National Aeronautics and Space Administration

The Dryden X-PRESS

Volume 55 Number 2 February 2013

Tomorrow's tech today

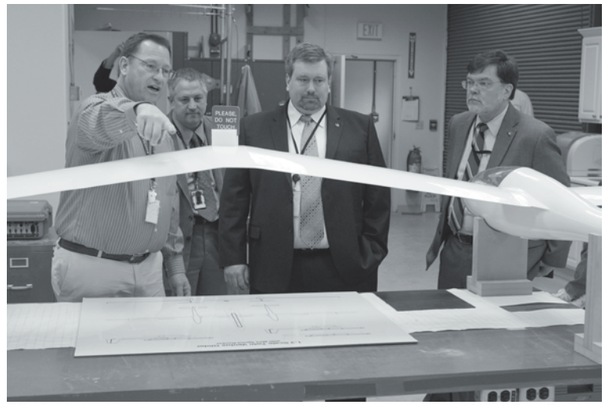
By Jay Levine
X-Press editor and
Alan Brown
Dryden Public Affairs

Imagine hypersonic breakthroughs that enable future missions to Mars, exponentially better sensors for aircraft and spacecraft that reduce weight and increase safety, and control systems that automatically react to flight conditions before emergency situations arise.

Dryden researchers can see that future. NASA technology leads, including chief technologist Mason Peck, deputy chief technologist Jim Adams and the center technologists council, recently toured the center and its associated aircraft operations facility in nearby Palmdale. They were introduced to Dryden researchers' ideas that could have major impacts on future aircraft and spacecraft systems.

Both Peck and the council were introduced to a range of Dryden technologies including fiber-optic sensor work, Space Launch System controls and adaptive controls technology. They also learned about the Multi-Disciplinary Hypersonic Trajectory Analysis and Optimization Research, an altitude compensating engine nozzle and flight research projects focused on enabling next-generation aircraft and spacecraft systems.

Peck also spoke about Dryden's technology having impacts beyond NASA that could "achieve a spark for other kinds of goods and services" by transferring the technology to industry for commercialization.



ED13-0019-32 NASA/Tom Tschida

Jerry Budd, left, shows off the 1/3-scale Twin Ventus glider center section that would be used to flight validate the aerodynamics of his Towed Glider Air-Launch concept to NASA chief technologist Mason Peck, center, and deputy chief technologist Jim Adams. Dryden's technology chief David Voracek observes.

ED13-0019-20 NASA/Tom Tschida

Tony Chen, left, discusses the mechanical testing of the Flight Loads Laboratory's upcoming Hypersonic Inflatable Aerodynamic Decelerator to Peck and Adams.

Work such as the automatic ground collision avoidance system has applications that could have broad appeal, Peck said. Concepts for a self-driving car are one example where the technology could be transferred to industry for use.

"Dryden will fly and test the technologies that will make the future possible," he added.

To make that future possible, Peck encouraged Dryden staff to continue seeking partnerships with industry, academia and other federal agencies.

After his Dryden technology tour and an all-hands session with Dryden employees, Peck and Adams visited some of NASA's partners at the Mojave Air and Space Port in Mojave, Calif., including Firestar Technologies, Masten Flight Systems and XCOR Aerospace.

Masten demonstrated their progress on developing a reusable vertical-launch-and-landing sub-orbital space access vehicle by conducting a 60-second tethered test launch of its Xombie prototype vehicle, followed by a tour of the follow-on Xaero-B vehicle now under development.

At XCOR, Peck and his entourage viewed a brief test firing of a tiny rocket nozzle, and were briefed by XCOR president Jeff Greason about the development of the Lynx sub-

Technology, page 7

It was closer than we knew

By Jay Levine
X-Press editor

The United States and the Union of Soviet Socialist Republics, commonly known as the Soviet Union dominated by Russia, battled for supremacy in space in the 1960s in a race that was much closer than people realized.

The Soviet Union had the early lead with the first launch of the Sputnik 1 satellite on Oct. 4, 1957. Another milestone was reached when Yuri Gagarin became the first human in space and the first in orbit on April 12, 1961 in a Vostok spacecraft. The U.S., however, ultimately declared victory when U.S. astronauts Neil Armstrong and Edwin "Buzz" Aldrin set foot on the moon on July 20, 1969.

