



The Dryden X-PRESS

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New tech may help air traffic control

By Jay Levine
X-Press Editor

Mail and packages may one day move from city-to-city aboard unmanned aircraft systems, or UAS, flying in the same airspace as airliners, cargo planes, business jets and private aircraft. When it does, it is likely that a technology developed and flight tested at Dryden helped to make it possible.

The Automatic Dependent Surveillance-Broadcast, or ADS-B, sensor is an air traffic control technology that will be required in all aircraft traveling in the National Airspace System. However, the ADS-B coupled with other components and technology might have added benefits to UAS, said Dryden engineer Ricardo Arteaga, the system's architect. Arteaga and his team adapted the ADS-B system for UAS during the past year and recently flew it on the Ikhana aircraft (see related article).

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ED12 0082-30

NASA Photo by Tony Landis

NASA's Ikhana glides in for landing at the conclusion of the first checkout test flight of the new ADS-B Automatic Dependent Surveillance-Broadcast aircraft tracking technology on an unmanned aircraft system.

Flying the future

Ikhana flights validating ADS-B system

By Gray Creech,
Dryden Public Affairs

Dryden flew its Ikhana MQ-9 unmanned aircraft with an Automatic Dependent Surveillance-Broadcast, or ADS-B, device, for the first time on March 15.

It was the first time an unmanned aircraft as large as Ikhana – with a 66-foot wingspan, a takeoff weight of more than 10,000 pounds, and a

cruising altitude of 40,000 feet – has flown while equipped with ADS-B. ADS-B is an aircraft tracking technology that all planes operating in certain U.S. airspace must adopt by January 2020 to comply with Federal Aviation Administration regulations.

Current tracking devices aboard aircraft are called transponders, but the ADS-B isn't just a new-fangled transponder. It provides much more

detailed and accurate information to air traffic controllers, and will enable navigation by satellite in addition to the current system of ground radars.

Ground radars interact with transponders once every four to 12 seconds in order to get an aircraft's position, velocity and altitude. In contrast, the ADS-B constantly and automatically broadcasts

See ADS-B, page 8

MUTT set to fly this summer

Gray Creech

Dryden Public Affairs

Dryden soon will have a new dog in the yard, and it's a real MUTT. That's short for the Multi-Use Technology Testbed, a small unmanned aircraft being developed by the U.S. Air Force Research Laboratory to test technologies that will be needed for new kinds of lightweight, flexible aircraft.

MUTT is one of the Air Force's newest X-planes, designated X-56A. The 7.5-foot-long aircraft has a 28-foot wingspan and will be powered by two 52-pound thrust JetCat P200-SX turbine engines. It is being built in California under contract to Lockheed Martin Corp., which will conduct the flight experiments for the Air Force Research Laboratory.

Dryden will oversee the flights for AFRL during summer 2012, and then take ownership of the X-56A MUTT for follow-on research after the Air Force tests are finished in early autumn.

"Flexible wings and fuselages can



Image courtesy AFRL/Lockheed

Above is an artist's rendering of X-56A Multi-Use Technology Testbed, or MUTT, aircraft.

result in significant reductions in the structural weight of aircraft," says Gary Martin, deputy project manager for NASA's Subsonic Fixed Wing Project at Dryden.

But unlike the short, stiff wings found on most aircraft today, long, thin wings like those on the X-56A are susceptible to uncontrollable vibrations, called flutter, that result

from the force of air flowing over them. Bending forces from wind gusts and atmospheric turbulence can also stress thin wings.

"To maintain the long-term health of the structure and ride quality in a more flexible airplane, we need to actively alleviate gust loads on the airplane and suppress flutter, so gust load alleviation and

active flutter suppression are two of the key technologies that NASA is working to advance," Martin said.

MUTT is designed to address this problem by enabling engineers to practice suppressing flutter by adjusting software programs in the aircraft's flight control computer. With MUTT, researchers also expect to learn how better to ease gust loads, which will make flexible airplanes safer when they experience in-flight turbulence.

