Crew Dragon, SpaceX's Next-Generation Spacecraft

SpaceX's Crew Dragon is an autonomous spacecraft designed to deliver crew and critical cargo to orbiting destinations. Crew Dragon launches atop a Falcon 9 rocket from Launch Complex 39A at NASA's Kennedy Space Center in Florida. As part of NASA's Commercial Resupply Services contract with SpaceX, the company developed its Dragon spacecraft to carry cargo to space, but it was designed with people in mind from the beginning.

Crew Dragon Design and Development

Crew Dragon was developed in collaboration with NASA's Commercial Crew Program. In 2014, NASA awarded Commercial Crew Transportation Capability (CCtCap) contracts to Boeing and SpaceX to each safely and cost-effectively transport astronauts to the International Space Station from the United States. Crew Dragon can carry up to seven passengers but will carry up to four astronauts for NASA missions, and is designed for water landings. Crew Dragon's displays will provide real-time information on the state of the spacecraft's capabilities—anything from the spacecraft's position in space, to possible destinations, to the environment on board. Crew Dragon is a fully autonomous spacecraft that can be monitored and controlled by onboard astronauts and SpaceX mission control in Hawthorne, California.

Dragon comprises two main elements: the capsule, which is designed to carry crew and critical, pressurized cargo, and the trunk, which is an unpressurized service module. The capsule is subdivided into the pressurized section, the service section, and the nose cone, which is opened once on orbit and stowed prior to re-entry. Near the base of the capsule, but outside the pressurized structure, are the Draco thrusters, which allow for orbital maneuvering. Additional Draco thrusters are housed under the nose cone, along with Dragon's Guidance Navigation and Control (GNC) sensors. Dragon's trunk provides the mating interface for the capsule to Falcon 9 on its ascent to space. On orbit, half of the trunk contains a solar array, which powers Dragon, and the other half includes a radiator, which rejects heat. Both the radiator and solar array are mounted to the exterior of the trunk, which remains attached to Dragon until shortly before re-entry when the trunk is jettisoned. Crew Dragon was designed with three windows so passengers can take in views of Earth, the Moon, and the wider solar system right from their seats. Crew Dragon has an Environmental Control and Life Support System (ECLSS) that provides a comfortable and safe environment for crew members. During their trip, astronauts on board can set the spacecraft's interior temperature to between 65 and 80-degrees Fahrenheit (18-27°C). Crew Dragon features an advanced abort system with eight SuperDraco engines and a series of parachutes that can be activated instantaneously from the moment they are armed on the launch pad all the way through orbital insertion.

During the CCDev1 phase, NASA awarded a total of $50 million to five companies to stimulate efforts within the private sector to aid in developing and demonstrating safe, reliable, and cost-effective crew transportation and capabilities. The second round of Commercial Crew Development (CCDev2) kicked off in April of 2011 when NASA awarded nearly $270 million to four companies to further develop and demonstrate safe, reliable, and cost-effective transportation capabilities. Winners of CCDev2 were Blue Origin (US$ 22 million), Boeing (US$ 92.3 million), SpaceX (US$ 75 million), and Sierra Nevada (US$ 80 million). NASA later funded an additional US$ 20.6 million to Boeing and US$ 25.6 million to Sierra Nevada Corporation by exercising optional, pre-negotiated milestones, which were part of their original Space Act Agreements, to accelerate development. In 2012, the agency extended its CCDev2 agreement with Blue Origin in an unfunded capacity. Through the agreement, the agency continued to support developing the company's Space Vehicle and related systems. CCiCap continued the development of three fully integrated systems in August 2012.

The Space Act Agreements called for industry partners to develop crew transportation capabilities and to perform tests to verify, validate, and mature integrated designs. NASA later funded an additional US$ 20 million to Boeing, US$ 20 million to SpaceX, and US$15 million to Sierra Nevada Corporation by exercising optional, pre-negotiated milestones, which were part of their original Space Act Agreements, to accelerate development. On December 10, 2012, NASA announced the next step to launch American astronauts from U.S. soil. NASA selected three companies and awarded a total of nearly $30 million under the CPC contracts. Throughout CPC, the first phase of a two-phase contract, companies worked with NASA to achieve safe, crewed missions to the space station. It included data that will aid in developing engineering standards, tests, and analyses of crew transportation system designs. During the CPC phase, these American companies' advances also aimed to launch American astronauts to the International Space Station from the United States, ending the NASA's dependency on Roscosmos' Soyuz program to deliver its astronauts to the ISS. The second phase of the certification contract, CCtCap, aimed to commercially built and operated integrated crew transportation systems. Two Federal Acquisition Regulation (FAR-based), fixed-price contracts were awarded in September 2014 following an open competition. Through its certification efforts, NASA's goal was to ensure the selected commercial transportation systems meet the agency's safety and performance requirements for transporting NASA crew to the International Space Station. NASA awarded a total of $6.8 billion under CCtCap contracts (Boeing - $4.2 billion, SpaceX - $2.6 billion).