Fortieth Anniversary
Pioneering the Future

The Dryden
X-Press

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Dryden gets high marks

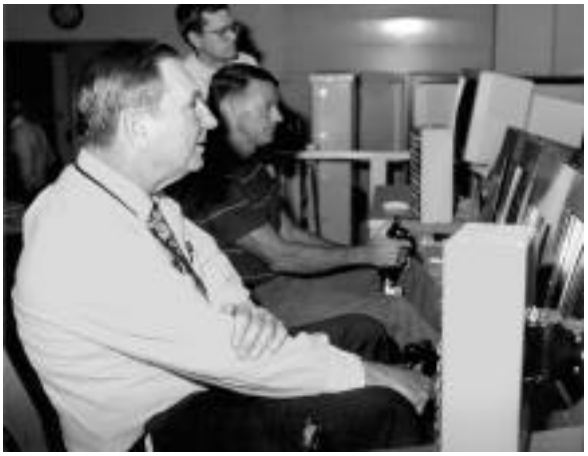
■ Armstrong says Center on target with NASA goals

By Jay Levine
X-Press Editor

Dryden is well prepared to meet the goals of Communicate Knowledge, one of the four cross-cutting processes in the NASA Strategic Plan, said Gen. Spence M. Armstrong, NASA associate administrator for the Office of Aero-Space Technology during a visit here Oct. 22.

The cross-cutting processes, which include Communicate Knowledge, support the four NASA enterprises – Space Science, Earth Science, Human Exploration and Development of Space, and Aero-Space Transportation, said Armstrong, who is the Agency process owner of Communicate Knowledge.

"My batteries are charged," Armstrong said.



NASA Photo by Jim Ross

Gen. Spence M. Armstrong, NASA Associate Administrator for the Office of Aero-Space Technology tries the X-33 Advanced Technology Demonstrator simulator during his recent visit to Dryden

Armstrong told Dryden employees the Center is on track on using the vital strategy that makes project managers and researchers responsible for getting the word out on their projects. Project managers know the most about what they do and how they do it, and they must communicate the message.

Communicate Knowledge has its roots in the Space Act of 1958 that required the widest practical and appropriate dissemination of information concerning NASA's activities and results.

Reductions in workforce, technological advances and an emphasis on measurable results led NASA to re-evaluate the way it communicates the knowledge that it generates. Managing information to ensure it is easily accessible is a responsibility and a NASA top priority.

The goal of the Communicate Knowledge Process is "to ensure that a timely variety of exemplary communication, events, activities and products created by

See Communication, page 2

PHYSX test is a success

By Kirsten Williams
Public Affairs Specialist

NASA performed an airborne experiment Oct. 22 aimed at gathering data about flight at more than five times the speed of sound. The last two vehicles to gather such information were the hypersonic X-15 aircraft and the Space Shuttle.

Almost 30 years to the day the X-15 aircraft made its final flight, an Orbital Sciences Corporation Pegasus Space Launch Vehicle mated to an L-1011 aircraft took off from Cape Canaveral Air Station, Fla., carrying the Pegasus Hypersonic Experiment, managed by Dryden. The L-1011 "dropped" the Pegasus booster just after 5 p.m. PDT.

The hypersonic experiment, a highly instrumented glove on the Pegasus booster's first-stage delta wing, gathered more than 90 seconds of temperature, pressure and airflow data before the experiment was jettisoned along with the booster's first stage. Maximum speed was in excess of Mach 8, and maximum altitude was about 200,000 feet.

The Pegasus booster, owned and operated by Orbital Sciences Corporation Dulles, Va., carried the wing glove aloft as a secondary mission; its primary goal was to put a commercial payload into orbit.

NASA Photo by Carla Thomas

Ron Gilman, who was a Dryden contractor for 10 years and now works for a Navy research branch, was borrowed to shine up the Pegasus Hypersonic Experiment, PHYSX. He was instrumental to the design and fabrication of the "glove." Dryden arranged for Gilman to help prepare the the test.

"Everything was 100 percent successful," said Jerry Budd, Pegasus Hypersonic Experiment project manager. "We gathered flight data to compare with computer-generated predictions to see if the computer models used are accurate or if we need to make adjustments to improve them. These computer models then could be used as higher-accuracy design tools to help design future hypersonic vehicles."

Information from the Pegasus Hypersonic Experiment will contribute to the construction of future hypersonic vehicles, which could carry people and payload into space or around the world at speeds of more than 3,800 miles per hour. At such speeds, a trip from Los Angeles to New York would take less than an hour.

