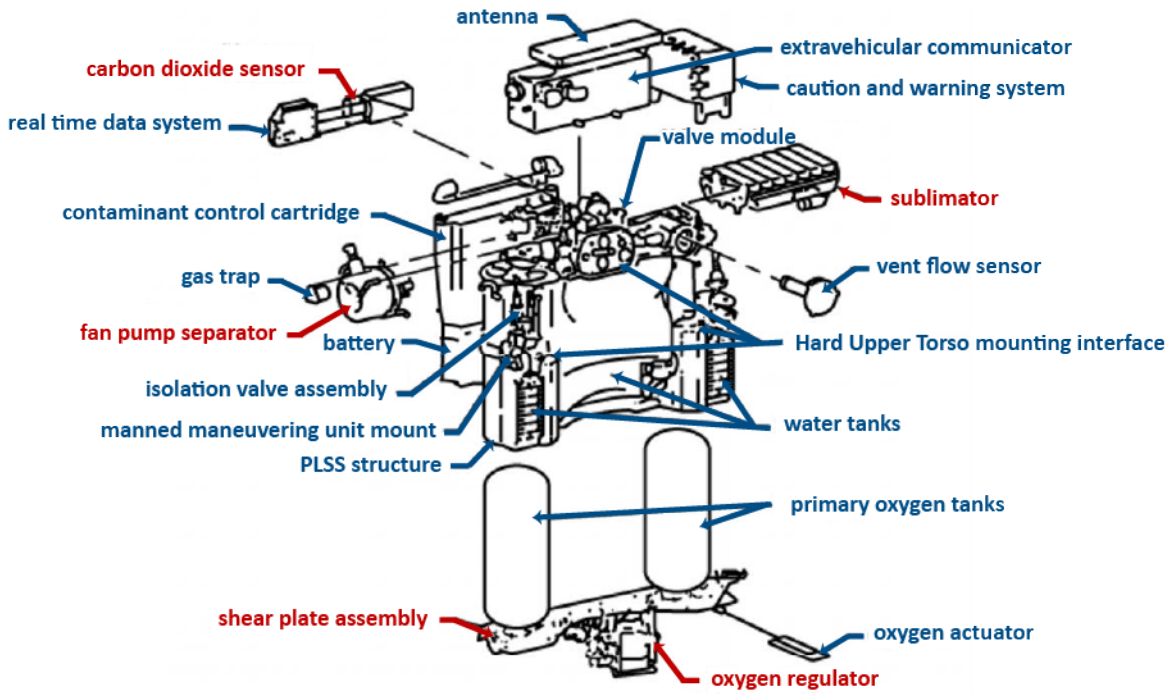
Figure 1: EMU Primary Components



Source: NASA.

The EMU is a highly complex system composed of various components, the most critical of which NASA and its support contractor—Collins—track to ensure they maintain sufficient inventories for replacement or refurbishment as needed. NASA considers a component to be critical based on the amount of inventory that is available and allocated for future suits. When NASA does not have spare components on the ground (except for those already allocated to, or set aside for, a specific spacesuit), these components represent an increased risk to NASA. As of July 2025, NASA and Collins were tracking 11 critical PLSS components that do not have any non-allocated spares on the ground, 7 of which have 2 or fewer spares in total. Table 1 highlights, in red, PLSS components we identified as having failures and delays (discussed in detail later in the report) and a description of their function.

Table 1: Primary Life Support System Components and Descriptions

Labeled Diagram of PLSS Components


PLSS Component	Description
Fan pump separator	Circulates oxygen and coolant while removing moisture and gas to ensure functionality of the spacesuit's systems and regulation of the astronaut's body temperature.
Shear plate assembly	Provides the connection point for the oxygen tanks, oxygen actuator (the device that regulates oxygen pressure), and the oxygen regulator.
Sublimator	Removes water vapor, typically from the air breathed by the astronaut, and returns it to the cooling water supply.
Carbon dioxide sensor	Monitors levels of carbon dioxide within the spacesuit.
Oxygen regulator	Provides the correct oxygen pressure control for crewmembers before, during, and after EVA operations.

Source: NASA Office of Inspector General (OIG) presentation of Agency information.

EMU Maintenance

Designed in the 1970s and in use since the Space Shuttle Program in the 1980s, the EMU has surpassed its intended design life of 15 years. To address the risks associated with the continued use of the spacesuits, including age-related failures and technical issues, NASA specifies the replacement and refurbishment cycles for PGS and PLSS components. While PGS components are typically replaced every 8 to 10 years, PLSS components are typically refurbished as needed. Further, NASA requires the PLSS to

go through ground maintenance every 6 years or after 25 spacewalks, whichever comes first.[6] Spacesuits are returned to Earth for ground maintenance, which involves dismantling the suits for inspection and detailed component testing. While some components are thoroughly cleaned, other components are checked to ensure they are still within their limited lifespan and operating as intended.

Astronauts also perform some maintenance of the EMUs on the ISS, including cleaning, component replacements, and hardware inspections. According to a NASA official, some of these maintenance tasks were only ever intended to be performed by trained experts with specialized tools in a clean environment on Earth, increasing safety risks if maintenance is not done properly.

Scrub and Cleansing of Water Loops in EMU Spacesuit

NASA astronaut Barry Wilmore, Expedition 41 flight engineer, conducts a scrub and cleansing of the water loops in his spacesuit on the International Space Station.

Source: NASA.

EMU Risks

Previously identified EMU design flaws increase the risk of and have led to unexpected water in helmets, thermal regulation malfunctions, and astronaut injuries, examples of which can be found below. These issues are acknowledged by NASA to compromise the safety and effectiveness of ISS operations.

Water in Helmets. In separate incidents that occurred in 2013 and 2022, spacewalks were suspended due to unexpected water leakage in an EMU helmet. Water intrusion into the helmet creates hazardous conditions, including risk of asphyxiation, impaired vision, and a compromised ability to communicate. Following the July 2013 incident—a nearly catastrophic spacewalk in which an Italian astronaut experienced dangerous levels of water in his helmet—a helmet absorption pad and snorkel were added to provide for water absorption and an alternative air source.

Water Leakage in EMU Spacesuit Helmet

A water leak occurred in the helmet of Italian astronaut Luca Parmitano, forcing NASA to abort a July 16, 2013, spacewalk.

Source: NASA.

Then, in March 2022, water inside the helmet of a German astronaut partially obstructed his vision through his visor after returning from a spacewalk. NASA subsequently returned the spacesuit to Earth for analysis and declared a "no-go" for spacewalks while it investigated the issue. In October 2022, NASA resumed spacewalks after the investigation found no hardware issues with the spacesuit and the water was determined to be condensation caused by the combination of high levels of astronaut exertion and the cooling setting on the EMU. To mitigate the issue, NASA developed both a helmet

[6] While the original plan in 1982 was to return the EMUs to Earth after every Shuttle mission to be examined for defects and necessary maintenance, NASA extended how often the suits would undergo ground maintenance several times. As a result of the impending retirement of the Space Shuttle and NASA's limited ability to return EMUs from the ISS, in 2008 NASA extended the maintenance cycle to the current requirement of every 6 years or after 25 spacewalks.

absorption pad extender and helmet absorption band—in addition to the original helmet absorption pad—and implemented operational controls for crewmember thermal management.

