



2018 Fall Edition

LANGLEY INSIGHT

NASA's Langley Research Center Quarterly Update for Legislators and Staff



Bridenstine meets with interns at Langley's Advanced Structures and Materials Laboratory during his official tour of the center. Credits: NASA/David C. Bowman

NASA Administrator Visits Langley Research Center

After a busy first three months in his new role as NASA's administrator, Jim Bridenstine paid his first official visit to NASA's first field center – Langley Research Center.

Bridenstine, who was sworn into office April 23 as the agency's 13th administrator, spent the day at NASA's Langley Research Center in Hampton, Virginia, where he and his staff toured the center. The July 31 visit included some lessons about Langley's past, presentations on the varied missions the center currently supports and revitalizations underway to advance the agency's priorities.

"Langley is one of 10 field centers that NASA is proud of and that is really doing amazing work on a whole host of areas," he said. Those areas include studying the Earth's atmosphere and climate, advancing commercial and emerging aviation markets and supporting NASA's return to the Moon and future missions to Mars.

Bridenstine also was excited about Langley's role in the agency's return to the Moon as part of a journey to Mars, notably in entry, descent and landing.

"This time it's not going to be about placing flags and footprints on the surface of the Moon and it's not about winning the Cold War," he said. "It's about having a permanent presence around the Moon for economic activity and eventually taking all of that sustainable architecture and replicating it on Mars."

In addition to touring such facilities as the National Transonic Facility, the Advanced Structures and Materials Laboratory and the Katherine Johnson Computational Research Facility, Bridenstine held a standing-room-only town hall with Langley employees where he answered questions from the audience.



Measurement Systems Laboratory Update

Construction is well underway for NASA Langley's 4th new building, the \$97M Measurement Systems Laboratory. With over 60% of the construction complete, this project is a boon to the region as General Contractor W.M. Jordan and local subcontractors are performing the work. We are looking forward to the ribbon cutting in Fall of 2019. NASA Langley's next construction of facilities project, the Flight Dynamics Research Facility will replace the 80-year-old Vertical Spin Tunnel.

NASA Awards Contract for Climate Pathfinder Mission Instrument

NASA has awarded a contract to the University of Colorado Boulder's Laboratory for Atmospheric and Space Physics (LASP) for development of a reflected solar spectrometer for the agency's Climate Absolute Radiance and Refractivity Observatory (CLARREO) Pathfinder mission.

The cost-no-fee contract provides for the formulation, implementation, launch, operation and analysis of the CLARREO Pathfinder mission's reflected solar spectrometer. The period of performance spans eight years and the total contract value is \$57.4 million.

CLARREO Pathfinder will demonstrate the technology needed to assess coastal flooding risks more effectively and better inform policy. NASA's Langley manages the mission for the agency's Science

<https://www.nasa.gov/feature/nasa-administrator-praises-langley-s-rich-past-bright-future>

Katherine Johnson's 100th Birthday

August 26, 2018 marked Katherine G. Johnson's 100th birthday, and many Langley employees expressed admiration for the woman whose math powered some of America's first triumphs in human space exploration.

Her 100th birthday was recognized throughout NASA and around the world. But at Langley, the milestone created an extra measure of pride and joy. Johnson spent her entire 33-year NACA and NASA career at Langley.

Johnson did trajectory analysis for Alan Shepard's May 1961 mission Freedom 7, America's first human spaceflight. At a time when digital computers were relatively new and untested, she famously checked the computer's math for John Glenn's historic first orbital spaceflight by an American in February of 1962.

In terms of lives touched, Johnson's work with youth stands alongside her impact as a world-class mathematician. Langley's Katherine G.



Johnson Computational Research Facility, which opened in September 2017, offers a physical reminder of her contributions.

"The Katherine Johnson building is near where I work, so I think about her often," said Kimberly Bloom, director of Langley's Child Development Center. "It's an important

story — how she empowered women of all races and she encouraged kids to learn. She influenced culture here at NASA, but also beyond and made an impact. She certainly is a role model. I'd like to thank her for all she's done not only for NASA but also for this country."

<https://www.nasa.gov/feature/Langley/at-langley-admiration-and-gratitude-multiply-on-katherine-johnson-s-100th-birthday>

NASA's InSight Passes Halfway to Mars, Instruments Check In

NASA's InSight spacecraft, en route to a Nov. 26 landing on Mars, passed the halfway mark on Aug. 6. All of its instruments have been tested and are working well.



