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Bell Textron Inc.

The Bell Textron Inc. APT 70 Unmanned Aircraft System flew for 10 minutes from Bell's facility on Floyd Carlson Field, near Fort Worth, Texas, on Sept. 28. It was the second flight for NASA's Systems Integration and Operationalization demonstration. See story on page 2.

UAS could transport vital organs, blood

Urgent medical transportation simulated in SIO demonstration

By **Teresa Whiting**

NASA Armstrong Public Affairs

A vision of what future critical medical response could look like was simulated on NASA's second flight of the Systems Integration and Operationalization (SIO) demonstration Sept. 28 with partner Bell Textron Inc.

The SIO demonstration activity is a partnership with the FAA and industry partners to conduct demonstrations of potential commercial applications using different sizes of unmanned aircraft systems (UAS). SIO aims to accelerate the safe integration of UAS for commercial applications into the National Airspace System by tackling key challenges UAS operations face.

The Bell Autonomous Pod Transport 70 (APT 70) UAS flew for 10 minutes from Bell's facility on Floyd Carlson Field, near Fort Worth, Texas. The aircraft was operated by a remote pilot based at the ground control station.

Bell used the APT 70 to conduct a flight representing an urgent medical transport mission. It is envisioned in the future that an operational APT 70 could provide rapid medical transport for blood, organs and perishable medical supplies (payloads up to 70 pounds). The APT 70 is estimated to move three times as fast as ground transportation.



Bell Textron Inc.

Bell Textron Inc. used the remotely-piloted APT 70 to conduct a flight representing an urgent medical transport mission Sept. 28. It is envisioned in the future that an operational APT 70 could provide rapid medical transport for blood, organs, and perishable medical supplies (payloads up to 70 pounds). The APT 70 is estimated to move three times as fast as ground transportation.

“This demonstration is a step on the path toward certification of commercial UAS operations,” said Kurt Swieringa, NASA SIO technical manager. “Services such as urgent medical supply transportation can be beneficial to the public and can highlight the positive use cases commercial UAS operations provide.”

The flight path took the APT 70 over the sparsely populated Trinity River and surrounding land near the Dallas Fort Worth International Airport in Class B Airspace, which includes residential areas and highways. Complex coordination

and approvals with the FAA and local authorities was required for the flight to occur.

Bell's subcontractors include Xwing and the University of Massachusetts Amherst's Center for Collaborative Adaptive Sensing of the Atmosphere (CASA). Xwing integrated a multi-sensor Detect and Avoid (DAA) system to allow the pilot on the ground to “see and avoid” other air traffic. This works alongside Bell's Command and Control (C2) system used to communicate with air traffic controllers who are monitoring and directing piloted aircraft. CASA's

displays provide local weather risk awareness and route-based weather alerts. Data was collected from these systems to compare effectiveness to visual observers, which were in place for this demonstration to ensure the safety of the public and the airspace.

NASA's role in SIO is to leverage years of research in DAA and C2 systems to facilitate discussions and provide technical insight as technology and policy evolve.

The goal is to work with industry to help incentivize the creation of C2 and DAA systems based on standards 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 General Atomics Aeronautical Systems Inc. (GA-ASI) and American Aerospace Technologies Inc. (AATI). GA-ASI completed their demonstration activity in April and AATI is expected to follow Bell. 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 increase industrywide progress toward routine commercial unmanned aircraft operations.

Hispanic employees, Spanish-speaking experts sought

NASA's Spanish language communications program is searching for Hispanic employees to highlight, as well as Spanish-speaking subject matter experts for media interviews and other outreach products. People who are interested in collaborating are asked to fill out a questionnaire: <https://forms.gle/vYyynMGWUCfPxpRY6>.

For Spanish speakers, there is a weekly newsletter and the communications program is on Twitter, Instagram, YouTube, Facebook, and ciencia.nasa.gov. Contact María José Viñas (mj.vinas@nasa.gov) for more information.



AFRC2020-0114-1

Steven Lee

NASA Armstrong pilot Troy Asher flew Oct. 9 with photographer Jim Ross Friday and pilot Wayne Ringelberg flew Oct. 10 with videographer Lori Losey in the F/A-18 at the Edwards Air Force Base hybrid Aerospace Valley Air Show.