Even on the day the U.S. claimed victory, the outcome was not certain until American astronauts made it back safely from the surface of the moon, said NASA Chief Historian William Barry. Barry, who has been NASA's chief historian since 2010, discussed how and why the Soviet Union lost the race to land a man on the moon during a Dryden colloquium presentation Jan. 31

Until the dissolution of the Soviet Union about two decades after the space race was decided, the level of the secret effort was unknown, Barry noted. There are three prevalent explanations as to how the Americans overcame the Soviets – there never was a race, the Soviets gave up or they tried but failed because of a combination of spending, poor leadership, and the death of chief designer Sergei Pavlovich Korolev in January 1966.

Barry argued that the space race really started in 1964, not 1961. In January 1964, the flight of the first Block II Saturn I vehicle known as SA-5 gave the U.S. the capability to launch a larger payload than the Soviets for the first time. Then in May, detailed plans for the Apollo program were unveiled and the Gemini program was well under way. Gemini set new records with 10 flights.

However, the USSR pulled off another coup when Alexei Leonov in the Voskhod 2 became the first human to walk in space on March 18, 1965. Then it seemed the Soviet effort stalled. Its next human flight came two years later on April 23, 1967, but ended in tragedy when the new Soyuz 1 spacecraft crashed on landing, and Cosmonaut Vladimir Komarov perished. The Soviet flight schedule suggests that they dropped out of the race around the time of the change of leadership in 1964, Barry said.

Years passed and the first Soviet N-1 test launch, an effort started in 1964, came late in the game, on Feb. 21, 1969. The rocket exploded 69 seconds after liftoff. The Soviets tried again on July 3, 1969, but that one blew up just after liftoff and destroyed two launch pads.

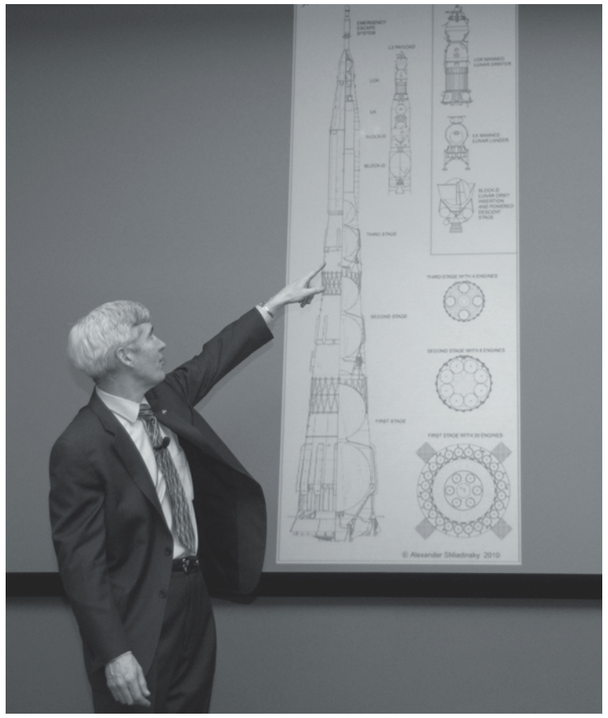
The N-1 destruction was a setback, but the space race wasn't over until the Soviet Luna 15 crashed on the moon about two hours before Armstrong and Aldrin lifted off from the surface in July 1969, he added.

"The Soviets lost the Moon Race largely because they started too late and tried to do too much at the same time. They were running, in the end, three major programs plus the parallel effort to develop the Soyuz spacecraft they needed to make it all happen," Barry said.

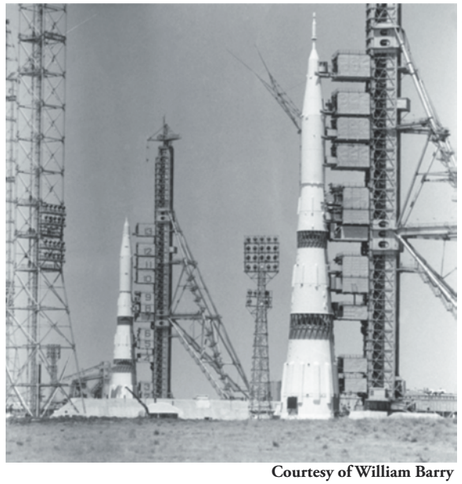
"They expended massive amounts of effort and treasury and all for the same reasons we did – not to colonize outer space and have a long-term human space flight program, but to achieve a political goal of upstaging the other superpower," he said.

