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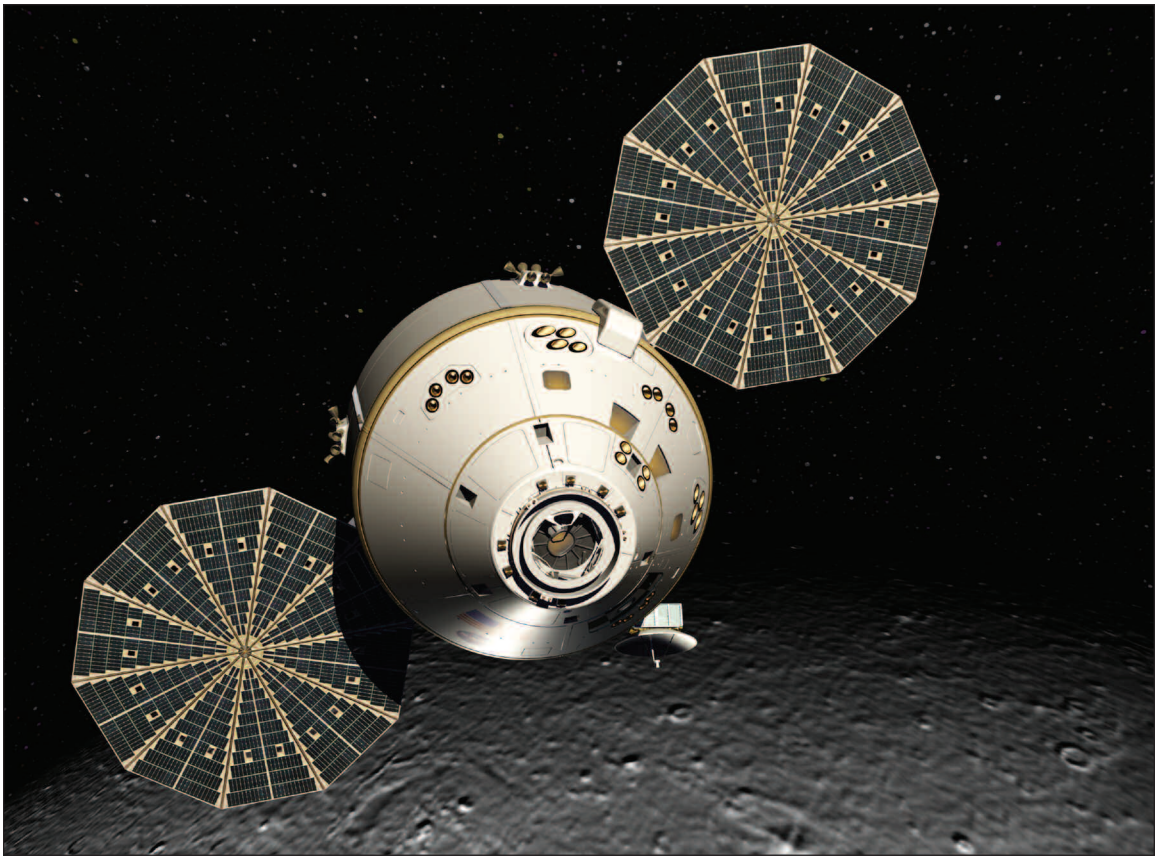
Constellation Program:

America's Spacecraft for a New Generation of Explorers

The Orion Crew Exploration Vehicle



The Orion crew exploration vehicle and its service module orbit the moon with disc-shaped solar arrays tracking the sun to generate electricity.

America will send a new generation of explorers to the moon aboard NASA's Orion crew exploration vehicle. Making its first flights early in the next decade, Orion is part of the Constellation Program to send human explorers back to the moon, and then onward to Mars and other destinations in the solar system.

A component of the Vision for Space Exploration, Orion's development is taking place in parallel with missions to complete the International Space Station using the space shuttle before the shuttle is retired in 2010.