Virtually inspiring

By Teresa Whiting
Armstrong Public Affairs

NASA Armstrong and Edwards Air Force Base joined forces to present a hybrid Aerospace Valley

Air Show Oct. 9-10. Instead of traveling to Edwards, guests viewed flyovers, some from directly over their home, as the aircraft flew over major Antelope Valley cities.

From home people also were invited to participate virtually on social media and in STEM

Air Show, page 7



AFRC2020-0114-2

Ray Hunting

NASA pilots James Nelson and David Fedors flew Oct. 9 and pilots Donald Broce, Tim Williams and videographer Mike Agnew flew Oct. 10 in the C-20A in the Edwards Air Force Base hybrid Aerospace Valley Air Show.

News at NASA

Cassiday returns to Earth

After 196 days living and working in Earth's orbit aboard the International Space Station, NASA astronaut Chris Cassidy returned from his third space mission Oct. 21, with cosmonauts Ivan Vagner and Anatoly Ivanishin of the Russian space agency Roscosmos.

During this latest mission, Cassidy served as commander of Expedition 63 and welcomed SpaceX Demo-2 crew members Robert Behnken and Douglas Hurley of NASA – the first astronauts to launch to the space station on an American spacecraft from American soil since the retirement of the space shuttle in 2011.

Cassidy and Behnken completed four spacewalks, totaling 23 hours and 37 minutes, to upgrade station batteries. The final spacewalk was the 10th for both astronauts, making them two of only four U.S. astronauts to complete 10 spacewalks. Cassidy now has spent a total of 378 days in space, the fifth highest among U.S. astronauts.

While on station, he contributed to hundreds of experiments, including a study of the influence of gravity on electrolytic gas evolution, which looks at bubbles created using electrolysis. Gravity is a key factor in creating buoyancy for bubbles, so microgravity makes it possible to single out bubble growth and study its effect in processes.

An MQ-9 remotely piloted aircraft flown by 163d Attack Wing pilot Lt. Col. Paul Brockmeier, with sensor operator Master Sgt. Anthony Martinez, views the smoky San Gabriel Mountains of southern California in transit to a fire mission in northern California in August. The 163d Attack Wing is based at March Air Reserve Base in Riverside County, California.

Master Sgt. Gregory Solman



NASA pilot Scott Howe's missions have him seeing the Fire down below

By Jay Levine

X-Press editor

NASA pilot Scott Howe is flying a remotely piloted MQ-9 with infrared cameras that can see through smoke and ash. The live images are overlaid with maps and satellite imagery of California wildfires to give commanders a more complete picture of what they face.

Howe is not flying the Ikhana, a civilian variant of the MQ-9 that was based at NASA Armstrong. This fire season he has often been flying a MQ-9 for the California Air National Guard as they assist with some of the most devastating wildfires in the state's history.

To date the fires have consumed more than 3 million acres and six of the largest 20 fires in California were this year, said Sagar Fowler, a Cal Fire battalion chief. Cal Fire is California's arm of the U.S. Department of Forestry and Fire Protection.



AFRC2016-0143-01

NASA/Carla Thomas

Scott Howe, a NASA Armstrong pilot, assisted with monitoring California's wildfires by operating a MQ-9 remotely piloted aircraft for the California Air National Guard. The MQ-9 closely resembles the Ikhana aircraft, in the background, which Howe had piloted when the aircraft was based at Armstrong.

At the height of operations, there were about 18,700 firefighters battling 27 wildfires, nearly 2,400 fire engines are deployed, 129 aircraft were assigned and more than 360 bulldozers plowed fire lines critical to stopping the fire's movement, Fowler said.

Call of duty

Howe began assisting National Guard wildfire monitoring during the 2018 fire season. He supported a few missions last year and has been very active this year. In fact, for the first time the National Guard has flown as many as three MQ-9 aircraft simultaneously to assist with fires that are located through the entire state.

He flies from a ground station based at March Air Reserve Base in Riverside County in California. In Howe's 13 years with his unit called the Grizzlies, this was the first time the entire unit was involuntarily mobilized. He has tallied about three weeks of flying so far and another eight days on alert since the worst of the crisis began around Labor Day.