The space race has lessons for space policy makers today.

"Countries don't spend a lot on space things unless they have a political purpose. It's not done for scientific reasons, or engineering reasons, it's done for political reasons," Barry argues.



ED12-0331-10 NASA/Jim Ross



Courtesy of William Barry

Above, *William Barry, NASA's chief historian, points out features of the N-1 rocket. The rocket was part of the Soviet Union's entry into the race with the U.S. to reach the surface of the moon first.*

At left, *N-1 rockets are positioned on launch pads.*

In that case, good engineering goes out the window and the effort is not sustainable beyond reaching the political goal. Regarding future exploration of Mars, Barry hopes it evolves differently than a space race with a superpower.

"I hope we go to Mars for good reasons and not political reasons and we find a way to do it within budget and collaboratively," he said.

Grunsfeld tours DAOF

John Grunsfeld, associate administrator of NASA's Science Mission Directorate and a former space shuttle astronaut, was brought up to date on the status of a variety of airborne science missions flown on NASA aircraft during a recent tour of the Dryden Aircraft Operations Facility in Palmdale. He also was briefed on the upgrades to and upcoming astronomical science flights on the Stratospheric Observatory for Infrared Astronomy.

SOFIA science mission operations director Erick Young of the Universities Space Research Association and SOFIA project scientist Pamela Marcum outlined the next series of astrophysics flights for the SOFIA observatory in 2013. SOFIA program manger Eddie Zavala and aircraft manager Brent Cobleigh then detailed the upgrades made to the observatory's avionics and telescope control systems during the past year.

Grunsfeld was also briefed on upcoming airborne Earth science campaigns by NASA's ER-2 high-altitude aircraft, the DC-8 flying laboratory, JPL's UAVSAR synthetic aperture radar on a modified C-20A (G-III) and the autonomously operated Global Hawks. He was also updated on plans for the Discover-AQ pollution study over central California that was flown from the Dryden facility by an instrumented P-3B Orion aircraft from NASA's Wallops Flight Facility and a B200 King Air from NASA's Langley Research Center, both in Virginia, during the latter part of January and early February.

ED13-0008-16 NASA/Jim Ross

John Grunsfeld, left, and a DSI telescope technician examine the framework supporting the 100-inch primary mirror in the telescope cavity of NASA's SOFIA flying observatory.

Holm wins alumni award

Gwen Holm, Dryden's director of mission support, received the N. Dale Wright Distinguished Alumni Award. The Romney Institute of Public Management at Brigham Young University chooses the recipient.

"Holm embodies the personal and professional qualities expected of our graduates," said David Hart, director of the Romney Institute. "We celebrate her dedication to commitments as well as years of her untiring public service."

Holm's colleagues selected her for her commitment to high standards of excellence and to service at work and in the community.

James McDonald, one of Holm's former professors, spoke about his former student at the recent award ceremony.

Award, page 8

Photo courtesy of Gwen Holm

Gwen Holm and N. Dale Wright stand by the seascape he painted and gave to Holm following her acceptance of the Distinguished Alumni Award from the Romney Institute of Public Management.

News at NASA

Asteroid to pass Earth

Small near-Earth asteroid 2012 DA14 will pass very close to Earth on Feb. 15. In fact, it will be so close that it will pass inside the ring of geosynchronous weather and communications satellites.

It is anticipated when the asteroid passes, it will be the closest to Earth of any object of its size.

NASA's Near-Earth Object Program Office can accurately predict the asteroid's path and there is no chance that the asteroid might be on a collision course with Earth.

Nevertheless, the flyby will provide a unique opportunity for researchers to study a near-Earth object up close. The facts about the safe flyby of Earth by asteroid 2012 DA14 are detailed at http://www.nasa.gov/topics/solarsystem/features/asteroidflyby.html.

Pitre passes

John "J.P." Pitre, a former Dryden contract employee, died Feb. 3. He was 62.

Mr. Pitre was hired in the 1990s as a member of the cable plant team responsible for designing, installing and maintaining the complex cabling and wiring infrastructure at Dryden. That cabling was later extended to the DAOF and AERO campuses.

Services for Mr. Pitre are scheduled for Saturday, Feb. 16, at 1pm at the Wayside Chapel in Rosamond.