As of Aug. 20, the spacecraft had covered 172 million miles (277 million kilometers) since its launch 107 days ago. In another 98 days, it will travel another 129 million miles (208 million kilometers) and touch down in Mars' Elysium Planitia region, where it will be the first mission to study the Red Planet's deep interior. InSight stands for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport.

The InSight team is using the time before the spacecraft's arrival at Mars to not only plan and practice for that critical day, but also to activate and check spacecraft subsystems vital to cruise, landing and surface operations, including the highly sensitive science instruments.

Experts from NASA's Langley Research Center were key to providing modeling and computer simulations, which will be used by the InSight entry, descent and landing (EDL) team led by NASA's Jet Propulsion Laboratory along with Lockheed Martin Space and NASA's Ames Research Center.

Since early missions, such as Viking in 1976, Langley has played a central role in EDL simulations. The Langley group, led by Rob Maddock with Charlie Zumwalt, Alicia Dwyer Cienciolo, and Daniel Litton, is continuing that job today, building on previous projects including the Mars Science Laboratory, one of the largest and most complicated landings so far, and Phoenix, which is very similar to InSight.

<https://mars.nasa.gov/insight/news/2018/nasas-insight-passes-halfway-to-mars-instruments-check-in>

NASA Puts Mars-forward Student Technologies to the Test

NASA is exploring ways to provide water using existing resources on multiple planetary surfaces and engaging universities in this mission through the RASC-AL (Revolutionary Aerospace Systems Concepts – Academic Linkages). The Mars Ice Challenge is one of several RASC-AL collegiate design competitions sponsored by NASA and administered by the National Institute of Aerospace in Hampton, Virginia, that exercise innovation in support of NASA's vision for expanding human space exploration – in this case, a technology demonstration for critical in-situ resource utilization (ISRU) capabilities.

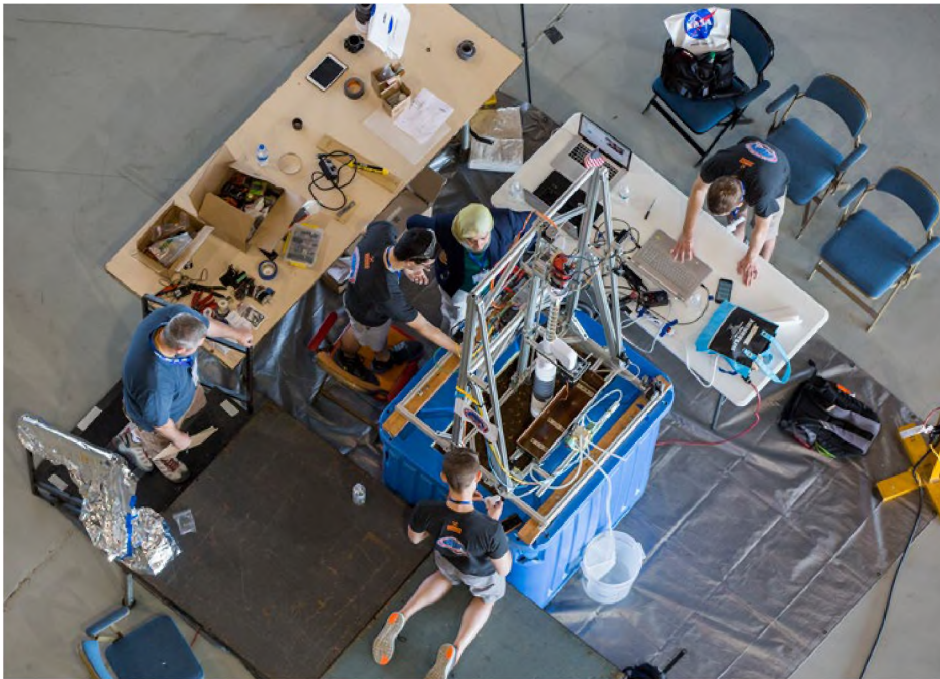
In its second year, Mars Ice Challenge judges 10 competitively selected teams to travel to NASA's Langley Research Center from June 5-7 to demonstrate unique methods for harvesting water from simulated Martian subsurface ice. The goal? Extract as much water as possible over a two-day period.

