NORTHROP GRUMMAN

National Aeronautics and
Space Administration

NASA

OVERVIEW

CRS-14 Mission

Northrop Grumman's 14th contracted cargo resupply mission (CRS-14) with NASA to the International Space Station will deliver nearly 8,000 pounds of science and research, crew supplies, and vehicle hardware to the orbital laboratory and its crew. This will be the third mission under Northrop Grumman's Commercial Resupply Services-2 contract with NASA. Launch is set for Thursday, Oct. 1 at 9:38 p.m. EDT.

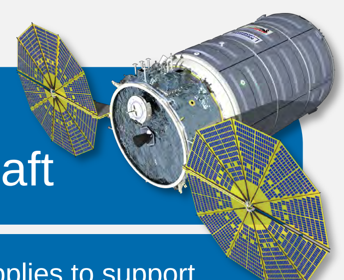
Launch Vehicle
Antares 230+ Rocket

- Third flight of Antares 230+ Rocket
- Flight-proven launch vehicle that carries Cygnus to low-Earth orbit

Launch Site:
Wallops Flight Facility, Virginia

S.S. Kalpana Chawla

The Cygnus spacecraft for this space station resupply mission is named in honor of Kalpana Chawla, who made history at NASA as the first female astronaut of Indian descent. Chawla, who devoted her entire life to understanding flight dynamics, lost her life during the STS-107 mission when the Space Shuttle Columbia disintegrated upon reentering the Earth's atmosphere.



Cygnus Spacecraft

- Will deliver hardware and supplies to support dozens of science and research investigations
- Will conclude its NASA mission after about three months attached to the space station's Unity module
- Will perform secondary mission objectives after departing station

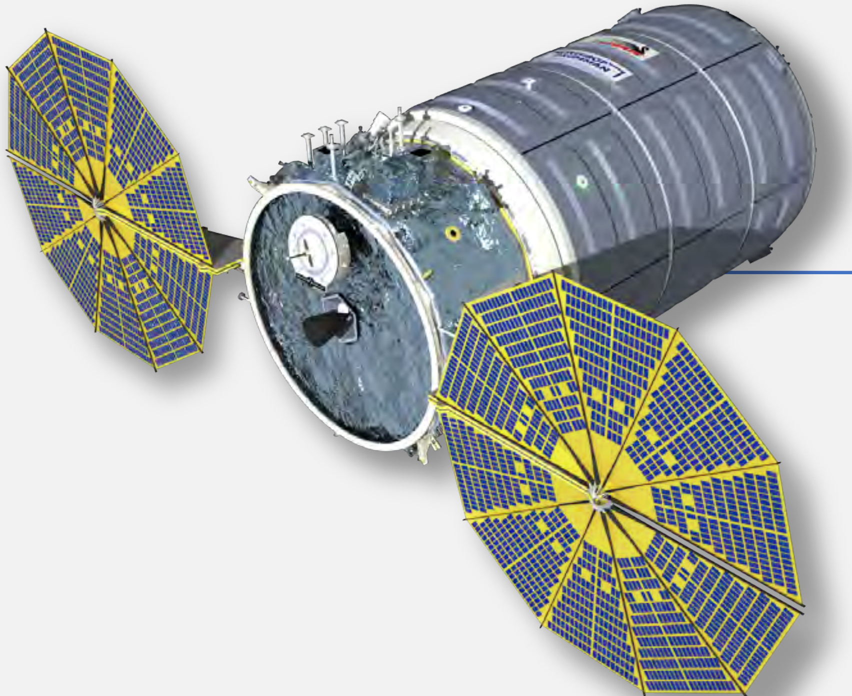
NORTHROP GRUMMAN

National Aeronautics and Space Administration

CARGO

CRS-14 Mission

*Masses are subject to change prior to launch



Crew Supplies
1,874 lbs. / 850 kg

Science Investigations
2,683 lbs. / 1,217 kg

Spacewalk Equipment
333 lbs. / 151 kg

Vehicle Hardware
2,712 lbs. / 1,230 kg

Computer Resources
156 lbs. / 71 kg

Total Cargo:	**7,758 lbs. / 3,519 kg**
Total Pressurized Cargo with Packaging:	**7,829 lbs. / 3,551 kg**
Unpressurized Cargo (SharkSat):	**71 lbs. / 32 kg**

Northrop Grumman's SharkSat payload is a prototype supporting on-orbit technology evaluation. Consisting of a radio frequency payload with an electronically steered antenna, SharkSat will serve as a pathfinder for technologies with applications in 5G, advanced satellite communications and autonomous / cognitive systems in a software-defined architecture, providing data about the performance of key technologies in low-Earth orbit.

Food Launching on NG-14:

In addition to the standard menu and crew specific food containers, crew-requested treats in a shelf stable food kit and a fresh food kit including the following will be sent to the space station:

Garlic, apples, baby carrots, grapefruit, oranges, cherry tomatoes, brie cheese, prosciutto, chorizo, dark chocolate covered cranberries, genoa salami, hot chocolate, praline pecans, smoked gouda, smoked provolone, summer sausage, and cakebites.

National Aeronautics and
Space Administration

HARDWARE

CRS-14 Mission

Highlights

Universal Waste Management System (UWMS): Next-generation waste management system, with future plans to fly on the Orion spacecraft, this self- contained microgravity-compatible toilet will allow the crew to have two fully functional lavatories on orbit.