NASA showcases Airborne Science

By Jay Levine
X-Press editor

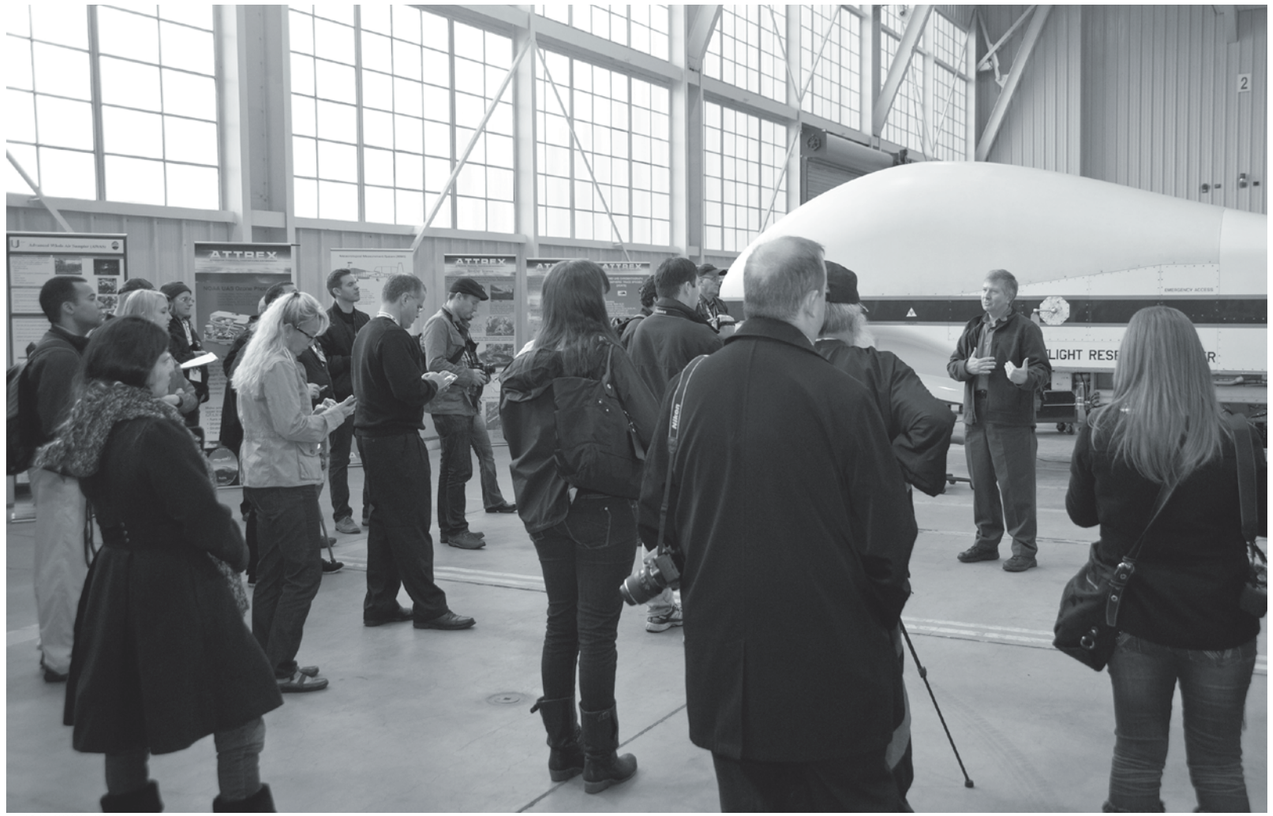
NASA uses ground, air and space assets to monitor the environment, develop models of the world's climate and provide information for policymakers to make informed decisions.

News and social media representatives learned about the agency's overarching environmental mission and how NASA aircraft support that mission at the Airborne Science Showcase Jan. 25 at Dryden's main campus and at the Dryden Aircraft Operations Facility in Palmdale.

Airborne Science enables scientists to answer questions that require the use of airborne platforms, said Randy Albertson, deputy program manager of NASA's Airborne Science Program. Instruments on the aircraft help calibrate and validate satellite instruments, support new sensor development, initiate process studies and develop the next generation of scientists and engineers, Albertson said. Missions are flown all over the world in partnership with industry, universities or other government agencies, he added.