The aircraft flies between 20,000-26,000 feet altitude as part of the conditions of

Fire missions, page 7

Space FOSS

Where no FOSS has gone before

By Jay Levine

X-Press editor

A system originally developed to collect strain and other measurements on aircraft has been advanced and its durability enhanced for potential use in space.

Researchers at NASA Armstrong hope to validate the new version of their Fiber Optic Sensing System (FOSS) with four research boxes recently sent to NASA's Langley Research Center in Hampton, Virginia.

Environmental testing will determine if the systems can withstand heat, cold, vibration, pressure and other severe conditions encountered during a rocket flight and if there is potential signal interference. Shock testing, the only part of the work that will not be completed at Langley, will happen at the MGA Research Corp. in Manassas, Virginia, about 160 miles north of the NASA center.

"It will take about four to five months to complete the testing that will start with some functional checkouts of the boxes once they arrive at Langley," said Eric Miller, Armstrong's FOSS project manager.

If it is successful, this enhanced system called the Compact Fiber Optic Sensing System (cFOSS), or the FOSS rocket box, offers the ability to take thousands of measurements along a fiber optic wire about the thickness of a human hair.

Jonathan Lopez, an Armstrong research engineer,



AFRC2020-0102-22

NASA/Ken Ulbrich

NASA research engineer Jonathan Lopez works on preparing a Compact Fiber Optic Sensing System unit, also known as a FOSS rocket box, which was developed at NASA Armstrong. The unit is a new variant of aircraft technology that researchers have advanced to withstand the harsh environments of a rocket launch and space travel.



AFRC2020-0102-35

NASA/Ken Ulbrich

Bolts are torqued on a Compact Fiber Optic Sensing System unit, also known as a FOSS rocket box, which was developed at NASA Armstrong. NASA research engineer Jonathan Lopez prepares the unit for packaging and transport to Langley Research Center in Hampton, Virginia, where it will undergo environmental testing.

completed the final prep of the systems heading to Langley. He installed the box lids, cut foam for each unit to cradle the system and placed the FOSS boxes in separate protective cases for transport. Equipment to facilitate the testing also was sent.

"The FOSS team has spent the last few years designing these systems to ensure they meet and exceed the strenuous requirements performing in a rocket launch environment," Lopez said. "To help ensure this an engineering design unit was integrated and put through pre-environmental testing here last year. It is a great feeling to finish the integration process of the FOSS space flight units."

The engineering design unit is a fifth box that will stay at Armstrong and will not be sent for environmental testing, he explained. That unit that will fly on a future Blue Origin New Shepard rocket through NASA's Flight Opportunities program. The space FOSS experiment will travel as a self-contained experiment on the suborbital rocket and measure strain and temperature with the payload in a locker on the vehicle.

Lopez and Allen Parker, Armstrong FOSS senior research engineer, will travel to and from Langley to assist in the integration, operation, data collection and any trouble-shooting challenges that arise.

Of the four systems sent to Langley, one is a qualification box that will be put through extremes

Space FOSS page 6

Space FOSS... from page 5

beyond what any system would experience in use, Miller said. The other three boxes will be put through more standard requirement testing of the conditions the units would experience in flight.

One of three space flight rated boxes will go on the Low-Earth Orbit Flight Test of an Inflatable Decelerator (LOFTID).

The space-rated FOSS will measure distributed temperatures on the backside of the LOFTID aeroshell that is anticipated to launch in 2022. Measuring those temperatures will give engineers a thermal map of how the decelerator heats up. The inflatable aeroshell, which is less rigid than a traditional heat shield, is designed to decelerate and protect heavy payloads from the intense heat of atmospheric re-entry.

The remaining two space-rated boxes will support the Launch Services Program (LSP) at NASA's Kennedy Space

Center in Florida in partnership with United Space Alliance on flights of its Vulcan rocket.

Future applications of the technology could include monitoring spacecraft systems during missions to the Moon and landings on Mars.

One FOSS is rated for use in space, the Advanced Cislunar and Surface Capabilities (ACSC) enhanced tempFOSS sensor could be considered for use on future Artemis missions to monitor extreme distributed cryogenic fuel temperatures.

Because launch vehicles have a number of different thermal and mechanical subsystems, Parker explained, the team envisions a FOSS system that will provide a number of measurements on the cryogenic tanks, not just on the outside of the tank but possibly also on the inside to measure fuel level.

