

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
George C. Marshall Space Flight Center  
JUSTIFICATION FOR OTHER THAN FULL AND OPEN COMPETITION  
(JOFOC)  
For United Launch Alliance (ULA) Vulcan Centaur V Upper Stage

**1. Federal Acquisition Regulation (FAR) 6.104-1(a)(1)<sup>1</sup> – Identification of the agency and the contracting activity, and specific identification of the document as a “Justification for other than full and open competition.”**

This document is a justification for other than full and open competition prepared by National Aeronautics and Space Administration (NASA) George C. Marshall Space Flight Center (MSFC).

The procuring agency is NASA, and the contracting activity is MSFC.

**2. FAR 6.104-1(a)(2) – The nature and/or description of the action being approved:**

This justification provides the rationale for contracting by other than full and open competition to award a sole-source contract to United Launch Alliance (ULA) to procure replacement upper stages for use in the Space Launch System (SLS) for the Artemis IV and Artemis V missions. This approach leverages current support infrastructure and will use, with relatively minor modifications, an existing ULA upper stage. All other alternative solutions fail to meet the performance requirements, would require significant modifications to hardware that is still under-development, or would require the development of new hardware that does not currently exist.

The SLS program baseline for the first three launches of the Artemis campaign, Artemis I through Artemis III, utilized the Block 1 configuration, which includes a ULA modified Delta IV Cryogenic Second Stage (Delta IV) variant of an Interim Cryogenic Propulsion System (ICPS). Beyond this initial configuration, NASA planned to upgrade to the Block 1B configuration. For this upgraded configuration, the vehicle core stage, core stage engines, and boosters remained unchanged, however the Block 1B vehicle would replace the Delta IV ICPS with a more powerful upper stage called the Exploration Upper Stage (EUS) which would allow for more ambitious missions beyond the capabilities of the Block 1 vehicle. NASA planned the Block 1B vehicle’s first launch to be part of the Artemis IV mission, but due to eroding cost and schedule delays NASA now requires an alternate upper stage, for the \*Artemis IV and Artemis V missions. While ULA’s Delta IV was the ICPS used on the

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<sup>1</sup> NASA implemented Revolutionary FAR Overhaul (RFO) Part 6 via Procurement Class Deviation 25-10 on July 27, 2025. The citations in this document reference the RFO.

\* Artemis launch naming/numbering converting is subject to revision solely at NASA’s discretion.

Artemis I mission and will be used on the Artemis II and III missions, ULA has retired that Delta production line in support of developing their new Vulcan Centaur fleet. The Vulcan Centaur V is the upper stage for ULA's Vulcan rocket.

This effort includes production, delivery, inspection, acceptance, sustaining engineering, and all necessary pre- and post-flight requirements for 2 flight units and 1 flight spare unit, including flight spare line replacement units (LRU), in support of the Artemis IV and Artemis V missions currently planned for 2028.

**3. FAR 6.104-1(a)(3) – A description of the supplies or services required, to meet the Agency's needs (including the estimated value):**

Consistent with the NASA Authorization Act of 2010 (Public Law 111-267) and subsequent Presidential direction, NASA established the SLS Program and initiated development of the SLS vehicle. The SLS Program has developed a launch system architecture, which includes several design configurations intended to support various mission requirements, to meet an evolving capability strategy consistent with the reference missions and at a pace prescribed by the available budget.

The Artemis Program Block 1 SLS configuration supports NASA's initial steps to meet the Agency's long-term goal to expand human presence beyond low-Earth orbit. Artemis I was successfully flown in November 2022 with Artemis II and Artemis III forecasted to fly in early 2026 and mid-2027 respectively. To maintain a flight rate of approximately one Artemis flight per year beyond Artemis III, NASA needs to acquire additional upper stage capabilities. To meet this need and support the Nation's objective of returning to the Moon, NASA is standardizing the design of the SLS and increasing its flight rate. Standardizing the SLS design and increasing its flight rate will have a direct safety benefit for crew and will reduce costs to fund additional missions.

Pursuant to this need, NASA identified the requirement for continuation of the Block 1 SLS configuration through Artemis V, which also requires continuation of upper stage support consistent with that design configuration. This approach leverages current support infrastructure and will use, with relatively minor modifications, an existing upper stage.

