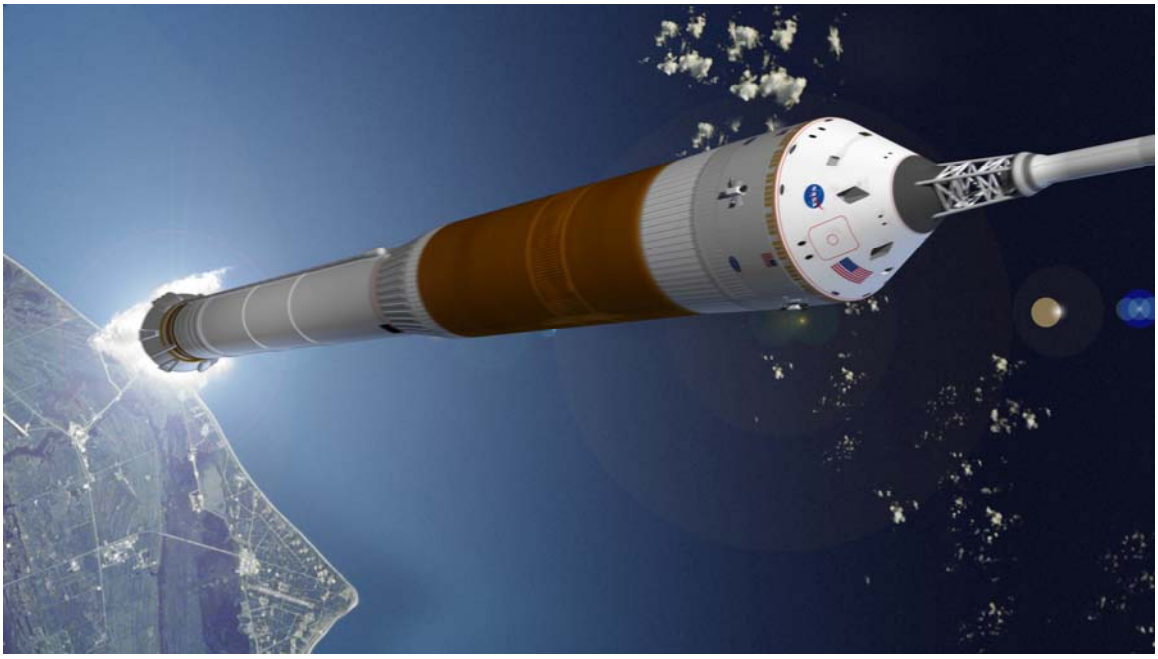
Constellation (CX)

Going to the Moon and Beyond

Before 2020, NASA astronauts will again explore the surface of the Moon where they will build outposts and pave the way for eventual journeys to Mars. The journey begins with the development of a new space exploration system that is affordable, reliable, versatile, and safe. The centerpiece of this new system is a new crew exploration vehicle (CEV).

The Crew Exploration Vehicle

The CEV is a spacecraft designed to carry four astronauts to and from the Moon, support up to six crew members on future missions to Mars, and deliver crew and supplies to the International Space Station. The new CEV is shaped like an Apollo capsule, but it is three times larger.



The high tech design combines the very best of the original Apollo and the Space Shuttle. Although the new CEV may have an Apollo shape, the new spacecraft will have significant advances, including:

- Modern materials and manufacturing processes
- Advanced avionics
- Computer systems and the knowledge gained from 40 years of human flight