The X-56A MUTT is a low-speed, subsonic and sub-scale aircraft. However, aircraft that fly faster than the speed of sound also can benefit from this research. The knowledge gained about flutter and gust suppression will be used in designing the proposed supersonic X-54, an aircraft that will demonstrate sonic boom-quieting technologies that could someday alleviate the noise concerns currently preventing supersonic commercial flight over land in the United States.

ER-2 arrives in Iceland for research

After an all-night flight from its home base in Palmdale, a NASA ER-2 high-altitude environmental science aircraft arrived in Keflavik, Iceland April 2 to begin a series of flights over the next five weeks that are intended to validate the accuracy of a new laser altimeter named MABEL.

NASA research pilot Tim Williams flew the long-winged ER-2, which departed from its base at the Dryden Aircraft Operations Facility adjacent to Air Force Plant 42 in Palmdale April 1 and arrived more than nine hours later at Keflavik International Airport. That transit flight had been delayed for several days due to bad weather over Iceland and high winds in Palmdale.

MABEL, an acronym for the Multiple Altimeter Beam Experiment Lidar, was developed



NASA Photo

Iceland Television interviewed Dryden research pilot Tim Williams, who was still wearing his high-altitude pressure suit shortly after his arrival at Keflavik International Airport.

at NASA's Goddard Space Flight Center to simulate a similar instrument planned for NASA's IceSat-2 environmental satellite that is scheduled for launch in 2016.

The instrument was operating during a portion of the flight over sea ice and the Greenland ice sheet, and initial reports indicate the data received looks promising, according to a report from mission manager Chris Jennison. The first dedicated science mission was scheduled for the first week of April.

Although not directly connected to the Spring 2012 Operation IceBridge Arctic polar ice survey flights being staged out of Greenland, the ER-2 flights will be conducted concurrently with many of the same flight tracks flown by IceBridge mission aircraft. Operation IceBridge is the largest survey of Earth's polar ice ever flown.

Buzz rockets into Smithsonian

The Disney space ranger Buzz Lightyear action figure that flew aboard Discovery on the STS-128 space shuttle mission in 2009 will soon be enshrined at the Smithsonian's National Air and Space Museum in Washington, D.C.

The plastic representation of the Lightyear character that was featured in the Disney-Pixar Toy Story animated movie series spent 15 months on the International Space Station before it was returned to Earth on Discovery when it landed at Dryden on Sept. 11, 2009.

A ceremonial donation of the Lightyear figure was hosted by the museum along with Pixar and NASA March 29 in the museum's Moving Beyond Earth gallery 113. Pixar's chief creative officer John Lasseter presented the action figure to the museum, followed by a panel discussion with NASA and museum representatives accompanied by film clips of Lightyear in space. The Lightyear figure will go on display



ED09 0266-34

NASA photo by Tony Landis

The Disney-Pixar Buzz Lightyear space ranger action figure disembarks from Discovery following its landing at Edwards Air Force Base on Sept. 11, 2009.

later the same gallery that featured the ceremonial donation event.

While on the space station, Lightyear supported NASA's education outreach program Science, Technology, Engineering and Mathematics education emphasis by

creating a series of fun educational online outreach programs.

Following Lightyear's return, Disney joined with NASA to create a new online educational game and an online mission patch competition for school kids across America.

Trek to Dryden

Nichelle Nichols, who portrayed Lt. Uhura on the 1960s television show Star Trek, visited Dryden for Women's History month activities March 29. While at the center she toured some of the facilities including the Global Hawk command center. She is pictured with Phil Hall, who explained some of the unmanned aircraft's operations.



ED12 0049-30

NASA Photo by Tom Tschida

NSSC honored with two awards at annual event

The NASA Shared Services Center received two awards at the 16th Annual Shared Services and Outsourcing Excellence Awards Ceremony held in Orlando, Fla., on March 8.

Out of about 40 submissions, including Fortune 500 companies,

the NSSC was the first place winner in the excellence in culture creation category. In addition, the NSSC was the runner-up in the excellence in customer service category.

These awards form the industry's benchmark in best practices and business excellence. The awards are

open to all internal and external shared services organizations from all countries and a panel of industry experts judge the submissions.

