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Rising expectations

Aeronautics a focus at N.M. Balloon Fiesta

Photo courtesy Jay Levine

A wave of hot air balloons lifts off at the Albuquerque, N.M., International Balloon Fiesta.

By Jay Levine
X-Press Editor

When as many as 900,000 people visited the International Balloon Fiesta in Albuquerque, N.M., Oct. 2-10, one place where they learned something they might not have known about was at the NASA exhibit.

Though many people are aware of the agency's space mission, not as many are familiar with NASA's aeronautics research conducted at four centers across the nation: Ames Research Center at Moffett Field, Calif., Dryden Flight Research Center, Glenn Research Center in Cleveland, and Langley Research Center in Hampton, Va.

NASA Aeronautics, which has a history of bringing key technologies to all aspects of aviation, is looking to do so again with its latest "green aviation" initiative. The program seeks to test and integrate technologies for reducing aircraft noise and emissions, maximizing fuel usage and improving air-traffic management.

"We were excited to have a lead role in the aeronautics exhibit in the NASA tent at the Balloon Fiesta," said Mary Ann Harness, Dryden public outreach specialist and exhibit coordinator. "We have a number of people who come again and again because there is so much to see and experience."

Balloon Fiesta attendees learned not only about the history of NASA aeronautics through a number of displays, including a timeline of aviation achievements, but experienced some of it personally. For example, an F-15 cockpit simulator gave visitors the chance to picture themselves in the pilot's seat, lifting off the runways at Edwards.

When exhibit attendees exited the cockpit, they had an opportunity to learn about the wind tunnels that are used for research on different aircraft shapes or the aerodynamics of various parts of an aircraft.

New to the exhibit this year were twice-daily presentations by former Dryden aerospace engineering technician Jim Sokolik, a space shuttle tire flown on the orbiter Discovery, and kiosks that showed aeronautics can be fun and games.

Sokolik demonstrated a high-altitude pressure suit that was used in the Mach 3 SR-71 program during daily hands-on life support demonstrations and longer presentations at Albuquerque-area schools. Sokolik allowed participants to taste astronaut food, which is eaten by pilots of high-altitude aircraft on long missions.

The shuttle tire on display was from Discovery's 12-day STS-116

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New tool is testing well

By Jay Levine
X-Press Editor

ED10 0042-16 **NASA Photo by Tom Tschida**

A software-development team prepares for a research flight with a new tool. In the aircraft, from left, are Ryan McMahon and David Marten. Outside the cockpit, from left, are Katherine Ryan, Gianmarco Di Loreto, Jade Lemery and Bruce Cogan.

Software being developed at Dryden could provide future aircraft designers with a better prediction tool that will accurately gauge how an aircraft would fly when a flight control surface is damaged and adaptive, or "intelligent," flight control software is used to compensate for the loss.

Ample handing-quality metrics are available for standard areas of the flight envelope. However, damage to a flight control surface may require aircraft to operate in regimes for which there currently are no handling-quality scales or tools that can predict how it will fly or if it is flyable, explained Bruce Cogan, a Dryden researcher and lead on the project.

One example is cross coupling, which causes an unexpected response to the aircraft when the pilot moves the control stick. If the pilot pulls back on the control stick to climb the aircraft may climb, but it will also roll to the left or right. That left or right motion could make the aircraft hard to control. This situation is generally not a concern, except in a case where the aircraft has been damaged.

This research is intended to provide a metric for use by future designers in measuring cross coupling and building control laws to eliminate it, Cogan said. The tool could eventually be part of standard engineering software that aircraft designers use.

Somewhat ironically, research with one of the few fixed-wing aircraft where cross coupling applied also was done at Edwards Air Force Base. The AD-1 research aircraft, which was flight-tested at Dryden, exhibited heavy cross coupling due to the ability to change the angle of the wing in flight.

The concepts were developed initially through a Small Business Innovative Research agreement with Hoh Aeronautics Inc. of Lomita, Calif., and are based on a metric developed for helicopters. Unlike fixed-wing aircraft, helicopters exhibit cross coupling in routine flight. The overall concept is to apply helicopter cross-coupling metrics to a damaged fixed-wing aircraft.

The end result is software that predicts how an aircraft would fly when damage occurs in flight and how well an adaptive controller compensates for cross coupling. That software recently took flight in a U.S. Air Force Test Pilot School simulator and on the F-16 variable-stability in-flight simulator test aircraft, or VISTA.

"The VISTA is a good test bed for the research because the aircraft software is easy to modify and the aircraft is able to 'fly' like different aircraft," Cogan explained. "In this case, the software was modified to fly like an F-16 and simulate effects of various degrees of simulated cross-coupling damage to the flight control surfaces."

