National Aeronautics and Space Administration

THE ARMSTRONG X-PRESS

Volume 62 Number 3 April 2020

AFRC2020-0058-032 NASA/Carla Thomas

NASA Armstrong engineer Mike Buttigieg works on an oxygen hood system prototype worn by Dr. Daniel Khodabakhsh from the Antelope Valley Hospital. The hood is designed to help coronavirus patients who don't yet need a ventilator, but who are experiencing breathing troubles. The hood forces oxygen into patients with mild coronavirus symptoms, minimizing the likelihood that the patient will need to use a ventilator.

Lending a hand

Center assists community COVID-19 response

Return to center plans begin, page 2

Successful partnership

By Teresa Whiting
NASA Armstrong Public Affairs

NASA Armstrong has joined forces with an Antelope Valley task force to build medical devices to help patients with coronavirus.

Armstrong partnered with Antelope Valley Hospital, Lancaster, Virgin Galactic, The Spaceship Company and Antelope Valley College to develop innovative ideas to solve possible shortages of critical medical equipment.

"NASA is more than scientists, engineers and explorers. We are neighbors and members of communities across the country," said NASA Administrator Jim Bridenstine. "In a time like this, it's critical that we contribute the vast expertise of our workforce to do all we can to help our neighbors, our communities and the nation."

This task force is working closely with medical professionals at the hospital to provide alternative solutions to needed equipment that is not available for a large-scale emergency.

One of their first efforts was to build a prototype oxygen hood that has now proven to work for the doctors at the hospital. The production of 500 will begin next week at TSC's Faith Facility in Mojave.

"I've been inspired by the teamwork shown by the Antelope Valley task force in response to the challenge of COVID-19. Now more than ever, it is crucial that we share knowledge, skills and collaborate," said Virgin Galactic CEO George Whitesides. "By producing several innovative health solutions for regional hospitals over a few weeks, we are protecting health care workers on the front lines while improving patient care. It is truly showing the best of American public-private cooperation."

The device, developed by NASA engineer Mike Buttigieg, is an oxygen hood for COVID-19 patients exhibiting minor symptoms and will minimize the need for those patients to use ventilators. The device functions like a continuous positive airway pressure (CPAP) machine to force oxygen into a patient's low-functioning lungs.

"We looked across our center's expertise in innovation, engineering, design and fabrication of unique systems, to bring NASA knowledge and people together to collaborate on solving the needs and challenges brought about by the COVID-19 situation," said Armstrong Chief Technologist David Voracek.

AFRC2020-0059-024 NASA/Carla Thomas

NASA engineer Mike Buttigieg works on the Aerospace Valley Positive Pressure Helmet, a device successfully tested by Antelope Valley Hospital doctors. The Spaceship Company and Armstrong began producing 500 helmets and submitted a request April 22 for FDA emergency use authorization.

NASA engineer Allen Parker and this team at Armstrong designed a canopy that protects health care workers by safely covering COVID-19 patients while still allowing health care providers access to the patients to provide care.

"The patient will be located inside this canopy where aerosol viral contaminants will be vacuumed out through a viral filter located within the canopy," Parker said. "In doing so, the health provider can freely work around the patient outside the canopy with minimal risk."

The ingenuity and teamwork displayed by NASA employees, along with their task force partners while in quarantine, may help in prepare for future emergencies that affect the nation. Learn more about NASA's efforts to aid in the national response to COVID-19 at https://www.nasa.gov/coronavirus.

Preliminary return to center plans begin

By Jay Levine
X-Press editor

The Armstrong Executive Leadership Team is developing preliminary plans for when it is safe to begin bringing groups of employees back to the center.

Glenn Graham, Armstrong's Safety and Mission Assurance director, and Dr. Dwight Peake, Armstrong's chief medical officer and flight surgeon, discussed safety and medical activities during an Armstrong Center Management Board (CMB) April 22. The meeting with branch chiefs, project managers and other supervisors focused on what they should consider as they begin detailed planning for resuming on center work.

