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First Mars airplane? Innovation could lead to flier in 2022-24

By Jay Levine

X-Press editor

When an aircraft makes its first flight on Mars in the 2020s, a NASA Armstrong innovation may have made it possible.

A prototype of the Preliminary Research Aerodynamic Design to Land on Mars, or Prandtl-m, which is a flying wing aircraft with a twist, is planned to be ready for launch from a high altitude balloon later this year. The Prandtl-m will be released at about 100,000 feet altitude, which will simulate the flight conditions of the Martian atmosphere, said Al Bowers, NASA Armstrong chief scientist and Prandtl-m program manager.

The tests could validate how the aircraft works, leading to modifications that will allow it to fold and deploy from a 3U CubeSat in the aeroshell of a future Mars rover. A CubeSat is a miniature satellite used for space research that is usually about four inches in each dimension, a 3U is three of those stacked together.

“The aircraft would be part of the ballast that would be ejected from the aeroshell that takes the Mars rover to the planet,” Bowers said. “It would be able to deploy and fly in the Martian atmosphere and glide down and land. The



NASA Illustration/Dennis Calaba

The above illustration shows what a Prandtl-m might look like flying above the surface of Mars.

Prandtl-m could overfly some of the proposed landing sites for a future astronaut mission and send back to Earth very detailed high resolution photographic map images that could tell scientists about the suitability of those landing sites.”

Because the Prandtl-m could

ride in a CubeSat as ballast aboard the aeroshell/Mars rover piggyback stack going to Mars in 2022-2024, the additional weight would not add to the mission’s cost, he said. Once in the Martian atmosphere, the Prandtl-m would emerge from its host, deploy and begin its mission.

“It would have a flight time of right around 10 minutes. The aircraft would be gliding for the last 2,000 feet to the surface of Mars and have a range of about 20 miles,” Bowers said.

Before that happens, a

Prandtl-m, page 11



ED15-0137-64

NASA/Tom Tschida

A new experimental test wing attached to a truck rolls across the dry lakebed. It is anticipated the Hybrid-Electric Integrated Systems Testbed, or HEIST, could lead to future aircraft that are more fuel efficient, quieter and more comfortable.

HEIST wing research underway

Editor's note: NASA Armstrong hosted a NASA Social on electric propulsion for media and social media May 12. This article provides some details about what that technology is and what it could ultimately mean for future aircraft.

By Anna Kelley

NASA Armstrong Public Affairs

NASA's Leading Edge Asynchronous Propellers Technology (LEAPTech) is working to develop an aircraft that advances fuel efficiency, reduces noise, and improves ride quality, through the use of distributed electric propulsion.

Researchers from NASA Armstrong and Langley research centers, in cooperation with Joby Aviation and Empirical Systems Aerospace (ESAero), created an experimental wing called the Hybrid-Electric Integrated Systems Testbed (HEIST).



ED15-0158-18

NASA/Tom Tschida

Members of the media and social media were invited out to NASA Armstrong for a NASA Social May 12 to see one of the latest innovations in aeronautics.

SOFIA goes to New Zealand for science

By Kate Squires

NASA Armstrong Public Affairs

NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA, departed from Christchurch, New Zealand June 19 for the first of 15 planned Southern Hemisphere deployment science flights.

For the next five weeks SOFIA will operate from the U.S. National Science Foundation's Antarctic Program facility at Christchurch International Airport. Flying out of New Zealand enables SOFIA to study celestial objects that are more easily observed, or can only be observed, from southern latitudes.

"SOFIA's 2013 deployment to New Zealand and the resulting observations were of great scientific value," said Eddie Zavala, SOFIA program manager. "Our research staff and guest investigators have been looking forward to building on that success with our return to the Southern Hemisphere this month."

During this deployment, five



NASA/SOFIA/USRA/G. Perryman

SOFIA received a water-arch salute from the Christchurch International Airport fire brigade after landing in New Zealand June 14 to begin a 6-week deployment for Southern Hemisphere science flights.

cameras and spectrographs will be used: the Faint Object Infrared Camera for the SOFIA Telescope (FORCAST) and the German Receiver for Astronomy at Terahertz Frequencies (GREAT) for a total of 15 flights, plus

the First Light Infrared Test Camera (FLITECAM), the High Speed Imaging Photometer for Occultations (HIPO), and the Focal Plane Imager (FPI) in ensemble

SOFIA, page 12

NASA, partners test system

By Peter W. Merlin

NASA Armstrong Public Affairs

NASA, working with government and industry partners, is testing a system that would make it possible for unmanned aircraft to fly routine operations in United States airspace.

Through the agency's Unmanned Aircraft Systems Integration in the National Airspace System (UAS-NAS) project, NASA, General Atomics Aeronautical Systems Inc. (GA-ASI) and Honeywell International Inc., are flying a series of tests which began on June 17 and will run through July at NASA Armstrong.

