SpaceX CRS-6

Sixth Commercial Resupply Services Flight to the International Space Station

National Aeronautics and Space Administration

April 2015 **OVERVIEW**

The Dragon spacecraft will be filled with more than 4,300 pounds of supplies and payloads, including critical materials to directly support about 40 of the more than 250 science and research investigations that will occur during Expeditions 43 and 44. Science payloads will study new ways to possibly counteract the microgravity-induced cell damage seen during spaceflight, the effects of microgravity on the most common cells in bones, gather new insight that could lead to treatments for osteoporosis and muscle wasting conditions, continue studies into astronaut vision changes and test a new material that could one day be used as a synthetic muscle for robotics explorers of the future. Also making the trip will be a new espresso machine for space station crews. After five weeks at the space station, the spacecraft will return with more than 3,000 pounds of cargo, including crew supplies, hardware and computer resources, science experiments, space station hardware, and trash.

DRAGON CARGO

	LAUNCH ITEMS	RETURN ITEMS
TOTAL CARGO:	**4387 lbs / 2015 kg**	**3020 lbs / 1370 kg**
Crew Supplies	1102 lbs / 500 kg	161 lbs / 73 kg
Crew care packages		
Crew provisions		
Food		
Vehicle Hardware	1142 lbs / 518 kg	560 lbs / 254 kg
Crew Health Care System hardware		
Environment Control & Life Support equipment		
Electrical Power System hardware		
Flight Crew Equipment		
Japan Aerospace Exploration Agency equipment		
Science Investigations	1860 lbs / 844 kg	990 lbs / 449 kg
U.S. investigations		
Japan Aerospace Exploration Agency investigations		
European Space Agency investigations		
Computer Resources	35 lbs / 18 kg	4 lbs / 2 kg
Command and Data Handling		
Photo and TV equipment		
EVA equipment	51 lbs / 18 kg	189 lbs / 20 kg
Misc Return Cargo/Trash	---	992 lbs/ 450 kg
Total weight of cargo without packaging	4184 lbs / 1898 kg	2751 lbs / 1248 kg

RENDEZVOUS AND RETURN

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, ESA (European Space Agency) astronaut Samantha Cristoforetti and NASA astronaut Terry Virts 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 from Houston for the station's arm to install Dragon on the bottom side of the station's 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 five 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. This is the sixth of 15 missions under the modified SpaceX Commercial Resupply Services contract with NASA.

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RESEARCH HIGHLIGHTS

Center for the Advancement of Science in Space -Protein Crystal Growth-3 (CASIS PCG-3)

This investigation crystallizes monoclonal antibodies the human immune system uses to fight diseases and pathogens. Crystallizing these proteins in microgravity produces larger, more perfect specimens for pharmaceutical researchers to study in detail.

Cell Shape and Expression

The Cell Shape and Expression research program will provide for the first time a reliable experimental model able to highlight the relationships between microgravity, cell shape and gene expression, which may also inform pharmacological ways to counteract microgravity-induced cell damages.

Fluid Shifts Before, During, and After Prolonged Space Flight and Their Association with Intracranial Pressure and Visual Impairment (Fluid Shifts)

More than half of American astronauts experience vision changes and alterations to parts of their eyes during and after long-duration spaceflight. The Fluid Shifts investigation measures how much fluid shifts from the lower body to the upper body, in or out of cells and blood vessels, and determines the impact these shifts have on fluid pressure in the head and changes in vision and eye structures.

Observation and Analysis of Smectic Islands In Space (OASIS)

OASIS studies the unique behavior of liquid crystals (commonly used in display screens) in microgravity, including their overall motion and the merging of crystal layers known as smectic islands.

Osteocytes and Mechanomechano-transduction (Osteo-4)

Osteo-4 studies the effects of microgravity on the function of osteocytes, which are the most common cells in bone. These cells reside within the mineralized bone and can sense mechanical forces, or the lack of them, but researchers do not know how. Osteo-4 allows scientists to analyze changes in the physical appearance and genetic expression of mouse bone cells in microgravity.

Rodent Research-2

Similar to astronauts, mice flown in space undergo rapid loss of both muscle and bone. These changes are thought to be similar to what occurs in aging and with certain muscle wasting and bone loss diseases. By studying accelerated bone and muscle loss in space, researchers seek to gain insight into how these diseases might occur at the cellular level and be able to identify parts of the process that can be targeted by drug therapies, which could lead to new treatments for these conditions.

Synthetic Muscle

Robots can perform tasks too difficult or dangerous for humans. Robots built with synthetic muscle would have more human-like capabilities, but the material would have to withstand the rigors of space. This investigation tests the radiation resistance of an electroactivepolymer called Synthetic Muscle™, developed by RasLabs, which can contract like real muscle and can also expand.

The Fluid Shifts investigation looks at how shifts in fluid pressure affect astronaut vision and eye structure.

Rodent Research-2 could lead to new treatments for osteoporosis and muscle wasting conditions.

Synthetic Muscle tests the radiation resistance of a new material that can contract and expand like real muscle.