Thermal regulation malfunctions. Overheating or extremely cool temperatures are risks faced by the astronauts while conducting spacewalks in the EMUs. NASA provides cooling and ventilation garments to help mitigate uncomfortable and potentially dangerous body temperatures.[7] The current spacesuit design uses a sublimator—a device that converts water from a solid to a gas—to remove heat from the astronaut's body and the suit's life support system. Multiple incidences of water contamination have led to issues with cooling spacesuits. Sublimators are a critical life support component with few spares available and malfunctions with this component could lead to inoperable spacesuits.

Astronaut injuries. The bulky EMU design and the physical demands of a spacewalk also increase the risk of various types of injuries. Astronauts have reported shoulder issues, such as abrasions, strains, and skin irritations, as well as more severe injuries requiring surgery. This is partially attributed to limitation of movement, inadequate suit fit, body position, and donning (putting on) and doffing (taking off) the Hard Upper Torso. Astronauts have also experienced hand injuries caused by the EMU's internal pressure and limited glove mobility.

During EVAs, spacesuit specialists from NASA and Collins support real-time operations by monitoring the health of the spacesuit and ensuring timely responses to anomalies. For example, during a June 2024 spacewalk, an EMU experienced a water leak in its service and cooling umbilical unit, which provides water, power, and oxygen to the EMU while the astronaut is in the ISS's airlock preparing for the spacewalk. As a result, NASA canceled the spacewalk.

NASA and Collins investigate anomalies such as these for failures that occur both at the ISS and on the ground, with NASA officials telling us most failures occur during ground testing. NASA's decision on whether to proceed with an EVA is influenced by the findings of these investigations and discussed as part of the EVA Readiness Review process.[8] Health risks associated with EVAs—such as the potential for decompression sickness (gas bubbles in body tissue), hypoxia (low oxygen levels), or hypercapnia (high carbon dioxide levels)—are addressed through hazard analyses that are reviewed by a Safety Review Panel composed of representatives from organizations across NASA. For the June 2024 incident, NASA investigated the issue, replaced the faulty umbilical unit and seal, and resumed spacewalks in January 2025.

[7] NASA standards state that astronaut impairment begins when core temperatures increase more than 1 degree Fahrenheit above the average human body temperature of 98.6 degrees Fahrenheit.

[8] The EVA Readiness Review process includes an assessment of any open failures or anomalies from prior EVAs before conducting a subsequent EVA.

Extravehicular Activity Space Operations Contract (ESOC) Management

After competitively awarding Hamilton Standard—now Collins—the original contract for EVA EMU requirements in 1977, NASA has sole-sourced all subsequent EVA operations support contracts to Collins, including ESOC.[9] Awarded in 2010 for $324 million over 5 years, ESOC is the contract by which Collins supports NASA's spacewalking capabilities, including hardware provisioning, sustaining engineering, mission planning, and real-time operations support for the ISS.[10] Subsequent decisions to extend the operational life of the ISS have increased the contract's period of performance and value. As of July 2025, ESOC was valued at $1.5 billion and had been extended through 2027. However, this could rise to more than $1.8 billion if NASA exercises options to extend the contract through 2030—the planned end of the ISS's operational life. Through fiscal year (FY) 2024, NASA had obligated over $1.3 billion to Collins for ESOC, with an annual average of over $86 million.

Since ESOC is a cost-plus-award-fee contract, NASA evaluates Collins' performance every 6 or 12 months and develops an award fee performance evaluation report to determine the award fee score and amount of award fee Collins will earn for each award fee evaluation period.[11] The fee is intended to incentivize and reward Collins for its performance. Through FY 2024, NASA and Collins completed 18 of 21 award fee evaluation periods, and Collins earned 90 percent of the total award fee available. NASA has developed three evaluation criteria categories to evaluate Collins' performance: (1) Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements; (2) Cost; and (3) Subcontracting Goals. Each evaluation category is evaluated separately and the scores from each category are measured against a specific weighting factor. Table 2 shows the evaluation categories and their respective weighted values.

[9] According to Federal Acquisition Regulation (FAR) Section 6.302, NASA may use a sole-source contract when the supplies or services it requires are only available from one or a limited number of responsible sources, and no other type of supplies or services will satisfy the Agency's requirements. In this case, full and open competition of contractors is not required.

[10] ESOC is an indefinite-delivery, indefinite-quantity contract and has both cost-reimbursable and fixed-price task orders for spacesuit component design, refurbishment, production, and testing. An indefinite-delivery, indefinite-quantity contract refers to NASA's ability to issue an undefined number of task orders for services up to a specified amount of money. This allows NASA to issue task orders when the need for a particular service arises. Under a cost-reimbursement approach, NASA approves all designs, manages all development and schedules, and owns the product after delivery by the contractor. While this process gives NASA maximum control over the contractor's design and final product, most of the cost, schedule, and outcome risks are borne by the government. Alternatively, a fixed-price task order provides a set price that does not change even if the contractor's costs increase during the period of performance, shifting risk to the contractor.

[11] A cost-plus-award-fee contract is a cost-reimbursement contract that provides for a fee consisting of (a) a base amount fixed at inception of the contract and (b) an award amount, based upon a judgmental evaluation by the government, sufficient to provide motivation for excellence in contract performance. While the first 10 award fee evaluation periods were conducted every 12 months, award fee evaluation periods changed to 6 months in duration beginning in Award Fee Period 11. However, following Award Fee Period 18, the duration will revert back to 12 months.

Table 2: ESOC Award Fee Evaluation Categories and Weightings (effective as of August 2021)

Evaluation Category	Description	Weight
Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements	*Management and Technical Performance:* all aspects of the contractor's quality and schedule.	65%
	Business Management: response to proposals, requests for data, and engagement in cooperative relationships with other ISS Program contractors.	
	Compliance with Safety and Health Requirements: implementation and adherence to health and safety plan, management of safety incidents, and environmental compliance.	
Cost	Actual cost performance compared to negotiated contract values.	25%
Subcontracting Goals	Success in achieving contractual subcontracting goals for small businesses.	10%

Source: NASA OIG summary of the ESOC Award Fee Plan.

An evaluation team recommends to the Performance Evaluation Board a numerical value for each category used to determine the total award fee score for each evaluation period.[12] The Fee Determination Official—for ESOC, the ISS Program Manager—then makes the final decision on the amount of award fee provided to the contractor. For example, a total award fee score of 80 would be equivalent to Collins receiving 80 percent of the available award fee for that period. Table 3 shows the numerical score and criteria required for each adjectival rating included in ESOC.