Orion will be capable of carrying crew and cargo to the space station. It will be able to rendezvous with a lunar landing module and an Earth departure stage in low-Earth orbit to carry crews to the moon and, one day, to Mars-bound vehicles assembled in low-Earth orbit. Orion will be the Earth entry vehicle for lunar and Mars returns. Orion's design will borrow its shape from the capsules of the past, but takes advantage of 21st century technology in computers, electronics, life support, propulsion and heat protection systems.

Veteran Shape, State-of-the Art Technology

Orion will be similar in shape to the Apollo spacecraft, but significantly larger. The Apollo-style heat shield is the best understood shape for re-entering Earth's atmosphere, especially when returning directly from the moon. Orion will be 5 meters (16.5 feet) in diameter and have a mass of about 22.7 metric tons (25 tons). Inside, it will have more than two-and-a-half times the volume of an Apollo capsule.

The larger size will allow Orion to accommodate four crew members on missions to the moon, and six on missions to the International Space Station or Mars-bound spacecraft. Orion is scheduled to fly its first missions to the space station by 2014 and carry out its first sortie to the moon by 2020.

A launch abort system atop the Orion capsule will be capable of pulling the spacecraft and its crew to safety in the event of an emergency on the launch pad or at any time during ascent.

Orion's power and propulsion systems will be housed in a service module that will be mounted directly below the capsule, covering the entry heat shield during launch and in-space activities. A spacecraft adapter will connect the Orion capsule and service module to the launch systems.

Orion will be launched into low-Earth orbit by the Ares I crew launch vehicle. To maximize the crew's safety, Orion and its abort system will be placed at the top of the Ares I rocket. The rest of the two-stage Ares I will be stacked vertically, below the crew vehicle. This design will virtually eliminate the possibility of debris from the booster striking Orion during ascent.

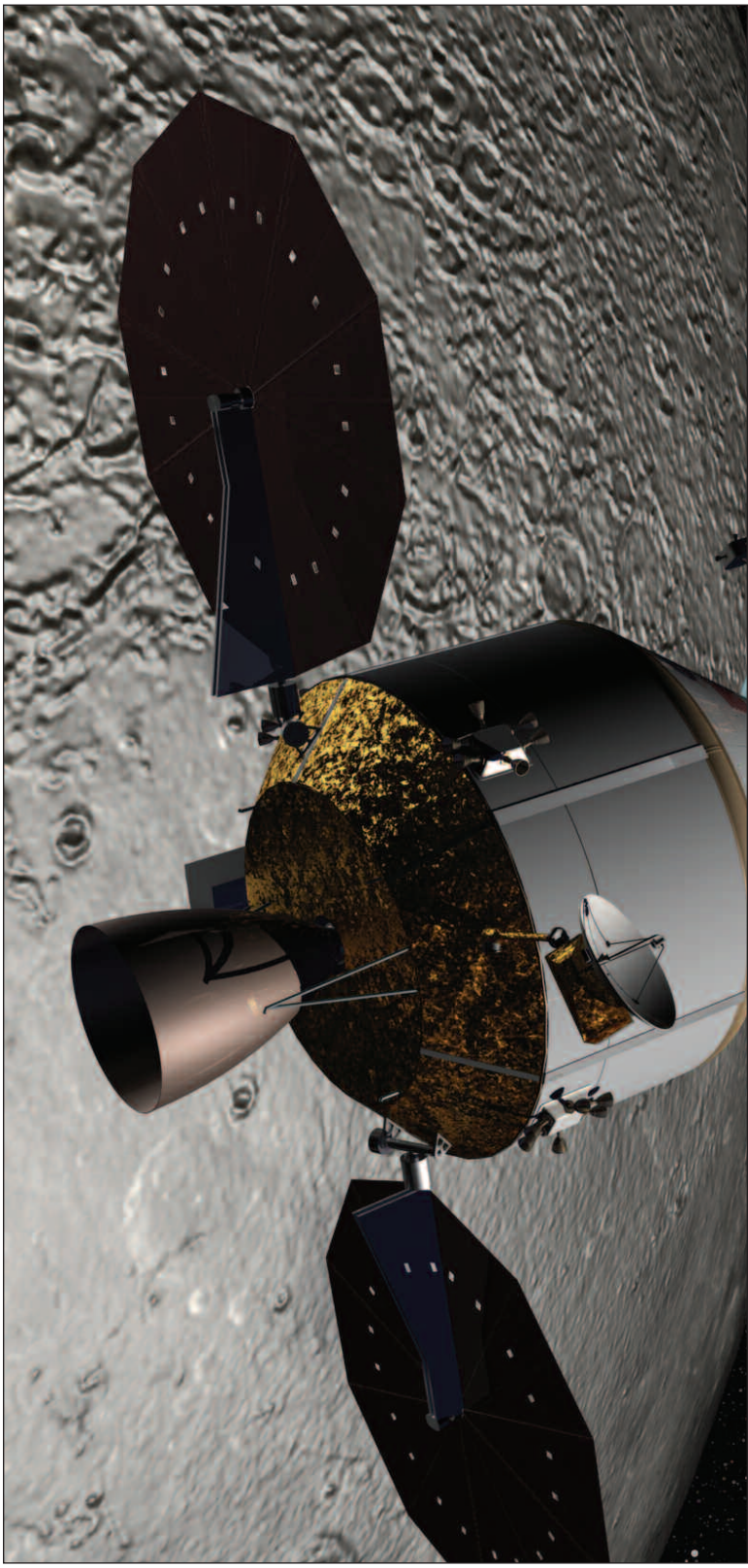
Orion will be able to remain docked to the station for up to six months, providing a means for the crew to return to Earth at any time. The spacecraft will have the ability to stay in lunar orbit untended for the duration of a lunar surface visit that could be up to six months.