One of the central themes was all employees need to remain flexible and vigilant with respect to COVID-19 mitigation measures. Other key takeaways included the importance of sharing best practices among branches, warning each other about close calls and practices that don't work well, holding each other accountable and watching out for complacency.

"Employee health is the center's top priority and the guiding principle for planning our return to the center is having employees continue to telework as much as possible," Graham said. "This is to ensure social distancing and to minimize close contact between employees." Additionally, he asked supervisors to tell their people "if you feel sick, don't come to work, and if you start to feel sick at work to go home."

High-risk populations should expect to continue teleworking for an extended period, including employees with high risk family members or other high-risk persons in their care. High-risk personnel who want to return to the center may be able to get conditional approval based on additional mitigations and depending on their place of work and type of work.

The decision to return to Armstrong will include federal, state and agency guidance plus local threat conditions. People

Preliminary plans, page 3

Preliminary plans... from page 2

should expect a risk-based, phased approach to re-entering Armstrong in accordance with the agency's pandemic framework. For example, as the center moves from Stage 4 back to Stage 3, then Stage 2 and more and more groups of employees will gradually be allowed onto the center and the remaining employees will continue to telework.

Before any project work resumes at Armstrong there are a series of actions needed. It will take about a week for facilities, information technology, safety and security personnel to come in to prepare the center. Work includes items such as flushing water lines, checking heating, ventilation and air conditioning systems, cleaning facilities, making sure networks are up and running and conducting grounds maintenance.

Also, the center will ensure adequate personal protective equipment (PPE) and cleaning and sanitizing supplies are available. Finally, there will have to be adequate COVID-19 testing capability available before work resumes.

Supervisors were asked at the CMB to survey work areas before their employees arrive to confirm PPE availability and ensure that social distancing criteria can be met. If not, they will need to determine other ways to keep their employees safe, like limiting the number of people at one time in labs and offices, rearranging furniture or mandating mask usage. Each one of these options presents challenges, and for this reason people can expect a mix of on-site and off-site work to continue through the end of the fiscal year, Graham said.

NASA/Bill Werner

After the presentation, Graham and Peake answered questions posed by the supervisors and they reiterated that this set of challenges is uncharted territory. For that reason, people should expect local guidance to change often based on conditions and lessons learned.

NASA elevated every center to Stage 2 March 14, when the agency strongly encouraged employees to telework. NASA leadership decided to move to Stage 3 March 17, which dictated mandatory telework and allowed only mission essential personnel to access Armstrong. The center moved to Stage 4 March 24, which remains in effect, due to rising number of COVID-19 cases in the area and to comply with local, state and federal guidelines.

NASA's Ames Research Center in California and Marshall Space Center in Alabama were the first two centers to go to Stage 3 after employees at those centers tested positive for COVID-19.

3 former center employees pass

Three former center employees recently passed.

John Bosworth

John Bosworth, a former center aerospace engineer, passed April 22. He was 59.

Bosworth worked at the center for 36 years and was a key part of the success of the forward swept wing X-29, the international X-31 enhanced fighter maneuverability demonstrator and Intelligent Flight Controls flight research. He also enjoyed mentoring new engineers.

Bosworth began an internship at the center at age 19. On his first day he met Connie, who also had started her first day as an intern in Human Resources. They were married for 32 years.

Friends said he represented the best of the best and was kind, patient and calm.

Gregory Cole

Gregory Cole, who worked at Armstrong for decades, passed Feb. 15. He was 53.

Cole began work for the NASA Armstrong Cable Plant team in 2000, where he was responsible for phone and computer network infrastructure.

People who knew him said he had an exemplary work ethic, was loyal, had a gentle nature, and was cheerful, respectful and funny.

Bernadine Herrick

Bernadine Herrick, who worked at the center for 11 years, passed Feb. 19. She was 77.

Herrick had worked for NASA for 20 years, including the last part of her career in Code A for Acquisitions.

She loved to camp and travel.