Table 3: ESOC Award Fee Performance Ratings

Adjectival Rating	Score	Criteria (ESOC Award Fee Plan)
Excellent	91 to 100	Of exceptional merit; exemplary performance in a timely, efficient, and economical manner; very minor (if any) deficiencies with no adverse effect on overall performance.
Very Good	76 to 90	Very effective performance; fully responsive to contract requirements; reportable deficiencies but with little identifiable effect on overall performance.
Good	51 to 75	Effective performance; fully responsive to contract requirements; reportable deficiencies but with little identifiable effect on overall performance.
Satisfactory	50	Meets or slightly exceeds minimum acceptable standards; adequate results; reportable deficiencies with identifiable but not substantial effects on overall performance.
Unsatisfactory	0	Does not meet minimum acceptable standards in one or more areas; remedial action required in one or more areas; and deficiencies in one or more areas which adversely affect overall performance.

Source: NASA OIG representation of the ESOC Award Fee Plan.

[12] The Performance Evaluation Board evaluates the contractor's performance every award fee evaluation period based on input from various program officials.

ESOC is managed jointly by the ISS Program and the ISS EVA Office. The ISS Program falls under the Space Operations Mission Directorate; the ISS EVA Office is within the Extravehicular Activity and Human Surface Mobility Program, which falls under the Exploration Systems Development Mission Directorate's Moon to Mars Program.[13]

Previous NASA Office of Inspector General and External Reports on NASA Spacesuits

In April 2017, we found NASA was managing multiple design and health risks associated with the EMUs used by the ISS crew.[14] We also raised concerns about the inventory of EMU life support systems and the Agency's ability to continue supporting the current fleet of EMUs through the ISS's end of life, which was 2024 at that time.

In August 2021, we reported on NASA's efforts to design and develop next-generation spacesuits—to replace the existing EMUs—for use on the ISS and Artemis missions.[15] We found that NASA's schedule to produce the first two flight-ready next-generation spacesuits by November 2024 was not feasible and lacked sufficient schedule margin. NASA had spent over $420 million on spacesuit design and development and was on track to spend over $1 billion by the time the two suits would be ready. While NASA intended to design, develop, and take ownership of the two flight suits and then contract with industry to procure additional suits, in April 2021, the Agency altered its acquisition approach to instead use contractor-developed and -owned suits. Contracts for this effort, known as the Exploration Extravehicular Activity Services contract, were awarded in 2022 to two contractors—Collins and Axiom Space—to develop both ISS and Artemis suits.

Since 2019, the Aerospace Safety Advisory Panel's annual reports have acknowledged the safety risk of continuing to use the EMU and recommended NASA transition away from those suits "before the risk to EVA becomes unmanageable."[16] The Panel expressed concerns with NASA's ability to maintain the legacy EMUs and noted the development of the next-generation spacesuits to be imperative. In 2024, the Panel stated they were concerned about the aggressiveness of the next-generation spacesuit schedule and identified the suits as one of the critical path items to the Artemis III mission, currently scheduled for mid-2027. They emphasized the current ISS suits are well beyond their design life and called the obsolescence of the suit a "persistent and critical risk" for the ISS.

[13] The ISS EVA Office manages EMUs on the ISS and oversees the development, logistics, and availability of all EVA hardware. The Extravehicular Activity and Human Surface Mobility Program is responsible for developing next-generation spacesuits, human-rated rovers, tools, and spacewalking support systems for use in microgravity, on the lunar surface, and on other planets.

[14] IG-17-018.

[15] IG-21-025.

[16] The Aerospace Safety Advisory Panel provides advice and makes recommendations to the NASA Administrator on matters related to aerospace safety.

NASA Faces Challenges to Maintain Current ISS Spacesuits through 2030

Collins—the sole provider of EMU maintenance and operations—has struggled to ensure sufficient critical life support components for the spacesuits are delivered when needed and within budget and that meet quality expectations. Collins' performance over the last several years has declined, due in large part to the company's supply chain challenges, parts obsolescence, and ineffective management practices. Despite these issues, NASA has limited leverage to incentivize improved performance, and its use of award fees has proved to be an ineffective motivator. Given Collins' ongoing challenges and the increased risk that NASA will be unable to perform critical spacewalks, we question all of the award fees provided to the contractor from FYs 2020 through 2024.

Collins' Poor Performance on ESOC Increases Spacewalk Risks

Contractor Performance Impacts Schedule, Cost, and Quality of Spacesuit Components

Until the ISS's planned decommission at the end of the decade, NASA will continue to require EVA capabilities to perform upgrades and corrective and preventative maintenance to the Station. However, Collins' performance on ESOC increases programmatic risks to NASA as it attempts to conduct safe spacewalks outside the ISS and maintain critical EMU life support component inventories. The contractor is experiencing considerable schedule delays, cost overruns, and quality issues that significantly increase the risk to maintaining NASA's spacewalking capability.

Schedule Delays

Collins is years behind its delivery schedule for several components that NASA considers critical to completing spacewalks. For example, a fan pump separator, due in 2022, has been delayed to late 2025. A fan pump separator is essential to ensuring a consistent flow of breathable air, regulating the astronaut's body temperature, and preventing water from interfering with breathing. The most notable failure of a fan pump separator occurred in July 2013 when an astronaut experienced dangerous levels of water in his helmet resulting in an almost catastrophic spacewalking incident. Additionally, a refurbished shear plate assembly, due in 2022, has been delayed to late 2025 as well. The shear plate assembly provides the crucial connection points for the oxygen tanks that supply breathable air.

Another critical component experiencing significant delays is a sublimator that was due in 2020, but as of August 2025, had yet to be delivered. As a result, NASA continues to use existing sublimators past their design life while waiting for Collins to deliver the replacement part. The sublimator is responsible for condensing water vapor and removing it from the ventilation loop, which is critical to regulating the

astronaut's body temperature by providing cooling and removing excess heat.[17] There have been multiple incidents of a faulty sublimator. For example, in March 2022, water was found in an astronaut's helmet caused by sublimator carryover, which is excess moisture from the sublimator that condenses when the suit is repressurized. NASA officials told us the sublimator is one of the highest risks to maintaining its spacewalking capability.

Further, a carbon dioxide sensor, due in 2020, experienced such severe delays that in January 2024 NASA issued a Stop Work Order for the new sensor and a waiver to extend the use of the existing sensors for the remainder of the ISS Program.[18] The carbon dioxide sensor is critical to measuring the level of carbon dioxide in the suit's breathable air. There have been several failures of this sensor during EVAs over the last 15 years.