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Inside

STS-95 lands safely at KSC

Discovery's astronauts glided to a smooth landing at the Kennedy Space Center Nov. 7 to wrap up a nine-day, 3.6 million mile mission which marked the return of John Glenn to orbit and saw the crew members successfully conduct more than 80 scientific experiments.

Commander Curt Brown and Pilot Steve Lindsey set Discovery down on the 3-mile long landing strip at KSC at 9:04 a.m. Pacific time, following a flawless hour-long descent back from space. A missing drag chute compartment door, which popped off during liftoff on Oct. 29, posed no problem for the astronauts and had no effect on the landing.

For Payload Specialist Glenn, the landing was a gentler return home than he experienced more than 36 years ago when he splashed down in the Atlantic Ocean in his Friendship 7 capsule after becoming the first American to orbit the Earth. Glenn experienced only about 3 g's of gravitational force during today's reentry, half of what he experienced during his Mercury capsule mission in 1962.

"One G and I feel fine," Glenn exclaimed from the middeck following Discovery's wheelstop on Runway 3-3 at the Kennedy Space Center. "The view is still tremendous, give yourselves a pat on the back," Glenn added, as he congratulated his crew mates on the completion of the 92nd flight in Shuttle history.

Brown, Lindsey, Glenn, Mission Specialists Steve Robinson, Scott Parazynski and Pedro Duque of the European Space Agency and Payload Specialist Chiaki Mukai of NASDA were scheduled to be reunited with their families later in the day following postflight medical exams and medical tests associated with some of the biomedical experiments.

The astronauts spent the night near the Kennedy Space Center before leaving Florida for a heroes' welcome back at Ellington Field in Houston Sunday. A crew return ceremony marked the astronaut's homecoming, led by NASA Administrator Daniel Goldin, Johnson Space Center Director George W.S. Abbey, members of Congress and Houston Mayor Lee Brown.

A parade in downtown Houston on Veteran's Day honored the STS-95 astronauts, the nation's veterans and NASA.

Communication ... from page 1

NASA Offices and Centers are available to all appropriate audiences for every funded NASA project or operation," Armstrong said.

To meet that goal, NASA Administrator Daniel S. Goldin assigned Armstrong – who then served as NASA Associate Administrator for Human Resources and Education – the responsibility of documenting NASA's Communicate Knowledge Process.

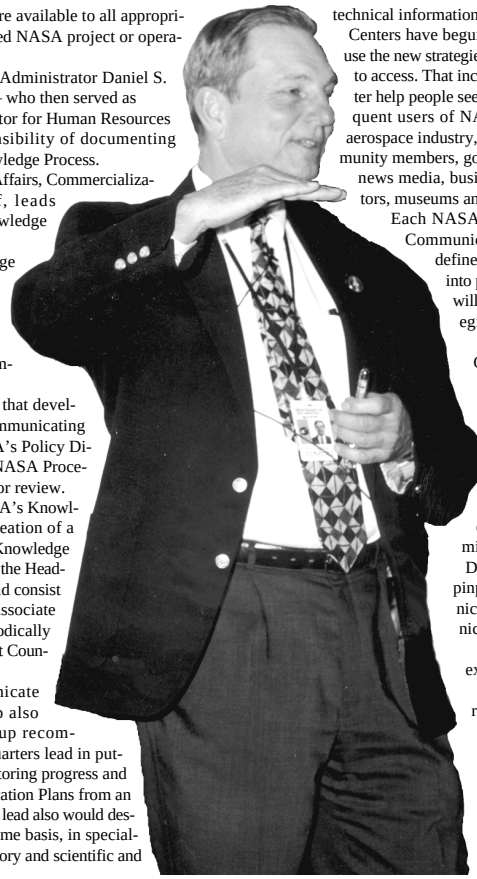
Lee Duke, Dryden Public Affairs, Commercialization and Education chief, leads Dryden's Communicate Knowledge planning.

"Communicating knowledge is not necessarily a new thing. It's just a better way of organizing what to do and how to plan for that communication and address all of our customers," Duke said.

Duke was part of the team that developed the report entitled "Communicating NASA's Knowledge." NASA's Policy Directive is complete, and the NASA Procedures and Guidelines is out for review.

The "Communicating NASA's Knowledge" report recommends creation of a Headquarters Communicate Knowledge Board of Directors chaired by the Headquarters lead. The board would consist of administrators or deputy associate administrators reporting periodically to NASA's Capital Investment Council.