"We are excited to continue our partnership with GA-ASI and Honeywell to collect flight test data



ED14-0341-44

NASA/Carla Thomas

NASA's Ikhana is being used to test a system that will allow uncrewed aircraft to fly routine operations within the National Airspace System.

that will aid in the development of standards necessary to safely integrate these aircraft into the National Airspace System," said

Laurie Grindle, UAS-NAS project manager at Armstrong.

UAS in the NAS, page 8

News at NASA

Tool could illuminate mystery of dark matter

A new NASA computer simulation shows that dark matter particles colliding in the extreme gravity of a black hole can produce strong, potentially observable gamma-ray light. Detecting this emission would provide astronomers with a new tool for understanding both black holes and the nature of dark matter, an elusive substance accounting for most of the mass of the universe that neither reflects, absorbs nor emits light.

"While we don't yet know what dark matter is, we do know it interacts with the rest of the universe through gravity, which means it must accumulate around supermassive black holes," said Jeremy Schnittman, an astrophysicist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "A black hole not only naturally concentrates dark matter particles, its gravitational force amplifies the energy and number of collisions that may produce gamma rays."

In a study published in *The Astrophysical Journal* on June 23, Schnittman describes the results of a computer simulation he developed to follow the orbits of hundreds of millions of dark matter particles, as well as the gamma rays produced when they collide, in the vicinity of a black hole. He found that some gamma rays escaped with energies far exceeding what had been previously regarded as theoretical limits.

Mars Generation

Carson wants a role in early Mars missions

By Jay Levine
X-Press editor

Some people spend their lives deciding on a career, but for 14-year-old Alyssa Carson the goal has been clear since she was 3 years old – be among the first humans to explore Mars.

She knows that to meet her goal she must work hard, learn everything she can and prepare for steep competition. Carson showed her enthusiasm as she became the first to complete the NASA Passport program started in 2013 that required visiting all of the NASA's 14 visitor centers and having a "passport" stamped at each location.

People who want to join the NASA Passport program can sign up at <http://www.visitnasa.com/nasa-passport-to-explore-space>. The NASA Armstrong Gift Shop can provide an official stamp. Completing the NASA passport earns an official 8-page Passport to Explore Space, the stamps and savings on NASA visitor goods and services.

As part of Carson's passport journey, she came to NASA Armstrong in 2013, but it was during the government shutdown. On May 6, she returned to see what she missed.

"I think after visiting these places and seeing these different things it helps show me what we can do and what the rockets can accomplish and how far we can go," Carson said of her journey. "It also has taught me where we are today and where we are going. It motivates me to work even harder."

To recognize her achievement as the first person to complete the passport program, she was granted a special tour of NASA Armstrong. The best part of her visit was a rare opportunity to sit in an F/A-18 cockpit.



ED15-0146-07

NASA/Tom Tschida

Alyssa Carson wants to be among the first to go to Mars. She is working toward her goal and recently came to Armstrong as part of the NASA Passport program. Above, she sits in an F/A-18 aircraft. Below, she learns about the Global Hawk.



ED15-0146-02

NASA/Tom Tschida

"It was a little intimidating and a little scary because I was sitting in a jet. It was really neat that it wasn't a simulator. It was the real deal. Just being able to see the systems and getting to punch a few buttons, it was a lot of fun and really cool."

Carson said there were other memorable experiences.

"I think when we visited I knew a

little bit. One thing that surprised me was some of the unmanned aircraft that I saw. I didn't know NASA Armstrong was doing a lot with those systems and I found out a lot more about that and how the vehicles work."

For Carson, NASA has been an inspiration and a goal from an early age.

In fact, Carson said the most valuable advice she received was from former NASA astronaut Sandy Magnus, a veteran of two shuttle missions and a 4.5-month assignment aboard the International Space Station as an engineer and science officer for the Expedition 18 crew.

"When I was nine I met Sandy Magnus at a Sally Ride Festival, a local festival they used to have in the Louisiana area," Carson explained. "Sandy told me that she had decided at the age of nine to become an astronaut, but at the time it was very difficult for women to become an astronaut. She eventually succeeded and went to space three times."

"For her deciding at nine and me being nine, it really showed me that you can start young and you can decide what you want to be when you are younger and then eventually grow up to realize your dream. It can become a reality."

Carson has had a number of opportunities since then, including a NASA-funded trip to the National Air and Space Museum of the Smithsonian Institution to join one of two panels in January 2014. The main panel was on the 10th anniversary of the Mars rovers. A NASA representative contacted Carson and her family to participate in the second panel discussion on a future Mars mission. She was chosen for completing the NASA Passport program and her interests and work toward her goal to be one of the first to visit Mars.

"I sat on the panel with three Ph.D.s and an astronaut. It was a good experience to hear their insights on a Mars mission and their experience from the fields they represented. It was a lot of fun."