Cost Overruns

Compounding the issue, since ESOC is a cost-reimbursable contract, NASA must assume the financial risk of the cost overruns associated with these component development and refurbishment delays. Over the last three fiscal years, Collins overran its cost plans by an average of nearly 15 percent, a total of $34 million. Some individual components ran over budget by significantly more, including the carbon dioxide sensor, which at one point was 75 percent (more than $8 million) over its original budget. To address Collins' poor management of these issues, NASA requested Collins submit two separate Corrective Action Plans—one in 2019 and the other in 2023. The Corrective Actions Plans were to include a determination of root causes for the cost overruns and actions that Collins would take to correct the weaknesses. As of August 2025, NASA had not approved one of Collins' Corrective Action Plans because cost overruns and delays in assembling and delivering EMU components persist.

Quality Issues

NASA and its astronauts rely on high-quality spacesuits when conducting inherently risky spacewalks so they can be done safely and efficiently. Over the last 5 years, Collins has experienced several lapses in quality when it comes to spacesuit component manufacturing and maintenance. For example, Collins cleared an expired component to be sent to the ISS. Then, years later, Collins flagged the same component for removal from service entirely. However, over a decade later in 2020, Collins discovered the expired and obsolete component was still being used on a spare Hard Upper Torso on the Station. Notable examples of other quality-related issues include the following:

- Collins' materials group wrote a memorandum recommending a reduction in the lifespan from 15 years to 3 years for a critical component with known design issues. However, Collins management did not become aware of the memorandum until 2 years after it was written.
- Collins shipped a Hard Upper Torso to NASA for use on the Station with a shoulder bearing that did not meet minimum requirements for pressurized time.
- Collins delivered incorrectly built leg assemblies to NASA after they improperly passed multiple inspection points. This called into question all leg assemblies, including those on the Station, which required valuable crew time to evaluate the components for deficiencies.

[17] A ventilation loop is a closed loop that circulates oxygen; removes carbon dioxide, humidity, and trace contaminants; and regulates the temperature of the oxygen.

[18] A Stop Work Order is a written order from the contracting officer to the contractor to stop all or part of the work temporarily until a decision is made to continue or terminate the work.

External and Internal Factors Cause Poor ESOC Performance

Collins' failure to effectively manage crucial spacesuit components is the result of several systemic and interrelated factors: supply chain challenges, parts obsolescence, and ineffective management practices. While Collins has varying degrees of control over each factor, we nonetheless identified them as overarching root causes for the performance issues experienced on ESOC within the last several years.

Supply Chain Challenges

Collins attributes delivery delays primarily to challenges with managing its supply chain, citing issues like unreliable suppliers, problems with labor resource retention, and lingering impacts of the COVID-19 pandemic. For example, according to Collins, delays in delivering the oxygen regulator—one of the highest risk life support components in the EMU—are due to its subcontractor's lack of qualified technicians, lack of necessary technical details, and the component's complexity. According to NASA officials, the oxygen regulator is sourced from only one company, which is currently behind schedule and has had long-standing performance issues. Further, Collins' subcontractor for this component has also experienced issues with some of its own suppliers, compounding delays for NASA. Exacerbating this issue, NASA officials told us Collins is often too reliant on subcontractors it is familiar with and is not willing to seek alternative options. In addition, several Agency officials noted the "brain drain" of knowledgeable spacesuit experts at Collins and their subcontractors who no longer work for those companies following Collins' June 2024 withdrawal from the Exploration Extravehicular Activity Services effort and due to the upcoming planned decommissioning of the ISS.

Many of these challenges are not unique to Collins and exist throughout the aerospace industry. As such, supply chain risk mitigation processes exist within NASA that could reduce the effects of these issues. For example, the Agency recently implemented a requirement to include its Supply Chain Visibility Data Requirement Deliverable—the provision of supply chain information to NASA on prime contractors, subcontractors, and suppliers—in certain major contracts valued at over $20 million, with the option to include it in other contracts at the Agency's discretion.[19] There are also internal and interagency boards and working groups NASA could seek to leverage for additional perspectives on their supply chain and obsolescence challenges.

Parts Obsolescence

Parts obsolescence has been an increasingly difficult challenge to overcome. ISS operations have been extended multiple times to more than 10 years past its intended lifespan, causing the EMUs to operate decades past their intended lifespan of 15 years. As a result, numerous spacesuit components are being used longer than planned. Given the advancing age of the EMU design, suppliers that have historically been in a component's supply chain may no longer produce the required parts or may not even currently be in business. This issue is worsened by the relatively small industrial base for the niche parts necessary for maintaining a spacesuit. Further, ensuring the EMU keeps up with certain technological advances in the decades since its development can cause extensive redesigns, leaving NASA more likely

[19] The Supply Chain Visibility Data Requirement Deliverable—managed by the Supply Chain Risk Management Program within NASA's Office of Safety and Mission Assurance—contractually mandates that a prime contractor provide NASA with supply chain information on the top three levels of a contractor's supply chain: the prime, the prime's subcontractors, and the subcontractors' suppliers. Contractors submit o NASA the data, which is then housed within an internal Agency database. This level of visibility allows for increased insight into the Agency's various supply chains and a more strategic management of its supply chain challenges. The Supply Chain Visibility Data Requirement Deliverable is currently not included in ESOC.

to instead accept the risk of maintaining its existing, outdated components. Several NASA officials told us that parts obsolescence was one of the biggest challenges to maintaining EMUs.

Ineffective Management Practices

The ISS Program attributes Collins' performance issues to outdated and ineffective management practices. In March 2023, four NASA program managers sent a letter to senior Collins leadership regarding the contractor's poor management of several NASA human space flight contracts, including ESOC. See Table 4 for the main areas of concern across multiple programs discussed in the letter.

Table 4: Areas of Concern Identified by NASA in Letter to Collins Leadership

Area of Concern	Description and Impact
Unacceptable Schedule and Cost Performance	Inability to perform to plan, exacerbated by macro-level supply chain and rate increase challenges resulting in systemic late deliveries, significant cost overruns, and increased schedule risk.
Contracting and Negotiating	Corporate overhead resulting in delayed or incomplete proposals.
Staffing Resources and Supplier Management	Insufficient resources in procurement, project engineering, and operations resulting in ineffective procurement, execution, and sub-tier management.
Project Management and Scheduling	Nonexistent or poorly managed Integrated Master Schedules, deficiencies with supplier oversight, and other functional areas resulting in delays ordering components and critical path impacts.
Risk and Opportunity Management	Inconsistent risk identification resulting in lack of risk mitigation plans and ability to close out risks.

Source: NASA OIG representation of March 2023 letter NASA sent to Collins.

