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The Dryden X-PRESS

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X-48 program complete

By Gray Creech
Dryden Public Affairs

All good things must come to an end, as the saying goes.

After flying the remotely-piloted X-48B and X-48C Hybrid/Blended Wing Body research aircraft for nearly six years, the joint NASA-Boeing X-48 project team recently completed a highly successful and productive flight test project at Dryden.

The manta-shaped X-48 Hybrid Wing Body technology demonstrator flew a total of 122 flights, 30 of them as the C-model. The last flight of the X-48C occurred on April 9, having first flown eight months ago on Aug. 7, 2012.

"We have accomplished our goal of establishing a ground to flight database, and proving the low

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ED13-0057-24 **NASA/Carla Thomas**

The X-48C Hybrid Wing Body aircraft flies over Edwards Air Force Base on Feb. 28. The long boom protruding from between the tails is part of the aircraft's parachute-deployment flight termination system.

It's time to plan for the Hybrid Wing Body

Center Director's Column
by David McBride

The X-48 Blended Wing Body remotely piloted aircraft in two different iterations completed 122 flights, which makes it the most extensively flown unmanned X-Plane research project. Now that it is complete, we must begin planning for a human piloted, near full-scale Hybrid Wing Body aircraft.

The X-48 project established the low-speed stability and control concept and its operations from ground to flight. The project team also modified the flight control system software, making it suitable for future development of a potential full-scale commercial hybrid or blended wing aircraft.

However, it is difficult for a commercial company to accept all of the risk of new technological breakthroughs by building a near full-scale demonstrator on its own. It is simply too risky to bet the company on a new radical aircraft configuration. But a partnership on such a manned X-Plane could deliver that future transport aircraft business to American industry.

It is the role of government and NASA to deliver technology ready for use to encourage growth and innovation in the private sector. Just as NASA and The Boeing Company partnered with the Air Force Research Laboratory in Dayton, Ohio, and Cranfield Aerospace Limited of the United Kingdom to create the X-48 project, a partnership could be forged for a near full-scale Hybrid Wing Body technology demonstrator that will

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Fond farewell

Dryden's space shuttle operations wrap up

By Jay Levine
X-Press editor

The lights were turned off, the door was locked and the key was turned in on the Space Shuttle Program at Dryden March 29, as the transition and retirement phase of the program ended.

Although the orbiters were retired when Space Shuttle Atlantis completed STS-135 in July 2011, there were shuttle assets to be inventoried and prepared for disposition, the remaining orbiters delivered to museums and the program shut down. That's now essentially complete. The remaining tasks involve Dryden logistics personnel clearing out the remaining shuttle assets that have been turned in to them for disposition.

"It's a surreal time sending people home on a contract that has been around for such a long time," said George Grimshaw, the last shuttle support operations manager and shuttle transition manager at Dryden. He referred to the Space Shuttle Landing and Research Aircraft Support Services contract held by Lockheed Martin Information Systems and Global Services that officially ended March 31. The contract had different names and evolving tasks over the years, but had continued at Dryden since 1968.

In addition to supporting shuttle development and the approach and landing tests of the Enterprise space shuttle prototype, Dryden was the main site for early landings of the shuttle program. It then became the main backup site for shuttle landings when the weather wasn't good at Kennedy Space Center, Fla.

"People are shocked when you say the shuttles are not flying anymore and they're in museums," Grimshaw noted.

An example of one shuttle-related item is the overland transporter used to move every shuttle assembled at Rockwell International (now The Boeing Company) Space Systems' facility located at Air Force Plant 42 in Palmdale to Dryden – all except Endeavour.

ED09-0127-12 NASA/Jim Ross

Atlantis is moved to the Dryden Mate/Demate Device for preparations to transport it back to the Kennedy Space Center in Florida.

ED09-0253-98 NASA/Tony Landis

With space shuttle Discovery hoisted 60 feet above ground in the Mate-DeMate gantry at Dryden, NASA's modified Boeing 747 shuttle carrier is towed beneath for mating with Discovery prior to a ferry flight to Kennedy.

Endeavour, the last shuttle to be built, was gently lifted with the Orbiter Lifting Frame, a bare-bones Mate Demate Device at Plant 42, to the back of a NASA 747 Shuttle Carrier Aircraft and flown directly to Kennedy Space Center. After the overland transporter was used for Atlantis' journey to Dryden in 1985, it collected dust near the southwest corner of Dryden's Mate Demate Device, or MDD, for almost 27 years.

Ironically, the overland transporter was brought back to service for transporting Endeavour on its final 12-mile journey from the Los Angeles International Airport to the California Science Center in Los Angeles, where it now is a science center artifact.

"It sat out in the desert, it was dusty and the paint faded. It was disassembled, inspected and reassembled for use," Grimshaw said.

The MDD at Dryden, used to hoist the orbiter's onto NASA's 747 Shuttle Carrier Aircraft, is unique among the three built (one at Kennedy Space Center and the Orbiter Lifting Frame first built at Vandenberg Air Force Base and later transferred to the shuttle facilities in Palmdale before it was taken down a few years ago. It also differed from the other MDDs because it had additional capability for servicing the shuttles following a landing at Edwards.