For the flight tests, the aircraft took off under student control. Once in the air, the instructor pilot would switch to one of 25 pre-programmed configurations, changing it to enable the student to fly the new configurations, Cogan said. Also, safety trips were in place to ensure that flight controls reverted to those of a standard F-16 in case the aircraft approached dangerous conditions. Then, TPS students flew and rated the controllability of the aircraft in about 230 flight scenarios during nine research flights.

As a whole, the software predicts cross coupling and the controllability of the aircraft, which were then compared to the students' experiences. Students used the Cooper-Harper scale, a recognized pilot rating system for flying qualities, to judge the aircraft performance. A tracking task was designed by the students to evaluate the aircraft. Early results showed a good comparison between predicted and actual handling qualities for varying degrees of cross coupling.

The enthusiasm and contributions of the student pilots added to the positive results, Cogan said.

"We listened to their comments, and they thought of things we didn't about introducing cross-coupling challenges," Cogan said. "They wanted to get good results for us on what was a very tight, compact schedule. It was a win-win."

The Air Force Test Pilot School team included project pilots Maj. Dail Fields, Maj. David Marten and Italian Air Force Capt. Gianmarco Di Loreto. Project engineers included Robert Koo, Jade Lemery and Katherine Ryan. Bill Gray was staff advisor for the project, which

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Halloween can be scary

Although Halloween is intended to be fun for kids of all ages, without some special consideration and preparation Halloween can also be a real scare. Here are a few safety tips to follow this Halloween season.

Driving safety:

•Motorists traveling on Halloween night should remember that children are everywhere – streets, sidewalks, crosswalks and parking lots.

Advice to parents:

•Children under the age of 12 should be accompanied by an adult.

•Know the route your kids will take if you are not going with them.

•Set a curfew for children who are not being supervised by an adult.

•Explain to children the difference between tricks and vandalism.

•There is safety in numbers; unaccompanied older children should stay together in groups.

•Ensure that your child is not tempted to eat treats before you have a chance to examine them. Exercise caution with homemade treats or damaged wrappers.

Costume safety:

•Costumes should be made of bright material, visible in the dark or bearing reflective tape.

•Consider using face paint; masks can hinder a child's visibility.

•Make sure costumes fit properly. Loose costumes may cause children to trip and fall.

•Tape child's name, address and telephone number to the inside of their costume.

•Do not allow sharp instruments to be used as part of costuming.

Trick-or-treat safety for children:

•Carry a flashlight.

•Walk on sidewalks, or on the left side of the road facing traffic.

•Avoid shortcuts.

•Stop at all curbs.

•Travel on well-lit streets.

•Obey all traffic signals and rules of the road.

•Trick-or-treat in well-known neighborhoods.

•Approach only homes that have a front porch light on.

•Accept treats only at the front door. Never enter the home of a stranger.

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the Test Pilot School called Project Icarus: Limited Handling Qualities Evaluation of Cross Coupling.

The work wasn't accomplished without a lot of perseverance and patience, as the concept originated in 2004.

Proposals originally were written for testing the ideas on the N/F-15B Intelligent Fight Control Systems aircraft. Dryden researcher Peggy Hayes first saw the need for this information when she was working on intelligent flight control systems on the F-15 and began looking for a solution to the problem.

The ideas were developed with help from Dave Mitchell through the Dryden SBIR agreement with Hoh Aeronautics. Mitchell was the principal investigator and used his experience in handling qualities and helicopters to make the program a success.

Early simulation tests proved successful and led to the current effort. When Hayes moved on to another project, Cogan took on the work.

Cogan hopes to analyze the information and refine it for potential use on Dryden test aircraft. One such aircraft might be F/A-18 no. 853, which is being used for research on Integrated Resilient Aircraft Control, or IRAC. The IRAC project is part of the Aviation Safety program under NASA's Aeronautics Research Mission Directorate.

Now that the concept is proven through flight the development process will continue, leading to validation for its use in helping make aircraft safer.

Oct. 17, 1958 – The X-15-1 (56-6670) arrived at the North American Aviation test facility at Edwards Air Force Base by truck.

Oct. 27, 1970 – John A. Manke piloted the highest flight in the X-24A, achieving an altitude of 71,400 feet.

Oct. 5, 1983 – Rogers Smith and Victor Horton delivered F-4C (63-7424) to the Dryden Flight Research Facility from Hill Air Force Base, Utah, for use in the Spanwise Blowing Program.

Oct. 16, 1997 – The second RQ-3A DarkStar UAV (696) arrived at Dryden.

