



THE ARMSTRONG X-PRESS

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UAS

Integration in the

NAS

Flights expected to lead to rule changes for unmanned aircraft, new economic opportunities

By Jay Levine
X-Press editor

NASA's Unmanned Aircraft Systems Integration in the National Airspace System, or UAS in the NAS, project is attracting international attention as increasingly complex flight tests take place over Armstrong.

Two events at Armstrong June 29 and July 13 gave industry, the Federal Aviation Administration (FAA) and international entities updates about how that work – which is meant to enable UAS to gain routine access to the NAS where commercial aircraft fly – is progressing.

To do so, the project is working with industry, academia and other government agencies to develop recommendations for the FAA to safely open the skies to allow UAS to fly in the same airspace with human-piloted aircraft and enable new economic opportunities.

“The technical focus of the UAS Integration in the NAS project is on detecting and avoiding other aircraft, command and control of the aircraft and human factors such as how to arrange the displays to maximize the pilot’s ability to make decisions,” said Robert Sakahara, Armstrong’s acting UAS



AFRC2017-0148-70

NASA/Carla Thomas

The Ikhana remotely piloted aircraft flies a research mission for the Unmanned Aircraft Systems Integration in the National Airspace System project.

Integration in the NAS project manager.

Using NASA’s remotely piloted Ikhana aircraft as a demonstration platform, attendees to the July 13 event viewed on a screen what the aircraft’s ground cockpit instrumentation looked like during a flight test.

One of the Ikhana displays showed the surrounding airspace as it flew. When its airspace was broached by another airplane, the cockpit displays presented the Ikhana pilot with alerts and information about how to respond to the intruder.

The flight was one in a series of flight tests at Armstrong that began in June and is continuing into August. During that test, the Ikhana dealt with 21 intruder encounters, each one different from the others.

Flight tests still to come will generate information that will be helpful in developing UAS-related standards for use with a new Airborne Collision Avoidance System that will support the FAA’s Next Generation Transportation System.

Earlier, on June 29, the UAS in the NAS project hosted commissioners

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F-18 bringing the boom to Florida

By Matt Kamlet

Armstrong Public Affairs

NASA's research to advance supersonic flight will take wing over the launch site for the agency's storied space program in August.

Teams and aircraft from Armstrong and Langley Research Center in Virginia, two of the agency's centers that conduct extensive aeronautical research, will deploy to Kennedy Space Center in Florida for a nearly two-week flight series campaign.

The historic spaceport will play host to the second series of Sonic Booms in Atmospheric Turbulence flights, or SonicBAT, continuing from 2016's successful supersonic research flights flown at Edwards Air Force Base.

SonicBAT helps NASA researchers better understand how low-altitude atmospheric turbulence affects sonic booms, which are produced when an aircraft flies at supersonic speeds, or faster than the speed of sound. The upcoming flight series is a key initiative in validating tools and models that will be used for the development of future quiet supersonic aircraft, which will produce a soft thump in place of the louder sonic boom.

"In SonicBAT, we're trying to figure out how much atmospheric turbulence changes sonic booms," said Ed Haering, SonicBAT's principal investigator at Armstrong.

The initial series of SonicBAT flights provided NASA with data on the effect of atmospheric turbulence on sonic booms in a dry climate. The upcoming flights will continue that effort by collecting data in the same fashion to measure the effect of the humid climate of Florida.

"Turbulence can make sonic booms quieter, or it can make them louder. Last summer we tested in the hot, dry climate of Edwards Air Force Base. We know that humidity can make sonic booms louder, so we need to test some place wetter and Kennedy fits that bill," Haering said.

Sonic boom signature data will



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NASA/Ken Ulbrich

An F-18 research aircraft, like the one pictured here, is scheduled to produce sonic booms over Kennedy Space Center. The sonic booms will be recorded by equipment in the air and on the ground, providing NASA researchers with data to help them better understand the impact of atmospheric turbulence on sonic booms.



NASA/Lockheed Martin

NASA is working to develop an experimental airplane called the Low Boom Flight Demonstration aircraft, which will be capable of traveling at supersonic speeds without producing a loud, disruptive sonic boom.

be collected from these tests using audio equipment to capture noise levels both above and below the turbulence layer, which will provide a comparison of the sonic boom both before and after it travels through atmospheric turbulence.