Judges looked at excellence in customer service, culture creation, people and communication, value creation and improvement and

News at NASA

SLS gets a step closer

America's next heavy-lift launch vehicle – the Space Launch System – is one step closer to its first launch in 2017, following the successful completion of the first phase of a combined set of milestone reviews.

The SLS Program has completed step one in a combined System Requirements Review and System Definition Review – both extensive NASA-led reviews that set requirements to further narrow the scope of the system design and evaluate the vehicle concept based on top-level program requirements.

The reviews include setting launch vehicle requirements for crew safety and interfacing with the Orion Multi-Purpose Crew Vehicle to carry it to deep space as well as the ground operations and launch facilities at Kennedy Space Center in Cape Canaveral, Fla. Additionally, the reviews set cost and schedule requirements to provide on-time development.

The milestones are two in a series of life-cycle reviews advancing the vehicle from concept design to flight readiness. Step one included a focused technical review of the program requirements with information on cost, schedule and risk.

The combination of the two reviews as well as safety and reliability analyses is a different way of conducting program reviews.

Protective Services aims for success

By Jay Levine
X-Press Editor

Dryden Protective Services officers see a suspicious man who was possibly armed and dangerous enter a building.

Officers knock on the door and ask the suspect to surrender. There is no response. They draw their weapons and enter one at a time, quickly sweeping through the building. In the last room the officers search they find the suspect, who surrenders without a fight.

The man was one of their trainers, Matt Rieck, the building was Trailer 42 and the exercise allowed Protective Services officers to obtain the kind of training they don't usually have the ability to do.

As dilapidated buildings have come up for removal, Protective Services personnel have been permitted to use them for training. Since Trailer 42 is scheduled for destruction, Protective Services Personnel have inquired if another building will be available for similar training exercises, which are all completed at no cost to NASA.

Walking through Trailer 42, the blue paint spots on the wall indicate where former drills have taken place and why it would not be practical to have the drills in functional Dryden offices. It is through this grownup version of cops and robbers that the officers learn what it's like to work through a weapons malfunction in the middle of a shootout, or learn the best way to approach a suspect with maximum view for the officer and minimum ability for the perpetrator to attack the officer.

"It's one thing to shoot a target on a range and something else to have to use those skills as events are unfolding and ever changing," said David Spencer, who is the Dryden Protective Services site manager. Spencer also is an investigator and trainer, as is Rieck, who is the Protective Services site manager at



ED12 0049-28

NASA Photo by Tom Tschida

the Dryden Aircraft Operations Facility in Palmdale.

"The goal is to give officers the opportunity to experience scenarios they might really find themselves in. If they see the scenario, it will be easier for them to react," said Rieck, who is certified in defensive training, as a range master and has a Master of Business Administration

degree in leadership.

There are a number of skills that are honed through such exercises.

"We want to enhance their weapon handling skills. We are able to do things here that we can't do on the Air Force range and you wouldn't want to do with live ammunition. This gives reality-based training with built-in safety

mechanisms so no one gets hurt," said Spencer, who is a graduate of the Federal Bureau of Investigation Special Weapons and Tactics, or FBI SWAT, School and a 12-year member of the El Segundo, Calif., SWAT Team.

A number of precautions are taken to ensure the training is completed with no more than a welt

as a reminder that the officers need to learn from the situation that caused the welt. Officers' guns carry special ammunition for the drills that leaves a blue paint spot on the person or wall it hits. The bullets are specially marked and the guns are modified so actual bullets will not fit into the assembled training weapon.

If it seems that Protective Services officers are more svelte than they used to be, it's because they are. About five years ago the Dryden Protective Services Office instituted a program they call the Security Officer Fundamentals Certification Course.

New officers are required to complete two weeks of training



ED12 0049-03

NASA Photo by Tom Tschida

Above, trainer David Spencer goes over the parameters of the exercise with Davin Link, Hugo Orozco, Juan Carrillo, and John Theisen.



ED12 0049-30

NASA Photo by Tom Tschida

Above, Protective Services officers find and capture the suspect in their training exercise. At left, officers work through a drill where they have to shoot a suspect from a seated position.