Carson, page 12

Students study Earth from DC-8

By Beth Hagenauer

NASA Armstrong Public Affairs

Thirty-two undergraduate students are participating in an eight-week NASA Airborne Science field experience designed to immerse them in the agency's Earth science research.

Now in its seventh year, NASA's Student Airborne Research Program (SARP) provides a unique opportunity for undergraduate students majoring in the sciences, mathematics or engineering fields to participate in all aspects of a NASA Airborne Science research campaign.

Airborne science research uses aircraft as sky-high platforms for making observations, gathering remote-sensing data with instruments or taking samples. These data can be coupled to NASA's global satellite observations for a better understanding of the complete Earth system.

SARP participants are given the opportunity to observe and participate in the instrument installation, flight planning and scientific data collection that is the basis of every successful NASA Earth science airborne campaign. These campaigns play a pivotal role in the acquisition of process-oriented knowledge about the Earth system, as well as calibration and validation of NASA's space-borne Earth observations, remote-sensing measurements and high-resolution imagery for Earth system science.

Armstrong hosted the SARP event, which kicked off on June 15 with lectures by university faculty members, NASA scientists and program managers. There will be students aboard the agency's DC-8 based at Armstrong on each of the six flights during the week of June 22 when they will measure pollution, aerosols (small particles suspended in the atmosphere) and air quality in the Los Angeles basin and in California's Central Valley. The students will also use airborne



NASA

Dennis Gearhart (seated), remote sensing field engineer at NASA's Ames Research Center, describes the MASTER instrument to SARP participants.

“SARP is one of NASA's tools for exposing future scientists and engineers to the Earth Science missions that support environmental studies and the testing and development of new instruments and future satellite mission concepts.”

and ground-based remote-sensing instruments to study forest ecology in the Sierra Nevada and ocean biology along the California coast.

Students are mentored by NASA scientists from Headquarters in Washington, D.C., the Langley Research Center in Hampton, Virginia, and the Ames Research Center at Moffett Field, California. Additional mentors are university faculty members, postdoctoral fellows and graduate students from the University of California in Irvine, San Diego, Santa Cruz and Davis. The University of Colorado in Boulder, the University of Wisconsin and the University

of Houston are also providing mentors.

The aircraft will overfly dairies and oil fields in the San Joaquin Valley, as well as parts of Los Angeles, the Santa Barbara Channel and the Salton Sea at altitudes as low as 1,000 feet in order to collect air samples, measure aerosols and air quality. The DC-8 can fly at altitudes of 42,000 feet, carry 30,000 pounds of scientific instruments and seats up to 45 experimenters and crew.

During the last two flights, half of the students will be in the field taking validation or complementary measurements while the DC-8 flies overhead.

The final six weeks of the program will take place at the University of California in Irvine, where students will analyze and interpret the data they collected aboard the aircraft and in the field. In addition to these data, students can use data gathered by SARP participants in the previous six years. At the conclusion of the program, each student will present his or her results and conclusions to an audience of NASA scientists and administrators, university faculty

members and fellow SARP students. Many students go on to present their SARP research projects at national conferences. In 2014, eight students presented their research at the American Geophysical Union fall meeting and three were selected for the AGU Outstanding Student Paper Award.

Students participating in the 2015 SARP represent 32 different colleges and universities from across the United States and Puerto Rico. They were competitively selected based on their outstanding academic performance, future career plans and interest in Earth system science.

SARP is one of NASA's tools for exposing future scientists and engineers to the Earth Science missions that support environmental studies and the testing and development of new instruments and future satellite mission concepts. The program's goal is to stimulate interest in NASA's Earth science research and aid in the recruitment and training of the next generation of scientists and engineers, many of whom will be getting their first hands-on research experience during this program.

SARP is managed by NASA's Ames Research Center through the Cooperative for Research in Earth Science and Technology (ARC-CREST), under the leadership of the National Suborbital Education and Research Center at the University of North Dakota with funding and support from NASA's Earth Science Division.

NASA uses the vantage point of space to increase our understanding of our home planet, improve lives and safeguard our future. NASA develops new ways to observe and study Earth's interconnected natural systems with long-term data records. The agency freely shares this unique knowledge and works with institutions around the world to gain new insights into how our planet is changing.

... and we fly airplanes



ED15-0120-52

NASA/Tom Tschida

Dana Purifoy, left, presents the NASA Armstrong Annual Safety Award - Individual to Wason "Haku" Miles. Miles observed an accident and carefully extracted a woman out of a car until help could arrive.



ED15-0120-53

NASA/Tom Tschida

Dana Purifoy, left, presents the NASA Armstrong Annual Safety Award - Teams to Tom Speer. Speer and Troy Asher prevented serious engine damage to the Stratospheric Observatory for Infrared Astronomy during heavy maintenance.

elements for more than 30 minutes.

"That's what it feels like just missing the storm,' the captain later told the anxious passengers," Purifoy said. "It brought home why the delays were necessary."