Teams mounted their prototype drills at individual test stations using 4-foot tall commercial fishing coolers filled with

600-pound ice blocks and a half-meter of pitcher's mound clay and gravel to replicate a slice of the Martian surface as closely as possible.

The selected teams include two from West Virginia University and one each from Alfred University, Colorado School of Mines, Carnegie Mellon University, University of Tennessee, Knoxville, Massachusetts Institute of Technology, Northeastern University, Rowan University and Virginia Tech.

This year, the team from Northeastern University placed first overall and collected the most water with its concept titled Planetary Articulating Water Extraction System. The second-place winner and clearest water went to West Virginia University – Second Generation Mountaineer Ice Drilling Automated System. The best technical papers went to Massachusetts Institute of Technology – High Yield Dihydrogen-monoxide Retrieval Assembly and Virginia Tech – Virginia Tech Ice Extractor.



Teams and their advisors travelled from their universities and set up their drilling systems in the hangar at NASA's Langley Research Center. Teams had a day to set up before the two-day competition began.

Credits: NASA/David C. Bowman

<https://www.nasa.gov/feature/langley/nasa-puts-mars-forward-student-technologies-to-the-test>



NASA Technologies Significantly Reduce Aircraft Noise

A series of NASA flight tests has successfully demonstrated technologies that achieve a reduction in the noise generated by aircraft and heard by communities near airports.

The Acoustic Research Measurement (ARM) flights, which concluded in May, at NASA's Armstrong Flight Research Center in California, tested technology to address airframe noise, or noise that is produced by non-propulsive parts of the aircraft, during landing. The flights successfully combined several technologies to achieve a greater than 70 percent reduction in airframe noise.

"The number one public complaints the Federal Aviation Administration receives is about aircraft noise," said Mehdi Khorrami, an aerospace scientist at NASA's Langley Research Center in Virginia, and principal investigator for Acoustic Research Measurement. "NASA's goal here was to reduce aircraft noise substantially in order to improve the quality of life for communities near airports. We are very confident that with the tested technologies we can substantially reduce total aircraft noise, and that could really make a lot of flights much quieter."

NASA tested several experimental designs on various airframe components of a Gulfstream III research aircraft at Armstrong, including landing gear fairings and cavity treatments designed and developed at Langley, as well as the Adaptive Compliant Trailing Edge (ACTE) wing flap, which had previously been flight-tested to study aerodynamic efficiency. The aircraft flew at an altitude of 350 feet, over a 185-sensor microphone array deployed on the Rogers Dry Lake at Edwards Air Force Base in California.

<https://www.nasa.gov/press-release/nasa-technologies-significantly-reduce-aircraft-noise>

NASA Langley Collaborates with Industry to Develop Space Technologies

NASA is partnering with U.S. companies and small businesses to develop technologies that have the potential to significantly benefit the economy and future NASA missions.

Recent announcements of selections for the agency's Tipping Point solicitation and Phase II of NASA's competitive Small Business Technology Transfer (STTR) program include several proposals with NASA's Langley Research Center in Hampton, Virginia.

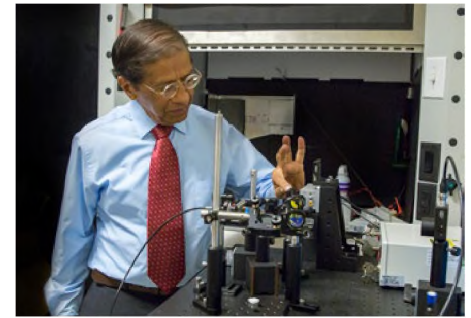
NASA selected 10 Tipping Point proposals totaling approximately \$44 million and Langley is a partner on one \$3 million

proposal. The agency also selected 20 research and technology proposals -- valued at \$15 million -- from 19 American small businesses for STTR Phase II and Langley will manage three of the selected proposals totaling \$2.25 million.

"Building partnerships is important," said Kim Cannon, technology transition lead at Langley. "It allows NASA to do the fundamental work that we're good at and it allows industry to leverage that work and build their success."

