



# SpaceX Demonstration Mission

## MISSION OBJECTIVES

While the Dragon spacecraft's attempt to visit to the International Space Station represents an historic first, the act of berthing itself represents only one of many significant challenges involved in this mission. And while successfully berthing with the space station is an important goal, it is only one measure of success.

During this flight, SpaceX must complete milestones for two separate missions – COTS 2 and COTS 3. SpaceX and NASA agreed on the following objectives for those two missions.

## COTS 2 OFFICIAL MISSION OBJECTIVES

- Complete Licenses and Certifications:
  - United States Air Force 45<sup>th</sup> Space Wing certifies launch
  - Federal Aviation Administration issues licenses to launch and to return the spacecraft from orbit.
- Rocket Launch and Spacecraft Inserted into Orbit:
  - Falcon 9 rocket ascends through lightning towers on the launch site without contact
  - Rocket's 1<sup>st</sup> stage separates from its 2<sup>nd</sup> stage and the 2<sup>nd</sup> stage engine ignites
  - Rocket's 2<sup>nd</sup> stage places the Dragon spacecraft into planned orbit – currently 310 km x 340 km above the Earth ( $\pm 50$  km, altitude not to exceed 368 km)
  - Dragon is also placed in planned inclination - currently 51.6 degree ( $\pm 0.25$ degrees)
- On-Orbit Operations:
  - Dragon spacecraft separates from rockets 2<sup>nd</sup> stage
  - Solar arrays deploy from Dragon's trunk and function properly
  - Dragon completes system checkout
  - Dragon initiates phasing and height adjustment maneuver
  - Dragon performs Abort Demonstration
  - Dragon performs Absolute GPS Demonstration
  - Dragon establishes communication with International Space Station using SpaceX's COTS UHF Communication Unit (CUCU). Astronauts on the space station are able to issue commands to Dragon using the Crew Command Panel (CCP).
  - Dragon performs Relative GPS Demonstration
  - Dragon demonstrates free drift, the Dragon stops and floats freely in orbit as it will when grappled by the space station's robotic arm
  - Dragon's performance during extended time in orbit is demonstrated, testing that the vehicle's components are able to operate in the environment (vacuum, thermal, and radiation) found in space, especially Dragon's solar arrays, radiators, avionics, and trunk
  - Performance of new, redundant (X3) avionics, and spacecraft systems is demonstrated



- De-orbit Burn & Separation:
  - The Dragon spacecraft's Draco thrusters successfully perform de-orbit burn sending the vehicle back to Earth on target for landing within landing area
- Controlled Entry, Descent, and Landing:
  - Dragon successfully deploys main parachutes
  - Dragon lands in set landing area 300 miles off of the west coast of Southern California.
- Recovery:
  - The Dragon spacecraft is successfully recovered.

### **COTS 3 MISSION OBJECTIVES**

- On-Orbit Operations- Approach:
  - NASA approves Dragon to enter Approach Ellipsoid
  - 3D Flash Laser Imaging Detection and Ranging (LIDAR) camera used for navigation during approach to the Space Station are tested
  - Dragon holds on R-bar
  - Dragon demonstrates a retreat on R-bar
- International Space Station – Attached Operations:
  - Dragon is commanded to free drift
  - Dragon is successfully grappled by the station's robotic arm - Space Station Remote Manipulator System (SSRMS)
  - Dragon's Passive Common Berthing Mechanism (PCBM) successfully mates with the International Space Station
  - Astronauts open Dragon's hatch
  - Astronauts remove cargo from Dragon then load cargo onto Dragon
- On-Orbit Operations- Departure:
  - Dragon is successfully de-berthed from the Space Station
  - Dragon successfully lowers its orbit for reentry
- Recovery:
  - Outbound cargo is recovered on earth and returned to NASA