Safety wasn't convenient, but the passengers understood the delays were necessary.

"In those situations with easily identifiable threats, no one is complaining about safety causing delays," Purifoy said. "We need to have the same patience when the threat may not be as easy to recognize. We need to work as a team, be vigilant to avoid safety risks that we can anticipate and understand there are times that safety is not about convenience, it's about sending everyone home in the same condition they came to work."

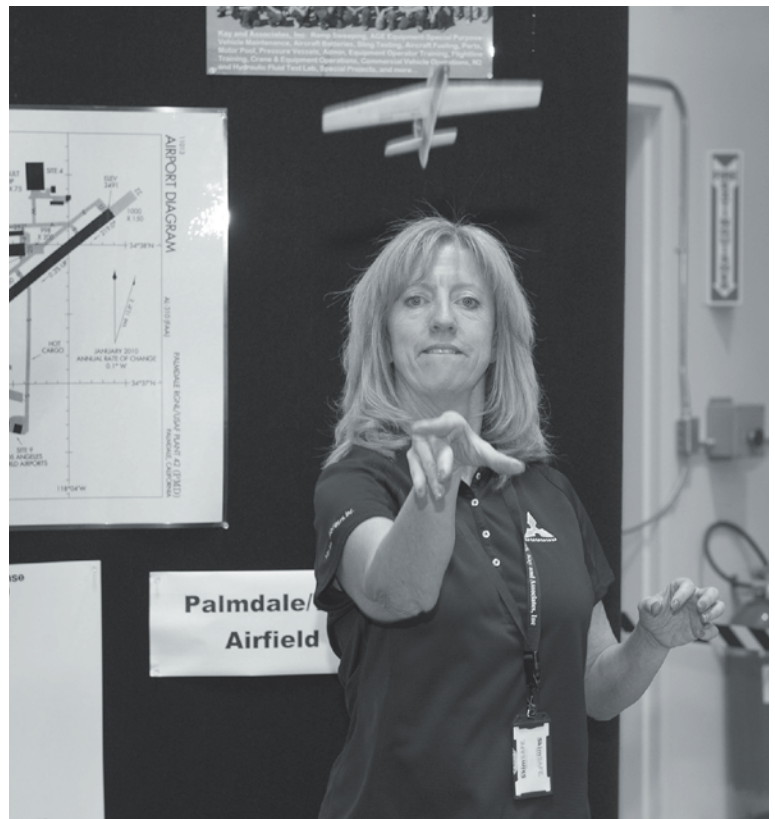
But even experienced pilots can make mistakes, said Jack Gregory, Armstrong Mission Support director. When he was in the U.S. Air Force there was a B-52 accident that was the result of a culture that essentially signed off on risky behavior.

An experienced B-52 pilot, but one who nevertheless had a penchant for dangerous operation of the aircraft at low altitude, exceeded the flight limits of the B-52 aircraft, Gregory explained. It happened during preparations for an airshow and the pilot's actions led to the airplane stalling and a subsequent crash that claimed the four-man crew. Failure to act by the many in the pilot's supervisory chain over a long period of time resulted in this final tragedy, he added.

"Safety in itself is not the paramount behavior on which we should focus," Gregory said, "Rather, professional discipline is the paramount goal and it will drive safety as a byproduct."

Armstrong employees understand safety's place in the high-risk operations, but many don't face major hazards in our jobs, he said. However, much of the Armstrong workforce can relate to the significant safety risks of just getting to and from work.

Safety, page 8



ED15-0120-69

NASA/Tom Tschida

Judy Grizzard flies an airplane at the Safety Day Kay & Associates exhibit.

We are NASA Armstrong

By Jay Levine

X-Press editor

It takes everyone's help to fly airplanes and to do it safely. That was the message from the recent NASA Armstrong Safety Day.

To celebrate the diverse tasks that contribute to mission success, a brief video was shown that included center employees introducing themselves, stating where they are from, what their job is and ending by saying "and I fly airplanes."

Each person highlighted in the video then appeared on stage to remove a puzzle-shaped piece that revealed the logo for the Safety Day event. Armstrong Center Director David McBride removed the final piece and congratulated employees on more than 3,500 research flight hours without an accident.

"It takes all of us to do that job safely," he said. "We have some of the most diverse aircraft and vehicles probably anywhere in the world. There is probably not another organization this size that handles the type and variety of aircraft you all make possible."

"You operate high performance aircraft capable of going Mach 2 and aircraft from the model shop that fly so slow they are in danger of a bird strike from the rear," McBride said. "It takes all of us to fly all of them safely. It takes all of you to do your work correctly and safely and to speak up when you see something that's not right."

Dana Purifoy, Safety and Mission Assurance director, recounted a commercial flight from Dallas to Los Angeles that illustrated the importance of safety.