A Headquarters Communicate Knowledge Working group also should be formed, the group recommended, to assist the Headquarters lead in putting the policy in place, monitoring progress and integrating Center Communication Plans from an Agency wide perspective. The lead also would designate specialists, on a part-time basis, in specialties such as public affairs, history and scientific and technical information.



Centers have begun to grapple with how to best use the new strategies and make information easier to access. That includes looking for ways to better help people seeking NASA information. Frequent users of NASA knowledge include the aerospace industry, all levels of education, community members, government agencies, libraries, news media, business, general public, legislators, museums and the technical community.

Each NASA Center helped develop the Communicate Knowledge process that defines how the strategy will be put into place. Now individual Centers will focus on how to use the strategies.

Dryden's team is defining Communicate Knowledge processes by helping each project form an individual Communicate Knowledge plan, with events, services, press releases, education materials, open houses or other activities to get the word out on the projects during critical milestones in the program.

Dryden's team also is helping pinpoint recommendations for products, services and events to help communicate Center research. It also is creating a timeline for integrating Communicate Knowledge ideas into everyday work.

The policy is meant to assist project managers to broaden their view and expand the number of people who learn about their work.

A Center processes document is expected to go to senior management review in early 1999.

One potential return on the investment of adequately communicating about research projects is funding. Tight dollars are more likely to go to projects that people know about and for which the results are promising, Armstrong said.

Communicating knowledge could be one of the keys in the resurgence of flight research through the communication of what projects are achieving and how those results can have broad applications.

Dryden contacts

People with questions about the Communicate Knowledge process are encouraged to contact a member of the Dryden process team. Here is a list of the members and their areas of expertise:

- Lee Duke, Dryden Communicate Knowledge Process Owner
- Fred Brown, Public Affairs
- John Childress, Public Service
- Marriane McCarthy, Education
- Dill Hunley, History
- Yvonne Kellogg, Technology Commercialization
- Gerry Malcolm, Research Engineering
- Jack Spear, Reaserch Projects and Airborne Science
- Linda Quinby, Scientific and Technical Information (technical reports and printing)
- Dave Fisher, Research Reports Facilitator of the Research Library
- Dick Ewers, Flight Operations
- Mike Medsker, Resource Management

New artwork

NASA Photo by Tom Tschida

Retired NASA research pilot Bill Dana and Judi Dana, his wife, accepted this painting by artist Bob Schaar. The painting shows Dana in front of the X-15, with the M2-F3 and the F-104 in the sky.The painting was one in a series commemorating chief test pilots at

Honored

NASA Photo by Jim Ross

NASA Administrator Daniel S. Goldin, right, awarded Richard A. Piercy II, center, a NASA Public Service Medal for his work at the Lewis Center for Educational Research in Apple Valley, Calif. At left is U.S. Rep. Jerry Lewis, R-Calif.

Dana gives perspective

■ Retired Dryden pilot shows relevance of flight research work

By Jay Levine
X-Press Editor

The look of future space transportation owes its heritage to lifting body research at Dryden during the 1960s and 1970s retired Dryden Chief Engineer Bill Dana told a group of California elementary, middle and high school social science teachers.

Lifting bodies, or aircraft that use their fuselages for lift rather than wings, is an idea that came from the National Advisory Committee for Aeronautics and Langley laboratories. Flight test of a lifting bodies was advocated by Dryden engineer and model maker Dale Reed and flown by research pilots like Dana. Dana spoke to the teachers, who came to Dryden Oct. 29 to learn more about the aerospace heritage here in conjunction with National History Day.


Bill Dana

Dryden historian Dill Hunley, Reed and Dana explained the relevance of Dryden projects to modern day marvels like the Space Shuttle. Teachers also gained insight into how to make Dryden history a way to add excitement to teaching not only social science, but also math, science and technology lessons.

Dana flew the X-15 and most of the lifting bodies and explained how Dryden's history has influenced present air and spacecraft. He also talked about how Dryden research might have impacts on future space vehicles.

The X-15 was one of the most success-

See History, page 6

Chili Cook-Off

The Dryden Critical Issues Chili Cook-Off was highlighted by Judge's Choice Fred Brown. Honorable mention in the Judge's Choice category went to Venus Long. The People's Choice was Rosalia Toberman. Also at the event was a costume fasion show, which was attended by the Land Sharks, at right, and an alien.