Langley will collaborate with Blue Origin on their Tipping Point proposal to advance sensor suites that would enable landing anywhere on the lunar surface. NASA's Johnson Space Center and NASA's Jet Propulsion Laboratory are the other partners. This project will mature critical technologies that enable precision and soft landing on the Moon. The project team will integrate Langley's Navigation Doppler Lidar (NDL) technology, Terrain Relative Navigation (TRN), and altimetry sensors and

conduct flight tests prior to lunar mission implementation. Testing will be performed at approximately 100 km altitude on board the Blue Origin New Shepard vertical takeoff vertical landing (VTVL) suborbital vehicle. The resulting sensor suite will enable precision landing anywhere on the lunar surface.



Dr. Mool Gupta shows his optic fiber-based hybrid spectroscope, developed by Laser & Plasma Technologies, LLC, based in Hampton, Virginia, with the University of Virginia. Credits: NASA/David C. Bowman

<https://www.nasa.gov/press-release/langley/nasa-langley-collaborates-with-industry-to-develop-space-technologies>

Students from Virginia Call International Space Station

NASA's Langley Research Center in Hampton, Virginia hosted a downlink event Tuesday between Virginia students and European Space Agency (ESA) astronaut Alexander Gerst on board the International Space Station.

The downlink was held at the Virginia Air and Space Center and Students were able to ask questions about anything they would like to know about life aboard the space station, NASA's mission and upcoming science investigations.

More than 800 students across Langley's five-state region, including Kentucky, North Carolina, South Carolina, Virginia, and West Virginia participated in person or virtually. The student groups include Boys & Girls Club, 21st Century Community Learning Center and From One Hand To Another, a Not for Profit Organization established by Pharrell Williams to provide educational tools needed for the future success of children.

Linking students directly to astronauts aboard the space station provides unique, authentic experiences designed to enhance student learning, performance and interest in science, technology, engineering and math



European Space Agency astronaut Alex Gerst on the International Space Station. Credits: NASA

(STEM). Astronauts living in space on the orbiting laboratory communicate with NASA's Mission Control Center in Houston 24 hours a day through the Space Network's Tracking

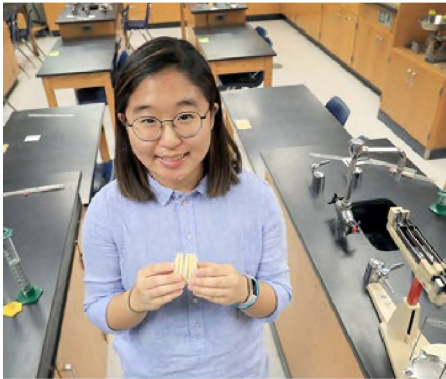
and Data Relay Satellites (TDRS).

Langley's event is the second of three downlink events happening as part of NASA's Year of Education on Station.

<https://www.nasa.gov/press-release/langley/students-from-virginia-to-call-international-space-station>

From the Daily Press, September 18, 2018

NASA Gives National Award for a Microgravity Challenge to Grafton High School Students



The 2018 Microgravity Expulsion from Water Experiments Challenge offered high-schoolers the chance to design and build objects that sink in normal gravity, but are expelled from water in a free fall from NASA Glenn's 79-foot experimental drop tower, which provides 2.2 seconds of near weightlessness during descent.

Yenna Chu, of from Grafton High School, devised a clear plastic box fitted with a water chamber bearing a bundle of pipette tips, installed a GoPro camera to record the wild ride, and dropped the thing over and over from the second story of her Yorktown home.

For that, she and her teammate from Grafton High School, Annie Cao, earned first place in a national student microgravity challenge sponsored by NASA Glenn Research Center

in Cleveland, Ohio. Chu is a senior at Grafton, while Cao is now a freshman at the University of Virginia.

"I really wasn't expecting it," Chu, 17, said amid her winning design and its prototypes in her school's chemistry lab.

It's already known that liquids behave differently in space because surface tension has a greater effect in microgravity. But this experiment added the hydrophobic element.

"The key part of this challenge is that the expulsion must result from the hydrophobic, or water-fearing, properties of the surface of each object," challenge director Nancy Hall explained in a NASA statement.

She and Cao were among 20 finalist teams chosen to send their top three performers – 3-by-3, 4-by-4 and 5-by-5 bundles of pipette tips with a hydrophobic coating – to NASA Glenn. There, researchers conducted drop tower tests on each design according to student instructions.