Since the Dryden MDD was no longer required, the decision was made to have it dismantled. However, the State of California considers it a historical asset, so an extensive documentation process known as recordation was required before the MDD could be dismantled. Dryden's Environmental Office led the effort, which included a written report and

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Shin recognizes Purifoy

Dryden project manager Dana Purifoy was honored recently by Jaiwon Shin, associate administrator of NASA's Aeronautics Research Mission Directorate, with the associate administrator's Leadership and Management Excellence Award for 2012. Purifoy, a former Air Force and Dryden research test pilot, was cited for his "can do" approach in ensuring that funding, scheduling and technical issues involved with the extensive modification of Dryden's Gulfstream-III aeronautics test bed No. 804 was completed on time, within budget and in compliance with the needs of researchers. Shin, left, presented the award certificate and trophy to Purifoy, right, at a town hall during a visit to Dryden on April 18.

ED13-0070-48 NASA/Ken Ulbrich

IT security lassos nasty and complex Trojan horse

By Jay Levine
X-Press editor

Anthony Thomas

A Trojan horse has galloped into some of Dryden's computer systems and aircraft, but Dryden's information technology security staff is working to contain and eradicate the malicious code, said Anthony Thomas, Dryden's chief information security officer.

Thomas spoke at a Town Hall meeting May 9 about a type of malicious code called a Trojan horse, which is a computer program that appears to perform one function but is actually doing something else undetected by the user. This hidden alternative function typically conducts activities that are harmful to the computer system or the data that resides on the system.

The specific Trojan horse software discussed at the Town Hall was first detected through a routine analysis of Symantec Endpoint Protection Anti-Virus logs in early April, Thomas said.

At first the Trojan horse software was considered a low-priority, low-risk incident by the information technology office until staff members began tracking the malicious code and discovered it had spread to a larger and more diverse set of systems than originally believed ranging from office computers to aircraft instrumentation systems.

The malicious code was found in various Dryden computer systems including stand-alone computer systems not connected to the Dryden networks such as the G-III No. 804 aircraft, he said. A total of 45 systems and 30 USB thumb drives were infected and 189 systems were scanned. So far, information technology staff members have invested more than 495 hours to meet the challenge.

Macintosh computers are not susceptible to the malicious code because it was specifically written to exploit Windows systems, he added.

Portable media such as thumb drives and portable hard drives inserted into USB ports have been identified as the major root cause for the spread of the Trojan horse, which looks like a viewer for computer assisted drawing and engineering programs, but in fact is not what it seems, he added.

The effort to capture an instance of the Trojan horse program proved challenging.

"Every time we thought we had discovered it, it destroyed itself, or wasn't where we thought it was," he added.

When the code was captured for analysis, the initial indications were that it was benign because the code didn't do anything. Further analysis

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News at NASA

So far, so good

Virgin Galactic and Scaled Composites successfully conducted their first rocket-powered flight of SpaceShipTwo, or SS2, April 29 in the skies over the Mojave Air and Space Port in Mojave, Calif.

"For the first time, we were able to prove the key components of the system, fully integrated and in flight," said Virgin Galactic Founder Sir Richard Branson, who was in Mojave to witness the flight.

"Today's supersonic success opens the way for a rapid expansion of the spaceship's powered flight envelope, with a very realistic goal of full space flight by the year's end. We saw history in the making today and I couldn't be more proud of everyone involved," he said.

Scaled Composites test pilot and former Dryden research pilot Mark "Forger" Stucky flew SS2 with Scaled Composites co-pilot Mike Alsbury.

SS2, also known as the Virgin SpaceShip Enterprise, was released from its White Knight II launch aircraft at about 47,000 feet altitude, rocketing upward to about 55,000 feet altitude and a speed of Mach 1.2 – about 800 mph – during a 16-second firing of its rocket engine.

Although SS2 is primarily intended for the public space tourism market, Virgin Galactic also plans to use the craft for carrying scientific experiments into sub-orbital space, including flight tests of developmental space-access technology payloads for NASA's Flight Opportunities Program.

***At right**, the M2-F1 lifting body aircraft is seen here under tow by an unseen C-47 at the NASA Flight Research Center, now Dryden, during a flight on Aug. 28, 1964. The low-cost vehicle was the first piloted lifting body to be test flown. **Below**, the flatbed truck and trailer that transported Sierra Nevada Corporation's Space Systems Dream Chaser engineering test article pauses behind Hangar 4802 on the aircraft ramp at Dryden, upon arrival at the center May 15. The vehicle was shrouded in protective plastic wrap with its wings and tail structure removed for its four-day overland transport from Sierra Nevada Corporation's facility in Louisville, Colo.*

ED13-0142-08 NASA/Tom Tschida

EC64-404 NASA

Lifting body legacy

By Jay Levine
X-Press editor

As Dryden prepares for the Sierra Nevada Corporation's Dream Chaser space-access vehicle to fly this summer in approach-and-landing flight tests, Dryden employees were recently reminded about the legacy of the aircraft's shape that was validated through flight research here.

Former Dryden Center Director Ken Szalai recalled the high-risk, low-cost M2-F1 lifting body aircraft during a colloquium at the center April 5. Szalai spoke on the exact day that 50 years prior a modified Pontiac Catalina convertible towed the M2-F1 lightweight lifting body aircraft piloted by Milt Thompson into the sky above Rogers Dry Lake for the first time.