Dale Mackel and Clair Sleboda won for the funnies costume. Aside from the fun stuff, Dryden raised $257.80 from the chili cook-off and bake sale and collected 100 canned food items for food baskets for less fortunate people in the local area.

The scariest costume honor went to Bruce Robinson, above.

NASA Photos by Les Teal

DuPont safety conference teaches how to avoid trouble

By Jay Levine
X-Press Editor

Ben Waide, DuPont Safety and Environmental Management Services senior consultant, explained strategies for safety excellence at a Dryden executive leadership workshop Oct. 22.

Dryden's record on safety is among the best in government and has fewer accidents than the aerospace industry – an year seriously enough to miss more than a day of work, said Tom Ambrose, Dryden's safety officer.

There is always room for improvement though, and Waide briefed senior management on ways to make Dryden's safety record even better.

"DuPont does not manufacture marshmallows. It manufactures chemicals with high-hazard chemical processes. It sets a

said.

All DuPont safety training is given by retired plant managers, who have experienced the value of making safety a priority and a part of their company's culture.

Commitment and involvement from management is critical in eliminating workplace accidents, Ambrose said. The workshop with senior management is a

See DuPont, page 7

News briefs

Dryden staff ran to battle breast cancer

About two dozen Dryden employees participated in the "Go for the Cure" Breast Cancer Awareness 5K Walk/Run sponsored by the Federal Women's Program.

The event began at the Oasis Community Center Oct. 28. NASA won the Award for the team with the most participants. Tracy Lee Crittenden from the legal office and Barbara Ann Allen from the fitness center organized the Dryden team.

Walkers included Shannon Furnier, Crittenden, Allen, Penny Chambers, Mary Davidson, John Davidson, Terry Mahurin, Aretha Roberts, Everlyn Cruciani, Kimberly Harris, BridgetteWashington, Cecilia Cordova, Andrea Harrold, Carmen Arevalo, Florence Garcia, Thelma Wheeler, Kelly Blankenship, Pamela Ann Bivins, Emmett (Jerry) Jacques and Brenda Bennett. Runners included Gloria Fields, Roger Truax, Andus Estrada, Jamie Willhite, Mike Thomson and Louis Steers. Dryden's motor pool loaned a van to transport the participants to the event.

Alan Brown, of Woodside Summit, captured an award for being one of the first runners to finish.

Halloween

NASA Photo by Jim Ross

Jordan Conner, 3, his dad, Reginald Conner and Max Weisenseel prepare for a parade. The costumed boys are from the Judy Janisse Chid Development Center, which had the parade Oct. 30. The boys and ghouls said they had a good time.

Tours resume

Public Tours began again Nov. 9 for the first time since Threatcon Bravo was initiated. Tour times are Monday through Friday at 10:15 a.m. and 1:15 p.m. by reservation. People may call 258-3446 or 258-3460 for more information.

Threatcon Bravo remains in effect.

Dryden's gym extends hours

The Afterburner Fitness Center began offering after work hours Oct. 20 on Tuesdays and Thursdays.

The gym will remain open until 6 p.m. on those days. Watch e-mail messages for more information on hours and class offerings.

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NASA
Dryden continues

F-8 Digital Fly-By-Wire

F-15 Advanced Control Technology for Integrated Vehicles

F-18 High Alpha Research Vehicle

XB-70 Valkarie

By Dill Hunley
Dryden Historian

Over the forty years since the birth of NASA on Oct. 1, 1958, what is today called the Dryden Flight Research Center has conducted a great variety of significant flight research on virtually every imaginable type of aircraft – often in partnership with the armed services, industry, and other federal agencies. At the time of NASA's founding, the High-Speed Flight Station, as Dryden was then designated, was just finishing its research with the rocket-powered X-1E that today sits in front of Dryden's Headquarters building.

NASA at 40
Part 1 of 2
Aeronautics Research

Data from it and the other early X-planes – including the D-558-1 D-558-2, X-1 models, the X-2 to X-5, and the XF-92A – enabled researchers at what became NASA's Langley Research Center to correlate and correct test results from wind tunnels with actual flight values. The combined results of flight and wind-tunnel testing enabled the U.S. aeronautical community to solve many of the problems that occur in the transonic speed range from about 0.8 to 1.2 times the speed of sound, which are expressed as Mach numbers. Some of those problems included pitch-up, buffeting, and other instabilities. This new research enabled reliable and routine flight of such aircraft as the century series of fighters (F-100, F-102, F-104, etc.) and all commercial transport aircraft from the mid-1950s to the present.

