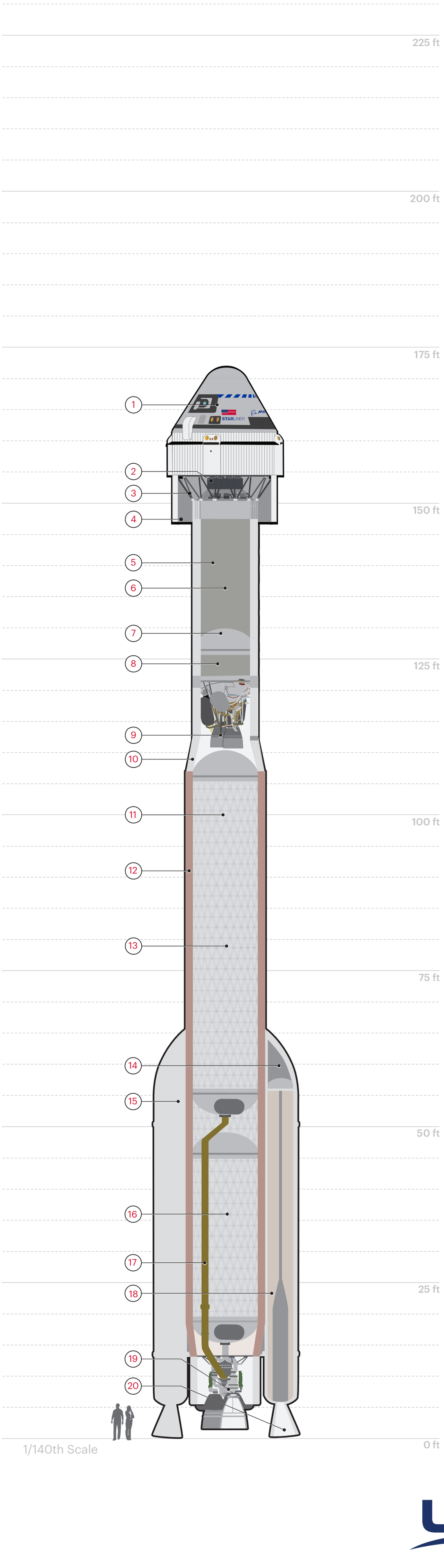
ATLAS V STARLINER



The Atlas V Commercial Crew configuration was developed specifically for the Boeing CST-100 Starliner spacecraft. Unlike typical Atlas V missions, this configuration does not include a payload fairing similar to those used to protect uncrewed spacecraft during ascent. Instead, the Starliner's own protective surfaces will take the place of the fairing.

Boeing's Commercial Crew Space Transportation (CST) spacecraft, the CST-100 Starliner, will be attached to the Atlas V using a unique launch vehicle adapter (LVA). The LVA serves as the structure to attach the CST-100 to Atlas V and also includes an aeroskirt to reduce the aerodynamic loads on the vehicle. The Commercial Crew Transportation System is a full-service system that provides all the elements needed to transport crew and cargo safely to and from low-Earth orbit. The system includes Starliner spacecraft assembly and testing, cargo integration, crew training and mission planning, launch vehicle integration and testing, launch and mission operations, and post-landing crew and cargo recovery. The Starliner was designed to accommodate seven passengers or a mix of crew and cargo. The spacecraft crew module has an innovative, weldless structure and is reusable up to 10 times with a six-month turnaround time.

ULA designed the aeroskirt to extend the Starliner aerodynamic surface which enhances the aerodynamic characteristics and loads on the Atlas V for the unique crewed configuration. The aeroskirt is a metallic orthogrid structure designed to be jettisoned for improved performance after booster stage separation. In the unlikely event that an emergency occurs during the boost phase of flight, the aeroskirt has provisions to provide a vent path for the launch abort engine plumes that push the Starliner Crew Module and Service Module away from the launch vehicle. The Starliner abort system provides complete, continuous abort capability from on the pad through orbit insertion.