Oct. 13, 1999 – The first X-43 vehicle arrived at Dryden by truck.

-Passings-

Donald Leroy Hall, 92, died Sept. 27 at his home in Windsor, Calif.

Hall was a Dryden aircraft mechanic from 1948 until his retirement in 1974, working on such planes as the Douglas D-558-2 Sky Rockets, the three X-15s, the X-4, the F-111, the B-47, the KC-135, the F-104 and the F-8 digital-fly-by-wire.

Former Dryden employee **Eloy Michael Varela**, 56, died Sept. 23.

News at NASA

NASA funds tribal STEM

NASA will award $3.3 million over three years to support academic excellence in science, technology, engineering and mathematics, or STEM, education at tribal colleges and universities.

The awards are part of a Cooperative Agreement Notice released by the NASA Office of Education Minority University Research and Education Program for the Tribal Colleges and Universities Project.

Three institutions were selected through a merit-based, peer-reviewed competition for funding. Awards will go to Kiksapa Consulting, LLC, of Mandan, N.D.; Salish Kootenai College of Pablo, Mo.; and the American Indian Higher Education Consortium in Alexandria, Va. The awards have a three-year period of performance and range in value from $215,000 to $592,000.

The initiative is a STEM education grant and mentoring program specifically targeting tribal colleges and universities. The goal of the project is to expand opportunities to academic institutions that prepare Native Americans to enter the nation's STEM workforce through internships, fellowships, research experiences, outreach, information exchange, capacity building and infrastructure development.

The first round of awards is valued at $1.107 million.

More information about the awards is available at http://nspires.nasaprs.com. For more information about NASA educational programs, http://www.nasa.gov/education.

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mission in December 2006. On that mission, astronauts delivered and attached the ISS third port truss, performed major rewiring of the station's power system and delivered new ISS personnel.

Dryden research aircraft contributed to the development of the shuttle's design, including its thermal protection, solid rocket booster recovery, flight control, braking and drag chute systems. In addition, the space shuttle prototype Enterprise was flown at the center in 1977 to evaluate glide and landing characteristics of the 100-ton vehicles.

The Darth Vader hot air balloon entourage visited the NASA staff at the Albuquerque International Balloon Fiesta during the 10-day event.

Photo courtesy Jay Levine

Visitors to the NASA exhibit waited their turn at a photo kiosk, where they could be photographed on either the moon or Mars at no cost. Another kiosk featured a NASA aeronautics memory game or a virtual airport, where visitors to the display zoomed in to see how NASA's technology has found its way to use on military, commercial and general aviation aircraft and helicopters.

The matching-game kiosk featured X-15 concept models, delta wing models of the 1980s, and an X-2 model that have all flown in NASA wind tunnels. When all of the pairs have been matched, a brief description of each item is available for the game player to review before going on to a more challenging game with even more matches to find.

The virtual airport allows people to click on various parts of the aircraft housed at different areas of the virtual facility. The featured areas of each aircraft are products of NASA research, including supercritical wings, area rule, winglets and digital fly-by-wire systems.

Supercritical wings refer to the wings' shape, which is flatter at the top, more curved on the underside with a downward curve at the trailing edge. The shape minimizes aerodynamic forces on the wing and improves the aircraft's efficiency at speeds just below the speed of sound. Area rule is one of the most revolutionary aircraft technologies, allowing an aircraft to fly faster and greater distances through reduction of aerodynamic drag where the wings attach to the fuselage.

Winglets are vertical endplates that are attached to aircraft wingtips that improve airflow and fuel efficiency. Digital fly-by-wire systems are now standard on most newer aircraft. They replaced heavier and less reliable hydraulic systems with a digital computer and electronic wires that send signals from the pilot to the aircraft's control surfaces.

At an event featuring hot air balloons, NASA appropriately had an F/A-18 half-scale blow-up model at the entrance of the agency's exhibit. A less expansive model of the Stratospheric Observatory for Infrared Astronomy, or SOFIA NASA 747SP aircraft, was also on display.

The SOFIA, a modified NASA 747SP with the world's largest airborne infrared telescope installed in its rear fuselage, will deploy to locations around the world. Its high-tech German-built telescope will scan the heavens to obtain clearer views than those taken with Earth-based telescopes.

Many people are familiar with the visible light images taken by the Hubble Space Telescope. The SOFIA display introduced visitors to the infrared spectrum by allowing them to see themselves on a monitor through the lens of an infrared camera.

Balloon Fiesta attendees saw spectacular and breathtaking views at the events on the field and in the sky. However, they also had opportunities for similar experiences while learning about the latest technologies and test beds that NASA is developing to advance aeronautics and reveal more about planet Earth and its environment.

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