Another pioneering aircraft, the X-15, began flying here less than a year after the establishment of NASA and completed 199 flights by Oct. 24, 1968. The rocket-powered X-15, launched by one of two B-52s (including 008 that still is flying), yielded enormous quantities of data in a variety of hypersonic disciplines ranging from aircraft performance, stability and control, aerodynamic heating, heat-resistant materials, and shock interaction that are valuable today for the design of high-speed aircraft, although no non-spacecraft has yet exceeded the top speed of the X-15 (Mach 6.72 or 4,534 mph).

Overlapping the X-15 research (and in partnership with the Air Force and North American), from 1967 to 1969 the Flight Research Center, as it was now called, flew the XB-70A – a triple-sonic, delta-wing research aircraft. The 23 NASA flights combined with over 100 Air Force flights and provided data for designing future supersonic aircraft in such areas as environmental noise (including sonic booms), potential flight corridors, operational problems and clear-air turbulence. It also validated wind-tunnel data and revealed drag components not consistent with or not simulated by wind-tunnel testing.

Soon afterwards, from 1970 to 1979 the Flight Research Center – renamed in honor of aerodynamicist and NASA

at 40
research excellence


X-1E


Clockwise, from lower left, are the X-1A, D-558 I, XF-92A, X-5, D-558 II and the X-4. The X-3 is in the center.

Deputy Administrator Hugh Dryden in 1976 – flew another high-speed aircraft, the YF-12. The program that yielded a wealth of information on thermal stress, aerodynamics, the high-altitude environment, propulsion (including mixed-compression, inlet research), precision measurement of gust velocity, and flight control systems. This information contributed to designing or improving other supersonic aircraft, including the SR-71 – of which the YF-12 was a precursor. SR-71s have continued the tradition of high-speed and high-altitude research at Dryden since 1990, examining such issues as sonic booms and radiation effects at high altitude. This research may be useful to future high-speed, civil transport aircraft.

From the early 1970s to the early 1980s, engineers and technicians at Dryden modified an F-8 and demonstrated the first fully computerized flight control system for any aircraft (without a purely mechanical backup system). Flying this digital fly-by-wire (DFBW) system without a mechanical backup was important in giving industry the confidence to develop its own digital systems, since flown on the F-18, F-16, F-117, B-2, F-22, commercial

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X-29


ER-2


Pathfinder Plus

Boom ! Boom !

Test determines Apex glider left wing's destruction point

By Jay Levine
X-Press Editor

Pressure slowly increased on the Apex glider's 21-foot left wing. Little by little the wing was stressed to the breaking point. Boom! Boom!

"The main part of the wing showed no sign of damage anywhere," said Steve Thornton, the designer of the Apex wing test apparatus. "It was the spar stub that goes through the fuselage and connects to the other wing where two glue joints failed at 8 g's."

In fact, the damage of the Oct. 21 test to destruction may be so slight that it could be repaired and used again, although there is no plan to do that. The wing will go back to its maker, Advanced Soaring Concepts of Camarillo, Calif., where it will be cut open and further inspected, Thornton said. The wing was designed to withstand forces up to about 7.5 g's, which it did in tests conducted in September.

The Apex glider is one of a series of high fliers NASA is studying as part of its Environmental Research Aircraft and Sensor Technology (ERAST) Program.

Thornton, an aerostructures loads engineer, said a September test verified the strength of the Apex boron composite wing, but the tests Oct. 21 looked at how well the tools and models used to design the wing worked.

NASA Photo by Carla Thomas

A researcher helps preapre the Apex glider left wing for testing.

"It confirmed the true ultimate test of the wing by going all the way to failure. In the end we learned were the wing broke and therefore how to improve the design to make it stronger or lighter, depending on the objective," Thornton said. "It also validated the model used to design and analyze the wing. It was a check on design tools to see how they are doing."

The steel pins in the wings have a lower margin of strength than the composite boron and epoxy material that makes up most of the wing, Thornton said. For that reason, it was one of the areas researchers had expected the wing to fail. Another suspect area was the spar shear web, a vertical part of the wing.

The test structure designed for these tests will be modified to test the Apex glider right wing. New fixtures will be designed and built to test the fuselage and tail sections. The test fixture uses vacuum pads to secure the lifting attachment to the wing. The vacuum pads are one of the innovative features of this test method, Thornton said. Usually a pressure or tension pad is glued directly to the wing and pulled to bend the wing.

Vacuum pads are especially useful in testing the light-weight class of aircraft in the ERAST Program because of the need to distribute the test loads over as much of the test wing as possible.