— a full 80 hours. Of those hours, 40 hours are academics about state and federal law, the use of force, arrest powers and a written test that officers must score at least 80 percent. The other 40 hours are instruction in defensive tactics including use of force, handcuffs, strikes, kicks and techniques to escape if a suspect has the officer on

the ground during a fight. Another element of that training is a two-minute, non-stop, fight drill with instructors using batons, boxing gloves and kicks.

In addition, officers are encouraged to work out and eat healthy year around and their fitness is tested

Researchers... from page 1

The March research flights combined a UAS aircraft, the ADS-B sensor, synthetic vision displays and radio communications for the first time. The integration effort advances state-of-the-art air traffic observation, Arteaga said.

Arteaga began by looking at available technology. He and the team then integrated these elements with his own ideas and designed a system of hardware and software that could meet the needs of the new FAA mandates. It made sense, he explained, to start small on a UAS to determine the merits of the ADS-B device before expanding its use to larger aircraft.

Arteaga considers the ADS-B system flown on Ikhana to be the next step in air traffic control surveillance technology evolution. The ADS-B system gives a UAS a capability it doesn't currently have – to periodically transmit its own three-dimensional position and airspeed, as well as that of other aircraft in the vicinity. Only air traffic controllers currently have information on each aircraft's position. The ADS-B system could help with a future requirement for UAS – a detection and warning system to avoid accidents.

The research flights measured the accuracy of the aircraft's position information to be within 10 meters. The synthetic vision display was also evaluated in flight for its ability to provide the pilot in the ground cockpit with enhanced awareness of the aircraft's environment. The creativity required to develop the three-dimensional visualization display was one of the best parts of the work, he said.

"A working prototype was built in May 2011 for demonstrating the initial ADS-B concept feasibility using an industry standard Earth (Internet) browser. During the initial power up everything worked as expected. It took time to flush out all the interfaces, since we were developing a new ADS-B synthetic vision display," Arteaga said.

Federal Aviation Administration



ED12 0082-1

NASA photo by Tony Landis

Engineers and technicians check the ADS-B equipment following its installation on the Ikhana unmanned aircraft.

officials are reviewing information gathered from the Ikhana flights to determine if the ADS-B system meets FAA requirements for certification, he said. The team is confident that the flights pinpointed the aircraft's position to less than two meters during some of the test points, significantly better than the current certification requirement. Once certification is acquired, the next goal is to integrate the system onto the unmanned Global Hawk, coordinate schedules, and see if the system works as well on a mostly autonomous – and larger – UAS.

The Dryden ADS-B system could be the right technology at the right time to assist the FAA in meeting its Congressional mandates for all aircraft to use GPS position information rather than the current radar-based systems in the United States by no later than 2020.

Regarding the integration of Unmanned Aircraft Systems, or UAS, in the National Airspace System, Arteaga's timing couldn't be much better. The U.S. Congress passed a bill providing the FAA with additional funding Feb. 6. The legislation requires military, commercial and privately owned UAS to have routine access to U.S. airspace by 2015 and makes the

"So, the lesson here is if at first you don't succeed, but the architecture is sound, you must try and try again to make it work."

Ricardo Arteaga
Dryden engineer

use of aircraft such as the Predator and Global Hawk possible for a multitude of missions.

The FAA currently restricts flight of unmanned remotely piloted, or autonomous aircraft primarily to designated military airspace. However, public agencies and their private partners have a method through the FAA to obtain permission to fly mostly small, unmanned aircraft at low altitudes away from airports and urban centers.

Certificates of Authorization, or COAs, are currently required in order to fly a UAS in the National Airspace System. Dryden personnel have become adept at working with the FAA on COAs, which for example were required when NASA's Ikhana flew in support of fire fighting missions. Submitting a COA requires a lot of paperwork and effort that can take nine months or longer to secure. The time

frame is prohibitive for a number of short-notice UAS missions. Arteaga said he believes his work can provide some solutions to these challenges.

The path hasn't been without its twists and turns. Arteaga understands the challenges of working with UAS first hand, as the biggest challenge for his team was integrating ADS-B with the Ikhana.