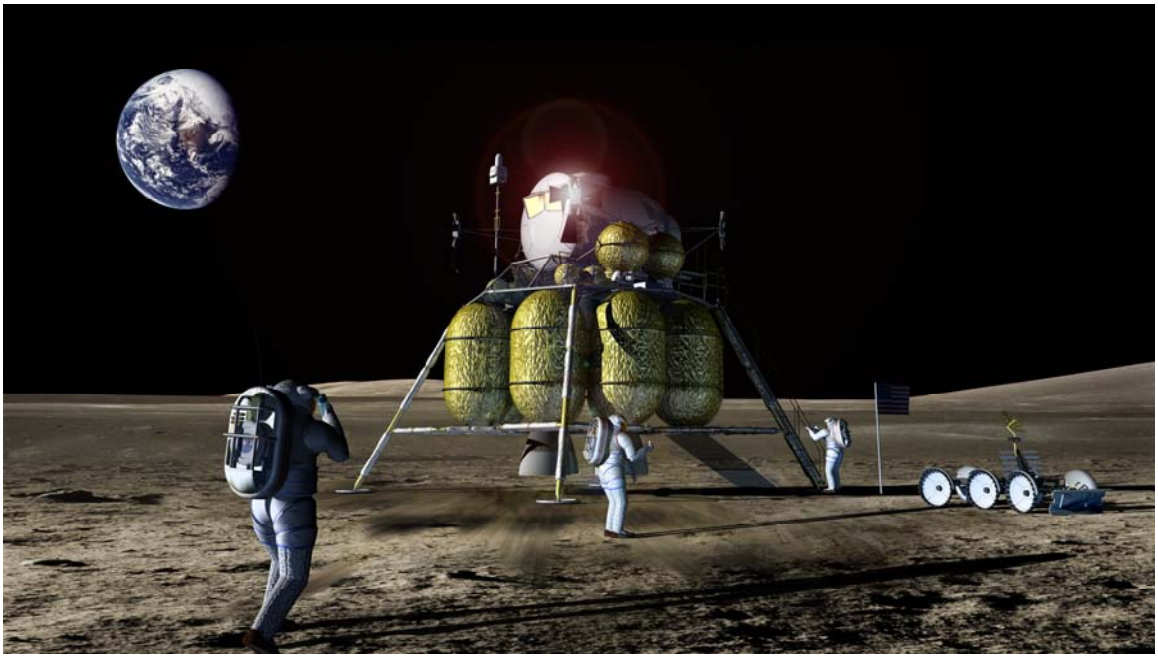
- Increased volume to carry a larger crew and move cargo
- Improved operational efficiency and overall capability
- The ability to parachute to a ground landing

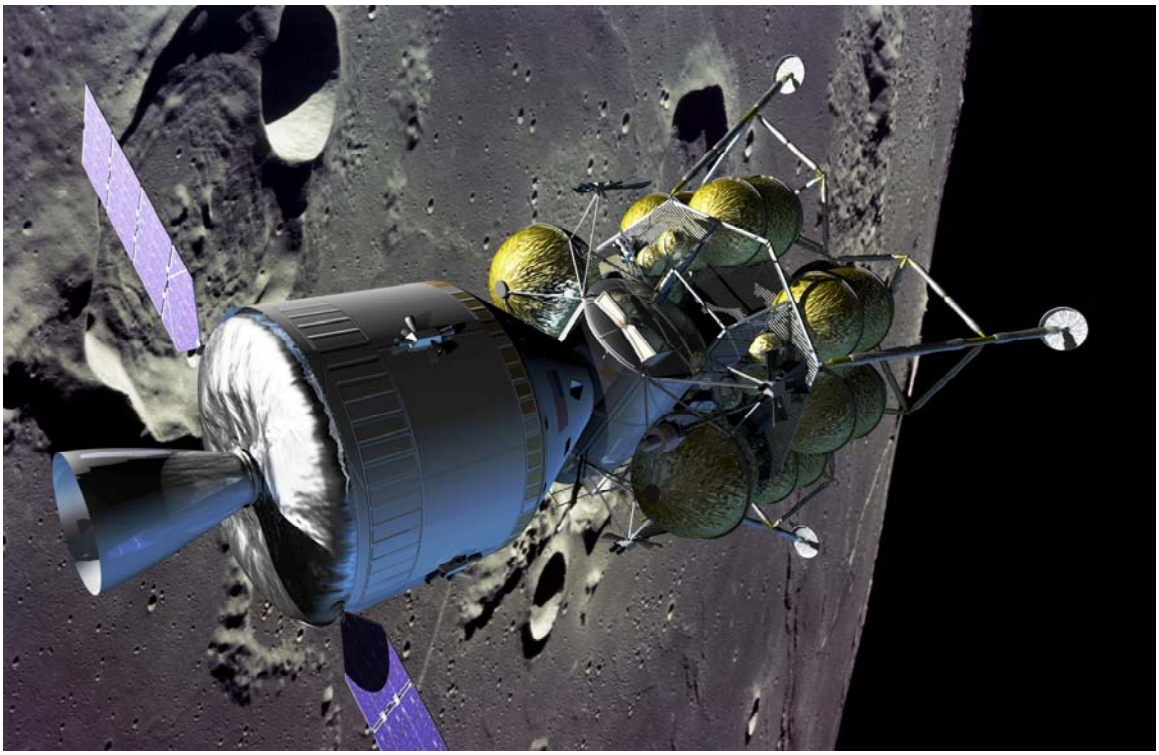
Powered by solar panels and currently considering the use of a liquid methane engine, the capsule shape allows the heat shield—the main thermal protection system—to be protected until it is needed for reentry. The capsule shape is more stable aerodynamically for nominal auto-guided entries and emergency aborts. The new CEV can be used up to 10 times.