Another new test technique incorporated for these tests is the use of hydraulic winches used either together or instead of hydraulic cylinders for applying the loads. Using mathematical equations, researchers determine how much load to apply to each area of the wing to match what would happen to the wing in flight.

"In a more generic sense, it (the Apex tests) demonstrated a loading method that is adaptable to all ERAST aircraft, except maybe Centurion. The load can be distributed on most wings, applied and controlled," Thornton said.

NASA Photo

NASA Nights

McElwain tells how NASA pilots fly safe

Bobby McElwain, a Dryden life support technician, will explain how pilots and aircrews are taught to fly safely and what to do if there is trouble at the NASA Nights at the Lewis Center for Educational Research.

His safety training of Dryden employees includes, but is not limited to, the SR-71 high-speed research aircraft, the F-18, F-15, F-16, B-52 and T-34.

McElwain often tells first hand accounts of how knowing what to do in an emergency situation can save lives.

The lecture is set for Wednesday, Nov. 18, at 6:30 p.m. The Lewis Center is in Apple Valley at 20702 Thunderbird Road.

Successful flight

NASA Photo by Lori Losey

X-38 Vehicle 132 was successfully carried underwing of the NASA B-52 Oct. 31. Researchers say they are planning drop tests for 1999. The X-38 is intended to lead to a spacecraft that will serve as an emergency return vehicle form the International Space Station. Construction of the Space Station is schedued to begin this month

History ... from page 3

ful research programs. All 199 flights of the X-15 originated from Edwards Air Force Base and contributed rocket, altitude, biological and heat transfer information that was used in many ways, such as the development of heat shields for the Space Shuttle.

Lifting bodies such as the M2-F3, the HL-10 and the X-24A and X-24B proved that an aircraft with a low lift to drag ratio could land unpowered. The concepts were applied to the Enterprise prototype for the Space Shuttle that was tested at Dryden in 1977.

Those tests, where Enterprise separated from a specially modified Boeing 747, succeeded and led to the current generation of Space Shuttles. Proposed next generation spacecraft also owe their designs to the lifting bodies.

For example, the X-33 Advanced Technology Demonstrator is a lifting body. It is anticipated that this spacecraft, which is under construction at Air Force Plant 42 in Palmdale by Lockheed Martin Skunk Works and its team of contractors, will be significantly cheaper than current ways to get payload to space.

And the X-38, which is a prototype for a vehicle expected to serve as a crew return vehicle from the International Space

See History, page 7

Contributions

... from page 5

airliners like the Boeing 777 and research aircraft such as the X-29 and X-31. Some of these aircraft would be uncontrollable without DFBW technology, which is not only lighter than mechanical systems but provides more precise and better maneuver control, greater combat survivability, and for commercial airliners, a smoother ride.

The Center flew a very different F-8 project, the Supercritical Wing (SCW), from 1971 to 1973. This project illustrates a frequent aspect of flight research here in that it employed a design developed elsewhere in NASA – in this case by Dr. Richard Whitcomb at the Langley Research Center using his own insights and wind-tunnel testing. Larry Loftin, director of aeronautics at Langley, decided, "we're going to have a flight demonstration. This thing is so different from anything we've ever done before that nobody's going to touch it with a ten-foot pole without somebody going out and flying it." In this case, unlike many others, flight research did not yield any major discoveries; generally there was good correlation between wind-tunnel and flight data. The SCW increased the transonic efficiency of the F-8 by as much as 15 percent, as a result of which most new transport aircraft today employ supercritical wings.

To mention just two other series of research efforts, the Digital Electronic Engine Control and Highly Integrated Digital Electronic Control projects with the F-15 in the 1980s have resulted in improvements to the F-100-PW-220 and -229 engines (on the F-15 and F-16 aircraft) as well as more advanced engines. More recently, Dryden has engaged in several thrust vectoring efforts on the F-18 High Angle-of-Attack Research Vehicle, the X-31, and F-15 Advanced Control Technology for Integrated Vehicles projects that promise great dividends in maneuverability for both current-production and future military aircraft.

In these and many other projects, the Dryden Flight Research Center and its partners have shown that while theory, ground-research facilities, and now Computational Fluid Dynamics are critical for the design of aircraft and for the advancement of aeronautics, flight research remains indispensable, which is why Dryden is today NASA's Center of Excellence for Atmospheric Flight Research.

The SR-71 high-speed research aircraft taxis, above. The X-2, a B-50 and its crew, below.

