



The Dryden

# X-**PRESS**

Volume 54 Number 11 October 5, 2012



ED12-0317-073

NASA/Jim Ross photo

*Endeavour and its host NASA 747 Shuttle Carrier Aircraft make a final flight over Edwards Air Force Base Sept. 21. Dryden is visible on the upper right.*

# Final Flight

**By Jay Levine**

X-Press editor

People from all over California enthusiastically watched the skies for a glimpse of space shuttle Endeavour and its host, NASA's 747 Shuttle Carrier Aircraft, Sept. 21 as they flew by a number of communities and landmarks on their way to Los Angeles International Airport.

Endeavour arrived a day earlier at Edwards Air Force Base on the last stop of its final ferry flight. NASA Dryden employees and

family members were welcomed to see the orbiter on Dryden's back ramp, news media were on hand to catch the landing and a "NASA Social" introduced Dryden to a number of new friends, followers of NASA social media accounts.

Dryden has been a part of Endeavour's support from STS-49, its first mission that landed at Edwards in 1992, and was the staging area for the last leg of its final ferry

**Endeavour, page 7**

# Event highlighted Dryden's work

By Jay Levine

X-Press editor

It's hard to stage an event for millions of your closest friends. For that reason, NASA Socials are designed to give participants a look behind-the-scenes at how the agency works to share with their followers and reach audiences that ordinarily would not have the same access.

For 38 attendees of the NASA Social at Dryden on Sept. 19-21, the sense of awe and wonder of the Space Shuttle Program was experienced first hand. Social media members had rare access to the landing of Endeavour atop its host 747 on Sept. 20 and the shuttle's departure for the final leg of its ferry flight Sept. 21 over key California landmarks before landing at the Los Angeles International Airport.

NASA Social participants experienced a three-day event as a result of a weather delay. NASA Social participants had the opportunity to learn about Dryden's historic role in the shuttle program. For example, the Approach and Landing Tests at Dryden with the shuttle prototype Enterprise in 1977 validated that the shuttle could land unpowered. All but one of the early shuttle landings were at Edwards Air Force Base and the shuttles returned from space to a California welcome 54 times during the operational shuttle program.

In addition, social media members saw some of the latest developments in aeronautics and technology and heard about elements of NASA's future in aeronautics and space exploration.

More than 2,300 social media representatives, who have accounts on Twitter, Facebook and Google+, signed up for one of the limited number of slots at the Dryden event.

NASA social media lead John Yembrick, moderator of the event, said attendees were given a number of unique opportunities to learn about NASA.

"The level of enthusiasm of the participants shows the benefits of



NASA/Jay Levine photo

*Dryden Director of Mission Support Gwen Young joined NASA Social media attendees in welcoming Endeavour to Dryden.*



ED12-0286-07

NASA/Tom Tschida photo

*Dryden senior machinist Keith Day describes the functions of a vertical milling center in the center's experimental fabrication shop to followers of NASA's social media accounts during the NASA Social at Dryden.*

doing these events in person with on-line engagement. We have had 30 NASA Socials and they are all unique, but this was one of the

finest we have hosted. They have a great communications team at Dryden. I am impressed with the work they have done to go above

and beyond to work for this social media experience," Yembrick said.

NASA Socials have an important role.

"These events make NASA more accessible and communicates our story to a more general audience that perhaps has not heard it before," he added.

Social media representatives came from all over the United States including Arizona, California, Georgia, Illinois, Massachusetts, Nevada, New Jersey, New York, Ohio and Texas. The social media representatives' backgrounds included educators, social media strategists, videographers and numerous other vocations/avocations.

The social had meaning for Kaci Heins, a teacher from Flagstaff, Ariz.

"It (Endeavour) was the first shuttle I saw up close. It was very emotional and I teared up," she said.

Participants such as Andy Rechenberg appreciated the special access.

"I know a lot about NASA, but I didn't know how many aircraft and space projects flew here," said Rechenberg, who hails from Cincinnati, Ohio.

He was excited about learning more about NASA future space work, but the Endeavour landing rated high.

"I was speechless when we were able to tour the NASA 747 with Endeavour on top. It was off the charts to be inside the SCA. You couldn't ask for more. Almost everything I see when I come to NASA Socials is hard to put into words. The NASA Social Media team outdid themselves. Expectations started high and stayed there," Rechenberg said.

Lisa Mattox, Dryden social media lead, said the weather delay afforded participants additional opportunities.