Lifting body aircraft are essentially wingless aircraft where the shape of the fuselage provides a small amount of lift in place of a conventional wing – an aeronautical concept known as low lift over drag – and makes it capable of safely landing unpowered.

ED13-0113-02 NASA/Ken Ulbrich

Former Dryden engineer and center director Ken Szalai recalled the legacy of the M2-F1 lifting body championed by the late Dale Reed and flown by the late Milt Thompson (in photos on the screen).

Szalai explained how the M2-F1 flight set the stage for research with a series of lifting body designs to study atmospheric flight that contributed to the aerodynamic data used in development of the space shuttle. Szalai brought the flight to life through video produced in 1997 for an event marking the restoration of the M2-F1 that features some of the key figures in their own words. He also welcomed several Dryden researchers including engineers Bertha Ryan and Wen Painter, pilot Don Mallick and Ross Briegleb, the son of the late M2-F1 builder Gus Briegleb.

The Dream Chaser embodies the answer to why research from 50 years ago continues to inspire and provide information for current vehicles, Szalai noted. The Dream Chaser's shape is based on the HL-20 lifting body design developed at NASA's Langley Research Center, Hampton, Va., from a Russian design that was never built.

To put the leadership, risk and methodology used to develop the M2-F1 in perspective, Szalai said many of the steps leading to the success of the first lifting body aircraft flights couldn't unfold the

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same way today because the eras and requirements are so different.

Szalai didn't criticize risk management in today's flight research, rather he focused on how the M2-F1 team's flight research unfolded. He stressed partnerships with the Air Force and other NASA centers are just as valuable today as they were then and more cooperative work should be pursued.

Alfred Eggers and other engineers originated the lifting-body concept in the mid-1950s at the National Advisory Committee for Aeronautics' Ames Aeronautical Laboratory at Moffett Field, Calif. However, Dryden researcher R. Dale Reed believed the only way those shapes would be used was to validate them through flight research.

Reed started by flying paper airplanes though the halls at work and decided to fly model aircraft based on lifting body designs, which his wife Donna filmed. With footage in hand, Reed demonstrated to management that the concepts worked and should be further researched with an experimental aircraft.

Reed found a champion for his cause in Thompson, at the time a pilot of the X-15 rocket plane. The two men then convinced Dryden (then Flight Research Center) Director Paul Bikle to fund the low-cost development of the M2-F1. Assured the idea was solid, Bikle gave the green light for work to begin.

ED13-0089-39 NASA/Ken Ulbrich

Colloquium panelists who recalled their experiences with the M2-F1 lifting body a half-century ago included (from left), Ross Briegleb, son of M2-F1 builder Gus Briegleb; colloquium speaker and former Dryden center director Ken Szalai; retired Dryden research pilot Don Mallick; and retired engineers Bertha Ryan and Wen Painter.

In all, the M2-F1 was assembled for about $30,000 and it has been hypothesized that the cost of such a vehicle from a prime contractor could have easily topped $150,000, Szalai said. Constructed of mahogany and spruce plywood and steel tubing, the aircraft was later dubbed the "flying bathtub" by the media for its unique shape. How items for the project were procured was handled carefully. For example, the modified Pontiac convertible needed for towing the aircraft was listed on official records as a "lifting body power plant."

The M2-F-1 framework, landing gear and controls were built in-house by specialists in the machine shop, among them Jerry Reedy who attended Szalai's presentation. The framework and the plywood outer shell were attached with just four bolts. The M2-F1 was later fitted with an ejection seat for the air-launched flights, Szalai said. Eggers was instrumental in getting the M2-F1 into a wind tunnel at Ames to gather data prior to the start of research flights, Szalai said.

The decision to fly wasn't unanimous. Szalai recounted Bikle's poll of top managers, one of who didn't believe it was worth the risk to fly the M2-F1.

"It was a pretty high risk and it could have meant his (Bikle's) career if there was a problem. He trusted Milt and the team and they believed it would work," Szalai said.

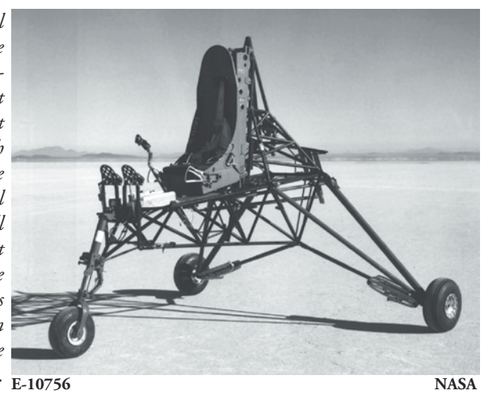
Bikle also gained confidence from frequent visits to the project and talking with the team as the M2-F1 progressed, Szalai explained. There also was an incremental process to flight as well as practical and analytical data to review.

Former Dryden research pilot Bill Dana summed up the M2-F1 in the 1997 video: "It defied imagination."

When the M2-F1 flight was a success, it "changed the world. We were no longer inexperienced in flying a lifting body aircraft." Szalai said. "The M2-F1 was the key to unlock the door to unpowered lifting body flight."

After more than 100 tows to very low altitudes by the hot-rod Pontiac, the M2-F1 was towed to higher altitudes for longer flights by a C-47. The more advanced lifting bodies that followed were air launched from the NASA B-52B to validate high-altitude flight characteristics. Those aircraft included the M2-F2, the M2-F3, the X-24A, the X-24B and the rocket-powered HL-10, which graces the entrance to Dryden.