YF-12s

F-16XL

NASA Photos

DuPont ... from page 3

first step and will be followed with training for supervisors and leads in January on safety in the workplace.

Managers can show their involvement by observing safe and unsafe behavior in their areas and correcting problems. Managers set the tone for the value employees place on safety.

"There tends to be a mistaken view among some personnel and managers that safety is the safety officer's business. DuPont's example makes it clear it is management's responsibility from the top to the bottom to prevent injuries. There aren't enough safety people to see everything and there shouldn't be. Safety should assist line management accomplish its job," Ambrose said.

A key tool for reducing accidents at Dryden, according to DuPont, is a stronger focus on "close calls." These are near accidents caused by unsafe practices. For example, a worker standing on the top rung of a ladder, or spilled liquid on a hallway floor that is not wiped up are accidents waiting to happen.

"Accident theory says for every 300 close calls, there is one serious mishap. If you manage the small items and address and prevent them, then you may be able to prevent that serious accident from happening," Waide said.

"All injuries are preventable" is the DuPont philosophy. From a worker's first day on the job, they are told they are expected to work safely. To DuPont, safety is good business and proper training with a focus on potential safety hazards is the way to reduce on-the-job injuries.

Safety is vital because it can reduce the number of lost work hours, decrease human suffering and worker compensation claims, improve a corporate image and increase poor employee morale, according to DuPont.

As a whole, NASA administrator Dan Goldin has made safety an initiative and aims for NASA to retain its stature as a world class organization in safety.

History... from page 6

Station, also has a lifting body shape and can be used much more cheapely than other types of transportation currently available.

Dryden also researched a critical technology that made current and future generations of air and spacecraft possible – digital fly-by-wire flight controls. Solely digital computer control proved successful during tests of the F-8 Digital Fly-By-Wire Program.

Use of computer controls that can react faster than humans made the impossible possible. Aircraft like the Space Shuttle, B-2 radar evading bomber and the F-117 stealth fighter would not be able to fly without fly-by-wire technology. Digital flight controls are used in many modern military and commercial jets such as the F/A-18 and new Boeing 777.

PHYSX ... from page 2

The goal of the experiment was to discover when the airflow over the Pegasus wing becomes turbulent and why. Intense heating is one of the major challenges of hypersonic flight, and airflow has a great impact on how hot vehicles become. Turbulent air generates intense heat because of increased friction between the air and aircraft structure, which can cause damage to aircraft.

A secondary goal for the project was to provide engineers with valuable experience in instrumenting and testing hypersonic vehicles.

All information the glove obtained was transmitted to the ground through a radio signal because the glove will not be recovered. To make transmitting the data possible, engineers at the NASA Langley Research Center, Hampton, Va., developed a special data acquisition, compression and processing system.

Wing Glove

The flight-test wing glove, made of nickel-plated steel, was mounted on balsa wood and surrounded by a thermal protection system structure made of Space Shuttle tile material that blended the glove into the wing. NASA Ames Research Center, Moffett Field, Calif., supplied the thermal protection system, which dissipates heat. The glove was mounted to the Pegasus wing at Dryden, while the Pegasus booster rocket was secured to its L-1011 launch vehicle at the Orbital Sciences Corporation's Vehicle Assembly Building at Vandenberg Air Force Base, Calif., before being ferried to Florida.

The wing glove carried a mix of traditional and high-frequency sensors capable of functioning during the flight conditions the Pegasus rocket experienced. The sensors provided engineers a variety of information like acceleration, air flow, pressure, temperature and strain.

Earlier tests

Preparation for the experiment included ground tests of a second glove at NASA Dryden, which concluded in May 1996. These tests ensured the glove was hardy enough to survive flight aboard the Pegasus. In addition, NASA evaluated many of the sensors for the experiment in July 1994 during an earlier Pegasus mission to make sure they would not interfere with the airflow over the Pegasus wing and to ensure the vibrations from the flight would not interfere with obtaining accurate data. In January 1995, Dryden's F-15 aircraft tested the data acquisition, compression and processing system the experiment used to communicate with the ground during a series of flights over Edwards Air Force Base.

Roles and Responsibilities

Dryden provided overall management of the wing glove experiment, glove design and buildup. Dryden also was responsible for conducting the flight tests. Langley was responsible for the design of the aerodynamic glove as well as development of sensor and instrumentation systems for the glove. Other participating NASA centers included Ames; Goddard Space Flight Center, Greenbelt, Md.; and Kennedy Space Center, Fla. Orbital Sciences Corporation is the manufacturer and operator of the Pegasus vehicle, while Vandenberg Air Force Base, Calif., serves as the site for the prelaunch assembly facility.