Managers from each of the programs who signed the letter—Extravehicular Activity and Human Surface Mobility, Gateway, ISS, and Orion—also provided numerous, specific examples of the direct and negative impacts that Collins' performance had on their program. Specific ESOC examples cited in the letter include the following:

- a 4 percent on-time delivery rate for EMU hardware in FYs 2021 and 2022, with 39 percent late and 57 percent not delivered at all
- minimal planning of corrective actions to improve overarching deficiencies identified by NASA
- a life support component that experienced repeated test setup errors with failed corrective action implementations between incidences
- inadequate management of key suppliers, with significant issues in timely contract negotiations, quality control, proactive risk management, and timely delivery
- years-long delays of multiple critical life support components

The letter concluded that Collins' performance was a risk to maintaining spacewalking and other NASA program capabilities, the health and viability of the ISS, and the Artemis II and III launch schedules. Underlining the deep-rooted management problems, NASA officials wrote over a year later in Collins' May 2024 award fee performance evaluation report that it was "becoming more difficult for the government to operate in a timely and effective manner with respect to ESOC" due to Collins' various systemic performance issues, including "a perceived unwillingness to work with the government in a timely manner."

NASA Has Limited Leverage to Improve Contractor Performance but Could More Fully Utilize Award Fees to Improve Accountability

Over the last 5 years, NASA has struggled to motivate Collins to improve its ESOC performance. The Agency has limited leverage to do so because there are no other spacesuit support contractor alternatives. Additionally, available contractual tools—performance ratings and performance-based award fees—have not been sufficient motivators for Collins. Furthermore, NASA's award fee scores for the highest weighted evaluation criteria do not consistently reflect Collins' actual performance, resulting in higher award fees that may disincentivize performance improvements. Finally, the contract's award fee plan is based on outdated guidance and does not align with current Federal Acquisition Regulations (FAR).

NASA Lacks an EMU Support Contractor Alternative

By sole-sourcing spacesuit contracts to Collins for the last several decades, NASA created a monopolistic environment in which it lacks alternative contractors for spacesuit maintenance. While the original spacesuits for the Space Shuttle Program were competitively awarded to Hamilton Standard (now Collins) in 1977, NASA noncompetitively awarded the company follow-on contracts for ISS spacesuits on a sole-source basis in 1988, 1997, 2004, 2010, 2020, and 2024. In accordance with federal policy, NASA notified industry of its intent to sole-source spacesuit maintenance awards to Collins with the justification that Collins "has the corporate knowledge . . . as well as the highly skilled know-how and experience in the processes and ownership of unique equipment necessary for maintaining and operating the existing EVA system."[20] NASA also noted the high costs (estimated at over $100 million) and unacceptable delays (a transition period of 3 years) that would be associated with selecting an alternative contractor.

In response to NASA's notification of intent to sole-source to Collins, no potential contractors expressed interest in competing for the spacesuit maintenance work. This was an unsurprising outcome given that Collins was the only known contractor capable of doing so and NASA was the only customer for that specific type of work. Overall, while the decisions to sole-source to Collins were understandable given the lack of realistic alternatives in a niche industry, reliance on a single contractor increased NASA's risk exposure to schedule delays, cost increases, and poor contractor performance.

NASA Has Limited Leverage to Incentivize Improved ESOC Performance

The most significant tools NASA has to manage Collins' performance are annual Contractor Performance Assessment Reporting System (CPARS) ratings and award fee payments.[21] While award fee payments offer financial incentives for positive performance, ratings within CPARS are visible to other federal agencies and therefore are meant to act as an incentive for contractors that may seek additional contracts from the federal government. Due to Collins' poor contract performance on ESOC, NASA has decreased Collins' CPARS ratings and reduced Collins' award fee scores. However, these decreases have

[20] FAR 6.303-2 requires federal agencies to "ensure that offers are solicited from as many potential sources as is practicable."

[21] CPARS is a web-based system that allows government agencies to report and rate contractor performance.

not incentivized improved performance on ESOC, as issues with Collins—especially in the areas of schedule, cost, and quality—continue.

For example, NASA's annual CPARS rating for Collins' ESOC performance with respect to schedule decreased between FYs 2020 to 2024 in the CPARS reports we evaluated. Similarly, with cost control, NASA decreased Collins' CPARS rating in FY 2023 following cost overruns that year of 27 percent. The decreased rating did not incentivize substantive performance improvement as Collins again received a low rating in FY 2024 when it overran cost plans by 14 percent, driven by development challenges. Even decreased award fee scores, which directly translate to reduced award fee payments, have not incentivized improved cost control. NASA gave Collins scores of just 50 in the Cost evaluation category for three of the last four award fee evaluation periods, during which cost overruns averaged 24 percent.

Furthermore, Collins' CPARS rating for quality dropped between FYs 2021 to 2023. Nevertheless, Collins' quality issues persisted, and in FY 2024, the company again received a low quality rating. In one instance, life support systems refurbished by Collins were found to have screws installed that were too long, an issue that reoccurred a month later despite NASA recommending corrective actions. These trends reflect the contractor's inability or unwillingness to enact long-term improvements in schedule, cost, and quality areas despite the low ratings.

ESOC Award Fees Do Not Consistently Reflect Collins' Performance

For this audit, we evaluated ESOC award fee performance evaluation reports and scores given to Collins over the last five fiscal years, from FYs 2020 through 2024. While we agree with NASA's scoring of Collins' performance in two of the three evaluation categories—Cost and Subcontracting Goals—we found the Agency is inflating Collins' scores in the category that has the greatest impact (65 percent) on the weighted award fee score—Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements (see Table 2 for descriptions of each of these categories).[22] Despite Collins' consistent underperformance in factors considered for this highest weighted evaluation category, particularly schedule and quality, NASA repeatedly provided Collins with "Excellent" or "Very Good" scores, resulting in a higher total award fee.

For example, in the most recent award fee performance evaluation report from November 2024, NASA officials wrote that schedule performance continued to "erode" and Collins' inability to manage its subcontractors' schedules not only resulted in schedule and cost issues, but also "increased the risk to potentially conduct safe EVAs." Despite this, NASA recommended a score of 90 for this evaluation category. Further, Collins is years behind schedule in the delivery of several critical life support components. In that same evaluation report, NASA also wrote that Collins had yet to deliver 17 items due between FYs 2017 to 2020 and 121 items due between FYs 2021 to 2024, underscoring the endemic schedule problems Collins failed to correct. And yet, in the nine award fee evaluation periods we reviewed, only once did NASA recommend a score less than 90 for this same category (an 89).

[22] Scores in each of the three evaluation categories are given a weighting—Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements (65 percent); Cost (25 percent); and Subcontracting Goals (10 percent)—to calculate a "weighted score." NASA officials then deliberate and discuss if the weighted score should be adjusted upwards or downwards based on more subjective criteria, with the final score (which determines the amount of award fee provided) determined by the Fee Determination Official. For ESOC, the Fee Determination Official is the ISS Program Manager.