News at NASA

Hubble now 30

Thirty years ago, on April 24, 1990, Hubble was carried aloft from NASA's Kennedy Space Center in Florida aboard the space shuttle Discovery, along with a five-astronaut crew. Deployed into Earth orbit a day later, the telescope opened a new eye onto the cosmos that has been transformative for our civilization.

Hubble is revolutionizing modern astronomy, not only for scientists, but also by taking the public on a wondrous journey of exploration and discovery. Hubble's never-ending, breathtaking celestial snapshots provide a visual shorthand for Hubble's top scientific achievements. Unlike any space telescope before it, Hubble made astronomy relevant, engaging and accessible for people of all ages.

Hubble's top accomplishments include measuring the expansion and acceleration rate of the universe; finding that black holes are common among galaxies; characterizing the atmospheres of planets around other stars; monitoring weather changes on planets across our solar system; and looking back in time across 97% of the universe to chronicle the birth and evolution of stars and galaxies.

Hubble has yielded to date 1.4 million observations and provided data that astronomers around the world have used to write more than 17,000 peer-reviewed scientific publications.

The Range

DATR assists with NASA space communications and nothing flies at Armstrong without it

Above, the Triplex 7M telemetry antenna at far right and the two radars to the left are a few of the assets of the Dryden Aeronautical Test Range at NASA Armstrong. Below, Jeff Koenig and Carlos Torres at NASA Armstrong prepare to support communications with the International Space Station and the Soyuz spacecraft scheduled for a rendezvous later that day.

AFRC2020-0025-10 NASA/Lauren Hughes

By Jay Levine
X-Press editor

As the number of flights increase to the International Space Station from commercial spaceships delivering U.S. astronauts and supplies and Russian Soyuz flights continue, NASA Armstrong is enhancing its abilities to be ready to help.

The center's Dryden Aeronautical Test Range (DATR) has for decades provided backup communications for the space station and the Russian Soyuz spacecraft that currently takes U.S. astronauts to and from the space station, said Tracy Ackeret, chief of range operations.

NASA's Commercial Crew Development program, which aims to transport U.S. and international astronauts and supplies to space by privately owned crew vehicles, periodically asks for DATR assistance in radar tracking spacecraft to confirm location. If DATR is requested, the range also is able to provide radar tracking support for landings.

In addition to supporting the space station and spacecraft scheduled to visit there, the range is involved in every flight from Armstrong. That responsibility has led to enhancements to the DATR's infrastructure to prepare for the next generation of experimental aircraft, such as the anticipated X-59 Quiet SuperSonic Technology (QueSST) aircraft.

AFRC2019-0235-12 NASA/Lauren Hughes

Soyuz support

The range began space communications involvement when the first component of the International Space Station was launched in 1998. The DATR's primary responsibility is for communications infrastructure that has enhanced the station's success and crew safety, Ackeret said. Upgrades continue to the Very High frequency (VHF) communications that backup the primary Space Network, which includes the

Tracking and Data Relay Satellites, and communicates with the Russian Soyuz spacecraft when it is out of range of Russia

NASA's VHF ground stations provide two-way, audio only communications and transmit over two frequencies, one for emergency communications with the station (VHF1) and the other (VHF2) for communicating with the Soyuz. Russia has its own VHF network. Working in combination, the NASA and Russian networks provide VHF communications on every orbit of the space station.

NASA's upgrades to VHF network ground antennas, currently underway, involve improvements to numerous electronic components and installation of new software for tracking the space station and Soyuz. Additionally, new antennas at the ground stations, able to operate at VHF1 and VHF2 simultaneously, will add redundancy to the network so that if one system fails, the other system will be able to take over immediately, Ackeret explained.

On most Soyuz missions the spacecraft docks with the space station before exiting Russia's VHF network coverage, as is the return to Earth. However, on missions requiring the Soyuz additional orbits to rendezvous with the space station, the NASA network stands by to provide emergency communication.