The upper stage design parameters and performance characteristics necessary to support the SLS Block 1 configuration for the Artemis missions are as follows:

- Human-rating in accordance with NASA Procedural Requirement (NPR) 87205.2B, "Human-Rating for Space Systems"
- Lift capability on orbit of approximately 60,000 lbs.
- Delta-V greater than 3,050 m/s with three engine ignitions (third ignition for disposal)
- Stage functionality to perform a separation event and three-axis control after insertion, but before separation of the Orion capsule
- Axial acceleration, not to exceed 2g
- Support NASA provided reference missions
- Overall integrated stacked height must clear Vehicle Assembly Bay (VAB) doors

- Fuel and oxidizer commodities similar to existing Ground Support Equipment (GSE) infrastructure

This effort will include integration of hardware compliant with the specified design parameters and performance characteristics to be compatible with the Block 1 configuration of the SLS vehicle, which includes modification, qualification, and manufacturing. The first upper stage must be ready to integrate into the SLS vehicle no later than nine months prior to launch (L-9 months) in support of the Artemis IV mission that is planned to occur in early 2028 and the second stage must be ready to integrate no later than L-9 months in support of the Artemis V mission that is planned to occur in late 2028.

The total Government estimated cost of this effort is \_\_\_\_\_, and the estimated period of performance, including post-flight requirements for 2 flight units and 1 spare unit, is approximately 6 years.

**4. FAR 6.104-1(a)(4) – An identification of the statutory authority permitting other than full and open competition:**

The statutory authority permitting other than full and open competition is 10 U.S.C. 3204(a)(1), as implemented by FAR Part 6.103-1(c), Only One Responsible Source and No Other Supplies or Services Will Satisfy Agency Requirements, due to the highly specialized nature of this requirement as detailed in Section 3 above.

NASA MSFC intends to procure Artemis IV and Artemis V upper stage capabilities on a sole source basis from ULA. Award to any source other than ULA would result in a substantial duplication of cost to the Government that is not expected to be recovered through competition and would result in unacceptable schedule delays in fulfilling the agency's requirements.

**5. FAR 6.104-1(a)(5) – A demonstration that the proposed contractor's unique qualifications or the nature of the acquisition requires use of the authority cited:**

NASA's requirement for an upper stage for the Artemis IV and V missions can only be met through a sole source contract to ULA for highly specialized services (support of the Centaur upper stage). Procuring these services from another source would incur substantial duplication of cost to the Government and introduce unacceptable delays in fulfilling NASA's requirements.

ULA's Centaur (with minor modifications) is the only existing in-space propulsion stage capable of meeting the SLS upper stage design parameters and performance characteristics, while also meeting NASA's schedule. To standardize the SLS for the Artemis IV and V missions to the current Block I configuration, the upper stage must be compatible with the current mobile launcher and Orion interfaces. No other existing stage (other than Centaur) has compatible size to be able to integrate into the mobile launcher. The Centaur also has common avionics and software with the current upper stage for Orion integration. As currently designed, the Centaur meets all requirements noted in Section 3 above.

The Centaur has completed both an extensive development program as well as qualification program including full scale testing. In addition, the Centaur has proven flight history data and validation. No other existing in-space propulsion stage requires such relatively minor modifications to be made fully compliant with the SLS upper stage design parameters and performance characteristics. The necessary modifications can be qualified with minimal structure and component testing. While additional sources could provide alternate solutions, that alternate hardware would require significant modifications which would yield substantial schedule delays and additional cost; therefore, ULA's Centaur is the only source capable of meeting near-term schedule requirements for Artemis IV and Artemis V.

ULA maintains access to the data rights for Centaur including the unique and specific design and testing knowledge/skills required to affect the types of minor modifications necessary to enable full compliance with the current SLS upper stage design parameters and performance characteristics.

The intended sole source contractor, ULA, provided, and will provide, the upper stages for Artemis I, II, and III. Therefore, this contractor uniquely understands the engineering effort required for this highly specialized and complex flight hardware, stemming from experience gained during the production process, integration including cross program interfaces, verification, mission certification, launch and mission operations. Examples of this unique capability and infrastructure include:

- i. Existing ULA Systems Integration Labs (SIL) are used to develop and test vehicle trajectory feasibilities and hardware-in-the-loop simulations at the Orion Integrated Test Lab (ITL) in the Orion contractor's Denver facility.
- ii. Established and proven support interfaces to KSC's Exploration Ground Systems (EGS) infrastructure that includes emulators used to ensure compatibility across integrated systems.  