To do this, a NASA Armstrong F-18 will take off from Kennedy's Shuttle Landing Facility and fly off the coast of Cape Canaveral at an altitude of 32,000 feet. The F-18

will fly a designated flight path where it will exceed Mach 1, the speed of sound, and produce a sonic boom.

Meanwhile, NASA also will fly a TG-14 motorized glider, equipped with a wingtip microphone, at an altitude between 4,000 to 10,000 feet, which is above the low-altitude turbulence layer. At the test point, the TG-14 will temporarily shut down its motor

and glide. This will eliminate any unnecessary noise, ensuring that the wingtip microphone will pick up a clean, accurate sonic boom signature before it travels through any turbulence.

To collect signatures of sonic booms that travel through the turbulence layer NASA and partners Wyle Laboratories and Gulfstream Aerospace will arrange two microphone arrays on the ground at Kennedy, each with 16 microphones to collect data.

The project aims to collect data in three different conditions, including low turbulence, medium turbulence and significant turbulence, to obtain a stronger understanding of how the variations impact sonic booms. To monitor these conditions, NASA meteorologists will be on-site using anemometers to measure wind speed, a sonic wind profiler to measure wind conditions at low altitude and a flux sensor to measure changes due to humidity.

NASA is expecting to fly the F-18 two-to-three times per day, starting Monday, Aug. 21 and will conclude the end of the month or early September, focusing on collecting data on a targeted minimum of 33 sonic booms.

While communities nearby Kennedy and Cape Canaveral Air Force Station may be able to hear traces of the sonic booms being produced over the NASA center, Haering said residents have no reason to worry.

"At the altitudes we are flying, sonic booms from aircraft have never been dangerous to people, animals or buildings, but they can be startling," said Haering. "We have carefully planned our flights so that there is little chance that people in larger communities such as Titusville to the west, or Cocoa Beach to the south, will be disturbed. Residents might hear a distant sound similar to a rumble of thunder. If the actual winds at the time of our tests are

Banks awarded scholarship

The NASA Armstrong Employee Exchange Council presented its 2017 John W. Russell Memorial Scholarship Award to Sean Banks Aug. 1.

Banks is a 2017 graduate of Rio Americano High School in Sacramento, California, who plans to major this fall in nuclear engineering at the University of California, Berkeley. Banks earned a 4.53 grade-point average, was a valedictorian and ranked third academically at his high school out of a class of 378 students.

The scholarship provides \$2,000 per year for up to four years for attendance at a four-year college or university, providing the recipient maintains a minimum grade-point average of 3.0 or higher. Applicants for the annual scholarship must be high school seniors with a parent working at Armstrong.

"I am excited about the award and the energy field," Banks said. "Nuclear energy is an up and coming career field." He is the son of Daniel and Lorna Banks of Carmichael, California. Daniel Banks is the NASA Armstrong technical lead for the Flight System Research Theme of



AFRC2017-0101-1

NASA/Ken Ulbrich

Sean Banks, second from left, accepts the 2017 NASA Armstrong Exchange John W. Russell Memorial Scholarship from Center Director David McBride. Next to Banks are his parents Dan Banks and Lorna Banks.

the Overland Supersonic Transport sub-project of the Commercial Supersonic Transport (CST) project.

"There were a lot of deserving people considered for the scholarship and we are really happy for Sean," his father said.

"He went to a very competitive

high school and worked really hard," his mom added.

In addition to excelling in advanced placement (AP) and honors classes, Sean Banks was heavily involved in numerous school and community activities,

Scholarship, page 8

Painting celebrates centennial

Armstrong Director David McBride presented this Nixon Galloway painting "Airspeed Breakthrough" to NASA Langley Director David Bowles at Langley's Centennial Gala in July. The painting celebrates the National Advisory Committee for Aeronautics (NACA, precursor to NASA) cowling research at NASA's Langley Research Center in Virginia (then the Langley Memorial Aeronautical Laboratory). The Curtiss AT-5A Hawk cowling flights resulted in the agency's first Collier Trophy in 1929 for improving engine cooling and reducing drag. Galloway, a well-known and respected aerospace artist passed in 2003.