The Centaur upper stage is 3.1 m (10 ft) in diameter and 12.7 m (41.6 ft) long. Its propellant tanks are pressure-stabilized, constructed of corrosion-resistant stainless steel. Centaur is a liquid hydrogen/liquid oxygen-fueled vehicle. Its standard configuration uses a single RL10C-1 engine producing 101.8 kN (22,890 lbf) of thrust; however the Centaur used for Commercial Crew will reconstitute the dual RL10A-4-2 engine configuration that historically flew on the Atlas II and Atlas III launch vehicles. The dual-engine Centaur provides 198.4 kN (44,600 lbf) of thrust to deliver the CST-100 spacecraft to orbit and allows trajectory shaping to limit crew loading on ascent. The cryogenic tanks are insulated with a combination of helium-purged insulation blankets, radiation shields, and closed-cell foam insulation. The Centaur forward adapter (CFA) provides the structural mountings for vehicle electronics and the structural and electronic interfaces with CST-100 Starliner.

The Atlas V common core booster (CCB) is 3.8 m (12.5 ft) in diameter and 32.5 m (106.5 ft) long. The booster's tanks are structurally stable and constructed of isogrid aluminum barrels, spun-formed aluminum domes and intertank skirts. Atlas V booster propulsion is provided by the RD-180 engine system (a single engine with two thrust chambers). The RD-180 burns RP-1 (Rocket Propellant-1 or highly purified kerosene) and liquid oxygen, delivering 3,827 kN (860,300 lbf) of thrust at sea level. The Atlas V vehicle is controlled by an avionics system that provides guidance, flight control and vehicle sequencing functions during the booster and Centaur phases of flight.

Two solid rocket boosters (SRBs) provide 3,100 kN (697,000 lbf) of additional thrust required at liftoff. With a diameter of 158 cm (62.2 in) and a length of 20 m (65.6 ft), the SRBs are constructed of a continuous graphite-epoxy composite casing with the throttle profile designed into the propellant grain. The SRBs are jettisoned by thrusters following a burn lasting approximately a minute and a half.

The vehicle's height with the Boeing CST-100 Starliner is approximately 52.4 m (172 ft).

Performance

LEO-ISS	13,250 kg (29,220 lb)

LEO-ISS (Low Earth Orbit-International Space Station) = 407 km circular at 51.6°

1. CST-100 Starliner
2. Centaur Forward Adapter
3. Launch Vehicle Adapter
4. Aeroskirt
5. Centaur
6. Centaur Fuel (LH2) Tank
7. Common Bulkhead
8. Centaur Oxidizer (LO2) Tank
9. Centaur Dual Engines (RL10)
10. Interstage Adapter
11. Booster Oxidizer (LO2) Tank
12. Common Core Booster
13. Isogrid Structure
14. Nose Cone
15. Solid Rocket Booster
16. Booster Fuel (RP-1) Tank
17. Booster Oxidizer (LO2) Feedline
18. Solid Rocket Propellant
19. Booster Engine (RD-180)
20. Solid Rocket Booster Nozzle

ULA is honored to once again launch American astronauts on an Atlas rocket. In 1962, an Atlas rocket launched John Glenn, the first American to orbit Earth. Atlas V, with its long heritage of success, will now become a key element of NASA's human spaceflight program. ULA and Boeing have partnered to develop a system that uses innovative technology to safely and reliably transport astronauts to the International Space Station from U.S. soil.

Atlas V rockets are built in ULA's state-of-the-art production facilities in Decatur, Alabama, and Harlingen, Texas.

Atlas V Starliner launches from Space Launch Complex-41 (SLC-41) at Cape Canaveral Space Force Station in Florida. SLC-41 has a rich history of launching extraordinary missions such as Voyager, Pluto New Horizons, Mars Science Laboratory, LRO/LCROSS, GPS and dozens of national security payloads.

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