Airborne Science aircraft capabilities range from the high-flying ER-2 and the unmanned Global Hawk aircraft, to more traditional aircraft like the B-200 King Air, the C-20A (G-III) and DC-8 flying laboratory. Aircraft are based at different NASA centers such as the WB-57 at Johnson Space Center in Houston, the P-3B from Wallops Flight Facility, Wallops, Va., a B-200 from Langley Research Center, Hampton Va. and a host of aircraft located at Dryden's facilities at Edwards and Palmdale.

Developing instruments and using those technologies to learn about atmospheric composition for development of models to predict future climate change is a valuable use of NASA aircraft, said Ken Jucks, NASA's Upper Atmosphere Research program manager.



ED13-0023-010 NASA/Jim Ross

Chris Naftel, Dryden Global Hawk project manager, talks to the social media attendees of the Airborne Science Showcase. The event introduced media and social media to Airborne Science missions, program and project managers, scientists, pilots and others who make the missions possible. Naftel said the Global Hawk is a good science platform because it is capable of flying at altitudes up to 65,000 feet for up to 30 hours. It also can fly 12,500 miles without refueling.

Eric Jensen of Ames Research Center, Moffett Field, Calif., principal investigator for the Airborne Tropical Tropopause Experiment, said the multi-year science campaign seeks to investigate unexplored regions of the upper atmosphere and how its chemistry is changing Earth in a warming climate. The mission will give scientists the information they will need to better understand and predict this phenomenon.

In addition, Hal Maring, NASA Radiation Sciences program manager, explained the NASA Earth Science Division seeks to determine if Earth's systems are changing and if so, can that change be predicted. Measurements taken from aircraft, satellites and the ground are used to develop and improve models that describe the entire Earth system, he explained. Measurements are taken from different climates and conditions to determine the atmospheric chemistry and under what conditions can it become a problem.

The science could not be accomplished without the instruments. Jim Crawford of NASA's Langley Research Center and principal investigator of the Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality, or DISCOVER-AQ, mission, said the science instruments flown aboard NASA aircraft "are not off-the-shelf instruments. They are one-of-a-kind instruments developed over a career."

Scientific instruments that are measuring air pollution from two aircraft over California's San Joaquin Valley between Bakersfield and Fresno in January and February during the DISCOVER-AQ mission, are enabling scientists to better understand how to measure and forecast air quality globally. Those same instruments are intended to improve the ability of satellites to consistently observe air quality in the lowest part of the atmosphere, Crawford said. If scientists could better observe pollution from space, they would be able to make

Showcase, page 6

ED13-0023-090 NASA/Tom Tschida

Dryden ER-2 pilot Stu Broce talks to BBC radio about his missions. BBC personnel included Jon Stewart, at left, and Bryan Darling behind the camera. Media and social media members were invited to the Airborne Science Showcase to learn more about NASA's environmental missions.

ED13-0023-039 NASA/Tom Tschida

Allison Gatlin, center, a writer for the Antelope Valley Press in Palmdale, interviews Jim Crawford of NASA's Langley Research Center, Va., and principal investigator of the Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality, or DISCOVER-AQ, mission. Reporter Rachel Azevedo walks down the stairs as cameraman Tony Rutanashoodech captures the action for CBS 47 in Fresno, Calif.

Showcase... from page 5

better air quality forecasts and more accurately determine where pollution is coming from and why emissions vary.

David Starr of Goddard Space Flight Center, PODEX mission principal investigator, explained polarimetric measurements from three instruments obtain information in a different way from other research methods flying aboard NASA's ER-2.

In addition to being briefed on a half-dozen current or near-term science missions, event participants were able to see many of the aircraft used in those missions.

For example, Chris Naftel, NASA Global Hawk project manager, explained that the Global Hawk Aircraft is ideally suited for environmental research because it is capable of flying 10 miles high at altitudes up to 65,000 feet for up to 30 hours. It also can fly 12,500 miles without refueling.

Decisions can be made as the Global Hawk is flying about where to send it to maximize data collection with its complement of up to 12 science instruments. It also can transmit information as it is collected to scientists on the ground. A Global Hawk was used on the recent HS3 mission to essentially complete a "CAT scan of a hurricane," Naftel explained.

In addition, a B-200 aircraft is used for validation and verification of science instruments that might one day fly on satellites, explained Walter Klein, B-200 project manager. Delwyn Moller of the Jet Propulsion Laboratory in Pasadena, Calif., and AirSWOT principal investigator, also was available.