"It was an enthusiastic group. When the Social Media event was

**See Social Media, page 8**

# ER-2 flew new instruments

During a few weeks in September, an ER-2 high altitude research aircraft operated from NASA's Wallops Flight Facility in Wallops Island, Va., and took part in the development of two future satellite instruments. The aircraft flew test models of these instruments at altitudes greater than 60,000 feet and gathered information researchers can use to develop ways to handle data future spaceborne versions will collect.

NASA Wallops was the temporary home of one of NASA's ER-2 research aircraft. The ER-2 from NASA's Dryden Aircraft Operations Facility in Palmdale carried two instruments, the Cloud-Aerosol Transport System (CATS) and the Multiple Altimeter Beam Experimental Lidar (MABEL). CATS and MABEL are test beds for



NASA/Brea Reeves photo

*The ER-2, which is based at NASA's Dryden Aircraft Operations Facility in Palmdale, arrived at NASA's Wallops Flight Facility in Virginia for flight research of science instruments that is now completed.*

instruments to be carried by future instruments they will share space on satellite missions, and because the ER-2 in part as a way to lower they are both high-altitude laser costs for both teams.

## Dryden researchers publish work

Dryden technical publications are available at the Dryden Research Library. Items that are restricted in distribution, such as International Traffic in Arms Regulations, or ITAR, are available in paper form at the research library.

Publications distributed to the public are also available electronically at: <http://xnet.dfrc.nasa.gov/Organizations/Library/index.html>

Dryden-developed technical publications are listed by month.

### September 2012

Curtis E. Hanson wrote "An Ad-Hoc Adaptive Pilot Model for Pitch Axis Gross Acquisition Tasks," NASA/TM 2012 216031.

### August 2012

Curtis E. Hanson and John J. Ryan co-wrote "Peak Seeking Optimization of Spanwise Lift Distribution for Wings in Formation Flight," AIAA-2012-4692. The paper was presented at the AIAA Guidance, Navigation and Control Conference, Minneapolis, Minn., on Aug. 13-16.

Franzeska Houtas and Edward H. Teets Jr. co-authored "Heat Stress Equation Development and Usage for the Dryden Flight Research Center," NASA/TM-2012-216030.

Daniel S. Jones, Syri J. Koelfgen, Marvin W. Barnes, Rachel J. McCauley, Terry M. Wall, Brian D. Reed and C. Miguel Duncan co-authored "Executive Summary of Propulsion on the Orion Abort Flight-Test Vehicles," AIAA-2012-3891. It was presented at the 48th AIAA Joint Propulsion Conference, Atlanta, Ga., July 29-Aug. 1.

Joseph W. Pahle, David E. Berger, Michael William Venti, and James Jeffrey Faber co-wrote "An Initial Flight Investigation of Formation Flight," AIAA-2012-4802. It was presented at the AIAA Atmospheric Flight Mechanics Conference, Minneapolis, Minn., on Aug. 13-16.

Brian R. Taylor authored "A Full-Envelope Air Data Calibration and Three-Dimensional Wind

Estimation Method Using Global Output-Error Optimization and Flight-Test Techniques," AIAA-2012-4410. It was presented at the AIAA Atmospheric Flight Mechanics Conference, Minneapolis, Minn., on Aug. 13-16.

David Wolfe, and Chris Regan co-wrote "Frequency Shift During Mass Properties Testing Using Compound Pendulum Method," NASA/TM-2012-216017.

### June 2012

D.W. Banks, M.A. Frederick, R.R. Tracy, J.R. Matischeck, and N.D. Vanacek co-authored "In-Flight Boundary-Layer Transition on a Large Flat Plate at Supersonic Speeds," NASA/TM-2012-216021.

D.W. Banks, M.A. Frederick, R.R. Tracy, J.R. Matischeck, and N.D. Vanacek co-wrote "In-Flight Boundary-Layer Transition on a Large Flat Plate at Supersonic Speeds," ISFV15-062. It was presented at the 15th International Symposium on Flow Visualization, Minsk, Belarus, on June 25-28.

# News at NASA

## Stream ran across Mars

NASA's Curiosity rover mission has found evidence a stream once ran vigorously across the area on Mars where the rover is driving. There is earlier evidence for the presence of water on Mars, but this new evidence – images of rocks containing ancient streambed gravels – is the first of its kind.

Scientists are studying the images of stones cemented into a layer of conglomerate rock. The sizes and shapes of stones offer clues to the speed and distance of a long-ago stream's flow.

"From the size of gravels it carried, we can interpret the water was moving about 3 feet per second, with a depth somewhere between ankle and hip deep," said Curiosity science co-investigator William Dietrich of the University of California, Berkeley. "Plenty of papers have been written about channels on Mars with many different hypotheses about the flows in them. This is the first time we're actually seeing water-transported gravel on Mars. This is a transition from speculation about the size of streambed material to direct observation of it."