When the Sierra Nevada's Dream Chaser flies at Dryden later this year, it will reinforce the center's legacy with lifting body aircraft that started with the M2-F1 50 years ago.



E-10756 NASA

The internal steel structure for the M2-F1 was built at the Flight Research Center. The external wooden shell was built by sailplane builder Gus Briegleb then attached to the framework.

Zero

Everyone on a Dryden construction site goes home safe. It happens every day, no exceptions, for more than 14 years.

By Jay Levine
X-Press editor

Clouds of dust arose from the ground where about a dozen men worked to bury a section of pipe they had installed across a Dryden parking lot. One man with a hard hat was in the trench working on the pipe before it was buried, as another watched to ensure he was safe.

Once the man completed his task, a bulldozer pushed dirt over the five-and-a-half-foot deep trench. Beep, beep, beep sounds became louder as an excavator, which had a sheep foot roller attachment, lumbered over the trench as it compacted the fill dirt over the new pipe.

It was part of nearly 4.5 miles of fire water pipe – used to supply fire hydrants and building sprinkler systems – that was replaced. The pipes extend from the water tanks on the hill to the former space shuttle area, with a number of stops in between on the continuing underground infrastructure project, said Kevin Andrews, one of 15 Dryden project advisors that monitor construction work.

"When we visit the job site we perform quality assurance by ensuring the contractor is following their safety plan, adhering to the terms of the contract and performing quality control on their work," Andrews said.

The project is one of dozens of examples of how processes and procedures in the Facilities Engineering and Asset Management team's, safety program have kept people safe on Dryden construction sites for more than 14 years without lost-time injury. Everyone goes home without injury every day.

NASA/Jay Levine

Workers bury a section of new fire water pipe, which is used to supply fire hydrants and sprinkler systems. It is one of more than 80 active construction projects at Dryden. The safety culture developed at Dryden has been successful for more than 14 years – no one has lost a day of work to an accident on a Dryden construction site.

The accomplishment was noted at a Dryden Monday Management Meeting April 22, the anniversary of the achievement. Dan Crowley, Facilities chief, Ralph Anton, Safety, Health and Environmental office manager, and Jim Eastman, Acquisitions director, received the "Triple Zeros" award in the form of three zero-shaped Mylar balloons.

Deputy Center Director Pat Stoliker said Dryden is clearly setting the standard for other NASA centers as well as industry to follow.

"This is evidence that our proven safety practices are working," he added.

A team effort

Only through collaboration between the three organizations can such a safety achievement be reached, Crowley said.

For example, the safety office offers expertise in Occupational, Health and Safety Administration regulations, fire safety and electrical work and a wealth of experience they like to bring to the table to solve challenges, Anton said.

"We help to facilitate a safe operation by ensuring everyone is on the same page. We let everyone know that anyone can stand up and say something is not safe and we will work together to mitigate it. Safety is all about communication, communication and more communication. We communicate internally, with other codes, outside agencies and with our customers. It's great to be part of a team that has a safety focus, yet makes things happen," he said.

The Acquisitions office is another key component of the team.

ED13-0054-1 NASA/Tom Tschida

***Above**, it takes a team to achieve an accomplishment as big as recording no injuries that required someone to miss work for more than 14 years, according to team members. Above are many of the people who work together to continue building a culture of safety at Dryden. The key organizations that make up the above team include the Facilities, Safety, Health and Environmental and Acquisitions offices. **Below**, Dan Crowley, Ralph Anton and Jim Eastman were presented the "Triple Zeros" award.*

ED13-0113-02 NASA/Ken Ulbrich

"We have daily safety meetings with contractors and inspectors and weekly status meetings that include the COR (contracting officer's representative). We keep track of what's happening and the type of issues going on during daily and weekly meetings with the safety guys, Code F, the contractors and the subcontractors. The first agenda item is safety and the biggest safety concern of the day and we just try to keep on top of the effort and plan for safety down the road. For example, if an electrical outage is planned, we all ensure electrical safety is stressed," said contract specialist Jim Hillman.

Big projects, big goals

Facilities manages projects worth tens of millions of dollars, oversees a cast of hundreds including contractors and subcontractors and has about 325 separate ongoing activities, about 80 of which are active.

Many of the jobs are not small ones, with some of the current and recent high profile work including the Facilities Support Center, the Consolidated Information Technology Center, major road and utility work, and separate $10 million projects to upgrade Dryden's electrical substations and the Loads Laboratory.

It all starts with a philosophy and buy-in from every member of the team that no one should be injured doing their job, team members said. It doesn't matter who you talk to in Code F, they will tell you the same thing – the goal is for no one to be injured.

Bill Werner, a facilities operations specialist, has worked at Dryden for more than 20 years in different roles in safety and facilities, both as a contractor and a civil servant. His varied experiences help him to bridge communication gaps among team members. It wasn't always like it is now and he spoke about how he, and the culture, have changed.

"We were not communicating as well as we could have and should have. I was looking for the simplest way to do things without others. I had a single focus then and through

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experience I learned I was making a huge mistake. I learned we need the group (safety, facilities, contracting and the mission program) to understand what we are doing, why we are doing it and how to keep people from being affected by what we do," he said.