AFRC2019-0130-01 NASA/Lauren Hughes

Above, the Dryden Aeronautical Test Range staff at NASA Armstrong monitor all aircraft flights from the center as well as supporting the International Space Station and Russian Soyuz missions. Sitting from left to right are Bailey Cook, Lucio Ortiz, Matt Kearns, Sonja Belcher, John Batchelor, Jeff Koenig, Will Peters, Russ Franz, Zack Springer and Mike Webb. Standing left to right are Joy Bland, Doug Boston, April Norcross, Randy Torres, Robert Racicot, Jesus Vazquez, Jim Abercromby, Steve Simison, Tracy Ackeret, Chris Birkinbine, Darryl Burkes, Joe Innis, Bruce Lipe, Pat Ray, Kevin Knutson, Greg Strombo, Bart Rusnak, Tim Burt, Al Guajardo, Feras, Abu-Issa and Hector Rodriquez. Below, Jesus Vazquez, Zach Springer and Sonja Belcher, from left, are at stations in the Mobile Operations Facility 5 at NASA Armstrong.

How they prepare

When the center is called up, such as Oct. 25 when NASA astronaut Jessica Weir and two others launched in a Soyuz for the six-hour trip to the space station, the range team went to work.

Jovany Bautista raised the DATR three-story high antenna and set in motion the 18-page readiness checklist. The next set of items included powering up and checking systems and tracking software in the communications control room at the DATR Aeronautical Tracking Facility. The preparations include a voice check with NASA's Johnson Space Center in Houston about three hours after the process begins.

NASA's Wallops Flight Facility in Virginia, which is operated by NASA's Goddard Space Flight Center in Maryland, provides emergency communications first as the Soyuz orbits over the Eastern U.S. and then responsibilities are passed to Armstrong as the spacecraft begins orbit over the Western U.S. Russia is responsible for providing VHF communications over Asia and Europe.

Richard Batchelor, communications technician, said the range's assets are available for 10 minutes every 90 minutes, or the amount of time it takes a spacecraft to make one orbit of the Earth.

Although Armstrong was called off once the crew safely made it to the space station, he explained that was not the case in March 2014 when communication was lost with Soyuz. An anomaly was discovered with the Soyuz rocket's software failed to make the orbital burns to allow it to dock with the space station.

AFRC2019-0130-12 NASA/Lauren Hughes

In that case NASA was asked to assist in determining the Soyuz location and establish a two-way communications link between Moscow and the Soyuz to continue working the challenge as the spacecraft's orbit entered the Western Hemisphere. Armstrong established communications between Moscow and the Soyuz, which resulted in a plan that safely brought the crew to the space station.

X-59 support

DATR engineers are working on interfaces with the onboard flight test instrumentation system that

Range, page 8

X-57 test strong

By Matt Kamlet
NASA Armstrong Public Affairs

AFRC2020-0038-11 NASA/Ken Ulbrich

Telemetry testing begins on the X-57 Maxwell, NASA's first all-electric X-plane, as the operations crew at NASA Armstrong records the results. Telemetry testing is a critical phase in X-57's functional test series. In addition to confirming the ability of the X-57 aircraft to transmit speed, altitude, direction and location to teams on the ground, telemetry testing also confirms the ability to transmit mission-critical-data, such as voltage, power consumption and structural integrity. X-57's goal is to help set certification standards for emerging electric aircraft markets.

Recent ground testing on NASA's first all-electric X-plane, the X-57 Maxwell, successfully demonstrated the aircraft's ability to transmit its telemetry signal, allowing the team the capability to track mission-critical data during flight.

This data will be received on the ground during X-57's flight tests, where it will be monitored in real time by the project team during flight operations and recorded for post-flight analysis to measure X-57's success in meeting its objectives, as NASA seeks to help set certification standards for future electric aircraft.

Completion of this round of tests, which took place at NASA Armstrong, marked continued progress on X-57's functional ground testing phase – a necessary step toward taxi and flight tests.