is a critical piece of ground support equipment (GSE) integrated into EGS's ground systems commanding architecture. is used to send commands to the which is an avionics box utilized on both the Artemis I, II, & III ICPS, as well as ULA's Centaur launch vehicle. Using the existing for Artemis IV and V would mitigate incurrence of additional cost associated with use, training, and integration of an alternate solution as well as reduction of technical complexity and minimization of schedule risk associated with commanding architecture development realized on the early Artemis missions with the upper stage's INCA commanding.
- iii. Established and proven support interfaces to JSC's Mission Operations at the Mission Control Center (MCC) including the Vehicle Ascent Launch Operations Room (VALOR), an engineering support room, located at ULA's Denver facilities.
- iv. Heritage Main Propulsion System (RL10) with existing facility, personnel, and engineering products allow the integration complexities to be reduced.

- v. Established interfaces with Mobile Launcher 1 including existing SLS common propulsion commodities (LOX and LH2) and umbilical connections. Alternate solutions would require more significant modifications to the ML1, including station locations of the crew access arm, umbilicals, and potentially the tank farm if those solutions utilized alternative propulsion commodities (e.g., LH2/LO2).
- vi. ULA's Emergency Detection System (EDS) will be flown on Artemis II and III.
- vii. Extensive flight component inventory, including existing spare common upper stage avionics that have already been procured by SLS that would be utilized.
- viii. ULA has knowledge of and experience with the SLS design and mission requirements including an extensive verification program.
- ix. ULA has knowledge of and experience with the SLS architecture and concept of operations.
- x. ULA has experience in making minor modifications to a heritage upper stage to meet the SLS requirements.
- xi. US domestic production infrastructure similar to previous SLS upper stage logistics.
- xii. Dedicated upper stage workforce at facilities in Denver where the Orion Integrated Test Lab (ITL) is located and at Cape Canaveral Space Force Station (CCSFS) located beside Kennedy Space Center (KSC) where Artemis IV and Artemis V will launch.

ULA's knowledge and technical skills related to SLS are easily transferable from the Delta IV heritage ICPS to the Centaur. Introduction of a new contractor at this time would result in significant duplication of cost, as well as significant additional time and expense to mature both the technology and the vendor to the level of technical capability required for sustained SLS upper stage flight hardware engineering that ULA already maintains.

In addition to the above, award to another source would cause unacceptable delays in meeting the Agency's requirements. If NASA were to utilize another contractor's solution, the SLS Program manifest and schedule requirements associated with upper stage utilization would be negatively impacted in such a way that NASA would be unable to meet the Artemis IV or Artemis V preparatory schedule events and launch dates.

- i. The NASA Kennedy Space Center (KSC) need date for processing is projected to be nine months prior to a launch. Award to another source would cause unacceptable delays to current launch schedules. These delays would derive from the procurement process, on/off ramping of new contractor personnel, the potential need for reworked activities, as well as efforts necessary to satisfy SLS technical and programmatic drivers. These activities could not be feasibly accomplished in time to satisfy current Artemis IV and Artemis V launch readiness dates.
- ii. A new prime contractor would likely encounter a substantial learning curve associated with performing sustaining engineering of upper stage flight units manufactured by a different contractor. ULA has established an associated learning and process improvement curve for sustaining engineering requirements, having already participated in the manufacture and launch of the first SLS upper stage flight unit on Artemis I in November 2022, as well as being involved in the ongoing operations and maintenance associated with the near term planned launch of Artemis

II. A new contractor would not be familiar with the sustaining engineering required to ensure successful integration and execution enabling mission success. The time required for a new contractor to become familiar with the existing processes and equipment adds significant risk to maintaining an already challenging launch schedule relative to SLS requirements.

**6. FAR 6.104-1(a)(6) – A description of the efforts made to ensure that offers are solicited from as many potential sources as practicable, including whether a notice was or will be publicized as required by part 5 and, if not, which exception under part 5 applies:**

This notice of NASA’s intent to award this sole-source action is being synopsisized on the Government-wide Point of Entry website (SAM.gov) per FAR Part 5. Market research has been conducted and is detailed in Section 8 below.

**7. FAR 6.104-1(a)(7) – A determination by the contracting officer that the anticipated cost to the Government will be fair and reasonable:**

The Contracting Officer's signature on this document indicates that it has been determined that the anticipated potential cost to the Government will be fair and reasonable. ULA will be required to submit a proposal to be evaluated and negotiated by the Government. Prior to the execution of a new contract, price analysis will be performed on the contractor's corresponding proposal to ensure price reasonableness. It is anticipated that ULA will provide pricing for this effort so that a pricing comparison will help the Government determine reasonableness.