The finding site lies between the north rim of Gale Crater and the base of Mount Sharp, a mountain inside the crater. Earlier imaging of the region from Mars orbit allows for additional interpretation of the gravel-bearing conglomerate. The imagery shows an alluvial fan of material washed down from the rim, streaked by many apparent channels, sitting uphill of the new finds.



ED12-0317-26 NASA/Jim Ross photo

Endeavour and its host NASA 747 Shuttle Carrier Aircraft covered a lot of territory in California before landing at Los Angeles International Airport. Above, Endeavour flies over the Los Angeles Coliseum. Clockwise, from top left, Endeavour flies over the California State Capital Building, the Golden Gate Bridge, Disneyland and the Hollywood sign.

# Sightings

## Endeavour's last mission covered a lot of California

Californians gazed at the morning sky Sept. 21 in an attempt to see the Endeavour and NASA 747 Shuttle Carrier Aircraft fly over their community. The final leg of Endeavour's flight from Kennedy Space Center, Florida, to Los Angeles International Airport offered many people an opportunity to witness the historic flight.



ED12-0317-17 NASA/Jim Ross photo

Endeavour flew over a number of California landmarks and locations including Santa Monica Pier.



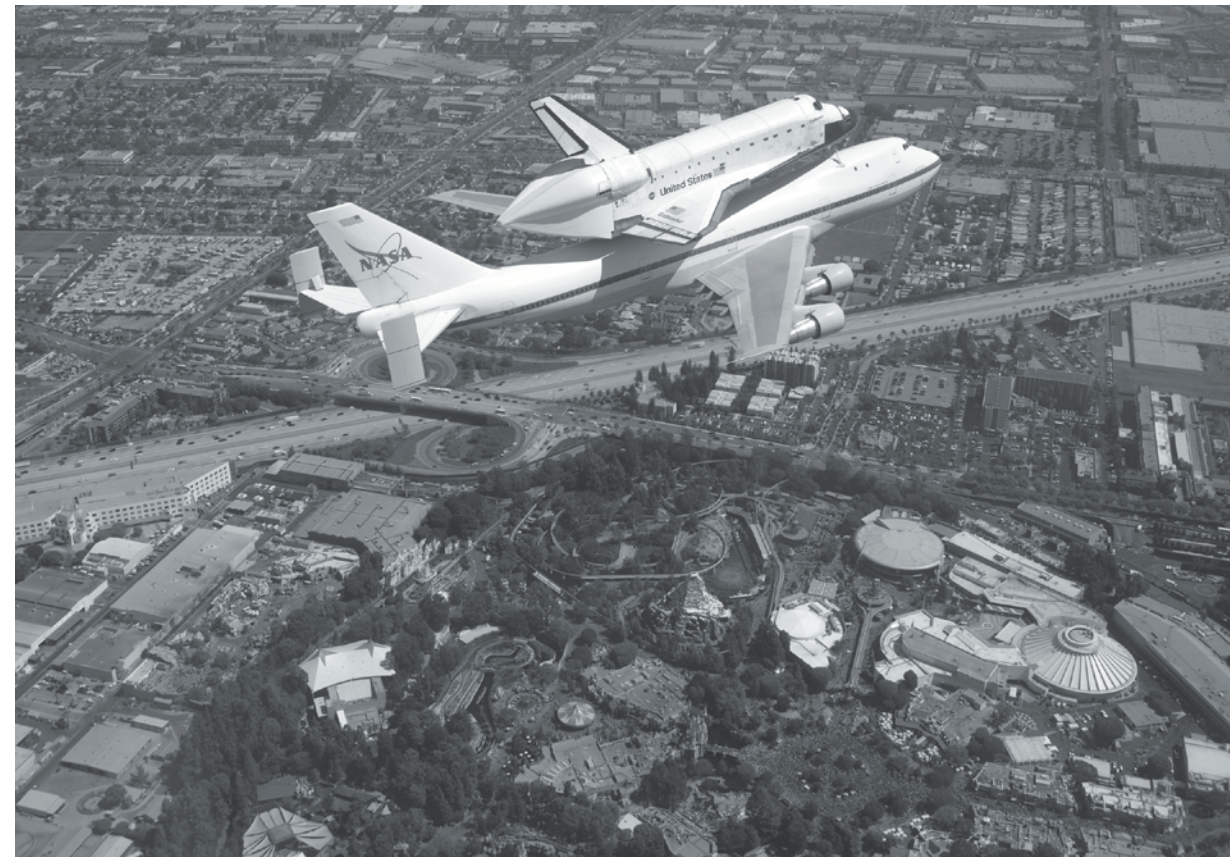
ED12-0317-007 NASA/Carla Thomas photo



ED12-0317-009 NASA/Carla Thomas photo



ED12 317-066 NASA/Tom Tschida photo



ED12-0317-046 NASA/Jim Ross photo

# Dryden hosts space shuttle SRB casings

Two space shuttle solid rocket booster casings arrived at Dryden Aug. 29 after a transcontinental trip from the Kennedy Space Center in Florida. The inert boosters are each more than 149 feet long and more than 12 feet wide. Two modified tractor-trailer rigs were used to haul the boosters overland.

Now owned by the California Science Center in Los Angeles, the boosters will remain in storage at Dryden until the science center's planned exhibit hall to house the space shuttle Endeavour is built. The boosters will be mounted alongside Endeavour in a vertical configuration, similar to what they would have been during launch into space.

The largest solid rocket motors ever developed, the four-segment space shuttle solid rocket boosters weighed about 193,000 pounds empty and 1.3 million pounds when loaded with more than 1.1 million pounds of propellant. The boosters were each capable of producing 2,650,000 pounds of thrust at liftoff, and provided the additional thrust needed for the first two minutes after launch to enable the space shuttles to escape the gravitational pull of Earth.

The Air Force Research Laboratory Propulsion Directorate at Edwards Air Force Base developed the solid rocket booster propellant. The propellant was composed primarily of atomized aluminum powder fuel and ammonium perchlorate oxidizer bound together with a synthetic rubber compound.



ED12-0293-09

NASA/Jim Ross photo