"The team spent several weeks integrating and testing ADS-B on the ground with FAA support, before testing its performance in flight. The RF (radio frequency) telemetry for data communications proved to be problematic, requiring the avionics boxes to be removed from the aircraft and sent to the lab several times before determining the proper polarities. So, the lesson here is if at first you don't succeed, but the architecture is sound, you must try and try again to make it work," he said.

"You have to be very passionate when inventing. Without passion, you can't tolerate failures. If you can't tolerate failures, you're never going to make it from concept to flight," Arteaga added.

Arteaga had help from a number of Dryden employees, he said, including Ron Ray, Sam Kim, Mauricio Rivas, Donald Johnson, Mike Dandachy, Andrew Gutierrez, Mark Pestana, Hernan Posada, Kathleen Howell, Kelly Snapp, Kurt Sanner, Terry Bishop, Eric Boyden, Russ James, Dave Ewers, James Smith, Patricia Linares, Greg Buoni and Ed Koshimoto. Undergraduate Student Research Program interns Andrew Strongrich, Christopher Romano, Michael Jermann and Bill O'Neill created the code for the project.

Seeing everything work in flight made for an excellent day Arteaga said, "There's nothing like being the first. This was the first time a medium-altitude class unmanned aircraft has flown while equipped with an integrated ADS-B technology. It works as intended and I feel elated and proud to be a NASA engineer."

Protective Services trainer David Spencer, left, shows Anthony Garcia a good technique for spotting the suspect that gives the least view of the officer.

ED12 0061-11
NASA Photo by Tom Tschida



Protective Services... from page 5

annually with an obstacle course. Protective Services officers also are required to have a California weapons permit and guard card.

Spencer and Rieck annually go to Kennedy Space Center, Fla., where instructional seminars are available and new training plans and scenarios are looked at for practicality, feasibility, the safety plan and real-life feel.

Many training exercises are based on real-life situations. For example, one training session had officers sit at a table and communicate visually and orally and engage targets. It was derived from a coffee shop incident outside Seattle, where a random gunman killed four officers sitting at a table without the officers having a chance to fire a single shot.

“Training is critical to deal with problems, so it becomes second nature to the officer when they are in a similar situation,” Spencer said.



ED11 0314-210

NASA photo by Carla Thomas

Short caused fire

By Jay Levine

X-Press Editor

A short in a Global Electric Motorcar, or GEM, electrical system started the Oct. 12 fire that resulted in the loss of the cart and a private vehicle parked next to it. In addition, a government vehicle parked next to the private vehicle also was heavily damaged in the blaze, as was government equipment in that vehicle.

The GEM was plugged into an outside electrical outlet while parked near Building 4824, the communications building, which is located on Lilly Drive near the railroad crossing. Both buildings 4824 and 4870 were evacuated and no injuries were reported.

Mishap investigators determined no one pulled any of the seven fire alarms, which delayed the Edwards Air Force Fire Department response. A person in Building 4840 made the emergency call to Building 4825, also known as Post One, and then the fire department was notified. Cell phone 9-1-1 calls were made with the intention of reaching Post One, but those calls went to emergency services off base that were then redirected back to Edwards.

To report emergencies from a cell phone at Dryden, a person must dial 661-276-3256 and give the location and nature of the emergency. At Dryden, the Edwards Air Force Base emergency services can be called from any landline by dialing 9-1-1, which goes directly to Post One and the Edwards Air Force Fire Department.

Black History month

KNBC reporter Toni Guinyard spoke at Dryden Feb. 28 as part of the center's celebration of Black History Month.



ED12 0067-38

NASA Photo by Tom Tschida

Mishap investigators were unable to determine the exact cause of the electrical short that caused the fire or the origin of the blaze. The GEM was destroyed in the fire and the debris was scattered from the pressure of the water used to put it out.