"We are doing telemetry testing to confirm that we will be able to monitor data on the ground during future flights," said X-57 Deputy Operations Engineering Lead Kirsten Boogaard. "It is important to make sure that everything works on the ground before we begin flight testing, first to ensure the safety of the flight and also to ensure that our mission data will be received by the control room during flights."

This mission data will help NASA researchers validate whether X-57, which is a converted Tecnam P2006T aircraft, successfully meets its "design drivers" – technical challenges to drive lessons learned and best practices. These design drivers include demonstration of an increase in energy efficiency, zero in-flight carbon emissions and flight that is much quieter for communities on the ground.

The success of X-57's ability to meet these objectives will be measured by comparing data from the electric aircraft's future flight tests to the performance of a baseline, combustion-driven P2006T aircraft.

NASA Langley/Advanced Concepts Lab, AMA, Inc

This artist's concept image shows NASA's first all-electric X-plane, the X-57 Maxwell, in its final configuration, flying in cruise mode over NASA Armstrong.

"This is important research data to monitor during flight. We need to be able to track the X-57's position, speed and altitude to see if we're reaching our flight conditions," said X-57 Flight Systems Lead Yohan Lin. "At the same time, the system needs to transmit sensor information such as cruise motor traction bus voltage, current, and propeller speed so that the electric aircraft's performance can be assessed."

Telemetry testing was conducted by establishing a Radio Frequency (RF) link between the aircraft and the downlink equipment of a NASA telemetry van. The X-57's two antennas, a top and a bottom antenna, were tested together first in the flight configuration, and then each antenna individually.

The transmitter was operated by an avionics technician in the X-57 cockpit, based on instructions from the test conductor. The instrumentation engineer and telemetry technician monitored the downlink signal in the van and

Mission, page 8

First flight is a success

Elvia Valenzuela
NASA Armstrong Public Affairs

NASA's first flight of its Systems Integration and Operationalization (SIO) demonstration activities happened April 3 with its partner General Atomics Aeronautical Systems Inc. (GAASI).

The SIO flights are a partnership of the Federal Aviation Administration, GA-ASI and other industry partners to conduct demonstrations of potential commercial applications using different sizes of unmanned aircraft systems (UAS). SIO aims to help accelerate the safe integration of UAS for commercial applications into the national airspace by tackling key challenges that currently prevent routine UAS operations.

GA-ASI's SkyGuardian flew for nine hours from its Gray Butte Flight Operations Facility near Palmdale to Yuma, Arizona, while operated by a remote pilot based at Gray Butte. Data was collected from a GA-ASI-developed Detect and Avoid (DAA) system to provide situational awareness of air traffic near the SkyGuardian.

The DAA system includes a Traffic Alert and Collision Avoidance System (TCAS II) used in manned aircraft that fly in civil airspace and an air-to-air, Due Regard Radar to detect and track nearby aircraft, which may not have active transponders. In the future the DAA system, will allow the remote pilot to "see" and navigate around airborne traffic just like an airborne pilot.

The flight demonstrated ways in which SkyGuardian can be used for a variety of commercial and public services applications using its onboard sensors. Services featured in the SIO flight included inspections of hundreds of miles of rail, power line, communication and canal infrastructure, agriculture monitoring and topological surveys, as well as wildfire and flood monitoring.

Photo courtesy of General Atomics Aeronautical Systems Inc./Ted Carlson

Above, General Atomics Aeronautical Systems Inc. flew its SkyGuardian unmanned aircraft to conduct a NASA Systems Integration and Operationalization demonstration activity on April 3. Below, another view of the flight.

Photo courtesy of General Atomics Aeronautical Systems Inc./Ted Carlson

"NASA's goal to help accelerate routine UAS operations into the national airspace has moved one step closer with this successful flight demo," said Mauricio Rivas, NASA Armstrong UAS integration in the NAS project manager. "Our efforts with General Atomics and our other SIO industry partners will help commercial UAS move closer toward certification."