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NASA/Ken Ulbrich

News at NASA

Stratosphere idea is solid

Scientists have discovered evidence for a stratosphere on a planet outside our solar system, or exoplanet. A stratosphere is a layer of atmosphere in which temperature increases with higher altitudes.

"This result is exciting because it shows that a common trait of most of the atmospheres in our solar system—a warm stratosphere—also can be found in exoplanet atmospheres," said Mark Marley, study co-author based at NASA Ames Research Center. "We can now compare processes in exoplanet atmospheres with the same processes that happen under different sets of conditions in our own solar system."

Reporting in the journal *Nature*, scientists used data from NASA's Hubble Space Telescope to study WASP-121b, a type of exoplanet called a "hot Jupiter." Its mass is 1.2 times that of Jupiter, and its radius is about 1.9 times Jupiter's—making it puffer. But while Jupiter revolves around our sun once every 12 years, WASP-121b has an orbital period of just 1.3 days. This exoplanet is so close to its star that if it got any closer, the star's gravity would start ripping it apart. It also means that the top of the planet's atmosphere is heated to a blazing 4,600 degrees Fahrenheit (2,500 Celsius), hot enough to boil some metals. The WASP-121 system is estimated to be about 900 light years from Earth—a long way, but close by galactic standards.

The new study presents the best evidence because of the signature of hot water molecules that researchers observed for the first time.

Oshkosh: One of the world's largest aviation events impresses

NASA supported the Experimental Aircraft Association AirVenture in Wisconsin July 24-30 and the more than 550,000 visitors from more than 80 countries that attended.

Armstrong contributed to the NASA exhibit that included an entire pavilion of displays and hands on activities at Aviation Gateway Park, numerous NASA speakers at AirVenture Forums, and a Theatre in the Woods program July 27 featuring senior leaders from four NASA research centers, including Armstrong Center Director David McBride, talking about X-plane development and traffic management for unmanned aircraft systems (UAS).

On the flight line, NASA static aircraft displays included a NASA T-38 Talon aircraft – used for astronaut training – a NASA SR-22 research aircraft and a former National Advisory Committee for Aeronautics (NACA) P-63 aircraft.

During AirVenture's Theater in the Woods, NASA Acting Chief Technologist Douglas Terrier moderated "New Aviation Horizons: Ready for Flight." The interactive panel included Tom Edwards,



NASA/Matt Kamlet

Douglas Terrier, left, led a panel at AirVenture including from his left, Tom Edwards, David McBride, Janet Kavandi and Dave Bowles. The panel discussed experimental aircraft and the air traffic management system.

deputy center director for NASA's Ames Research Center; McBride, Janet Kavandi, center director for NASA's Glenn Research Center and Dave Bowles, center director for

NASA's Langley Research Center. The focus of the presentation was the latest work on technologies involved with experimental aircraft and with testing traffic

management systems for UAS.

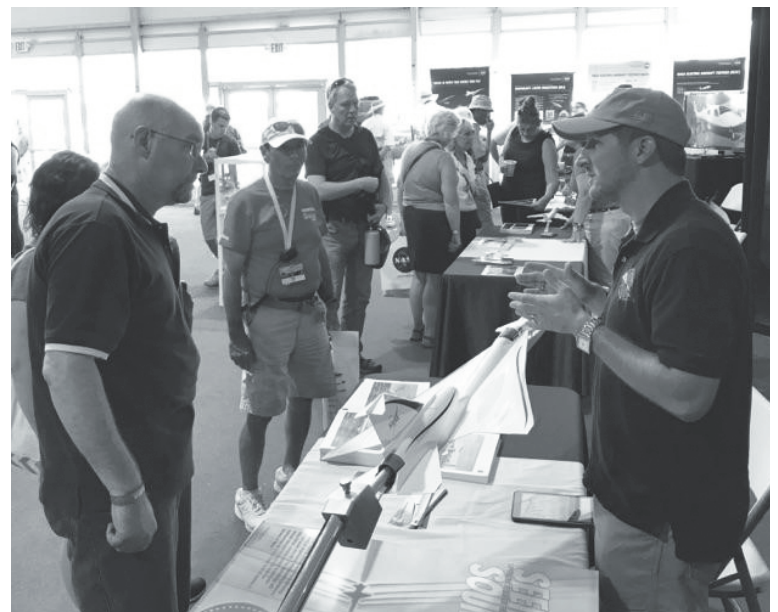
Armstrong subject matter experts included:

AirVenture, page 5



NASA/Matt Kamlet

Sean Clarke does a radio interview on the X-57 experimental aircraft.