His experience is valued.

"My biggest asset was understanding both sides and developing trust to reach our goals. We all look at things differently, but we all want the same things. The managers coming up are not tied to past preconceptions and are working to create a partnership that makes things more the way they could be than the way they have been," Werner said.

He also credited the investment in training that has helped people to understand what's going on and to see clearly what's right and wrong on a construction site.

"That added value is one of the reasons we are maintaining the safety record. I don't want to see anyone hurt or sent to the hospital and I really don't want to explain why a person is not coming home from work in the same condition they came to the job," Werner said.

Developing a culture of safety

Meetings held every day on construction sites that recap the biggest safety concerns are part of the safety culture evolution. Weekly safety meetings are also part of it, as is buy in from every member of the team. That's not to say there aren't close calls from time-to-time, but they are treated as an opportunity to improve.

Crowley recalled a string of near death accidents on a major Building 4800-renovation project in the late 1990s when he knew changes were needed. Crowley began at Dryden in 1988 as a facilities maintenance manager and served as a facilities project manager from 1991 to 2003 when he became Code F chief.

"I'm standing there watching the NASA doctors and nurses respond to the accident trying to save someone's life. In the process of getting the guy into the ambulance, all three of them became victims. The guy was covered with lead paint removal chemicals. He had gotten hurt in a man lift accident and the impact resulted in the chemicals spilling all over him," Crowley recalled.

But poor communication makes the situation worse.

"Nobody tells the medical team what he was doing, so they get these lead paint removal chemicals all over them and now there are four victims. It went from one victim to four victims in five minutes. Now we had to call another 9-1-1-response team. In that moment I am standing there completely useless and helpless as the project manager watching this unfold on my project. "I'm not doing this again," Crowley said.

Infused with a new sense of purpose, he went to peers in Code F and Center management. There were a few other accidents after that on other project managers' activities and they came to the same conclusion that Crowley had – a change was needed to stop the procedures and practices that were leading to people becoming injured.

Although Crowley likes to keep a low profile in the responsibility for the safety record, his staff members say his passion for safety resonates with them. Crowley began oversight of center construction programs, master planning, facilities operation and maintenance, energy and logistics management when he was selected for the post in 2003. He also served as chairman of the NASA Operations Engineering Panel.

Crowley received the NASA Exceptional Achievement Medal for construction safety in 2007 and a 2008 NASA Quality And Safety Achievement Recognition award for leadership in building a culture of safety.

Expectations and team

Crowley's team credits him with the leadership and passion for safety and he credits the team for following, refining and scrutinizing procedures. Because they have a regular review cycle for procedures, challenges are resolved before they become a breeding ground for accidents.

Another way to look at what Code F personnel have done is that they share an expectation that accidents are preventable and developing a culture that takes safety very personally. By constantly seeking to improve they keep the dialogue going – everyday.

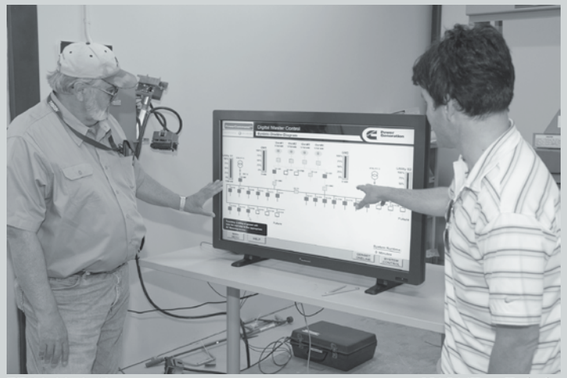
John Trigg is the Jacobs/Tybrin task lead for 15 facility project advisors. He is responsible for big picture monitoring of the jobs his team is working, helps to develop processes, reports, customer relations and safety.

Trigg comes from a safety background, having chaired a safety committee for the Monsanto Company. The Jacobs/Tybrin team reviews technical submittals for construction projects, including safety plans and hazard analysis. This group also coordinates digging activities, the use of cranes, area closures and utility outages so that accidents are prevented.

"We all are lined up on the safety goal line. It's not follow me, it's a combined effort," he said.

For team members, safety isn't just part of the job, it's a key thread in the fabric of their lives.

Alan Brown contributed to this report.



ED13-0070-48 NASA/Tom Tschida

Hazardous project result – no injuries

Wil Noffsinger, left, and Andrew Boykin show the digital master controls of Dryden's electric power housed at Substation 16. The substation recently underwent a $10 million renovation. Completing a project of that magnitude without injury requires a "massive amount of review throughout the construction," Boykin said. Start to finish plans and the nuts and bolts of the safety elements were in place long before the project was approved. Every day discussions of the plan ensured everyone understood what needed to happen. Electrical work is dangerous, but other elements like crane lifts of 80,000-pound transformers, were equally hazardous, Noffsinger said. Working smart is another building block of safety. Power outages have risks and as many as 15 center-wide outages could have been required. However, collaboration and planning reduced the outages to just five, he added.

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speed controllability of the concept throughout the flight envelope," said Fay Collier, manager of NASA's Environmentally Responsible Aviation project. "Both very quiet and efficient, the hybrid wing body has shown promise for meeting all of NASA's environmental goals for future aircraft designs," Collier said.