The winning model turned out to be the 5-by-5 pipette bundle. That, along with her

analysis of her results, clinched the win.

In addition to school, Chu is interning now at NASA Langley Research Center in Hampton, where her father works as an associate research fellow with the National Institute of Aerospace.

"The first time I got my results back, they were very great. They flew sky-high, hit the top of the (tower) bucket."

-Yenna Chu

Mars Parachute Test Launches from Wallops

A parachute test for a future mission to Mars was successfully launched on a NASA Black Brant IX suborbital sounding rocket at 9:30 a.m., Friday, Sep. 7, from the agency's Wallops Flight Facility.

The rocket carried the Advanced Supersonic Parachute Inflation Research Experiment (ASPIRE) from NASA's Jet Propulsion Laboratory in Pasadena California.

The payload is a bullet-nosed, cylindrical structure holding a supersonic parachute, the parachute's deployment mechanism, and the test's high-definition instrumentation -- including cameras -- to record data.

The payload descended by parachute and splashed-down in the Atlantic Ocean 28 miles from Wallops Island. The parachute was successfully recovered and returned to Wallops for data retrieval and inspection.



ASPIRE 3 Test was successfully conducted on Sept. 7, 2018. Credits: NASA/Patrick Black

<http://www.dailypress.com/news/science/dp-nws-nasa-grafton-award-20180918-story.html>

NASA Awards Contract for Force and Strain Measurement Capabilities

NASA has awarded contracts to two companies to provide force and strain measurement capabilities for programs and projects at NASA's Langley Research Center in Hampton, Virginia.

The primary objective of the Force Measurement Support Services (FMSS) contract is to provide high-quality force

and strain measurement capabilities for NASA's programs and projects by providing services to produce, calibrate, repair and develop force and strain measurement capabilities that incorporate technological advancements to meet current and future aerospace research challenges.

Indefinite-delivery/indefinite-quantity contracts were awarded to Calspan Systems Corporation and Modern Machine and Tool Co., Inc. based in Newport News, Virginia.

The FMSS contract has a maximum cumulative value of \$9 million over a 5-year period of performance.

NASA and Alaska Airlines Test Software that Saves Time, Fuel

NASA researchers are testing cockpit-based software that combines the power of integrated, real-time flight data with the touch-and-go ease of a tablet computer to put the power to save time and fuel at pilots' fingertips.

The Traffic Aware Strategic Aircrew Requests, or TASAR, project is a research partnership between NASA and Alaska Airlines testing NASA's Traffic Aware Planner (TAP) software, which merges and evaluates an unprecedented combination of real-time flight data to provide pilots with optimized flight path options.

Route optimization through TASAR offers a number of benefits, such as saving fuel and flight time and helping pilots make better, more informed route requests to air traffic controllers. David Wing, TASAR research lead at NASA's Langley Research Center, has seen TAP make suggestions that would save up to 1,800 pounds of fuel and 12 minutes of flight time, though he acknowledges that's probably a bit on the high side for a typical flight.

"Through simulations, we came up with rough estimates that an average airline flight might save 400 to 500 pounds of fuel and about four minutes of flight time," said Wing.

Early results are promising. On five of its first six flights with Alaska Airlines in the first week of a planned eight-month operational trial, the TAP software made reroute recommendations – changing the aircraft's path and/or altitude



Wing (left), Traffic Aware Strategic Aircrew Requests (TASAR) research lead, and Dr. Kelly Burke (right), developer of the Traffic Aware Planner (TAP) software interface. Credits: NASA/David Wing

– that reduced flight time or saved fuel, and more often than not, both.

Alaska Airlines continues to fly the TAP software on three aircraft flying multiple flights a week. During the planned eight-month operational trial on revenue flights, NASA plans to continue gathering data about TASAR's effectiveness, while Alaska Airlines gets their customers to their destinations a little more quickly and economically.



The Traffic Aware Planner (TAP) software recommends a reroute that would save both time and fuel on an Alaska Airlines flight. Credits: Alaska Airlines/Ingrio Barrentine

<https://www.nasa.gov/feature/langley/nasa-and-alaska-airlines-test-software-that-saves-time-fuel>

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