NASA/Matt Kamlet

Thomas Jones, right, talks about NASA's supersonic flight research.

Students learn as they fly

Emily Schaller

Science and Communications Project Manager
National Suborbital Research Center

This summer 32 undergraduate students are participating in an eight-week NASA airborne science field campaign designed to immerse them in the agency's Earth science research.

NASA's Student Airborne Research Program (SARP), now in its ninth year, provides a unique opportunity for undergraduate students majoring in science, mathematics or engineering fields to participate in a NASA airborne science research campaign. Students use the aircraft as high-altitude platforms for making observations, gathering remote-sensing data, as well as directly sampling the air where the plane is flying. NASA uses airborne data coupled with global satellite observations as well as ground-based data for a better understanding of the complete Earth system.

Hosted by Armstrong, SARP began June 19 with lectures by university faculty members, NASA scientists and program managers. For the first time this summer, three different NASA aircraft from two NASA centers (Armstrong and NASA Langley Research Center in Virginia) and NASA's Wallops Flight Facility, will be used to collect data for the program. The aircraft, a C-23 Sherpa, UC-12B King Air, and ER-2, all have different operating characteristics in terms of altitude, range, and payload and together provide a complementary set of observations. All three aircraft will be based in California for the research flights.

Students flew onboard either the NASA C-23 Sherpa or the NASA Langley UC-12 King Air June 26 and 27. They assisted in the operation of scientific instruments onboard the aircraft that sample and measure atmospheric gases and gauge air quality in the Los Angeles Basin and in California's Central Valley. The Sherpa aircraft flew over dairies, oil fields and crops in the San Joaquin Valley in addition to parts of Los Angeles at altitudes as low as 1,000 feet to collect data. The King Air flew higher at 28,000 feet to remotely sense atmospheric gases.

The students also used remote-sensing data collected by instruments onboard NASA's high-altitude ER-2 aircraft to study the response to drought on vegetation and changes in the ocean biology along the California coast. In addition to airborne data collection, students took measurements at field sites near Santa Barbara and Sequoia National Forest. These ground-based measurements will be used for calibration and validation of measurements taken by the aircraft teams and will also serve as a complementary data set for students to use for their individual research projects.

The final six weeks of the program took place at the University of California Irvine, where students analyzed and interpreted data collected



Megan Schill/Megan Schill Photography

Fred Okafor, Jacklyn Hallett and Nicole Cosenza listen to Life Support technician Wason "Haku" Miles explain the components of the ER-2 pressure suit.

aboard the aircraft and in the field. From this data analysis, each student developed a research project based on his or her individual area of interest. In addition to the new data collected, students can use data gathered by SARP participants during the previous eight years of the program to compare with current observations.

At the end of the program, each student presented his or her results and conclusions to an audience of NASA scientists and managers, university faculty members and fellow SARP students. Many students go on to present their SARP research projects at national conferences.

Students are mentored by scientists and engineers from NASA Headquarters in Washington D.C., NASA Langley, NASA Wallops, NASA Goddard Space Flight Center in Maryland and NASA Ames Research Center in California. Additional mentors are university faculty members, postdoctoral researchers and graduate students from University of California Irvine, University of California at Santa Barbara, University of California Santa Cruz, the University of Virginia, the University of Houston and Rutgers University in New Jersey.

Students who participated in the 2017 SARP represented 31 different colleges and universities from 21 different states. They were competitively selected from hundreds of applicants based on their outstanding academic performance, future career plans and interest in Earth system science.