Hail, 60 mph winds and crackling lightning grounded Purifoy's flight for nearly two hours. He and the other passengers on the plane trusted the professionals to make the right decisions. Once airborne, the aircraft was pounded by the



ED15-0120-39

NASA/Tom Tschida

The recent NASA Armstrong Safety Day was well attended and offered a full slate of speakers and exhibits were available. The event also featured an Employee Appreciation lunch.



ED15-0120-04

NASA/Tom Tschida

John Del Frate was one of the employees first seen on video talking about their job and then on stage removing a piece of the puzzle to reveal a graphic representing that all employees have a role in the safe flight of aircraft.



ED15-0120-09

NASA/Tom Tschida

After removing the final covering to the graphic about how everyone contributes to safe flight, Center Director David McBride expanded on the theme. He said everyone must remain vigilant to avoid accidents.

Safety... from page 7

Carmakers have attempted to limit risks by improving safety features in vehicles, such as safety belts, seatbelt warning lights and bells. In addition, state governments have made it a punishable offense to drive without a safety belt.

Despite all of the efforts to encourage people to wear seatbelts and to create vehicles with better safety features, 21,000 people were killed in 2013. More than 10,000 people were not wearing their safety restraints, Gregory said.

"At the end of the day, we are all responsible for our safety professionalism," he added.

Driving has many distractions and those distractions can cost a life, said Steve Foster, Quality Assurance chief.

In the moments it takes to write, respond to or view a text, tragedy can happen, he said. He unfortunately knows first hand how true that is as his parents' vehicle

was hit broadside by a woman who was texting and driving.

The texting woman was stabilized. His dad received bumps and bruises. Unfortunately, in one hour and 23 minutes, his mother passed away.

"Texting and driving isn't always done by teens," he explained. "Sometimes it's 50 year olds. Your life can change in one hour and 23 minutes."

Darlena Dotson of the California Highway Patrol said texting and talking on the phone are two of a number of distractions that accounted for the top cause of traffic collisions. In 2013, 70 percent of California driving accidents resulted from distracted driving.

In an effort to reduce the number of accidents, CHP officers handed out 66,000 tickets for distracted driving in April alone, Dotson said. Texting and calls are not the only items in the distracted

driving category, she said. A juicy hamburger, hot coffee or cold soft drink also can be distractions behind the wheel.

A video was shown of a woman texting the day before her graduation and, as a result, she lost the mobility and freedom she had enjoyed.

"You are 23 times more likely to get in an accident if you text and drive," Dotson said.

Safety practices at work and how they are executed matter and should be consistent outside of work as well, said Rusty Lowry. He was a U.S. Navy flight test engineer for nearly 35 years and a six-time national champion in vintage motorcycle racing. Lowry used his lessons learned from more than 400 motorcycle races when meeting requirements for safe and effective flight tests.

Having a safe workplace doesn't just happen. Retired U.S. Air

Force Maj. Gen. Larry Stutzriem, a recognized expert in national security, aerospace power and combat aircraft operations, told Armstrong employees that safety is not the goal. Safety is the culmination of a lot of work, situational awareness and contributions from each part of the team. Hard work is required to reduce risks to personnel, resources, property, reputation, mission and people's lives.

After the presentation and an employee appreciation lunch, booths also were available including the NASA Armstrong Safety and Environment Office, the NASA Employee Assistance Program, the NASA Safety Center, the NASA Safety Report System, the Exchange Council, Kay & Associates flightline driving safety, personal preparedness for natural disasters at home or at work and the Government - Industry Data Exchange Program.

UAS in the NAS... from page 3

This is the third series of tests that builds upon the success of similar experiments conducted late last year that demonstrated a proof-of-concept sense-and-avoid system. The tests engage the core air traffic infrastructure and supporting software components through a live and virtual environment to demonstrate how a remotely piloted aircraft interacts with air traffic controllers and other air traffic.

"This is the first time that we are flight testing all of the technology developments from the project at the same time," Grindle said.

This series of tests is made up of two phases. The first is focused on validation of sensor, trajectory and other simulation models using live data. Some of the tests will be flown with an Ikhana aircraft, a civilian version of the MQ-9 UAS. It is based at Armstrong and has been equipped with an updated sense-and-avoid system, as well as other advanced software from

Honeywell.

Other tests will involve an S-3B plane from NASA's Glenn Research Center in Cleveland, serving as a high-speed piloted surrogate aircraft. Both tests will use other aircraft following scripted flight paths to intrude on the flight path the remotely-piloted craft is flying, prompting it to either issue an alert or maneuver out of the other aircraft's path. These flights will also conduct the first full test of the traffic alert collision avoidance system (TCAS II) on a remotely piloted aircraft.

During the June 17 test, which lasted a little more than five hours, the team accomplished 14 encounters using the Ikhana aircraft and a Honeywell-owned Beech C90 King Air acting as the intruder. A second test was flown the following day, with a total of 23 encounters. The project team plans to fly more than 200 encounters throughout the first phase of the test series.