Armstrong researchers are working on the effort with a team at NASA's Glenn Research Center in Cleveland.

"We just completed a sync review



AFRC2020-0102-48

NASA/Ken Ulbrich

NASA research engineer Jonathan Lopez secures a Compact Fiber Optic Sensing System unit, also known as a FOSS rocket box, which was developed at NASA Armstrong.

and the plan is for the testing to be next summer," Miller said. "The prototype testing will be at Glenn. We will fabricate some cryogenic sensors and complete some initial checkouts at Armstrong and then we will integrate those sensors into their test set up this spring for testing in the summer."

Much of the technology effort to advance FOSS for use on rockets was funded by the Space Technology Mission Directorate's Center Innovation Fund. In addition, LSP and LOFTID also have provided funding in support of the FOSS rocket box development.

Air show... from page 3

engagement activities. In Spanish and English, NASA's California Office of STEM Engagement partnered with Edwards Air Force Base's 412th Test Wing STEM Outreach Program and the Air Force Research Laboratory to present STEM-focused virtual lessons and hands-on activities for students.

At the beginning of each lesson a subject matter expert from the Air Force, NASA and other aerospace organizations spoke about his or her job. Topics such as NASA's Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) project and several Air Force test programs were presented to students of various age levels.

"This educational partnership is extremely important for our STEM community," said Monica Uribe, NASA education specialist. "The program acts as a bridge between educators, students and their families to receive engaging hands-on activities and content knowledge. Our hope is to inspire students from a young age to pursue a career in STEM."

NASA Armstrong aircraft including the C-20A, the ER-2 and an F/A-18 graced the Antelope Valley skies alongside Air Force aircraft during the event. Families were able to see STEM lessons come to life during flights of various types of aircraft overhead incorporating the four main focus points educators often consider: kinesthetic (moving),



AFRC2017-0068-123

NASA/Ken Ulbrich

Howard "Dean" Neely piloted the NASA ER-2 in recent air show.

visual (seeing), auditory (hearing) and tactile (touching). The goal is to inspire the next generation of engineers and aviators in the Antelope Valley and beyond.

Fire missions... from page 4

a certificate of authorization (COA) with the Federal Aviation Administration granted to fly the missions. That process and early fire mission demonstrations were assisted by NASA Armstrong and the now retired remotely piloted Ikhana during the 2006 Western States Fire Mission.

His most intense experience this summer was supporting the Bobcat fire in the San Gabriel Mountains.

“The fire looked like a claw, or a tiger paw stretching south out of the mountains right up to a neighborhood in the Azusa area. “It literally was right in the backyard of these homes. It seemed like there was a firetruck parked in everyone’s driveway, every single home, ready to do whatever it took to defend each house. I really felt the urgency of what we were doing.”

Howe and his unit give fire commanders vital information about the fire’s hot spots and provide maps of the fires to strategically protect people, firefighters and property. His unit has another important job.

“There’s also the side benefit of noticing if a floating ember started a new spot fire way off that nobody has caught,” he explained.

Feeling the heat

During the El Dorado fire that was in the Oak Glen (in San Bernardino, California) area he barely believed the convective heat coming from the fire and how tall the flames were. Howe also observed the grit and bravery of the firefighters.

“I saw fire trucks parked at the bottom of this steep slope on a fire access road,” he said. “Firefighters had hiked hose sections uphill hundreds of feet in elevation in rugged terrain toward the fire.”

Howe saw a number of examples of how fast a fire moves when he was observing the Zogg



Master Sgt. Gregory Solman

An MQ-9 remotely piloted aircraft flown by 163d Attack Wing pilot Lt. Col. Paul Brockmeier, with sensor operator Master Sgt. Anthony Martinez, views the smoky San Gabriel Mountains of southern California in transit to a fire mission in northern California in August.

fire near Redding and Eureka in Northern California.

“If there is a small smoldering fire, sometimes those trees may have enough moisture where they don’t easily burn,” he explained. “However, when you get to the hottest part of the fire, the flames are three times higher than the tallest pine trees.”

That’s why he said evacuation orders are important.

“The fire also can move in a straight line, whereas the roads are confined to the twisty layout of

the terrain. When an evacuation order is given, it can’t be predicted if a person waits if he or she might find their escape route cut off by the fire. When it gets to that intense state, there’s not much you can do.”