AirVenture... from page 4

• **Sean Clarke** with an update on NASA's X-57, which is an experimental aircraft designed to demonstrate radically improved aircraft efficiency enabled by a new, optimized wing and electric propulsion.

• **Cam Martin** spoke on the Bell X-1 rocket-powered research aircraft "Glamorous Glennis" piloted by then Capt. Charles. E.

"Chuck" Yeager that made the first supersonic flight 60 years ago Oct. 14, 1947.

• **Heather Maliska** discussed what NASA is doing to support research, simulation, flight tests and validation of technologies that can help safely integrate UAS into the National Airspace System.

• **Paul Newton** recalled his experiences flying a wide range of

experimental research and scientific sensor platform programs on aircraft ranging from the T-34C, F-18 and F-15 to the Gulfstream III and Boeing 747.

• **Thomas Jones** detailed that the NASA Commercial Supersonic Technology (CST) Project has completed a preliminary design for a Low-Boom Flight Demonstration experimental airplane. The aircraft

is designed to generate shock waves that create a soft thump rather than the disruptive boom currently associated with supersonic flight.

• **Michael Hill** explained that as part of the effort to realize quiet supersonic flight, NASA researchers have been developing technology that allows visualization of sonic booms caused by shockwaves emanating from supersonic aircraft in flight.

KORUS-AQ researched air pollution

Steve Cole

NASA Headquarters

For six weeks in the summer of 2016 scientists from the United States and the Republic of Korea intensively studied air pollution over the Korean peninsula. Their mission: to diagnose the complex causes of the country's poor air quality and in so doing lay the groundwork for next-generation pollution monitoring from space that both nations plan to launch in the next few years.

Initial scientific results from the joint NASA-Korean field campaign released in July identified several strategies to reduce ozone and particulate matter levels in the Seoul metropolitan area and rural sections of the country. Seoul is one of the world's five most populated urban areas.

Scientists from NASA and South Korea's National Institute of Environmental Research (NIER) presented findings from the Korea-United States Air Quality study (KORUS-AQ) to representatives of the Ministry of Environment at a scientific briefing in Seoul. The analysis will inform South Korean policymakers developing air quality strategies and identifying specific emission sources.

The 2016 KORUS-AQ field experiment targeted May and June, a time of year when local sources of pollution typically dominate South Korea's air quality. During these months pollution from East Asia and China travels less frequently over the Korean peninsula due to weather conditions. The scientists collected data from space, sea, land and air. Airborne sampling was accomplished using two NASA instrumented aircraft: the DC-8 that is housed at Armstrong and the B-200 based at NASA's Langley Research Center in Virginia. A third aircraft that participated was from Hanseo University, Seosan.

Reducing ozone pollution and harmful fine particles in the air could be achieved by cutting emissions of



NASA

NASA and South Korea used research aircraft for an intensive study in and around the Seoul metropolitan area in 2016 to address the country's poor air quality and lay the groundwork for next-generation pollution-monitoring satellites.

nitrogen oxides and volatile organic compounds, the study found. Ozone at ground level is formed by chemical reactions between these gases in the presence of sunlight. These same gases also played a dominant role in the chemical formation of fine particulate matter, accounting for roughly half of the observed concentration. Overall, more than three-quarters of the particulate matter measured during the study was formed by secondary chemical reactions rather than being directly emitted from smokestacks or tailpipes.

"It's an encouraging result to see there is a clear overlap in the sources that need to be targeted to improve both fine particle and ozone pollution," said James Crawford, lead U.S. KORUS-AQ scientist from Langley.

Emissions from cars and trucks are one of the major sources of nitrogen oxides, according to the study, and industrial solvents, particularly toluene, were identified as the dominant volatile organic compounds contributing to the formation of ozone and particulate

matter.

Key sets of detailed measurements collected during KORUS-AQ of air chemistry and pollution over Seoul, from the surface to a height of 28,000 feet, are also being analyzed by NASA and Korean scientists working on new space missions that will for the first time measure air pollution hourly from geostationary orbit more than 22,000 miles away. These Earth-observing satellites will use reflected sunlight to detect certain pollutants throughout the atmosphere reaching miles above the surface. Determining how much of a target pollutant is at ground level where people live and breathe is a continuing challenge. Analysis of the KORUS-AQ data

sets will help scientists learn how to better tease out these details from space.