**8. FAR 6.104-1(a)(8) – Description of the market research conducted, and the results, or a statement of the reason market research was not conducted (e.g., urgent, and compelling requirement):**

In accordance with FAR 10.001, an extensive in-house review of available in-space propulsion capabilities was conducted by subject matter experts within the NASA Spacecraft Payload Integration and Evolution office in coordination with the NASA Advance Concepts office. The results of that analysis found that ULA is the only viable source for an in-space propulsion stage capable of meeting the current SLS upper stage design parameters and performance characteristics for current Artemis IV and Artemis V launch readiness dates.

This in-house review of the available in-space propulsion capabilities considered ULA’s Vulcan Centaur V (Centaur) and Blue Origin’s New Glenn Upper Stage (NGUS). See Figure 1, below.

When the design parameters and performance characteristics of the potential sources were compared against SLS upper stage design parameters and performance characteristics, only the Centaur is capable (with relatively minor modifications) of meeting the requirements of the Government. The other currently available commercial solution, NGUS, would require significant modifications yielding a need for

Compatibility with existing fuel and oxidizer commodity infrastructure at EGS was also taken into consideration. Overall integrated vehicle height was also taken into consideration in two ways: First, the overall height needs to fit within the height clearance of the existing and irreplaceable VAB. Second, the solution must minimize impacts to umbilical heights, with primary focus on crew access arm elevation.

The Centaur currently supports liquid oxygen and liquid hydrogen fueled flights minimizing modifications to existing EGS infrastructure. The Centaur also meets both overall integrated height requirements.

Although the NGUS had a demonstration flight in January 2025 and a second flight in November 2025, this vehicle is still considered to be in early phases of development whereas the Centaur has extensive heritage dating to the 1960s including its main engines, the RL-10. The Centaur is a variant of the Atlas Centaur which flew crew under the Commercial Crew Program. These flights exercised the main flight computer, Inertial Navigation and Control Assembly (INCA), and the required Emergency Detection System currently being flown on Artemis.

Using the NGUS would require significant modifications to both the stage and the EGS infrastructure. For example, using NGUS would require relocating the Mobile Launcher Crew Access Arm and modification to the upper stage umbilical retraction mechanism. The stage could be shortened to meet VAB height constraints but would require full scale development and testing to qualify the stage for the shorter configuration. Full scale testing/requalification would result in unacceptable schedule impacts and additional cost risk to the SLS Program.

ULA's established infrastructure, resources, flight history, existing cross program integration, and human rating familiarity with the Centaur upper stage represents the only currently viable opportunity for the Government to accomplish Artemis mission objectives and requirements while also maintaining the Agency's programmatic goals.

**9. FAR 6.104-1(a)(9) – Any other facts supporting the use of other than full and open competition:**

This action aligns with Executive Order (EO) 14369, Ensuring American Space Superiority, and its directive to enhance sustainability and cost-effectiveness of launch and exploration architectures.

This EO highlights the national interests discussed within this justification, the importance of the national priorities discussed, and the potential harm to achieving those priorities should it provide for full and open competition for this requirement.

**10. FAR 6.104-1(a)(10) – A listing of the sources, if any, that expressed an interest in writing in the acquisition:**

There are no alternate sources capable of meeting current SLS upper stage design parameters and performance standards in accordance with current scheduled SLS launch dates for Artemis IV and Artemis V.

**11. FAR 6.104-1(a)(11) – A statement of actions, if any, the agency may take to remove or overcome any barriers to competition before any subsequent acquisition for the supplies or services required:**

The Agency will continue to examine the market in the future for alternative solutions or new sources before executing any subsequent acquisitions for future missions.

**United Launch Alliance (ULA) Vulcan Centaur V Upper Stage  
JUSTIFICATION FOR OTHER THAN FULL AND OPEN COMPETITION  
SIGNATURE PAGE**

I certify that the facts presented in this justification are accurate and complete.

Christopher Calfee Digitally signed by Christopher Calfee  
Date: 2026.03.05 13:36:58 -06'00'

Chris Calfee  
Manager, Spacecraft Payload Integration Office  
Technical Representative

I hereby certify that the above justification is complete and accurate to the best of my knowledge and belief.

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*KAREN REILLEY*

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Karen Reilley  
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APPROVAL:

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