Orion will be capable of carrying pressurized cargo to the space station on unpiloted missions.

Journey to the Moon

For missions to the moon, NASA will use two separate launch vehicles, each derived from a mixture of systems with heritage rooted in Apollo, space shuttle and commercial launch vehicle technology.

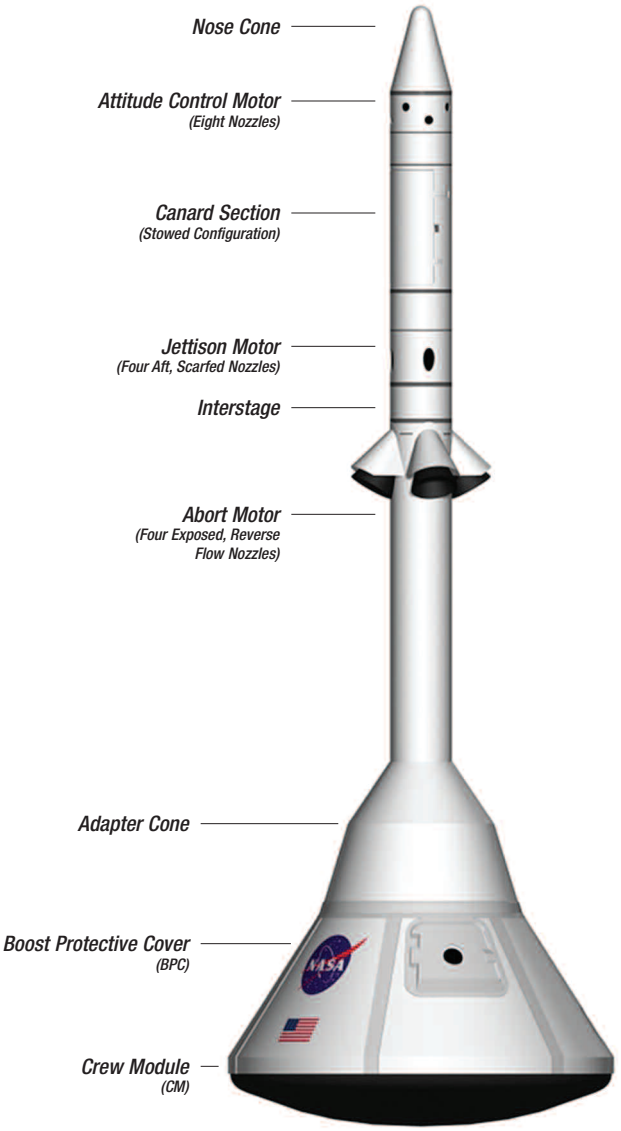
An Ares V cargo launch vehicle will precede the launch of the crew vehicle, delivering to low-Earth orbit the Earth departure stage and the lunar module that will carry explorers on the last leg of the journey to the moon's surface. Orion will dock with the lunar module in Earth orbit, and the Earth departure stage will propel both on their journey to the moon. Once in lunar orbit, all four astronauts will use the lunar landing craft to travel to the moon's surface, while the Orion spacecraft stays in lunar orbit. Once the astronauts' lunar mission is complete, they will return to the orbiting Orion vehicle using a lunar ascent module. The crew will use the service module main engine to break out of lunar orbit and head to Earth.



