SPACE GENERATION ADVISORY COUNCIL

# Artemis Program: Policy Directives and Lineage

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## Summary

Artemis is a U.S.-led space program involving crewed and robotic activity in service to lunar exploration and preparation for martian exploration. It consists of at least five launches between 2022 and 2029, with annual launches after that [1]. Artemis is a discrete spaceflight program but has strong mission and physical component links to previous National Aeronautics and Space Administration (NASA) programs.

## Program Overview

The Artemis program originated as a 2017 presidential memorandum known as Space Policy Directive 1, which gave NASA **federal directive and remit to undertake crewed exploration "beyond low-Earth orbit" (LEO) and to "lead the return of humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations"** [2]. Through Artemis, the U.S. will send crews into lunar orbit–including the first female and first person of color–and to the moon's surface for the first time since 1972.

Artemis's defining qualities are that it is collaborative between NASA, commercial, and international partners; it aims to establish the first, long-term human presence on the moon; and it views the moon as a stepping stone for gaining in-situ and analog knowledge in support of crewed missions to Mars [3], [4]. Artemis has six core vehicular and infrastructural elements: the Orion Spacecraft crew capsule, the Space Launch System (SLS) rocket, exploration ground systems for launch and recovery, Lunar Gateway (a "spaceship in lunar orbit"), a human landing system, and Artemis Base Camp [3].

## Relationship to Previous Space Programs

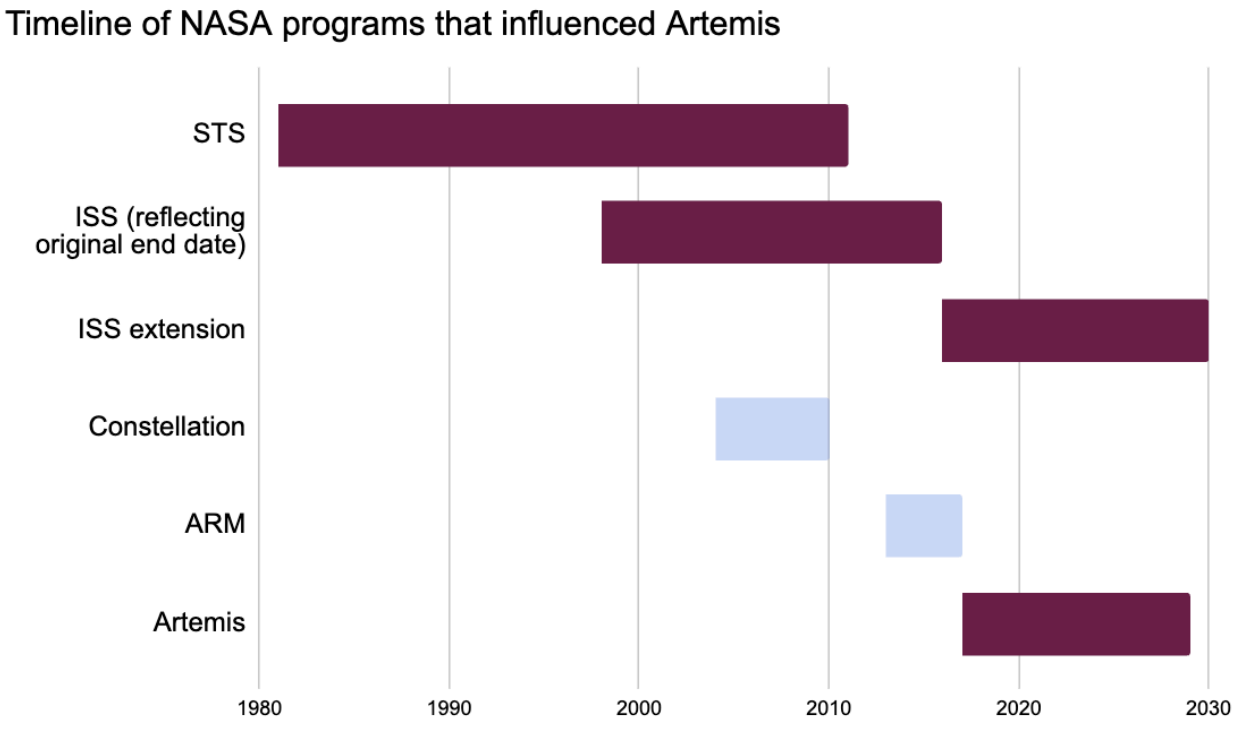
**While Artemis is a discrete program, the Orion capsule and SLS core elements predate it.** Artemis also has historical ties to preceding NASA programs, including Constellation, the Asteroid Redirect Mission (ARM), the space shuttle (formally the Space Transportation System or STS) program, and the International Space Station (ISS).