Award fee performance evaluation reports across the last five fiscal years also show multiple instances of significant quality lapses that, in our opinion, were not properly considered when determining award fee scores. Collins experienced several quality failures that resulted in expired or faulty parts being delivered to NASA or the ISS, such as an expired component discovered on the Station 20 years later, the late discovery by Collins management of a memorandum from the company's materials group reducing the lifespan of a critical component, and the delivery of incorrectly assembled parts. However, in the award fee evaluation periods when these issues were identified, NASA's recommended scores for this evaluation category were 94, 90, and 90, respectively.

According to NASA officials, while the award fee performance evaluation reports focus on areas of weakness, the overall score given to Collins is fair based on their review of Collins' performance over the entire ESOC contract scope. Specifically, the award fee scores NASA gave Collins in the highest weighted evaluation category are due to Collins' successful performance in other areas of the contract, particularly real-time EVA operations support. To Collins' credit, NASA consistently praised the contractor's team for its assistance with critical EVA activities, such as supporting ISS activities in low Earth orbit, conducting EVA test operations in NASA's Neutral Buoyancy Laboratory, and maintaining operations during large storms affecting the Johnson Space Center area.

Although this approach aligns with NASA guidance to consider outcome factors when making award fee determinations—and we agree that successful EVA operations is an important measure of Collins' performance, particularly when that success involves the safety of astronauts—an overemphasis on operations support unnecessarily diminishes the importance of other factors that contribute to these successful outcomes.[23] Absent a rebalancing of its contract evaluation, score inflation will continue to disincentivize Collins from improving its performance and suggest to the contractor that as long as its operations support is sufficient, it will not be significantly penalized for decreased performance elsewhere—performance that may ultimately result in poor outcomes during subsequent EVA operations.

Though we understand that contractors regularly face challenges, the award fee performance evaluations over the last several years present a holistic representation of a contractor that, in NASA's own words, "has not been demonstrating proactive, strategic leadership to improve performance, control costs, define and execute effective corrective action plans, successfully focus on recurrence control, or promote a culture that is clearly committed to continuous improvement." Despite these persistent and warranted criticisms, NASA consistently scored Collins in the 90s for the evaluation category with the highest weighting, thereby inflating its final recommended award fee scores. While we appreciate NASA's ability to consistently identify numerous endemic issues within this category, the Agency ultimately did not hold Collins fully accountable for its performance with respect to award fees.

A potential contributing factor to NASA's overly generous award fee scores is that the criteria for the highest weighted evaluation category are, in our judgment, broad and overly subjective. For example, the ESOC Award Fee Plan states the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements criterion "includes all aspects of quality and schedule" with an emphasis on performance compared to the contract's Statement of Work. However, it lacks

[23] *National Aeronautics and Space Administration's Award-Fee Contracting Guide* (August 12, 2022) states: "While it is sometimes valuable to consider input and output factors when evaluating contractor performance, it is NASA's preference to use outcome factors when feasible since they are better indicators of success relative to the desired result." Input factors are defined as intermediate processes, procedures, actions, or techniques that are key elements influencing successful contract performance (e.g., testing and other engineering processes and techniques, quality assurance and maintenance procedures, and subcontracting plans). Output factors are defined as the tabulation, calculation, or recording of activity or effort that can be expressed in a quantitative or qualitative manner. Outcome factors are assessments of the results of an activity compared to its intended purpose.

specific, objective criteria against which to measure Collins' performance, perhaps due to the breadth of topics within that evaluation criteria.

The Cost and Subcontracting Goals evaluation categories, on the other hand, have criteria against which NASA can objectively compare performance in that category to determine a rating, while still leaving room for some subjectivity to account for the context of the situation. For example, with the Cost category, if Collins varied from the cost plan by 7 to 10 percent in an award fee evaluation period, then that would equate to a "Good" to "Very Good" score range of 65 to 80 on the Cost scoring scale, with higher scores equating to smaller variances and lower scores equating to higher variances. Similarly, if Collins exceeds most of its criteria in the Subcontracting Goals category by 5 percent in an award fee evaluation period, then that equates to a "Very Good" score range of 84 to 90. These clear criteria allow for a more objective evaluation of Collins' performance, while still maintaining some leeway for subjective adjustments based on other factors.

Due to the inflated award fee scores in the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements category, as well as the category's lack of objective criteria, we are questioning all of the award fees provided to Collins over the last five fiscal years, 85 percent of the total available. See Appendix B for more details on these questioned costs.

ESOC Award Fee Plan Does Not Adhere to NASA and Federal Requirements

Rating criteria in the ESOC Award Fee Plan are based on outdated NASA requirements and do not conform to the criteria outlined in the FAR. ESOC contracting officials told us the contract was grandfathered into the older Agency requirements due to the age of the contract. Regardless, NASA's current requirements now state "All award-fee contracts shall utilize the adjectival rating categories and associated descriptions . . . contained in FAR 16.401(e)(3)(iv)" for the award fee evaluation categories.[24] See Table 5 for the differences in verbiage between the ESOC Award Fee Plan and the FAR.

[24] NASA FAR Supplement Section 1816.405-275(a).

Table 5: ESOC Award Fee Plan Compared to Federal Acquisition Regulations

Adjectival Rating	Score	Criteria (ESOC Award Fee Plan)	Criteria (FAR)
Excellent	91 to 100	Of exceptional merit; exemplary performance in a timely, efficient, and economical manner; very minor (if any) deficiencies with no adverse effect on overall performance.	Contractor has exceeded almost all of the significant award-fee criteria and has met overall cost, schedule, and technical performance requirements of the contract in the aggregate as defined and measured against the criteria in the award-fee plan for the award fee evaluation period.
Very Good	76 to 90	Very effective performance; fully responsive to contract requirements; reportable deficiencies but with little identifiable effect on overall performance.	Contractor has exceeded many of the significant award-fee criteria and has met overall cost, schedule, and technical performance requirements of the contract in the aggregate as defined and measured against the criteria in the award-fee plan for the award fee evaluation period.
Good	51 to 75	Effective performance; fully responsive to contract requirements; reportable deficiencies but with little identifiable effect on overall performance.	Contractor has exceeded some of the significant award-fee criteria and has met overall cost, schedule, and technical performance requirements of the contract in the aggregate as defined and measured against the criteria in the award-fee plan for the award fee evaluation period.
Satisfactory	50	Meets or slightly exceeds minimum acceptable standards; adequate results; reportable deficiencies with identifiable but not substantial effects on overall performance.	Contractor has met overall cost, schedule, and technical performance requirements of the contract in the aggregate as defined and measured against the criteria in the award-fee plan for the award fee evaluation period.
Unsatisfactory	0	Does not meet minimum acceptable standards in one or more areas; remedial action required in one or more areas; and deficiencies in one or more areas which adversely affect overall performance.	Contractor has failed to meet overall cost, schedule, and technical performance requirements of the contract in the aggregate as defined and measured against the criteria in the award-fee plan for the award fee evaluation period.