In just five years, the CEV will ferry crews and supplies to the International Space Station with as many as six trips to the outpost each year.

The Lunar Lander

Just as the CEV is similar to the Apollo spacecraft of the past, the lunar lander or lunar landing module is also similar to the one used by astronauts to reach the surface of the Moon 35 years ago. However, these landers will be bigger. The lander is attached to a rocket booster that is fired once the CEV connects to the lunar landing module in low Earth orbit. Firing the rocket booster sends the CEV and the lunar lander out of Earth orbit and toward the Moon.





Where Apollo landing sites were limited to the Moon's equatorial regions, the new lunar lander is able to reach any point on the lunar surface, including the poles. Four astronauts, rather than two, will be able to explore the Moon and spend up to a week, rather than a couple of days, on its surface.

The Launch System

After studying a variety of options, NASA chose a shuttle-derived option for the launch system because of its superior safety, cost, and schedule availability. The launch vehicle for the CEV is a single, four-segment, solid propellant rocket booster with a liquid oxygen/liquid hydrogen upper stage supporting one shuttle engine. This configuration can lift 25 metric tons.

The launch system for the lunar lander consists of five shuttle main engines and two, five-segment, solid propellant rocket boosters, yielding a lift of 106 metric tons to low Earth orbit and 125 metric tons if using an Earth departure stage.