The aircraft, designed by The Boeing Co. and built by Cranfield Aerospace Limited of the United Kingdom, was flown in partnership with NASA. The X-48C model, which was formerly the X-48B Blended Wing Body aircraft, was modified to evaluate the low-speed stability and control of a low-noise version of a notional, future Hybrid Wing Body, or HWB, aircraft design. The HWB design stems from concept studies being conducted by NASA's Environmentally Responsible Aviation project of future potential aircraft designs 20 years from now.

"Our team at NASA Dryden has done what we do best, flight test a unique aircraft and repeatedly collect data that will be used to design future 'green' airliners," said Heather Maliska, NASA Dryden's X-48C project manager. "It is bittersweet to see the program come to an end, but we are proud of the safe and extremely successful joint Boeing and NASA flight test program that we have conducted."

Primary changes to the C model from the original B version that flew 92 flights at Dryden between 2007 and 2010 were geared to transforming it to an airframe noise-shielding configuration. External modifications included relocating the wingtip winglets inboard next to the engines, effectively turning them into twin tails. The aft deck of the aircraft was extended about two feet to the rear. Finally, the project team replaced the X-48B's three 50-pound thrust jet engines with two 89-pound thrust engines.

"Our goal was to define the low-speed envelope and explore the low-speed handling qualities of the Blended Wing Body class of tailless aircraft, and we have accomplished that," added Mike Kisska, Boeing's X-48 flight test project manager.

The X-48C retained most dimensions of the B model, with a wingspan just longer than 20 feet, and a weight of about 500 pounds. The aircraft had an estimated top speed of about 140 mph, and a maximum altitude of 10,000 feet.

Because handling qualities of the X-48C differed from those of the X-48B, the project team modified the flight control system software, including flight control limiters to keep the airplane flying within a safe flight envelope. This enabled a stronger and safer prototype flight control system suitable for further development for potential full-scale commercial hybrid or blended wing aircraft in the future.

NASA's Aeronautics Research Mission Directorate and Boeing funded the X-48, which supported NASA's goals of reduced fuel burn, emissions and noise.

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provide the evidence required for the private sector to run with the new technologies.

The aircraft is predicted to be 20 to 40 percent more fuel efficient, while reducing the noise and air pollution usually associated with large transport aircraft – all key goals for NASA's Environmentally Responsible Aviation initiative.

Dryden has proven through prior research projects that to fly what others only imagine requires testing the aircraft. Only through flight can a research team adequately shake out the glitches in the actual test environment with an aircraft that closely approximates the size and characteristics of a near full-scale aircraft.

Whatever challenges a Hybrid Wing Body aircraft exhibits in shape, systems or integration, Dryden is the place for this work. The wind tunnel models have proven the concept. The X-48 project and its two iterations have further built confidence. Now it's time to build a Hybrid Wing Body aircraft and allow the nation and NASA's aeronautics to soar.

Technology and advancing technology to the point where concepts like the X-48 become viable products will make an impact on jobs in the United States. If a product like the Hybrid Wing Body aircraft can get to the market, it will own the market.

NASA/Cam Martin

Dryden Director David McBride, right, shows the X-48C to NASA Aeronautics Research Mission Directorate Associate Administrator Jaiwon Shin, center, and Robert Pearce, ARMD director for strategy, architecture and analysis.

With confidence established in the new aircraft configuration, commercial air carriers, mail and package companies and U.S. military and its allies would want it. Confidence would lead to orders for aircraft proven to be as efficient as we say it will perform.

Aeronautics is a small part of the NASA budget, but it is inspiring to think what an investment in the Hybrid Wing Body could mean. It would give industry an edge, put people to work and assist in reducing noise and air pollution.

We are not the only ones thinking about the Hybrid Wing Body and the impact NASA aeronautics can have on the world with constrained resources. During a U.S. House of Representatives Science, Space, and Technology Committee hearing April 17, 2013, Dr. John P. Holdren, director of the Office of Science and Technology Policy, and Rep. Mark Tanako, D-Calif., discussed the critical impact of NASA and industry partnerships to develop technology.

The congressman said he was impressed with the X-48 research he learned about on a recent visit to Dryden. Tanako and Holdren talked about the need for partnerships like those on the X-48 and the need to ensure U.S. aeronautical research stays ahead of the rest of the world.

When statements are made about the value of aeronautics in a meeting such as that, it is critical. This recognition of aeronautics and its importance to the aerospace industry in the United States is a good start.

In addition, Dryden has worked hard to maintain its wide range of competencies exactly for opportunities like this. We will be ready when the next X-Plane arrives at Dryden to once again change the world and its perceptions of what an aircraft can be.

Congratulations to the X-48 team on its successful completion of that project. Now lets take the steps as a nation to test a new X-Plane so the people of the U.S. can benefit from this work and the nation can remain number one in aeronautics.

ED13-0099-01 NASA/Tom Tschida

SOFIA staff marks 100th flight

The staff of NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA, gathered on the ramp outside the Dryden Aircraft Operations Facility in Palmdale, to mark a milestone – the flying observatory's 100th flight. The airborne observatory departed from the facility that evening on an engineering flight for the German Receiver for Astronomy at Terahertz Frequencies, or GREAT, spectroscopic receiver. GREAT works like a very high frequency radio receiver that detects light waves rather than light particles. The GREAT instrument was developed by a consortium of German research institutes led by the Max Planck Institute for Radio Astronomy in Bonn, Germany.