Source: NASA OIG representation of the ESOC Award Fee Plan and FAR 16.401(e)(3)(iv).

The ESOC Award Fee Plan evaluation criteria originate from a prior version of NASA's award fee contracting guide. However, a 2009 Government Accountability Office report found that this guide did not clearly specify how to define and rate satisfactory performance.[25] Specifically, the report noted that while "Satisfactory" performance equates to a contractor meeting minimum acceptable standards, NASA's guide states that "as a general guideline, a contractor which satisfactorily meets its contractual commitment will fall into the 'good' . . . range." Absent clear definitional distinctions, NASA further risks inflating award fees to Collins for performance that merely meets contractual requirements. Moreover, in using these outdated standards and not adhering to its own current requirements, the Agency is not holding Collins' performance on ESOC to the required standard of performance.

[25] Government Accountability Office, *Federal Contracting: Guidance on Award Fees Has Led to Better Practices but Is Not Consistently Applied* (GAO-09-630, May 29, 2009).

CONCLUSION

To ensure the continued operability of the ISS and the safety of the crew, NASA astronauts require well-maintained and reliable spacesuits. However, the spacesuits currently in use were designed more than 50 years ago and face multiple issues related to their design, inventory of critical components, and the performance of Collins, the contractor responsible for maintaining the suits. Over the last 5 years, Collins' performance has declined, leading to increased risks to the safety of the astronauts and ISS missions as well as cost increases and schedule delays.

While NASA has few options to improve the contractor's performance, the Agency has not fully leveraged one of its key contractual tools—award fees. Despite NASA's acknowledgement of Collins' poor performance, the Agency has continued to inflate award fee scores and provide Collins with monetary awards that do not align with NASA's own observations of their performance. With 5 years remaining on ESOC, if all options are exercised—and possibly more if the life of the ISS is extended yet again—NASA cannot continue with the status quo and allow contractual inertia to prevent improvements in the management of its spacesuits. Failure to implement such improvements increases the risks of higher costs, schedule delays, and operational shortcomings involving astronaut safety.

RECOMMENDATIONS, MANAGEMENT'S RESPONSE, AND OUR EVALUATION

To more effectively hold the Agency's ESOC contractor accountable for contract performance, we recommended the Associate Administrator for Space Operations Mission Directorate:

1. Adjust the ESOC Award Fee Plan to include clear, objective criteria for the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements evaluation category.
2. Align definitions in the ESOC Award Fee Plan with FAR guidance.

To improve overall supply chain management on ESOC, we recommended the Associate Administrator for Space Operations Mission Directorate:

3. Coordinate with an existing NASA supply chain group (e.g., Supply Chain Risk Management Program) to investigate alternative supply chain management strategies, such as evaluating the feasibility of incorporating the Supply Chain Visibility Data Requirement Deliverable into ESOC to increase visibility into spacesuit supply chains.

We provided a draft of this report to NASA management who concurred with Recommendations 1 and 3 and partially concurred with Recommendation 2. We consider management's comments and described planned actions responsive; therefore, the recommendations are resolved and will be closed upon completion and verification of the proposed corrective actions. In its response, NASA also noted it had identified information related to contractor performance and award fees that should not be publicly released, and we revised the report as appropriate.

Management's comments are reproduced in Appendix C. Technical comments provided by management and revisions to address them have been incorporated as appropriate.

If you have questions about this report or wish to comment on the quality or usefulness of this report, contact Laurence Hawkins, Financial Oversight and Audit Quality Director, at 202-358-1543 or laurence.b.hawkins@nasa.gov.

Robert H. Steinau
NASA OIG Senior Official

APPENDIX A: SCOPE AND METHODOLOGY

We performed this audit from September 2024 through August 2025 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Our overall objective was to examine NASA's management of the EMU spacesuits used on the ISS and the risks associated with their continued use. To accomplish our objective, we performed work at NASA Headquarters and Johnson Space Center. While at Johnson Space Center, we interviewed program management and safety experts from the Extravehicular Activity and Human Surface Mobility Program and the ISS Program, ESOC contract specialists, and representatives from Collins. Follow-up interviews were conducted as needed. Our selection of interview participants and topics was partially informed by an anonymous survey we sent in October 2024 to over 70 individuals from NASA and industry involved in spacesuit development, maintenance, management, or use. The survey provided a wider perspective of the challenges and risks associated with EMU maintenance. In preparation for the audit, we conducted routine coordination with the Office of Inspector General's Associate Counsel to the Inspector General and the Office of Investigations.

To assess the extent to which NASA and Collins are managing the current EMUs and the risks associated with using them, we reviewed ESOC documentation including the conformed contract as well as contract modifications, deliverables, and attachments like the award fee plan; performance evaluations (e.g., award fee performance evaluation reports and CPARS submissions) from the last five fiscal years; and risk presentations from both NASA and Collins. We also reviewed federal and NASA requirements on a variety of subjects, including safety and award fees, as well as FAR Part 52.

Assessment of Data Reliability

We used limited computer-processed data for this audit. We reviewed and analyzed NASA cost, obligation, and funding data for ESOC in NASA's financial accounting system. We concluded that the data was sufficiently reliable for the purposes of this audit. The findings and conclusions of this report do not rely on computer-generated data.

Review of Internal Controls

We evaluated the internal controls associated with NASA's management of its EMU spacesuits on the ISS. We reviewed appropriate policies, procedures, and regulations and conducted interviews with responsible personnel. Our recommendations, if implemented, will improve the identified control weaknesses. However, because our review was limited to these internal control components and underlying principles, it may not have disclosed all internal control deficiencies that may have existed at the time of this audit.

Prior Coverage

The NASA Office of Inspector General and Government Accountability Office have issued seven reports of significant relevance to this report. These reports can be accessed at https://oig.nasa.gov/audits/ and https://www.gao.gov/, respectively.

NASA Office of Inspector General

NASA's Management of Risks to Sustaining ISS Operations through 2030 (IG-24-020, September 26, 2024)

NASA's Management of the Artemis Supply Chain (IG-24-003, October 19, 2023)

NASA's Development of Next-Generation Spacesuits (IG-21-025, August 10, 2021)

*NASA's Management and Development of Spacesuits (*IG-17-018, April 26, 2017)

Government Accountability Office

NASA: Assessments of Major Projects (GAO-24-106767, June 20, 2024)

NASA Artemis Programs: Crewed Moon Landing Faces Multiple Challenges (GAO-24-106256, November 30, 2023)

NASA: Assessments of Major Projects (GAO-23-106021, May 31, 2023)

APPENDIX B: ESOC AWARD FEE QUESTIONED COSTS

The questioned costs identified during our audit and discussed in this report are the result of the improper award fees NASA gave Collins from FYs 2020 through 2024. In our judgment, Collins received inflated award fee scores in the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements evaluation category over the last nine award fee evaluation periods. As a result of the category's lack of objective criteria against which we could determine more reasonable scores, we are questioning all of the award fees provided to Collins over the last five fiscal years, 85 percent of the total available. While the award fee amounts are sensitive content and withheld from public release, we provided these amounts to NASA management.