Howe’s schedule

Because of the need for more missions, Howe had more responsibility this fire season flying portions of the missions in addition to the takeoff and landing support.

“I was able to see all aspects of the mission,” he said. “There are so many fires, so spread out through the entire state, separated by 100s of miles,” Howe said.

The Cal Fire team schedules a day in advance so when pilots start their shifts, they know where they are going.

“The big work for the pilot is not just putting the aircraft in a good position looking at a particular fire with the way the terrain can mask things, which is what you are doing when you are on station, when they need you to move, you have to build a whole flight plan and clearance to move that aircraft to a new location.”

Multiple target areas are slated for the two to three hour block. The shifts are nine hours and have a day, mid shift and swing shift. He reports for his shift an hour before he is scheduled to complete paperwork to fly, monitor feeds from the aircraft and attend the mission briefing including fires updates and statewide weather.

The pilots are assigned to a ground cockpit and given the mission assignment. Once seated in the ground cockpit, Howe usually can remove his mask required when people can’t socially distance. A plexiglass barrier between him and the sensor operator he is paired with in the other seat, receive an update briefing and the pilots switch seats when it is their opportunity to fly.

“We continue to update information as we go,” he added. “We have a white board next to each of the stations so that it is easy to track the mission and use that information to brief the next flight crew.”

Usually a rest period follows to get something to eat, check emails and complete office work. Typically, a pilot will fly two blocks during a nine hour shift if the unit is busy.

Regardless of the task, Howe is ready to help.

SOFIA undergoes scheduled maintenance

The Stratospheric Observatory for Infrared Astronomy, SOFIA, departed for scheduled maintenance at Lufthansa Technik's facility in Hamburg, Germany, on Sept. 29.

Lufthansa Technik's 747SP specialists will perform scheduled inspections and maintenance in coordination with flight, aircraft and scientific personnel from NASA Armstrong and NASA Ames Research Center, which is located in California's Silicon Valley. Scheduled maintenance such as this is required for all aircraft, much like the regular servicing of cars. Staff from the German SOFIA Institute (DSI) will also perform upgrades to the flying observatory's telescope. The maintenance is expected to be completed early next year.

SOFIA is a Boeing 747SP jetliner modified to carry a 106-inch diameter telescope. It is a joint project of NASA and the German Aerospace Center, DLR. Ames manages the SOFIA program, science and mission operations in cooperation with the Universities Space Research Association headquartered in Columbia, Maryland, and the German



NASA

SOFIA arrived in Germany for scheduled maintenance in September.

SOFIA Institute (DSI) at the University of Stuttgart. The aircraft is maintained and operated from Armstrong's Hangar 703 in Palmdale.

Foster, quality assurance chief, dies at 60

Steve Foster, NASA Armstrong's Quality Assurance branch chief, died Oct. 1. He was 60.

Foster had worked at the center for nearly a decade. Before his current post, Foster was a quality assurance specialist. In that job he was instrumental in the development of a program to detect counterfeit parts that was a model for the agency. He also helped write and edit several NASA quality assurance policies.

People who knew him said he

loved to golf and to make people laugh. He was artistic, caring, compassionate, musically talented, outgoing and had a quick wit. He also was known for his luck and his fun-loving personality.

Carol-Ann Thomas, who works in Armstrong procurement quality assurance, said Foster always talked to people and participated in center events.

"Steve was tremendously generous," Thomas said. "He was a very giving person who was always willing to contribute to fundraisers, office parties or collections we

were gathering. When there was a need, Steve would quietly assure the need was filled. He always wanted to make sure that it was done anonymously."

Glenn Graham, Armstrong Safety and Mission Assurance director, said Foster will be missed.

"Steve was a good leader who genuinely cared about the welfare of all those he supervised and who worked every day to help his people be the best," Graham said. "He was a big believer in self-improvement and in helping

anyone who needed or desired help."

Foster served in the U.S. Air Force for 27 years. He initially was a jet engine mechanic, then transitioned to become an aircraft crew chief and eventually became a master of all aspects of aircraft maintenance. During his career he worked on A-10, B-52, F-4, F-5, F-15, F-16, KC-135, T-6, T-37 and T-38 aircraft and engines. He served in Desert Storm in 1990-1991 and received many medals and commendations for his service.

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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

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