NASA and South Korea are both preparing air quality satellite missions for launch to geostationary orbits within the next five years. First will be the NIER Geostationary Environment Monitoring Spectrometer (GEMS), followed by NASA's Tropospheric Emissions: Monitoring of Pollution (TEMPO) instrument. TEMPO will make accurate hourly daytime measurements of tropospheric pollutants – ozone, nitrogen dioxide, sulfur dioxide, formaldehyde and aerosols – over the United States, Canada and Mexico. GEMS will provide similar data over East Asia.

Peer awards nominations open

The 2017 Armstrong Peer Awards nomination period will open Aug. 1 for nominating colleagues for the exceptional efforts they contribute to Armstrong and NASA. The nomination period continues until Sept. 7. Winners will be announced at a ceremony in the ISF Nov. 9. Additional information, as well as the nomination form, can be found at: <http://xnetapps.dfrc.nasa.gov/PeerAwards/>

For questions, please contact Robbin Kessler at ext. 3761.

Peebles, former oral historian, dies at 62

Curtis Peebles, a former oral historian, writer and editor in the NASA Armstrong (then Dryden) History Office, died Sunday, June 25. He was 62.

Beginning in 2000, Peebles for more than a decade served in the history office. He also had published a number of books outside of NASA, including with the Smithsonian Institution, the Naval Institute Press and the American Institute of Aeronautics and Astronautics.

Peebles also was considered an authority on debunking Unidentified Flying Object sightings and incidents.

He wrote or edited a number of books and articles on topics including NASA lifting body aircraft, the NASA Space Shuttle Program,

National Advisory Committee for Aeronautics (precursor to NASA) aircraft, the X-43 Hypersonic aircraft and edited two books on the recollections of Dryden pioneers.

Peebles also was the driving force behind the successful effort to have the International Astronomical Union name a minor planet, sometimes called an asteroid, after each of the X-15 pilots. The X-15 was a successful rocket-powered aircraft that recorded 199 flights, reached the edge of space and developed a wealth of information for space flight.

People who worked with Curtis said they respected him as a historian and will miss his kindness and his humorous aerospace history stories.



Courtesy of Cameron Law

Friendly competition

NASA Armstrong had 74 participants in a Team Edwards competition against California aerospace entities. The team finished eighth out of 23 teams. The events included building a human pyramid, as seen above, and a host of events such as tug of war, dodgeball, volleyball, sand soccer, watermelon eating, relay racing, balloon toss and can drive. Space X won the overall competition and Team Edwards was just three points behind Lockheed Martin for seventh place.

Boom... from page 2

much different from predicted, they might hear a boom sound like those heard when the space shuttle landed. That may be startling, but there is no reason to be alarmed."

Due to the flight path of the F-18 being taken over the Atlantic Ocean east of the Space Coast, some publicly accessible beaches to the north of Kennedy that are part of the Canaveral National Seashore will be able to hear the sonic booms louder than other surrounding areas.

Sonic booms can be heard as the result of shockwaves created by aircraft flying through the atmosphere faster than the speed of sound. The Federal Aviation Administration, or FAA, currently prohibits supersonic flight over land due to previously flown supersonic aircraft and their associated loud, disruptive sonic boom.

Decades of NASA research in supersonic flight, however, has now resulted in a unique aerodynamic design and technological advances for an aircraft that will mitigate the

sonic boom, making it considerably quieter.

In February 2016, NASA awarded a contract to Lockheed Martin for a preliminary design of a quiet supersonic X-plane called the Low-Boom Flight Demonstration aircraft, or Lbfd. This effort recently completed a successful preliminary design review, and NASA will soon initiate the next phase of the Lbfd concept through a new contract competition.

This second phase will focus on the detailed design and fabrication of the aircraft. When completed, the goal will be to fly the X-plane over communities throughout the country to test and demonstrate a quiet sonic thump. These flight tests will also provide data to the FAA for the development of potential noise standards for future supersonic flight over land.