"Our researchers and project engineers will be gathering a substantial amount of data to validate their pilot maneuver guidance and alerting logic that has previously been evaluated in simulations," said Heather Maliska, Armstrong's UAS-NAS deputy project manager.

The second phase of the third

test series will begin in August and will include a T-34C plane equipped with a proof-of-concept control and non-payload communications system. The aircraft, which will have an onboard safety pilot, will fly an operationally representative mission in a virtual airspace sector complete with air traffic control and live and virtual traffic.

Sitterle passes at 79

George Sitterle, who worked primarily on flight control systems in the 1960s and 1970s, died May 6. He was 79.

Sitterle worked at NASA Dryden, now Armstrong, in Flight Operations from 1962 to 1979. He is best known for his work on the flight control systems on the lifting body aircraft.

McCormick dies at 73

Don McCormick, a former flight engineer on airborne science aircraft at NASA Dryden, now Armstrong, died April 24, 2015. He was 73.

McCormick served in the U.S. Air Force for eight years, where he developed a love for flying. He was a flight engineer in the Air Force on a C-130 and for NASA Ames Research Center at Moffett Field, California, on the C-141 Kuiper Airborne Observatory aircraft.

Helicopter museum gets YO-3A

By Peter Merlin

NASA Armstrong Public Affairs

After serving with NASA for nearly four decades, the agency's YO-3A, an unusual airplane designed to fly silently, recently departed NASA Armstrong for its new home at the Vietnam Helicopters Museum (VHM) in Concord, California. One of only 11 aircraft of this type built by Lockheed Missiles & Space Company (LMSC) in 1969, the "Quiet Star" had a colorful history.

In response to Army requirements for a covert, nighttime battlefield observation platform, LMSC designers extensively modified a Schweizer SGS 2-32 glider, adding a muffled engine and bubble canopy. Pilot and observer were seated in tandem, with the observer in the forward position. The engine was equipped with a belt-drive system to turn the propeller more slowly and quietly than a conventional gear-reduction system. A special muffler reduced engine exhaust noise. Additionally, the YO-3A had extra insulation and sealed valve covers to reduce noise from internal equipment. The Quiet Star was equipped with a custom-made wooden propeller that had a wider chord than a conventional propeller for a similarly sized airplane. Polished and lacquered, the three-bladed prop designed for LMSC by



ED04-0311-14

NASA/Tony Landis

NASA researchers equipped the lightweight YO-3A with microphones mounted on the tail and wingtips to measure noise signatures from rotorcraft, as well as sonic booms caused by the SR-71 Blackbird.

master craftsman Ole Fahlin and built up from layers of Canadian Birch plywood one-sixteenth of an inch thick, was practically a work of art.

Nine YO-3A aircraft saw service in Vietnam where they were flown in concert with Army attack helicopters during dangerous nighttime combat missions. Amazingly, during 14 months

of operation in 1970 and 1971, none were shot down or damaged by enemy fire. The Louisiana Department of Wildlife and Fisheries subsequently acquired two of the aircraft and used them to aid in catching poachers, and the Federal Bureau of Investigation employed the YO-3A as a surveillance aircraft during an experimental program in Southern California. NASA's airplane was the last YO-3A completed at Lockheed's Sunnyvale, California, facility. Following combat service in Southeast Asia it was transferred to an airframe and powerplant mechanics school. NASA's Ames Research Center near Sunnyvale acquired the YO-3A from the school in 1977 and restored it to flight status.

Technicians at Ames equipped the Quiet Star with wingtip-and-tail-mounted microphones and recording devices to assess the in-flight acoustic signatures of a variety of Army helicopters and

tilt-rotor aircraft, as well as for SR-71 sonic boom measurements. NASA transferred the YO-3A to the agency's Dryden Flight Research Center (now Armstrong) at Edwards, California, in June 1997 where it remained in flyable storage until October 2004. It was then deployed to Ames for nearly two years before returning to Armstrong, where it was flown only sporadically. According to VHM project coordinator and historian Kurt Olney, the YO-3A was eventually declared surplus and the museum purchased it at auction from the General Services Administration.

"VHM is the best possible home for the YO-3A," Olney said, "because they have the resources to maintain and fly the airplane."

Olney and pilot Richard Osborne inspected the airplane at Armstrong, with concurrence from a representative of the Federal Aviation Administration, before flying it first to Fox Field near Lancaster and eventually to Concord. They expressed gratitude to numerous NASA personnel who maintained the YO-3A through the years and those who supported the airplane's departure to its new home. These included Armstrong Aircraft Maintenance Division chief Tom Grindle and research pilots Tim Williams and Hernan Posada. In years past crew chief Monte Hodges, now retired, and pilot Bill Brockett provided invaluable support. Olney also expressed gratitude to the late Ed Lewis who flew the plane on research missions and shared his expertise with the VHM team. Olney noted, "I especially want to thank crew chief Dale Hogg for his insights and critical maintenance information, and most importantly the actions he took [to maintain] the airplane in preparation for this day. The Vietnam Helicopter Museum will continue to share this amazing airplane with the public for many years to come.