NASA's role in SIO is to leverage its years of experience in Detect and Avoid (DAA) and Command and Control (C2) research to facilitate discussions, provide technical information, and weigh in all along the way as technology and policy evolve and mature. The goal is to work with industry to help incentivize the creation of C2 and DAA systems that are based on standards that have been informed by years of NASA research under the Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project. DAA and C2 are key systems needed to enable the safe integration of UAS into the NAS.

SIO's other industry partners are Bell and American Aerospace. Both have plans to perform their SIO demonstration activity later on this year. All flight demonstrations will be at altitudes above 500 feet.

NASA plans to document best practices and lessons learned from the SIO activity and provide it to the UAS community to help facilitate industry wide progress toward routine commercial unmanned aircraft operations.

Range... from page 5

will permit the range to manage unique telemetry and video data formats that are new to the center, said Darryl Burkes, Range Engineering branch chief. These formats are new to the center and are needed when the X-59 begins flight testing at Armstrong.

The new capabilities will permit ground processing of data acquired by flight test equipment during the Low Boom Flight Demonstration, he said. That includes real time telemetry data and video.

Also included are modifications and equipment for telemetry and voice coverage of ground operations at Building 703 in Palmdale. That equipment will support early flights of the experimental aircraft at Lockheed Martin Skunk Works, also located in Palmdale.

In addition, Mobile Operation Facility 5, which is a mobile ground control room that has supported Unmanned Aircraft Systems Integration into the National Airspace System flight tests, will be modified to support X-59 ground tests at Lockheed Martin.

Additional upgrades

Range cameras on the ground, long-range optics and ramp area cameras have been updated to high definition. As a result, a new video switch was required to send that video from multiple locations to where it needs it to go.

Another key upgrade is a new mission control system, which is a telemetry processing system. The enhancements will help the center meet customer requirements well into the future.

"We have spent millions updating all of the systems including such items as new UHF/VHF radios in our comm facility," Ackeret said. "The ones we had were 40 and 45 years old. Updating the video router is in progress, putting a high def camera on one of our radars, the new video switch and modifying antennas to accept C-band telemetry are going to enhance our capabilities."

AFRC2019-0130-11 NASA/Lauren Hughes

Kevin Knutson sits at a station in the main Blue Control Room at NASA Armstrong.

The C-band antenna enhancements are a response to changes in bandwidth availability and the range's efforts to take advantage to newly available aeronautical bandwidth. The range will continue to upgrade and modify to meet customer needs.

"We are ready to fly when they want to fly," Ackeret said.

Mission... from page 6

was able to confirm that the data messages were being received as expected.

Among the data monitored throughout the tests, the X-57 team specifically looked at RF power. This measurement allowed engineers to observe the signal strength of the overall transmission. The team also looked at the bandwidth and center frequency of the signal pattern to determine if the system is operating within the bounds of the allocated frequency range.

The testing indicated no major anomalies in the X-plane's ability to transmit data.

"This checkout verifies that we are operating at the right specifications," said Lin. "The next step will be functional testing of the cruise motors at high voltage and we'll be monitoring certain critical parameters using this telemetry system."

As X-57 Operations Engineering Lead Michael Quinton points out, this functional ground testing phase was indicative of things coming together over multiple areas for the X-plane and was a big step in leading toward taxi and flight tests.

"One of the best parts of our recent testing was getting an opportunity for all of our discipline engineers and technicians to come together, and support a single, real-time event."

The X-Press is published the first Friday of each month for civil servants, contractors and retirees of the NASA Armstrong Flight Research Center.

**Address: P.O. Box 273,
Building 4800, MS 1422
Edwards, California, 93523-0273
Phone: 661-276-3449
FAX: 661-276-3167**

**Editor: Jay Levine,
Logical Innovations, ext. 3459**

Managing Editor: Steve Lighthill, NASA

**Chief, Strategic Communications:
Kevin Rohrer, NASA**

National Aeronautics and Space Administration

NASA Armstrong Flight Research Center
P.O. Box 273
Edwards, California, 93523-0273

Official Business
Penalty for Private Use, $300