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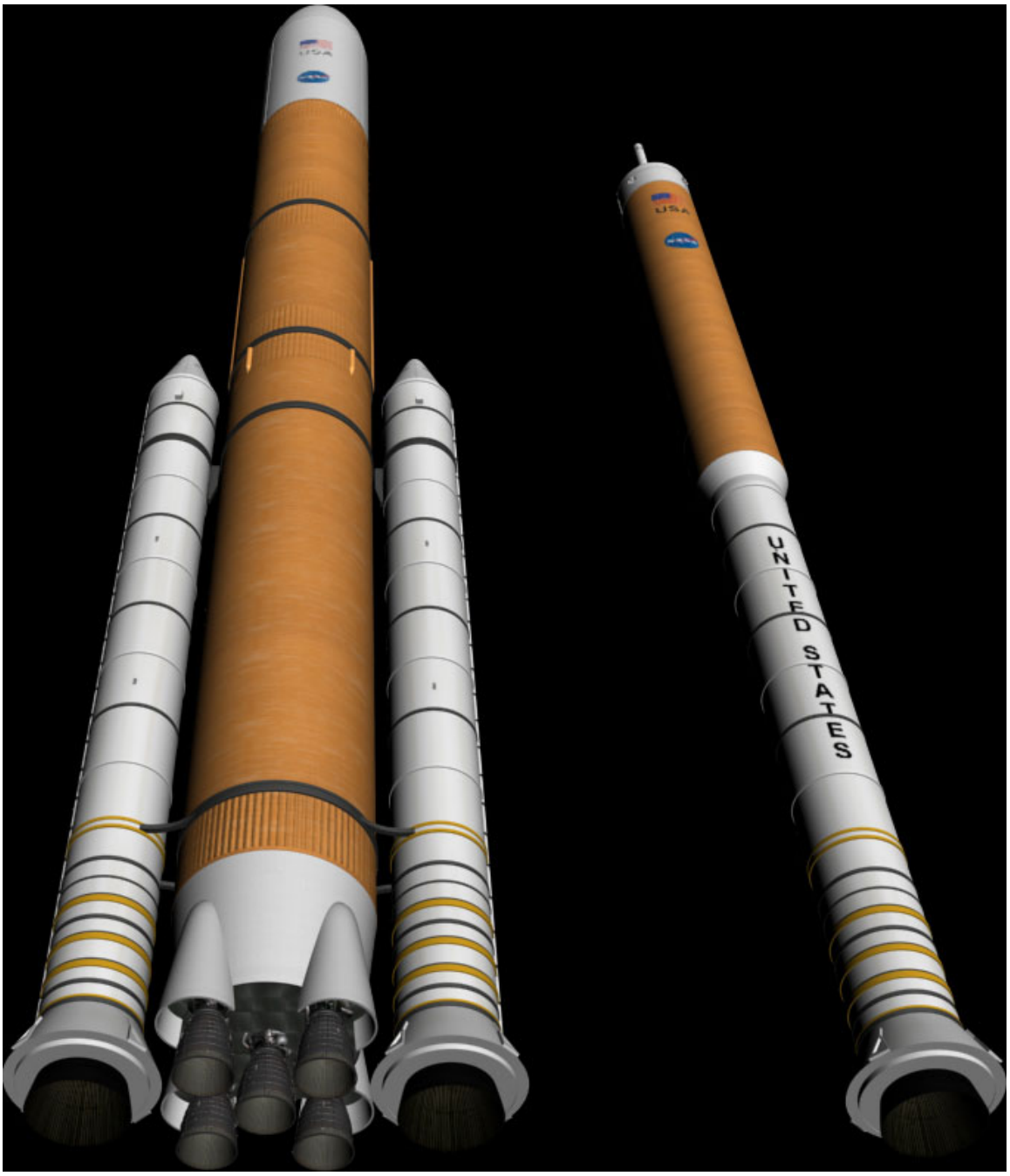

CEV Safety

With vision comes change and with change come new processes, policies, procedures, and requirements. In every facet of the CEV program, there is one overarching requirement: Safety! New CEV requirements documents will provide the critical guidelines and procedures necessary to ensure all aspects of launch operations are conducted safely. With that in mind, the fluid nature of bringing a new system to life will create many challenges for NASA, the Department of Defense, and the numerous contractors involved in the design, production, testing, reliability, and eventual launch of the CEV.

One such challenge for Range Safety is the determination of flight termination system requirements for the CEV. Currently, the Shuttle has a flight termination system only on the solid rocket boosters, but expendable launch vehicles have a flight termination system on all stages, including the solid rocket motors.

- Will the CEV flight termination system be similar to the ones used on expendable launch vehicle systems or will there be a new and distinctive configuration?
- Will linear-shaped charges be extended to the aft segment of the solid rocket boosters?
- Will emerging technologies, such as the enhanced flight termination system or the autonomous flight safety system, be considered for use?
- What will be the requirements/procedures for mission abort and termination of the launch vehicle once the crew capsule is jettisoned?

These are just a few of the critical flight termination system questions Range Safety must be able to answer to ensure pubic safety.

Whether it is a question of the type of flight termination system to be used or the conduct of a risk analysis to ensure public and workforce safety, the Constellation Program Office and Range Safety are committed to ensuring the Constellation family of vehicles are the safest and most reliable launch vehicles to ever launch from KSC.