



SPACEX CRS-11 MISSION OVERVIEW

SpaceX's eleventh contracted cargo resupply mission with NASA to the International Space Station will deliver almost 6,000 pounds of science and research, crew supplies and vehicle hardware to the orbital laboratory and its crew. Launch is targeted for Thursday, June 1, 2017.

The Dragon spacecraft will launch aboard a Falcon 9 rocket from Launch Complex 39A at NASA's Kennedy Space Center in Florida and arrive at the space station two days later. **Expedition 51** crew members Peggy Whitson and Jack Fischer of NASA, Thomas Pesquet of ESA (European Space Agency) and cosmonauts Oleg Novitskiy and Fyodor Yurchikhin of Roscosmos are currently living aboard the orbiting laboratory. Pesquet and Novitskiy are slated to return to Earth June 2 which will mark the start of Expedition 52. Fischer and Whitson will use the station's robotic arm to capture Dragon when it arrives on station. The spacecraft will be berthed to the Earth-facing port on the Harmony module.

Dragon will carry hardware and supplies to support dozens of the of approximately 250 science and research investigations that will occur during Expeditions 52 and 53. The unpressurized trunk of the spacecraft will also hold three payloads that will study neutron stars, test solar arrays, and hold instruments for Earth-observation.



TOTAL CARGO:

5970.1 lbs. / 2708 kg

TOTAL PRESSURIZED CARGO WITH PACKAGING:

3761.1 lbs. / 1665 kg

- *Science Investigations*
- *Crew Supplies*
- *Vehicle Hardware*
- *Spacewalk Equipment*
- *Computer Resources*

2356.7 lbs. / 1069 kg

533.5 lbs. / 242 kg

438.7 lbs. / 199 kg

123.4 lbs. / 56 kg

59.4 lbs. / 27 kg

UNPRESSURIZED

2209.0 lbs. / 1002 kg

- *Roll-Out Solar Array (ROSA)*
- *Neutron Star Interior Composition Explorer (NICER)*
- *Multiple User System for Earth Sensing (MUSES)*

716.5 lbs. / 325 kg

820.1 lbs. / 372 kg

672.4 lbs. / 305 kg

Installation and Undocking Overview:

About 10 minutes after launch, Dragon reaches its preliminary orbit. It then deploys its solar arrays and begins a carefully choreographed series of thruster firings to reach the space station. After a two-day trip, Jack Fischer will use the station's 57.7-foot (17.6-meter) robotic arm to reach out and capture the Dragon spacecraft as they operate from the station's Cupola. Ground commands will be sent for the station's arm to install Dragon on the bottom side of the Harmony module for its stay at the International Space Station. By the next day, the crew will pressurize the vestibule between the station and Dragon and open the hatch that leads to the forward bulkhead of Dragon.

During the next four weeks, the crew will unload the spacecraft and reload it with cargo to return to Earth. About five and a half hours after it departs the station, it will splash down in the Pacific Ocean off the coast of Baja California.



SPACEX CRS-11 SCIENCE OVERVIEW

The eleventh SpaceX cargo resupply launch to the International Space Station will deliver investigations and facilities that study neutron stars, osteoporosis, solar panels, tools for Earth observation, and more. Highlights include:

The Roll-Out Solar Array (ROSA) is a solar panel concept that is lighter and stores more compactly for launch than the rigid solar panels currently in use. ROSA has solar cells on a flexible blanket and a framework that rolls out like a tape measure. The new solar panel concepts are intended to provide power to electric thrusters for use on NASA's future space vehicles for operations near the Moon and for missions to Mars and beyond. They might also be used to power future satellites in Earth orbit, including more powerful commercial communications satellites.

The Neutron Star Interior Composition Explored (NICER) payload, destined for the exterior of the space station, will study the physics of neutron stars, providing new insight into their nature and behavior. These stars are called "pulsars" because of the unique way they emit light – in a beam similar to a lighthouse beacon. As the star spins, the light sweeps past us, making it appear as if the star is pulsing. Neutron stars emit X-ray radiation, enabling the NICER technology to observe and record information about their structure, dynamics and energetics. The payload also includes a technology demonstration called the Station Explorer for X-ray Timing and Navigation Technology (**SEXTANT**), which will help researchers to develop a pulsar-based, space navigation system. Pulsar navigation could work similarly to GPS on Earth, providing precise position and time for spacecraft throughout the solar system.

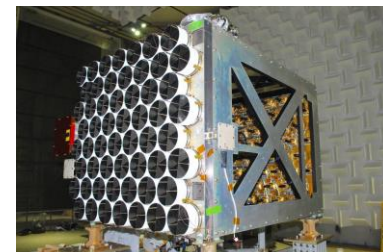
The Systemic Therapy of NELL-1 for osteoporosis (Rodent Research-5) investigation tests a new drug that can both rebuild bone and block further bone loss, improving health for crew members. When people and animals spend extended periods of time in space, they experience bone density loss, or osteoporosis. In-flight countermeasures, such as exercise, prevent it from getting worse, but there isn't a therapy on Earth or in space that can restore bone that is already lost. The results from this **ISS National Laboratory**-sponsored investigation build on **previous research** also supported by the National Institutes for Health and could lead to new drugs for treating bone density loss in millions of people on Earth.

The Fruit Fly Lab-02 study will use the fruit fly (*Drosophila melanogaster*) to better understand the underlying mechanisms responsible for the adverse effects of prolonged exposure to microgravity on the heart. Flies are smaller, with a well-known genetic make-up, and very rapid aging that make them good models for studying heart function. This experiment could significantly advance the study of spaceflight effects on the cardiovascular system and facilitate the development of countermeasures to prevent the adverse effects of space travel on astronauts.

The Multiple User System for Earth Sensing (MUSES) facility, developed by Teledyne Brown Engineering, hosts Earth-viewing instruments such as high-resolution digital cameras, hyperspectral imagers, and provides precision pointing and other accommodations. This **National Lab**-sponsored investigation can produce data to be used for maritime domain awareness, agricultural awareness, food security, disaster response, air quality, oil and gas exploration and fire detection.



The Roll-Out Solar Array (ROSA) is a new, more compact solar panel that will snap open in space, a favorable design over the rigid solar panels currently in use, pictured above. Credits: NASA



The Neutron Star Interior Composition Explored (NICER) payload, affixed to the exterior of the space station, will study the physics of neutron stars, providing new insight into their nature and behavior. Credit: NASA



MUSES hosts earth-viewing tools such as high-resolution digital cameras and hyperspectral imagers and provides precision pointing and other accommodations. It hosts up to four instruments at the same time, and offers the ability to change, upgrade, and robotically service those instruments. Credit: Teledyne Brown Engineering