About 21 persons representing 14 news and documentary organizations and another 32 social media followers of NASA participated in the Airborne Science Showcase. Twitter recorded more than 1.4 million initial impressions about NASA Airborne Science activity from "tweets" posted by event participants that were then re-tweeted by their followers.

ED13-0023-039 NASA/Tom Tschida

At left, *John McGrath, C-20 project manager, talks to social media members about the aircraft. To McGrath's left is Yunling Lou, who is the Jet Propulsion Laboratory's Unmanned Air Vehicle Synthetic Aperture Radar program manager. Lou explained the function of the synthetic aperture radar that flies in a pod (seen behind Lou) located under the aircraft.*

ED13-0023-071 NASA/Tom Tschida

ED13-0023-075 NASA/Tom Tschida

ED13-0023-050 NASA/Tom Tschida

Top left, *Environmental scientist Glenn Sachse details the DISCOVER-AQ air quality survey mission over California's San Joaquin Valley to reporter Tabitha Lipkin of Time Warner Cable News, Palmdale, aboard NASA's P-3B environmental science aircraft.*

Top right, *a representative of KNBC Channel 4 from Los Angeles interviews David Star, Polarimeter Definition Experiment principal investigator.*

At left, *David Diner, a multiangle spectropolarimetric imager principal investigator, shows Diana Izquierdo a stereographic 3-D image taken from instruments onboard the ER-2.*

Concept could fly soon

By Gray Creech
Dryden Public Affairs

Dryden is developing a novel rocket-launching technique called the Towed Glider Air-Launch Concept that could significantly reduce the cost and improve the efficiency of sending satellites into orbit.

The idea is to build a relatively inexpensive remotely or optionally piloted glider that will be towed to altitudes approaching 40,000 feet by a large transport aircraft. The glider will carry a booster rocket capable of launching payloads into low Earth orbit.

Engineers continue working trade-offs with launching the rocket either with the glider still in tow, or following release from the tow aircraft. Either way, after the rocket has launched, the glider will return independently of the tow aircraft to its base to be used again.

Gerald Budd, a NASA Dryden business development and towed glider project manager, displayed a 24-foot wingspan, twin fuselage proof-of-concept model of the glider that was constructed in NASA Dryden's model shop during a presentation at the Academy of Model Aeronautics' 15th Annual Expo in Ontario, Calif., in mid-January. The model will fly later this year, towed aloft by one of Dryden's small DROID – for Dryden Remotely Operated Integrated Drone – unmanned aircraft.

NASA illustration

An artist rendering of the Towed Glider Air-Launch Concept shows the towed glider following a rocket launch. A tow aircraft is seen clearing the launch area.

Recent feasibility analyses done by independent contractors indicate that a performance gain of up to 40 percent may be realized by use of Budd's towed-glider technique over vertical launch of a similar-sized rocket from the ground.

Additionally, air launch of rockets has the potential to lower the cost of placing payloads to orbit through operational efficiencies that are simply not available through vertical ground launch, Budd explained. Cost savings may be as much as 25 percent, based on recent Defense Advanced Research Projects Agency studies.

Historically, air-launched rockets have been carried and dropped from underneath modified, existing aircraft, such as Orbital Sciences' Pegasus rockets that are launched from the firm's modified L-1011 "Stargazer" launch aircraft. Currently, a huge new custom-built carrier aircraft is under construction by Stratolaunch Systems, Inc.

Budd maintains the Towed Glider Air Launch Concept has the potential to realize the operational flexibility of a custom airplane, but without the price tag.

"It's a real-estate problem," said Budd. "You're limited in what you can fit underneath an existing aircraft. Launching off the top of

Concept, page 8

Technology... from page 1

orbital space-access rocket plane for both space tourism and science missions.

At Firestar, chief executive officer Greg Mungas detailed a variety of high-tech hardware the firm has been developing with NASA assistance, including a Volkswagen engine being converted to run on rocket fuel; small-scale rocket nozzles and inexpensive rocket engines that burn environmentally friendly mono-propellants.

Masten and XCOR are partners in NASA's Flight Opportunities Program, which has contracted with them to fly promising technologies on sub-orbital space-access vehicles, while Firestar has developed several technical innovations to benefit NASA via the agency's Small Business Innovative Research and Small Business Technology Transfer programs.

"When we invest in technology it has a big impact on the nation," Peck added.

