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More than 20 Payloads Sponsored by the U.S. National Laboratory Slated to Launch on SpaceX CRS-12 to the International Space Station

KENNEDY SPACE CENTER, FL. (August 8, 2017) – The SpaceX Falcon 9 vehicle is poised to launch its 12th cargo resupply mission (CRS-12) to the International Space Station (ISS) no earlier than August 13th, 2017 from Kennedy Space Center Launch Pad 39A. The SpaceX Dragon spacecraft will carry more than 20 ISS National Laboratory payloads to conduct research across a variety of areas aimed at improving life on Earth, including research on Parkinson's disease, new anti-bacterial compounds, new approaches to treating blood pressure, and pioneering new advances in the use of stem cells for repairing damage from disease, among many others. Thus far in 2017, the ISS National Lab has sponsored more than 100 separate experiments that have reached the station.

Below highlights the sponsored ISS National Lab investigations as part of the SpaceX CRS-12 mission:

Activity of Mutated Drosophila in Microgravity
King's College (London, England)

Visible differences in flight between normal and mutant Drosophila flies will be monitored to identify if there are any positive differences in movement by placing the flies in a microgravity environment. The International Space School Educational Trust (ISSET) in partnership with King's College in London lead this endeavor.
Hardware Partner: Space Tango

Cactus-Mediated Carbon Dioxide Removal in Microgravity
King's College (London, England)

Oxygen output and carbon dioxide intake of a cactus sempervivum will be measured and evaluated to provide information on how to improve the efficiency of carbon dioxide regulation of long-term space travel. The ISSET is in partnership with King's College in London on this investigation.
Hardware Partner: Space Tango

Conversion of Adipogenic Mesenchymal Stem Cells into Mature Cardiac Myocytes
Dr. Robert Schwartz, University of Houston *(Houston, TX)*

Conversion of Adipogenic Mesenchymal Stem Cells into Mature Cardiac Myocytes uses the microgravity environment of space to examine how stem cells differentiate into specialized heart cells (cardiac myocytes). Previous studies using microgravity chambers on Earth have found that low gravity environments help specially programmed stem cells move toward becoming new heart muscle cells. The Cardiac Myocytes experiment delivers frozen stem cells in an experimental setup to the ISS where the cells are thawed, cultured under specific conditions, tagged, and then returned to Earth for analysis and comparison with control batches.
Hardware Partner: Techshot

Crystallization of LRRK2 under Microgravity Conditions (CASIS PCG 7)

Drs. Marco Baptista, Sebastian Mathea, and Stefan Knapp, The Michael J. Fox Foundation *(New York City, NY)*

Crystallization of LRRK2 Under Microgravity Conditions (CASIS PCG 7) uses the microgravity environment onboard the ISS to grow larger versions of an important protein, LRRK2, implicated in Parkinson's disease. Defining the structure of LRRK2 would help scientists better understand the pathology of Parkinson's and aid in the development of therapies against this target. However, on Earth, gravity interferes with the growth of this protein, leading to the generation of crystals that are small and too compact to study. CASIS PCG 7 uses automated biotechnology devices in space to grow larger crystals of this protein, which are then returned to Earth for detailed laboratory analysis.
Hardware Partner: CASIS

Genes in Space-4
Scott Copeland, The Boeing Company (Houston, TX)

Heat shock proteins are a family of chaperone proteins in cells that are induced by stress, including physical, chemical, or environmental stress. Their induction provokes a shielding role that protects the cell from entering an apoptosis, or cell death pathway. Under stressful conditions, the cell elevates the levels of different heat shock proteins that will work to stop different apoptotic proteins. Astronauts' bodies are subject to different kinds of stress in space (cosmic radiation, microgravity, etc.), so although their heat shock response will initiate, the question is—will it continue to protect cells even after prolonged exposure to multiple stressors? This study is novel because the efficiency of heat shock proteins has not been studied in humans after a prolonged exposure to cosmic radiation and microgravity. This experiment will use a model organism, the roundworm (*Caenorhabditis elegan),* and will investigate if the gene is expressed during stressful conditions in microgravity.
Hardware Partners: Amplyus *and Boeing*

Eli Lilly-Lyophilization
Jeremy Hinds, Eli Lilly & Company (Indianapolis, IN)

Lyophilization in Microgravity (Eli Lilly-Lyophilization) examines freeze-drying processes in the microgravity environment onboard the ISS. Freeze-drying is used to preserve food and medication but may create layering or other textures in the presences of gravity. Eli Lilly-Lyophilization freeze-dries a range of samples under microgravity conditions onboard the ISS and then returns the samples to Earth for comparison with control samples.
Hardware Partner: Zin Technologies

The Effect of Microgravity on Stem Cell Mediated Recellularization
Dr. Alessandro Grattoni, Houston Methodist Research Institute (Houston, TX) and Dr. Joan E. Nichols, University of Texas Medical Branch (Galveston, TX)

