



ORBITAL CRS-3 MISSION OVERVIEW

Orbital Sciences Corporation's third contracted cargo resupply mission with NASA to the International Space Station will deliver almost 5,000 pounds of science and research, crew supplies and vehicle hardware to the orbital laboratory and its crew. The scientific investigations Cygnus will transport include a study to enable the first space-based observations of meteors entering Earth's atmosphere, a multitude of student investigations covering topics such as the effects of microgravity on plant growth and the rates of milk spoilage in space and international research including a study to determine how blood flow from the brain to the heart in the absence of gravity. The Cygnus spacecraft will spend more than a month attached to the space station. In December, the spacecraft will dispose of approximately 3,000 pounds of trash during its fiery reentry into Earth's atmosphere.

TOTAL CARGO:

4883 pounds/2215 kg

- *Science Investigations* 1602.8 pounds/727 kg
 - US Investigations 1254.4 pounds/569 kg
 - International Partner Investigations 348.3 pounds/158 kg
- *Crew Supplies* 1649 pounds/748 kg
 - Flight Crew Equipment 273.4 pounds/124 kg
 - Food Supply 1360.3 pounds/617 kg
 - Flight Procedures Books 15.4 pounds/7 kg
- *Vehicle Hardware* 1404.3 pounds/637 kg
 - US Hardware 1338.2 pounds/607 kg
 - JAXA Hardware 66.1 pounds/30 kg
- *Spacewalk Equipment* 145.5 pounds/66 kg
- *Computer Resources* 81.6 pounds/37 kg
 - Command & Data Handling Equipment 75 pounds/34 kg
 - Photo/TV Equipment 6.6 pounds/3 kg

TOTAL CARGO WITH PACKAGING:

5057 pounds/2296 kg

The launch sequence of the mission will take approximately 10 minutes from the Antares liftoff through separation of the Cygnus spacecraft at its initial orbit. When it arrives to the space station, Expedition 41 Flight Engineer Barry "Butch" Wilmore will grapple Cygnus. Wilmore will use the space station's robotic arm to take hold of the Cygnus, dubbed the SS Deke Slayton. The name is a tribute to original Mercury 7 astronaut Donald "Deke" K. Slayton, who flew on the Apollo-Soyuz Test Project mission in 1975 and championed commercial space endeavors after retiring from NASA in 1982. He passed away in 1993. After Cygnus' capture, ground commands will be sent from mission control in Houston for the station's arm to rotate and install it on the bottom of the station's Harmony module. Under Orbital's Commercial Resupply Services contract, the company will deliver about 44,000 pounds or 20 metric tons of cargo to the space station during eight missions. Cygnus will remain at the space station until December.



National Aeronautics and
Space Administration



ORBITAL CRS-3 RESEARCH OVERVIEW

When the Cygnus cargo spacecraft delivers nearly 5,000 pounds of scientific research investigations, crew supplies, vehicle hardware and spacewalk tools to the space station, the new experiments arriving to the orbital laboratory will challenge and inspire future scientists and explorers, enable the first space-based observations of meteors entering Earth's atmosphere, help determine how blood flows from the brain to the heart in the absence of gravity and investigate the impact of space travel on both the human immune system and an individual's microbiome, the collection of microbes that live in and on the human body.

Orbital CRS-3 includes a wide variety of student research. One investigation by students from **Duchesne Academy of the Sacred Heart in Houston** tests the performance of pea shoot growth in space. Pea shoots grow so quickly on Earth that they can be harvested in two to four weeks. They also contain high amounts of vitamins and minerals, making them a potential source of food on long-duration space missions. Students will identify the best combinations of red and blue LED lights, which are used in the plant growth chamber, by analyzing the plants' mineral content upon return to Earth. The investigation is facilitated by NanoRacks and the Center for the Advancement of Science in Space (CASIS).

A group of 18 student-led investigations, collectively part of the **Yankee Clipper** suite of research under the Student Spaceflight Experiments Program, offers young scientists the opportunity to conceive of, design, implement and analyze scientific research questions in space. The studies investigate a range of topics from a crystal growth study that will enable students to learn more about how fluids act and form into crystals in the absence of gravity to how microgravity affect milk spoilage. Yankee Clipper is the eighth flight opportunity associated with the SSEP, an initiative of the National Center for Earth and Space Science Education in partnership with NanoRacks.

A human health study called **Drain Brain** will inform understandings of blood flow in space to possibly aid in the treatment of headaches and other neurological systems reported by crew members living on the space station. The special neck collar used to measure blood flow from the brain for the Drain Brain study, called a strain-gauge plethysmograph, does not require surgery or special knowledge to operate. This could make the collar a useful tool for monitoring patients on Earth who have heart or brain disorders. Drain Brain also could have implications for development of screening mechanisms for cognitive disorders like Alzheimer's disease.

The Meteor Composition Determination, or **Meteor**, uses high-resolution video and image analysis of the atmosphere to learn about the physical and chemical properties of meteoroid dust, which includes size, density and chemical composition. Investigating the elemental composition of meteors adds to our understanding of how the planets developed. Continuous measurement of meteor interactions with Earth's atmosphere also could spot previously unforeseen meteor showers.



The pea shoot plant growth chamber with LED lights.



A Perseid meteor streaks through Earth's atmosphere in Aug. 2011



Orbital's Antares rocket lifts off July 13, 2014 en route to the space station.