Award winners

NASA Photo by Tom Tschida

Dryden personnel brought home $6,200 in patents and fees for research articles. Form left to right are Acting Center Director Kevin Petersen, Jules Fickle, Dana Purifoy, Ed Haering, Laurie Marshall, Rod Bogue, Tony Whitmore, George Aragon, Rick Lind and John Carter.

Dryden honors standouts

Dryden employees who filed patents or wrote articles for NASA's publication "Tech Briefs" were honored during a ceremony Oct. 7. Two patents and nine articles totaled $6,200.

Patents:

• A Flutterometer Flight Test Tool (Marty Brenner, Rick Lind) The flutterometer is a flight test tool to be used during envelope expansion that predicts flight conditions for the onset of flutter and provides information to the pilot about what increases in Mach and dynamic pressure may be safely considered.

• A Stable Algorithm for Estimating Airdata from Flush Surface Pressure Measurements (Tony Whitmore, Brent Cobleigh, Ed Haering) The algorithm takes pressures from the nose of an aircraft, in this case it will be the X-33 Advanced Technology Demonstrator, and calculates air data such as altitude and Mach number.

Tech Briefs articles:

• "Ruggedized Laser Doppler Velocimeter" (Tim Conners, Kim Ennix, Dean Webb; Dryden, Roger Rudoff, John Hanscom, Robert Shearrer, William Bachalo; Aerometrics – a Small Business Innovation Research company)

• "Global Positioning System Drives Global Real-Time Interactive Map (GRIM)" (John McGrath, Ed Haering, Harry Miller, Jack Trapp, David Webber, Glenn Bever, Joe Collura (Tybrin Corp.); Jules Ficke (Sparta, Inc.), George Aragon (Orbital Astronomical Observatory)

• "Characterizing Nonlinear Dynamics from Wavelet Analysis" (Martin Brenner, Rick Lind, Dryden; Kyle Snyder University of Tennessee)

• "The X-36 Program: A Test Pilot's Perspective of RPA Flight Testing" (Dana Purifoy; Dryden)

• "Simple Low-Cost Laser Diode Vibration Sensor" (De Yu Zang, James Millerd, David Rosenthal, Eric Johnson, Cecil Hess, Matt Tonge - MetroLaser, a Small Business Innovation Research company)

• "Advanced Measurement of Angle of Attack and Sideslip" (Laurie Marshall, Dryden; Roger Foster (BF Goodrich); Brian Barber (Boeing)

• "Radiant Heat Flux Gage Calibration System Characterization" (Tom Horn)

• "F/A-18 Production Support Flight Control Computer System" (John Carter)

• "Dynamic Response Model for Pressure Sensors in High Knudsen Number Flows with Large Temperature Gradients" (Tony Whitmore, Dryden; Brian Petersen, Boeing (former Dryden co-op student)

Exchange Events

■ **Laughlin Trip, Friday-Sunday, Dec. 4-6:** Try your luck in Laughlin, Nev., and see if Lady Luck smiles before the holidays. Accommodations are at Harrah's Hotel and Casino and includes a buffet ticket and extensive gambling facilities.

The trip costs $104 for couples and $67 for single ticket purchases. The bus leaves from the Lancaster City Park and Ride at 1 p.m. on Friday, Dec. 4, and returns around 5 p.m. on Sunday.

■ **Childrens' Holiday Skating Party, Monday, Dec. 7:** Children who are infant to age 11 can come to the Lancaster Skating Rink for the annual Employee Activities Committee sponsored skate party from 6 to 9 p.m.

In addition to skating, Happy-Bo-Bappy and Mr. and Mrs. Santa Claus will entertain the children. Soda, hot dogs, cookies and prizes will be provided. The event is free for the children and a sign up sheet is in the Activities Trailer.

■ **Adult Holiday Dinner and Dance, Friday, Dec. 11:** "Snowflakes and Sugar Plumes" is the theme for the bi-annual Holiday Dinner and Dance. The event is set for the Antelope Valley Country Club in Palmdale and will begin about 6:30 p.m. and end at 1 a.m.

Price for the festive event is $22.50 a person and includes hor d'oeuvres, buffet dinner, dancing and a seasonal photo. Tickets are available from Joan in the Activities Trailer along with a complete menu and other part details.

The Dryden
X-Press

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