As a result of the mishap investigation, it is recommended that GEM operators:

- Use the correct charge cords for each GEM, such as 14-gauge wire for 25-foot extension cords and 12-gauge wire for 50-foot extension cords.
- Make sure the manufacturer's recommended three-wire grounded electrical extension cord is plugged into a 110-volt electrical outlet and a minimum 15-amp breaker outlet with ground fault interrupters protection.
- The ignition needs to be in the off position for charging a GEM.
- GEMs may not be driven or charged indoors. The exception is when a GEM is undergoing maintenance in designated areas.
- GEMs may be parked and charged as they were prior to the fire, unless the location is marked as “No Parking” or yellow striping indicates parking is prohibited.
- When a GEM is not in use, the key must be turned off and removed from the ignition. Keys may be stored indoors, left on the dash, or on a steering column lanyard.
- Report any unusual problems or abnormalities with the GEM cart to Kay and Associates, the contractor for fleet maintenance.
- Dryden management and supervisors will ensure operators receive training on safe GEM cart operation and charging.

For additional information, call the Safety, Health and Environmental Office at ext. 2307.

ADS-B.. from page 1

information every second to air traffic controllers. The more frequent updates, coupled with information updated through the Global Positioning System, result in much greater accuracy in the display of an aircraft's position, velocity and altitude.

It also was the first flight of hardware for the NASA Aeronautics research project known as UAS in the NAS, which is short for Unmanned Aircraft Systems Integration in the National Airspace System.

The equipment performed well during a flight lasting nearly three hours in restricted air space over Dryden's Western Aeronautical Test Range, which is part of Edwards Air Force Base and the China Lake Naval Air Warfare Center.

Being equipped with ADS-B enables NASA's Ikhana to provide detailed information about itself to air traffic controllers, airborne pilots of other ADS-B equipped aircraft flying in its vicinity, and to its pilots on the ground. Currently, only air traffic controllers can see all the aircraft in any given section of the sky.

The ADS-B checkout flight



ED12 0082-17

NASA photo by Tony Landis

The Ikhana is prepared for the first checkout flight of ADS-B Automatic Dependent Surveillance-Broadcast device.

aboard Ikhana kicked off a series in which researchers will collect ADS-B data while performing representative air traffic control-directed maneuvers.

As part of a collaborative effort, FAA's William J. Hughes Technical Center in Atlantic City, N.J., recorded ADS-B data from the flight and will help analyze the performance of the system installed in the aircraft. Researchers also evaluated new ADS-B laptop

software for displaying surrounding air traffic information to the UAS pilots on the ground.

"ADS-B is a cornerstone capability required in the NextGen, and understanding its performance and suitability for integrating unmanned aircraft into the National Airspace System is critical to the overall goals of the project," said Sam Kim, deputy manager of integrated test and evaluation for NASA's UAS in the NAS Project.

Developing technologies that will enable unmanned aircraft to fly safely among other planes in the nation's skies is the job of Kim's team.

ADS-B is a key component of the largest transformation of air traffic control ever attempted in the United States. Known as the Next Generation Air Transportation System, or NextGen, it is a multi-billion-dollar technology modernization effort that will make air travel safer, more flexible and more efficient. As the system gets better, its capacity will grow and the demand for different types of air transportation – even unmanned aircraft – will increase.

The effort is part of the Dryden-led UAS in the NAS Project, which is designed to contribute capabilities to reduce technical barriers related to the safety and operational challenges of unmanned and passenger-carrying airplanes sharing the same air space.

The UAS in the NAS Project is managed from Washington by the Integrated Systems Research Program office in NASA's Aeronautics Research Mission Directorate.

Davis, former safety employee, died March 11

Bette Davis, a former Dryden occupational health and safety professional, died March 11.

Davis retired from Dryden in 2008 and her husband Matt Graham is a senior Dryden

operations engineer.

Flying was a passion of Davis, who learned to fly in the mid 1970s and she restored her own plane.

Services for Davis were March 15. In lieu of flowers, Graham

requested that a donation be made to one of Bette's favorite charities in her honor including Guiding Eyes for the Blind, Paws With a Cause, or the Tehachapi Humane Society.

Chiefs named

Brad Flick, director of Research Engineering, announced the selection of C.J. Bixby as the chief of the Flight Systems Branch, or RF, and Richard Hang as chief of the Flight Instrumentation Branch, or RI.

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