Armstrong researchers publish their results

NASA Armstrong research resulted in two new articles in April.

William L. Ko and Van Tran Fleischer collaborated on, "Variable-Domain Displacement Transfer Functions for Converting Surface Strains into Deflections for Structural Deformed Shape Predictions," NASA/TP-2015-218464.

Chan-gi Pak and Samson S. Truong co-authored, "Extension of an Object-Oriented Optimization Tool: User's Reference Manual," NASA/TM-2015-218733.



ED15-0158-20

NASA/Tom Tschida

Attendees of a NASA Social at NASA Armstrong May 12 pose by the Hybrid-Electric Integrated Systems Testbed, or HEIST. HEIST could lead to future aircraft that are more fuel efficient, quieter and have a smoother ride.

HEIST... from page 2

HEIST is a rapid risk-reduction technology used to validate an all-electric, full-scale LEAPTech wing and motor configuration. The 31-foot, carbon-fiber wing carries 18 small electric motors and propellers that were designed and manufactured by Joby. Each motor can be operated individually at different speeds to optimize the performance and acoustics of the wing. ESAero, the prime contractor for HEIST, manages the system's integration, control and instrumentation.

This wing is being tested on a specially configured truck assembly, rather than in a wind tunnel, to reduce costs and allow for greater schedule flexibility. After completing initial testing at speeds up to 40 mph in December 2014 at the Oceano County Airport on

California's Central Coast, HEIST was delivered to NASA Armstrong to run tests at up to 80 mph on the base's Rogers Dry Lake.

Researchers will use this data to develop a sub-scale, piloted X-plane demonstrator proposed under NASA's Transformative Aeronautics Concepts program. NASA plans to fly the experiment in 2017 after modifying a 2,600-pound Tecnam P2006T aircraft with new cockpit interfaces for electric propulsion control and monitoring.

The wings and engines will also be replaced with an improved version of the LEAPTech wing, motors and batteries. The sub-scale distributed electric propulsion X-plane will become a stepping-stone to help with the design of a larger hybrid electric aircraft.



ED15-0158-40

NASA/Tom Tschida

Starr Ginn talked with JoeBen Bevirt of Joby Aviation during a NASA Social at Armstrong May 12.

Prandtl-m... from page 1

configuration will be developed for the first of three tests here on Earth.

“We have a number of summer community college students coming that are going to help us design and build the aircraft that will complete the first phase of the mission,” Bowers said. “We’re going to build some vehicles and we are going to put them in very unusual attitudes and see if they will recover where other aircraft would not. Our expectation is that they will recover. As soon as we get that information, we will feel much better flying it from a high-altitude balloon.”

In fact, Bowers credited the idea of the Prandtl-m to a brainstorming session with colleague Dave Berger, a NASA Armstrong aeronautical engineer who specializes in flow physics and propulsion and works with the Education Office. Berger and Bowers discussed a project that college students could immerse themselves in that would be extraordinary – helping to prepare a vehicle that could lead to a Mars flier was their answer.

“The actual aircraft’s wingspan when it is deployed would measure 24 inches and weigh less than a pound,” Bowers said. “With Mars gravity 38 percent of what it is on Earth, that actually allows us up to 2.6 pounds and the vehicle will still weigh only 1 pound on Mars. It will be made of composite material, either fiberglass or carbon fiber. We believe this particular design could best recover from the unusual conditions of an ejection.”

The Flight Opportunities Program, which is managed at NASA Armstrong, has agreed to fund two balloon flights during the next several years and potentially a sounding rocket flight following that to demonstrate how the flier would work on Mars, Bowers said. The flights will be at one of two locations – Tucson, Arizona, or Tillamook, Oregon. NASA’s Ames Research Center at Moffett Field, California, manages the Flight Opportunities solicitation



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NASA/Tom Tschida

The proposed Prandtl-m is based on the Prandtl-d seen coming in for a landing during a 2014 flight test. The aerodynamics offer a solution that could lead to the first aircraft on Mars.

and selection of technologies to be tested and demonstrated on commercial flight vehicles.

“We are going to use GPS initially, but obviously there is no GPS on Mars, so later on we will have to find something else for navigation,” Bowers said. “But the little autopilot that provides the waypoint navigation, that’s one of the things we’re going to exercise on a research vehicle and then on the prototype that flies on a future balloon flight.”

The flight test could also include some scientific research that will apply to a Mars mission.

“We could have one of two small science payloads on the Prandtl-m on that first balloon flight,” Bowers said. “It might be the mapping camera, or one might be a small,

high-altitude radiometer to measure radiation at very high altitudes of Earth’s atmosphere. Eventually the aircraft may carry both of them at the same time.”