The Effect of Microgravity on Stem Cell Mediated Recellularization (Lung Tissue) uses the microgravity environment of space to test strategies for growing new lung tissue. Using the latest bioengineering techniques, the Lung Tissue experiment cultures different types of lung cells in controlled conditions aboard the ISS. The cells are grown in a specialized framework that supplies them with critical growth factors so that scientists can observe how gravity affects growth and specialization as cells become new lung tissue.
Hardware Partner: BioServe Space Technologies

Evaluation of Radiation Deterrent Materials
Deerfield High School (Deerfield, IL)

Passive radiation-shielding materials will be evaluated based on density, cost, and on-orbit radiation deterrent effect to determine the most advantageous material for long-term space travel. The Higher Orbits Foundation and the 2016 Andromeda Award Winning Team DASA from Deerfield High School in Deerfield, IL lead this investigation.
Hardware Partner: Space Tango

NanoRacks – Cuberider-1
Sebastian Chaoui, Drummoyne NSW 2047 (Australia)

NanoRacks-CUBERIDER-1 (NanoRacks-CR-1) is an educational module that runs on computer code written by 9th and 10th graders. Students program sensors on NanoRacks-CR-1 to record data in the microgravity environment and conduct tests onboard the ISS and then send results back to Earth. Through this investigation, students devise their own experiments and experience space science firsthand.
Hardware Partner: NanoRacks, LLC

NanoRacks-National Center for Earth and Space Science Education – Student Spaceflight Experiments Program (SSEP) Mission 11
Dr. Jeff Goldstein, National Center for Earth and Space Science Education (Washington, D.C.)

The Student Spaceflight Experiments Program (SSEP) was launched in June 2010 as an education initiative that gives students the ability to design and propose real experiments to fly in low Earth orbit. The program provides seamless integration across STEM disciplines through an authentic, high-visibility research experience—an approach that embraces the Next Generation Science Standards. SSEP immerses hundreds of students at the local level in the research experience—students are truly given the ability to be real scientists and engineers. On the 11th mission from SSEP, 21 separate investigations will be launched from communities all over the United States and Canada.
Hardware Partner: NanoRacks, LLC

NanoRacks-SMDC-Maryland Aerospace Inc.-Kestrel Eye IIM (NanoRacks-KE2M)
Maryland Aerospace Inc. (Crofton, MD)

NanoRacks-SMDC-Kestrel Eye IIM (NanoRacks-KE IIM) is a microsatellite carrying an optical imaging system payload, including a Commercial Orbital Transportation System telescope. This investigation validates the concept of using microsatellites in low Earth orbit to support critical operations. An overall goal is to demonstrate that small satellites are viable platforms for providing critical path support to operations and hosting advanced payloads.
Hardware Partner: NanoRacks, LLC

NanoRacks-Ramon SpaceLab-01
Maya Golan, The Ramon Foundation (Giv'atayim, Irsael)

NanoRacks-Ramon SpaceLab-01 (NanoRacks-RSL-01) is a compilation of five NanoRacks MixStix investigations onboard the ISS. These investigations are aimed at examining the effect of microgravity on yeast fermentation, testing whether microgravity accelerates the dissolving of medication in simulated stomach acid, testing the formation of more stable emulsions of oil and water in space, measuring the growth of yeast in urine as a potential source of vitamins and a mechanism of filtering urine for drinking, and observing the transfer of a fluorescent plasmid during conjugation of Escherichia coli (E. coli) bacteria in microgravity as a step toward genetically engineering proteins.
Hardware Partner: NanoRacks, LLC

NASA ELaNa 22- CubeSat Launch Initiative – ASTERIA – JPL – NanoRacks
Sara Seager, Massachusetts Institute of Technology (Boston, MA)
(In partnership with NASA's Jet Propulsion Laboratory)

ASTERIA (Arcsecond Space Telescope Enabling Research in Astrophysics) is a technology demonstration and opportunistic science mission to advance the state-of-the art in CubeSat capabilities for astrophysical measurements. The goal of ASTERIA is to achieve arcsecond-level line of sight pointing error and highly stable focal plane temperature control. These technologies will enable precision photometry, i.e., the careful measurement of stellar brightness over time. This in turn provides a way to study stellar activity, transiting exoplanets, and other astrophysical phenomena, both during the ASTERIA mission and in future CubeSat constellations.
Hardware Partner: NanoRacks, LLC

NASA ELaNa 22 - CubeSat Launch Initiative – DELLINGR/RBLE – Goddard – NanoRacks
Dr. Larry Kepko, NASA's Goddard Space Flight Center *(Greenbelt, MD)*

A stream of charged particles called the solar wind, flows constantly outward from the dynamic sun, impacting Earth's magnetic field and leading to space weather effects, including roiling the outer layers of Earth's atmosphere. Dellingr/RBLE measures the magnetic fluctuations and molecular changes in this layer of Earth's

upper atmosphere in order to determine baseline conditions and observe space weather impacts. DELLINGR/RBLE will be deployed into low-Earth orbit via the NanoRacks CubeSat Deployer (NRCSD) on the ISS.
Hardware Partner: NanoRacks, LLC