Downing passes

Bob Downing, an Arcata Associates Inc. chief engineer, died April 26, 2013. He was 60.

He had worked at Arcata since 2002 and at Dryden for more than 30 years.

Mr. Downing was awarded a NASA Exceptional Service Medal on Aug. 23, 2012 for the exceptional design and management of the development and implementation of Dryden's Mission Control Center's data acquisition and processing system called the Western Aeronautical Test Range Next Generation System.

The system is instrumental in capturing and processing the data required by scientists and engineers who are conducting aeronautical and space related testing and research projects at the Center.

The celebration of Mr. Downing's life is set for June 15th from 2-4 p.m. at the Wrightwood Country Club at 1387 Oriole Rd., Wrightwood, Calif., 92397.

ITEA robotics teams visit Dryden, Edwards

Members of robotics teams and their advisors at a half dozen junior and senior high schools in Southern California's high desert recently gained insight to technology and engineering during a tour of Edwards Air Force Base and Dryden.

The tour, sponsored by the Edwards chapter of the International Test and Evaluation Association, or ITEA, enabled the students to witness the real-world application of many of the processes and procedures that they had employed in designing and building their competition robots for the 2013 spring season.

Following an overview of Dryden's aeronautics research projects from Al Bowers, the center's associate director of research, the students toured the center's experimental fabrication machine shop and then "flew" an F/A-18 high-performance aircraft simulator.

The Edwards ITEA chapter annually honors area robotics teams at a luncheon on the air force base, and this year included the tour of several Dryden facilities.

They also visited several Air Force facilities on the base. About 35 students and their adult advisors and mentors on the tour represented robotics teams at Serrano, Odyssey/Desert, Eastside and Tehachapi high schools, Desert Science Academy and Joe Walker Middle School.

ED13-0124-13 NASA/Tom Tschida

Members of the Tehachapi High School Cyber Penguins robotics team 585 watch technician Jerry Cousins demonstrate the CNC tube bending machine.

Cano, 45, passes

Reuben R. Cano, a Dryden employee twice between 1989 and 2007, died April 25, 2013. He was 45.

Mr. Cano was a senior computer systems engineer and UNIX system administrator with PRC Inc. from November 1989 to March 1996.

From 1996 to January 2002 he worked for User Technology Associates Inc. at the Jet Propulsion Laboratory in Pasadena.

Mr. Cano's co-workers described him as a go-to guy when something went wrong with the computers. He always had the answers and was a pleasure to work with, former co-workers said.

When Mr. Cano returned to Dryden in the 2000s, he worked with Symvionics Inc. as a project lead and managed a group of about 10 software and hardware engineers and maintained the entire UNIX environment.

A service to honor Mr. Cano's life was May 10, 2013 at the Davis Memorial Park in Las Vegas, Nev.

G-III preparing for ACTE

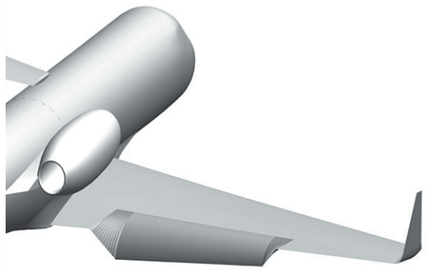
By Gray Creech
Dryden Public Affairs

NASA Dryden's Gulfstream G-III aerodynamics research test bed aircraft, tail No. 804, has returned to the air in a new phase of baseline flights in preparation for the Adaptive Compliant Trailing Edge, or ACTE, project

The aircraft continues to be under modification to support ACTE, a joint effort between NASA and the U.S. Air Force Research Laboratory.

The primary objective of the Phase 0B flight series is to give the test pilots experience with G-III handling qualities with the flight spoilers disabled prior to actual ACTE flights. The flights will also gather data from onboard instrumentation that will be used to establish a baseline for engineers to compare with data acquired after the ACTE flap is installed. In addition, newly installed state of the art instrumentation such as a laser-based fiber optic shape sensing system, a "hot film" anemometer system and a wing deflection measurement system will be characterized.

In the ACTE project, both of the G-III's conventional 19-foot-long aluminum flaps will be replaced with advanced, shape-changing flaps designed by FlexSys Inc., that form continuous bendable surfaces made of composite materials.



NASA graphic

This graphic image depicts how the Adaptive Compliant Trailing Edge flap might look when deployed during flight.

When conventional flaps are moved, gaps exist between the forward edge and sides of the flaps and the wing surface. The ACTE flap will be gapless, forming a seamless transition region with the wing while remaining attached at the forward and side. The improved flap should reduce drag friction and eliminate a major source of airframe noise generation.

If successful, this experiment will further technology to enable aircraft to be lighter weight, more fuel-efficient during cruise and significantly quieter during takeoff, approach and landing.

Work with the aircraft is funded through NASA's Aeronautics Research Mission Directorate as part of the Environmentally Responsible Aviation, or ERA, project under the agency's Integrated Systems Research Program.

Work with Dryden's G-III Aeronautical Research Test Bed is funded in part by NASA's Aeronautics Research Mission Directorate as part of the Environmentally Responsible Aviation, or ERA, project under the agency's Integrated Systems Research Program. The Air Force Research Laboratory provides additional funding for aircraft acquisition and the ACTE project.