A second research flight from a balloon is planned for next year and would feature an aircraft capable of returning to the launch site on a flight that could be as long as five hours as it glides back to Earth, he said.

“We will do the same thing again with a balloon flight to about the same altitude,” Bowers said. “On that mission Prandtl-m would actually be inside a CubeSat container. The balloon would drop the CubeSat container and then the aircraft would deploy from the container right after the drop, unfold and fly away.”

Success could lead to a third mission that is already being discussed because the Flight Opportunities Program has access to a sounding rocket capable of going to very high altitudes, Bowers said.

“That mission could be to 450,000 feet and the release from a CubeSat at apogee,” he said. “The aircraft would fall back into the Earth’s atmosphere and as it approaches the 110,000-to-115,000-foot altitude range, the glider would deploy just as though it was over the surface of Mars.”

“If the Prandtl-m completes a 450,000-foot drop, then I think the project stands a very good chance of being able to go to NASA Headquarters and say we would like permission to ride to Mars with one of the rovers.”

SOFIA... from page 3

during one flight to observe a stellar occultation by Pluto.

“Many of the observations planned for this deployment are aimed at studying the formation of massive stars,” said Pamela Marcum, SOFIA’s project scientist. “Massive protostars are rare, so even the nearest examples are more than a thousand light years away. SOFIA’s large telescope enables astronomers to resolve distant groups of such stars, allowing uniquely detailed observations of them and the material that surrounds them.”

“We are also interested in the other end of the stellar life cycle,” noted Dana Backman, astronomer and manager of SOFIA’s Outreach

programs. “During late stages, many stars develop intense winds, ejecting large amounts of their material into surrounding space. As those winds cool, some of the gas condenses into dust particles. The gas and dust are recycled into the interstellar medium, adding to the raw material for subsequent generations of stars and planets. Researchers want a more complete understanding of how that all happens.”

Observing from the Southern Hemisphere also enables SOFIA to view the Magellanic Clouds, two satellite galaxies of the Milky Way Galaxy that have had fewer generations of stars, and therefore contain smaller proportions of

heavy elements, than our own galaxy. Comparing star formation and stellar evolution in the Magellanic Clouds versus the Milky Way can help refine an understanding of how the earliest generations of stars in the universe formed from gas containing little or no heavy elements.

FLIPO and the FPI are expected to observe Pluto as it passes in front of a background star on June 29. That occultation event is fortuitously before the New Horizons spacecraft’s closest approach to Pluto on July 14. The near-coincidence of observations by SOFIA and New Horizons could provide investigators with a singular opportunity to link

the fly-by spacecraft’s “snap shot” measurements with an ongoing Earth-based research program monitoring long-term changes in Pluto’s atmosphere.

SOFIA is scheduled to return to the United States on July 24.

SOFIA is a joint project of NASA and the German Aerospace Center. The aircraft is based at NASA Armstrong, NASA’s Ames Research Center in Moffett Field, California, is home to the SOFIA Science Center that is managed by NASA in cooperation with the Universities Space Research Association headquartered in Columbia, Maryland, and the German SOFIA Institute at the University of Stuttgart.

Carson... from page 4

While some people might be intimidated by the opportunity, Carson said she was not.

“It really wasn’t that intimidating,” she recalled. “The first group I spoke to at the event was a 4-H group of about 400 to 600 kids. After speaking to a group that big, I didn’t get stage fright or nervous on the panel. I think they had me on the panel to give the views of someone young and who wants to go to Mars and how the Mars generation sees us going there and how we want it to happen.”

Carson remains focused.

“Alyssa has not wavered on her

dream of being an astronaut and being among the first crews to go to Mars,” said Bert Carson, her dad. “She works her butt off going after that dream. Now that she is growing up, she sees exploration of Mars and beyond as crucial to the survival of the human race. She feels it is her responsibility to be a part of the early crews that will take baby steps to live off the planet.”

Alyssa is in the 8th grade at Baton Rouge International School, where she studies all her subjects in four different languages including English, Spanish, French and Chinese (Mandarin). Success at

the specialized school could result in college credits and a full-ride scholarship, Bert Carson said.

“Science and math are my best subjects and I am on the robotics team,” Carson said. “I plan on learning Russian on my own and learning Portuguese through school so I will speak six languages,” Carson said.

She follows the Orion spacecraft development closely and has seen some of the core pieces of the Space Launch System that is being built at NASA’s Michoud Assembly Facility in New Orleans, which is near her home in Baton

Rouge, Louisiana.

For now, she continues to envision the day when she conducts experiments on the way to Mars, prepares others after landing on Mars, digs for water, tests the water and soil for Martian life and explores the planet. In the meantime, she will continue pursuing her dream and encouraging others along the way to follow their own dreams.

Her key message: “You have to work hard if it’s something you really want to do. You have to work hard and go for it and don’t let anyone say you can’t do it. Never be put down by anything.”

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