APPENDIX C: MANAGEMENT'S COMMENTS

National Aeronautics and Space Administration

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

September 26, 2025

Reply to Attn of: Space Operations Mission Directorate

TO: Acting Assistant Inspector General for Audits

FROM: Associate Administrator for Space Operations Mission Directorate

SUBJECT: Agency Response to OIG Draft Report, "NASA's Management of ISS Extravehicular Activity Spacesuits" (A-24-14-00-HED)

The National Aeronautics and Space Administration (NASA) appreciates the opportunity to review and comment on the Office of Inspector General (OIG) draft report entitled, "NASA's Management of ISS Extravehicular Activity Spacesuits" (A-24-14-00-HED), dated August 26, 2025.

While NASA believes that award fee scores represent a fair evaluation of the contract's overall scope, we agree to update the scoring plan in accordance with the details outlined in the management response below. NASA acknowledges that the language in the contract's award fee plan is based on an older version of Federal Acquisition Regulations (FAR) guidance but does not agree that this has influenced the award fee scores or that an update is required. The responses to the recommendations in this memo outline the actions NASA plans to take along with the supporting rationale.

In the report, the OIG makes three recommendations addressed to the Associate Administrator for Space Operations Mission Directorate (SOMD).

Specifically, the OIG recommends the following:

Recommendation 1: Adjust the Extravehicular Activity Space Operations Contract (ESOC) Award Fee Plan to include clear, objective criteria for the Management and Technical Performance, Business Management, Compliance with Safety and Health Requirements evaluation category.

> **Management's Response:** NASA concurs with this recommendation. The Fee Determination Official and Performance Evaluation Board conduct assessments based on various measurable elements pertaining to technical performance. These inputs provide a clear basis for determining contractor performance, and the resulting award fee reports for technical performance were focused on relaying this feedback to the contractor. NASA will better document the logic utilized to determine the scores for future award fee periods including performance across all areas of the contract,

relative areas of emphasis, and overall risk to the International Space Station (ISS) mission. Additionally, NASA will update the percentage breakdown of 65 percent, which includes the three categories of 1) management and technical performance, 2) business management, and 3) compliance with safety and health requirements to more discretely distribute these areas. Management and technical performance will remain heavily weighted and will include hardware performance, hardware/process/product quality, schedule, and supplier management. Quantitative data will be used as appropriate, as is currently done for Deliverable Item Lists. Business management will be folded within the existing cost section, which will remain at its 25 percent overall allocation.

Subsequent to final report issuance, NASA will determine whether any questioned costs identified in Appendix B of the draft report should be disallowed and will communicate that management decision to the OIG.

Estimated Completion Date: December 31, 2025.

Recommendation 2: Align definitions in the ESOC Award Fee Plan with FAR guidance.

Management's Response: NASA partially concurs with this recommendation. Upon careful review, NASA determined the following facts:

- The bilateral contract award of ESOC was signed by the contractor, Hamilton Sundstrand Space Systems International, Inc., d.b.a. Collins Aerospace, on September 22, 2010.
- Federal Acquisition Circular 2005-46 was published on September 29, 2010, which introduced the FAR amendment for FAR Case 2008-008, Award-Fee Language Revision, reflective of the current FAR definitions.
- NASA countersigned the bilateral contract award of ESOC on September 30, 2010.

The ESOC Award Fee Plan did not incorporate the September 29, 2010, FAC 2005-46 changes post contractor signature on September 22, 2010, and therefore, does not align with the definitions in the FAR guidance. While a bilateral modification to the Award Fee Plan to make updates to the definitions is permissible, doing so creates contractual risk. Reopening the contract for this negotiation may enable the contractor to pursue other concessions not contemplated by the Government. NASA will incorporate the current FAR language into the ESOC award fee plan if it can accomplish the change with no concession to the contractor.

Estimated Completion Date: December 31, 2025.

Recommendation 3: Coordinate with an existing NASA supply chain group (e.g., Supply Chain Risk Management Program) to investigate alternative supply chain management strategies, such as evaluating the feasibility of incorporating the Supply Chain Visibility Data Requirement Deliverable (DRD) into ESOC to increase visibility into spacesuit supply chains.

> **Management's Response:** NASA concurs with this recommendation. After receiving the draft recommendation, the ISS Extravehicular Activity (EVA) Office Manager and Supply Chain Risk Management Program Executive evaluated the potential benefits and impacts of adding the Supply Chain Visibility DRD to ESOC. The driving factor in the evaluation was the remaining ISS life and planned suit deliveries during this lifespan. The ISS end of life is planned for 2030. The ISS space suit delivery plan to support this ISS end of life is to deliver three additional suits, one each in 2026, 2027, and 2028. Components for these suits are needed well in advance of their delivery dates to ISS to facilitate assembly into the suit in time for acceptance testing and flight shipment. As referenced in the OIG report, the majority of components have sufficient inventory to support ISS life and the planned suit deliveries (there are approximately 11 components with schedule issues, some of which are due to supply chain issues). For the critical components, even if a new supplier was identified, the time to create a design, certify it, and produce it for flight would not meet NASA's needs for the last planned suit deliveries. An additional DRD to broadly change the management and visibility into the ESOC supply chain would also come at significant cost. For these reasons, NASA does not plan the addition of any DRDs to ESOC.
>
> NASA plans to continue to fully utilize all available assets to manage supply chain challenges. To do this, the ISS EVA Office will continue to work two aspects with the Supply Chain Risk Management Program. First, for the benefit of the Extravehicular Mobility Units, the current supply chain issues for specific piece parts are being shared with the Supply Chain Risk Management Program for potential alternatives. Second, the ISS EVA Office will continue to share data, including performance data, on an ongoing basis for ESOC suppliers to enhance the Supply Chain Risk Management Program data set to benefit other NASA systems.
>
> **Estimated Completion Date:** This action was completed on August 27, 2025.

We have reviewed the draft report for information that should not be publicly released. As a result of this review, we have identified information that should not be publicly released and have communicated such to the OIG, including data from the Contractor Performance Assessment Reporting System and award fee data.

Once again, thank you for the opportunity to review and comment on the subject draft report. If you have any questions or require additional information regarding this response, please contact Michelle Bascoe at (202) 384-6027.

Kenneth Bowersox

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Date: 2025.09.26 14:02:36 -04'00'

Kenneth Bowersox

cc:
Associate Administrator for Exploration Systems Development Mission Directorate
/Dr. Lori S. Glaze (Acting)

APPENDIX D: REPORT DISTRIBUTION

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(Assignment No. A-24-14-00-HED)