Trojan Horse... from page 3

by the NASA Security Operations Center discovered the Trojan horse software "knew" it was in a virtual environment commonly used for information technology analysis. The malicious code then was moved to real hardware and the Trojan horse tried to "call home" for instructions. The first instances of the Trojan horse software infecting Dryden can be traced back to 2008. It was a very complex piece of malicious code for that timeframe and this new version is even more complex, Thomas said.

Another indication of the complexity of this Trojan horse is its ability to hide itself in the recycling folder and generate run keys in an attempt to prevent its removal from the system. The recycle folder is like a recycle bin on a Windows desktop, except it exists as a hidden folder in all Windows directories.

The current iteration of the Trojan horse is rated a low risk priority due to the command and control server domain being inactive as well as a general decrease in the overall use of raw Internet Relay Chat protocols, or IRC, targeted by the malicious code. The risk still exists if the creator of the command and control domain were to activate the domain in the future because any system infected with the malicious code would try to communicate with it. Just because it's older technology doesn't mean that it isn't dangerous to some systems, such as some aircraft at Dryden that do use the IRC protocols.

Some lessons learned from the incident are that the data transfer processes needs to be controlled and documented, portable media should be scanned for viruses regularly and all computer systems must be covered under a security plan or some other chief information officer approved management process. There are 19 systems at Dryden that lack a system administrator and thus do not have a go-to individual when problems arise.

Dryden employees who operate Macintosh computers don't have to worry about conducting manual virus scans, as they are automatic when media are inserted into the system. However, for personal computers, additional policies on conducting scans could be needed to mitigate potential risks, Thomas said.

People need to know their system administrator and contact that person if they see something unusual. Don't delete files or turn off the computer when an anomaly appears. Also, call the NASA Security Operations Center at 877-627-2732, or by e-mail at soc@nasa.gov

Farewell... from page 2

photo and video documentation provided by Dryden's photo and video departments.

The lengthy effort to document the facility started in late 2010 and included interviews, high-resolution images and footage of the MDD in use. The footage includes the process of an orbiter being towed into the MDD through its lift onto the back of a NASA 747, taxiing to the runway and takeoff.

The state historical preservation office recently signed off on the recordation, Grimshaw reported. Once state approval is received, the MDD along with several of the former space shuttle offices and facilities are slated for demolition late this year or early 2014. The main shuttle hangar and Building 4859, at least for now, are home of The Boeing Company's Phantom Eye project.

Also of interest is the Crew Transfer Vehicle used for initial medical checks and then to move astronauts from the orbiter to Dryden medical facilities after an Edwards landing. The CTV was a Kennedy asset operated by Dryden-based United Space Alliance personnel and maintained by Lockheed Martin and Kay and Associates technicians.

The CTV arrived at Dryden in 1990 after service as a people mover at Dulles International Airport. Most of the people mover bench seats were removed and the interior was modified. It has found a new home at the Air Force Test Center Museum and is temporarily located at Building 1864 next to the Air Force's Orbiter Crew Module mock-up pending eventual display at the museum.

It was originally estimated that Dryden had 3,200 line items of shuttle assets, but that number swelled to well over 6,000 line items as the inventory of shuttle-related assets continued, Grimshaw said. The inventory ranged from large vehicles used to power, purge toxic fuels and cool the orbiter, and other ground support equipment to items like gloves, tools, fixtures and light bulbs.

The number of items is actually much higher, he explained, because light bulbs might be one line item, but there might be 50 of one kind and 100 of another. In fact, some of the payload processing assets totaled 268 line items, but contained 16,000 individual pieces of lab equipment, mostly glassware.

ED13-0124-13 NASA/Tom Tschida

The former NASA Crew Transfer Vehicle now belongs to the Air Force Test Center Museum.

NASA graphic

This concept illustration shows the shuttle/NASA 747 at Space Center Houston, which is a visitor center adjacent from Johnson Space Center in Houston.

"The list of line items doesn't begin to capture the enormity of the individual pieces," he added.

One of the larger remaining assets is the last flyable NASA 747 Shuttle Carrier Aircraft, No. 905. Johnson Space Center in Houston is working on a proposal to put the iconic aircraft on public display as the focus of a major new exhibit at Space Center Houston, the visitor center adjacent to Johnson.

Johnson officials transferred ownership of the highly modified early-model Boeing 747 jetliner to the privately operated visitor center May 2. The converted jetliner and a full-size space shuttle mockup that had previously been at NASA's Kennedy Space Center in Florida will become the centerpiece of a new $12 million exhibit complex as a tribute to the legendary Space Shuttle Program.

The six-story-tall exhibit will allow visitors to actually go aboard both the modified 747 and the shuttle mockup mounted on top, just as the real shuttles were mounted during their cross-country ferry flights.

As Dryden's role comes to a close, Grimshaw had a few final thoughts:

"It's been a good ride," he reflected. "The shuttle program was a showcase of American ingenuity and employed so many people. No matter what their role was in the program they had a sense of pride in their work.

"People lined the streets of Los Angeles to get a glimpse of Endeavour as it rolled down the streets to the California Science Center. That shows that the shuttle program continues to touch lives. It will also continue to inspire young people the way it inspired those of us that worked on the shuttle program."

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