If the FAA establishes that new sound standards based on the sonic boom research have

become acceptable to the public, commercial flights that can carry passengers at supersonic speeds, reducing commercial flight times considerably, could be just years away.

"Supersonic flight offers the potential to improve the quality of life of those that fly by greatly reducing travel time," said Peter Coen, NASA's Commercial Supersonic Technology project manager.

Building supersonic aircraft in the U.S. offers a potential for growth and high-quality jobs in the aerospace and air travel industries, all of which contribute significantly to the economic welfare of our country.

"In the nearer term, NASA's development of quiet supersonic flight technology needs support, interest and engagement from the community to ensure that the potential sound is acceptable to those on the ground," Coen said.

The SonicBAT flights in Florida

will mark a rare opportunity for NASA's aeronautics and space operations to come together, and for Kennedy, showcases the center's transformation into a 21st century multi-user spaceport.

"This shows that, as NASA, we are all striving for the same thing," said SonicBAT Project Manager Brett Pauer. "We're willing to work together and help each other in any NASA mission that may be happening, whether it be space-based, which we do a lot of at our aeronautics centers, or the space centers to help us out with aeronautics. I think there's a great amount of cooperation, even more than may be expected, between NASA centers."

Coen added. "It seems to me that 'one NASA' is the best way to describe the cooperative spirit that makes it possible for teams to reach out across the agency, and receive the kind of support SonicBAT has received from Kennedy Space Center."

Project... from page 1

from the International Civil Aviation Organization.

“Our focus was on the research we perform to support development of regulations that will allow routine access for UAS in the NAS without the need for FAA Certificates of Authorization (COA), or special routes to conduct missions,” said Laurie Grindle, acting deputy director of programs.

The ICAO is the International Civil Aviation Organization, a United Nations agency established in 1949 to consider and recommend international rules, such as those that will govern UAS, and is another rulemaking organization that NASA research supports. The ICAO contingent represented the highest ranking technical body in the organization.

“We wanted the ICAO

commissioners to return with better understanding that it’s not just sending commands up to a large UAV and it does what you want. It’s more difficult and there’s a lot more to that,” Sakahara said.

The briefings focused on NASA and Armstrong research that contributes to domestic regulation development.

Also attending were members of the Radio Technical Commission for Aeronautics, a nonprofit organization that serves as a federal advisory committee that works with industry, government agencies and academia based on FAA requests.

A lot of work remains to meet NASA’s goals for the UAS Integration in the NAS project that is ongoing at Armstrong and other NASA centers: Ames Research Center in California,



AFRC2017-0169-06

NASA/Bridget McBride

A group of visitors at Armstrong tour the Global Hawk autonomous aircraft.

Glenn Research Center in Ohio and Langley Research Center in Virginia. However, with NASA, industry and academia working

together to provide information to assist the FAA in regulations to safely integrate UAS in the NAS that day is getting closer.

Scholarship... from page 3

and received an AP Scholar with Distinction Award. Sean received a Graduating Class Presidential Academic Award, physics and mathematics Graduating Class awards and a Distinguished Scholar Award.

Banks was a member of the National Honor Society and achieved a Life Membership Highest Honor (Outstanding Sealbearer Award) in the California Scholarship Federation. He received Certificates

of Excellence in AP calculus, AP physics and pre-calculus. Banks was actively involved in year-round competitive swimming as a registered USA swimmer. He studied piano and violin and volunteered his time at the Loaves and Fishes Charity Services for the Homeless.

Banks participated in school athletic programs, lettering as a member of the varsity swim team. He was an active member of the

key club and was co-captain of the math league. He also served as a student peer tutor for pre-calculus students. In his freshman year in high school, he attended the Tehachapi High School Engineering and Manufacturing Academy.

NASA Armstrong Exchange Council scholarships are named for former Armstrong employees, with honorees selected on a rotating basis. Russell, who is

named on the current scholarship, was the original crew chief for Chuck Yeager on the X-1 program that resulted in achieving speeds above Mach 1. Russell later flew as one of the panel operators when the X-15 rocket plane launched from the NASA B-52 and reached the edge of space. Scholarship funds are raised from council activities including proceeds from vending machines, the Armstrong Gift Shop, cafeteria sales and fundraising events.

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