Crew Emergency Breathing Air Assembly (CEBAA): Consisting of a regulator manifold assembly and flight support equipment, this emergency air supply supports as many as five crew members for up to one hour during an International Space Station emergency ammonia leak.

New Acrylic Cupola Scratch Pane: This upgraded side trapezoid pane will provide improved optics for the crew when using the cupola.

Common Communication for Visiting Vehicles (C2V2) Data Converter: Hardware allowing the crew to install a mandatory software upgrade for the C2V2 on-orbit.

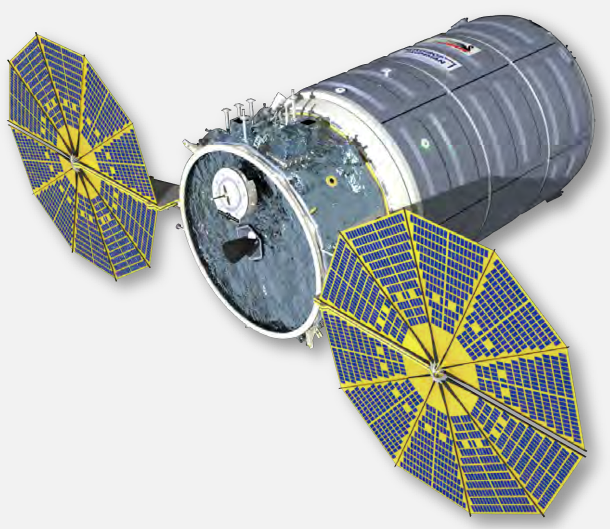
Functional Cargo Block Hardware: Critical fan, battery, and consumable hardware flying on a U.S. cargo vehicle for the first time to support scheduled maintenance on-orbit.

Advanced Resistive Exercise Device (ARED) Hardware Replacements: Belt/Pulley Assembly and Bench Cover replacement spares to support crew exercise on the ARED.

Robotic Arm Operators for Cygnus Capture

Chris Cassidy (prime)
NASA

Ivan Vagner
Roscosmos

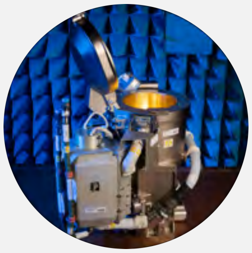


National Aeronautics and Space Administration

RESEARCH

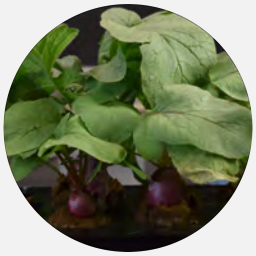
CRS-14 Mission

The new payloads arriving to the orbiting laboratory exemplify the breadth of research being conducted in microgravity, from plant growth to cancer therapies and technology development that will propel us farther in our mission to explore deep space. They also support the growing space economy, and seek to bring the wonder of working outside the space station back to those of us on Earth.



A new toilet is headed to the space station. A number of its features improve on current space toilet operations and help us prepare for future missions, including those to the Moon and Mars. The Universal Waste Management System (**UWMS**) demonstrates a compact toilet and the Urine Transfer System that further automates waste management and storage. Automated emptying of backup storage allows simultaneous use of both toilets on the space station, saving crew member time. A more reliable waste-disposal method makes things easier for the crew and allows them to focus on other activities such as research. The smaller footprint of the UWMS supports possible expansion of the number of crew members on the space station and planning for future exploration missions as well. Compact, efficient waste disposal technology also has potential applications in remote areas and those not served by traditional waste treatment systems on Earth and during disasters.

The investigation Elucidating the Ammonia Electrochemical Oxidation Mechanism via Electrochemical Techniques at the ISS (**Ammonia Electrooxidation**) examines a process for ammonia oxidation in microgravity. Ammonia is a small molecule made up of nitrogen and hydrogen. Oxidation is a reaction that breaks up these molecules, producing nitrogen gas, water, and energy. Ammonia oxidation could be used in space to produce water and energy by first converting the urea in human urine to ammonia. Both water and energy are critical needs on future long-term space missions. An electrochemical ammonia removal system could serve as an innovative water recovery system on long-duration missions to the Moon and Mars and provide vital drinkable water in remote and arid areas on Earth.



A new crop is headed to the space station. Researchers have conducted a number of studies on developing ways to produce food in space and help sustain crews on long-duration missions, including those to the Moon and Mars. Previous experiments have grown different types of lettuces and greens aboard the space station. The Assessment of Nutritional Value and Growth Parameters of Space-grown Plants (**Plant Habitat-02**) investigation adds radishes to the mix, cultivating seeds to see how different light and soil conditions affect growth. This model plant is nutritious, grows quickly (roughly four weeks from sowing to harvest), and is genetically similar to Arabidopsis, a plant frequently studied in microgravity. Findings could help optimize growth of the plants in space as well as provide an assessment of their nutrition and taste.

Scientists use many models and screening methods in efforts to develop more effective cancer drugs and reduce risks of harmful side effects. Leveraging Microgravity to Screen Onco-selective Messenger RNAs for Cancer Immunotherapy (**Onco-Selectors**) tests drugs based on messenger ribonucleic acids (mRNA) for treating leukemia. Found in all our cells, mRNA plays a role in the process of making proteins, and it can be different in healthy versus cancer cells. In normal gravity, the drugs to be tested are onco-selective, meaning they can tell cancer cells from healthy ones. Researchers expect any drugs that also demonstrate this trait in microgravity could make good candidates for safer, more effective, and affordable medicines to treat leukemia and other cancers. This could improve survival rates for thousands of people every year.