NDC-3: Chicagoland Boy Scouts and Explorers
Dr. Sandra Rogers, Boy Scouts of America Pathway to Adventures Council (Chicago, IL)
Boy Scout Troop 209, based in the Chicago-land area, will conduct an experiment so that the team can measure the mutation rate of a bacterium in a microgravity environment. Its findings could impact research on everything from tissue growth to cancer.
Hardware Partner: NanoRacks, LLC

Spaceborne Computer
Dr. Eng Lim Goh, and David Peterson, Hewlett Packard Enterprise (San Jose, CA)

Spaceborne Computer intends to run a year-long experiment of a high-performance commercial off-the-shelf (COTS) computer system on the ISS. COTS computer systems can be programmed to detect and respond to radiation events by lowering operating speeds or 'powering down.' This research helps scientists identify ways of using software to protect ISS computers without expensive or bulky protective shielding.
Hardware Partner: Hewlett Packard Enterprise

Space Technology and Advanced Research Systems (STaARS-1) Research Facility
Dr. Heath Mills, Space Technology and Advanced Research Systems Inc. (Houston, TX)

The STaARS-1 Research Facility is a multipurpose facility that will enable a broad range of experiments on the ISS. In the pharmaceutical market, STaARS-1 will facilitate novel drug discovery, drug compound production, and virulence modeling. STaARS-1 will support biomedical therapeutic markets through drug delivery system development, regenerative tissue engineering (stem cell technologies), and biofilm formation prevention. Within the energy markets, STaARS-1 will support studies targeting novel biofuel production through enhanced quality and quantity of multiple compounds.
Hardware Partner: Space Technology and Advanced Research Systems Inc.

STaARS BioScience-1
Dr. Sarah Wallace, NASA Johnson Space Center (Houston, TX)

STaARS BioScience-1 investigates the question of why a harmful strain of bacteria appears to abandon its harmful properties when exposed to microgravity environments. The bacteria Staphylococcus aureus (S. Aureus) N315 is an antibiotic-resistant strain of bacteria that mysteriously becomes innocuous when exposed to induced microgravity conditions on Earth. Extending this research into space, STaARS BioScience-1 uses automated equipment to grow S. Aureus N315 in protected batch cultures onboard the ISS and then returns the samples to Earth-based labs for detailed analysis of their biochemistry and genetic expression.
Hardware Partner: Space Technology and Advanced Research Systems Inc.

STaARS-iFUNGUS
Dr. Brandi Reese, Texas A&M Corpus Christi (Corpus Christi, TX)

Intraterrestrial Fungus (STaARS-iFUNGUS) cultures a rare type of fungus in the microgravity environment of space in order to search for new antibiotics. The fungus, Penicillium chrysogenum, differs from other fungi because it comes from deep in the Earth's subsurface and shows potential as a source for new antibacterial compounds. The STaARS-iFUNGUS experiment transports frozen samples of fungal spores to the ISS, grows the fungus in different nutrient mixtures over different intervals, refreezes the samples, and then returns them to Earth, where scientists examine how they grew and what chemicals they produced.
Hardware Partner: Space Technology and Advanced Research Systems Inc.

Story Time from Space – 4
Patricia Tribe, T2 Science and Math Education Consultants (League City, TX)

Story Time From Space combines science literacy outreach with simple demonstrations recorded onboard the ISS. Crew members read five science, technology, engineering, and mathematics-related children's books in orbit and complete simple science concept experiments. Crew members videotape themselves reading the books and completing demonstrations. Video and data collected during the demonstrations are downlinked to the ground and posted in a video library with accompanying educational materials. This marks the fourth opportunity for these books to launch to station.
Hardware Partner: CASIS

This launch manifest adds to an impressive list of experiments from previous missions in 2017 that include research in the areas of stem cells, cell culturing, protein crystal growth, external platform payloads, Earth observation, and remote sensing as well as student experiments. To learn more about these investigations and other station research, visit www.spacestationresearch.com.

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About CASIS: The Center for Advancement of Science in Space (CASIS) is the non-profit organization selected to manage the ISS National Laboratory with a focus on enabling a new era of space research to improve life on Earth. In this innovative role, CASIS promotes and brokers a diverse range of research in life sciences, physical sciences, remote sensing, technology development, and education.

Since 2011, the ISS National Lab portfolio has included hundreds of novel research projects spanning multiple scientific disciplines, all with the intention of benefitting life on Earth. Working together with NASA, CASIS aims to advance the nation’s leadership in commercial space, pursue groundbreaking science not possible on Earth, and leverage the space station to inspire the next generation.

About the ISS National Laboratory: In 2005, Congress designated the U.S. portion of the International Space Station as the nation's newest national laboratory to maximize its use for improving life on Earth, promoting collaboration among diverse users, and advancing STEM education. This unique laboratory environment is available for use by other U.S. government agencies and by academic and private institutions, providing access to the permanent microgravity setting, vantage point in low Earth orbit, and varied environments of space.

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