Research published

Dryden researchers work on some of the most dynamic projects at NASA. Technical publications released in December and January detail those projects.

December

Daniel S. Jones, Syri J. Koelfgen, Marvin W. Barnes, Rachel J. McCauley, Terry M. Wall, Brian D. Reed, and C. Miguel Duncan collaborated on the "*Executive Summary of Propulsion on the Orion Abort Flight-Test Vehicles*," NASA/TM2012-216049.

January

Percy J. Bobbitt, Domenic J. Maglieri, Daniel W. Banks, Michael A. Frederick, and Aaron W. Fuchs co-authored, "*Wind-Tunnel and Flight-Test Results for the Measurements of Flow Variables at Supersonic Speeds Using Improved Wedge and Conical Probes*," NASA/TM2012-216004.

Edward A Haering, Larry J. Cliatt II, Michael M. Delaney, Kenneth J. Plotkin, Domenic J. Maglieri, and Jacob C. Brown collaborated on "SCAMP: Rapid Focused Sonic Boom Waypoint Flight Planning Methods, Execution, and Results." The meeting paper was presented at the 51st AIAA Aerospace Sciences meeting including the New Horizons Forum and Aerospace Exposition in Grapevine, Texas, Jan. 7-10.

NSSC news

The NASA Shared Services Center quarterly publication, the NSSC News, is designed to provide updates on NSSC activities and contains information that NASA employees need to know.

It is available at www.nssc.nasa.gov/customerservice. Click on the newsletter icon for the latest issue.

ED12-0384-15 NASA/Tom Tschida

Mauricio Rivas recently accepted the NASA Group Achievement Award on behalf of the Ikhana Automatic Dependent Surveillance-Broadcast aircraft tracking system team from Dryden Center Director David McBride.

ED12-0384-17 NASA/Tom Tschida

Russell Leonardo represented the Dryden Information Technology Infrastructure Integration program team when he accepted the NASA Group Achievement Award recently from McBride.

Concept
... from page 7

a carrier aircraft is problematic from a safety perspective. Our approach allows for significant payloads to be carried aloft and launched from a purpose-built custom aircraft that is less expensive because of the simplicity of the airframe, having no propulsion system (engines, fuel, etc.), on board," Budd said.

Dryden and NASA's Office of the Chief Technologist are funding the initial research and development effort. Potential Department of Defense and industry partnerships are being explored.

Award
... from page 3

"She had an enthusiasm for learning and was undaunted with difficult material. It's very exciting to see how well she's doing in her profession," McDonald said.

Holm, who graduated with a master's degree in public administration in 1983, is responsible for Dryden's offices of acquisition, finance, facilities and protective services. Holm was selected for senior executive service in December 2000 and began serving as mission support director in 2001. In 2005 and 2010 she received the rank of Meritorious Executive for her accomplishments in NASA programs.

When accepting this award, Holm shared her vision for public service.

"Public service is an honor and a great responsibility — we are stewards of taxpayer dollars," Holm said. "Our jobs may seem thankless at times, but we should take great pride in the knowledge that we can make bad things good and good things better."

The Romney Institute of Public Management, which is part of Brigham Young University's Marriott School of Management, was named in 1998 for three-term Michigan governor George W. Romney.

Fantini passes

Jay Fantini, a Dryden mathematician and software engineer, died Jan. 30. He was 52.

Mr. Fantini began his career at Dryden as a Woodside Summit contractor in the early 1990s. NASA hired him in 1999. One of his many contributions was in maintaining the computer coding of the Flight Data Archival System.

Jay authored a number of NASA technical publications. He also co-authored *The Coupled Exponential* and *Development and Testing of the Phase 0 Autonomous Formation Flight Research System*.

A memorial service is set for Feb. 23 at 2 p.m. at Desert Vineyard Church in Lancaster.

The X-Press is published the first Friday of each month for civil servants, contractors and retirees of the Dryden Flight Research Center.

Address: P.O. Box 273, Building 4839
Edwards, CA 93523-0273
Phone: 661-276-3449
FAX: 661-276-3566

Editor: Jay Levine, Tybrin, ext. 3459

Managing Editor: Steve Lighthill, NASA

Chief, Strategic Communications:
Kevin Rohrer

National Aeronautics and
Space Administration

Dryden Flight Research Center
P.O. Box 273
Edwards, CA 93523-0273

Official Business
Penalty for Private Use, $300