Plans to develop and use the Orion capsule for crewed missions to LEO and the moon have featured in the ambitions of three presidential administrations and the corresponding NASA programs [5]. **Orion is a direct carryover from two canceled programs: Constellation and ARM.** Constellation would have provided for the development of a crewed vehicle and the necessary rocket for the U.S. to send astronauts "back to the moon, Mars and beyond"--landing humans on the moon by 2020 [6], [7]. Constellation was heavily influenced by the STS program and original ISS timeline. The shuttle was expected to be retired in 2010 and the U.S. would need a way to independently launch astronauts to the ISS or else become dependent on partners to do so. The loss of space shuttle Columbia in 2003 enlivened the discussion between NASA and the White House around next steps for crewed American spaceflight; the Orion crew capsule was one

outcome, conceived for Constellation missions and touted as being "10 times safer during ascent and entry than its predecessor, the space shuttle" [6], [7], [8]. Constellation was announced in 2004 and canceled in 2010 [5], [6].

ARM was announced as a "combination of robotic and crewed missions which substantially contributes to advancing technologies, systems, and operational capabilities required for human missions to Mars" [9]. It planned to use a wide variety of space assets and ground infrastructure to identify, redirect, and explore asteroids. Orion was the crew capsule NASA planned to use to transport astronauts from Earth to an asteroid and back again. As in the Constellation program, this would put Orion to use on deep space missions and support NASA's goals for renewed lunar and Martian exploration [9]. ARM was announced in 2013 and canceled in 2017 [5], [10].

**The SLS was originally established in the NASA Authorization Act of 2010** [11]. Among other items, the act specifically directed NASA to develop the SLS to specific technical parameters. It further stipulated that existing contracts, personnel, and other assets from previous programs and specifically previous Orion projects be utilized by NASA in developing the SLS. Some components of the SLS are derived directly from the STS, such as upgraded RS-25 engines and modified solid rocket boosters [13], [14]. There is also STS and Constellation infrastructure at multiple NASA locations that has been repurposed for the SLS [15].



## Conclusion

Artemis is, in several ways, the culmination of decades of work across NASA programs. It is also the successor to the Apollo program and will lay the groundwork for future U.S.-led interplanetary travel. However, Artemis is currently over budget and behind schedule. A recent audit found that the SLS alone had seen "$6 billion in cost increases and over 6 years in schedule delays" [16]. Some of these challenges spring from the origin of Artemis components in previous programs. A former NASA deputy administrator has said of the budgetary and schedule overshoots that "decisions [NASA] made more than a decade ago locked them into this design that really was not focused on operability" [17]. Putting to use the surviving components of previous programs means that Artemis must reconcile technology and infrastructure from different eras and different programs–some of which was originally built with very different missions in mind.

## Author Bio

Dr. Juliana Rinaldi-Semione is a research fellow and policy impact specialist in the University of Nottingham's Faculty of Engineering. A cross-disciplinary professional, she has a PhD in politics and contemporary history and an MA in law and ethics. Juliana's work focuses on the implications of the Sustainable Development Goals and human rights for long-term human space exploration. Juliana was born and raised in California, and currently lives in the U.K.

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