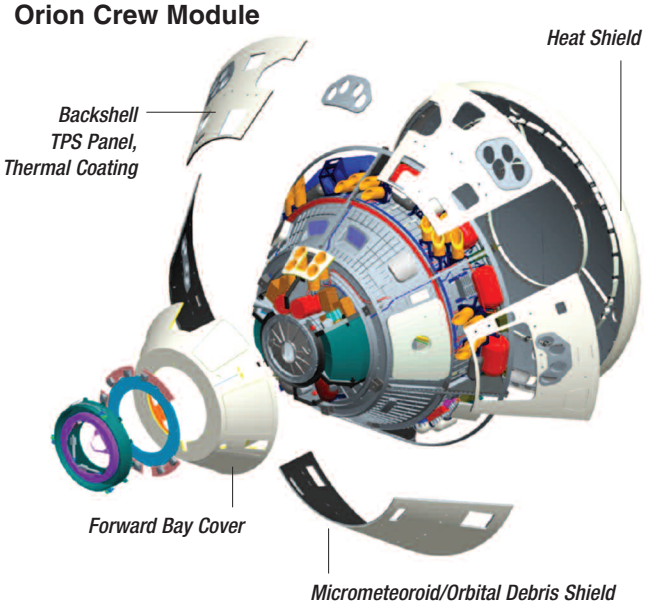
Orion and its crew will reenter Earth's atmosphere using a newly developed thermal protection system. Parachutes will further slow Orion's descent through the atmosphere.

The Orion crew exploration vehicle and service module, docked to a conceptual lunar landing craft, orbit the moon.

Orion and Launch Abort System



Orion Crew Module



Development of Orion and associated Constellation Program elements is a joint effort involving every NASA center, and is led by the Orion Project Office at Johnson Space Center (JSC) in Houston. Lockheed Martin is NASA's prime contractor for design, development, testing and construction of Orion. The Orion Project reports to the Constellation Program Office, also in Houston, and Constellation is a key program of NASA's Exploration Systems Mission Directorate in Washington. JSC is leading development of Orion's crew module. Langley Research Center in Hampton, Va., is leading development of the Orion launch abort system. Glenn Research Center in Cleveland, Ohio, is leading development of the Orion service module and spacecraft adapter. The Ares I and V launch vehicle development are being led by Marshall Space Flight Center in Huntsville, Ala. Pre-flight processing and launch operations for Orion will be led by Kennedy Space Center in Florida.

Orion launches from Kennedy Space Center, Florida, bound for Earth orbit atop an Ares I crew launch vehicle.

Orion, with solar arrays feathered, approaches the International Space Station. Orion will be capable of carrying up to six people or cargo to the station.

Orion by the Numbers

Diameter	5 meters	16.5 feet
Pressurized Volume	20 cubic meters	692 cubic feet
Habitable Volume	11 cubic meters	380 cubic feet
Total Propulsive Capability (Service Module Engine)	1,738 meters per second	5,700 feet per second
Service Module Engine Thrust	33,362 Newtons	7,500 pounds
Lunar Return Payload	100 kilograms	220 pounds
Dry Mass	14,045 kilograms	30,965 pounds
Propellant Mass	9,350 kilograms	20,613 pounds
Landing Weight	7,337 kilograms	16,174 pounds

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