*The wheels of the tractor-trailers carrying one of the two space shuttle solid rocket booster casings create clouds of dust as it crosses Rogers Dry Lake.*



ED12-0293-17

NASA/Jim Ross photo

*One of the two space shuttle solid rocket boosters is lifted from a special lowboy trailer dolly on which it was mounted.*



ED12-0293-04

NASA/Jim Ross photo

*Two giant cranes were used to lift each of the two space shuttle solid rocket booster casings prior to placing it into its temporary storage location outside Dryden's former shuttle hangar. The Mate/Demate Device used for stacking the orbiter and its host 747 at Dryden is in the background at right.*

## Endeavour... from page 1

flight into history.

The nine-day STS-49 mission included the capture of the inoperable INTELSAT VI communications satellite and replacement of its rocket motor. It took three attempts to capture the satellite for repair. This mission marked the first time three space shuttle astronauts walked in space simultaneously, and it also was the first time four space walks took place on the same shuttle mission.

Former Dryden public affairs chief Don Haley recalled the arrival of Endeavour's first landing, which occurred on May 16, 1992.

"To celebrate that first flight and landing, public affairs contacted schools from the Antelope Valley to the coast to invite students to view the landing here at Dryden," Haley recalled. "We would have had hundreds of buses and many thousands of school kids watch the landing from the ramp, but the flight was postponed for a couple of days and many of the school districts couldn't recover and recycle for the new landing day," he said.

However, about 3,500 students were still able to view the landing, according to the May 29, 1992 issue of the *X-Press*. The landing also attracted about 15,000 visitors to Dryden and an estimated 100,000 people watched the conclusion of Endeavour's maiden flight from the east shore viewing site on Rogers Dry Lake at Edwards.

"With the Endeavour going now to the (California Science Center) museum, it'll be nice for those kids who watched that first landing here to visit the Endeavour display once it's set up and show their kids and grandkids the shuttle they saw land at Edwards many years ago," Haley said. "It might even draw a tear or two."

Former Dryden Center Director Ken Szalai recalled attending Endeavour's rollout ceremony in Palmdale.

"It demonstrated a strong



ED12-0316-048

NASA/Tom Tschida photo

*Los Angeles Police Department personnel and former NASA astronaut and Dryden test pilot Gordon Fullerton, seated, join the crew of the NASA 747 Shuttle Carrier aircraft. The standing men are, from left, Larry LaRose, J.J. Johnston, Jeff Moultrie, Frank Batteas, Bill Brockett, Henry Taylor, Troy Asher, Jim Less and Bill Rieke, officer Kevin Standage, Sgt. Stephen Roussel and Glenn Grossman.*



ED12-0316-078

NASA/Tom Tschida photo

*Media, social media and Dryden employees and family wait for a press conference on Dryden's back ramp on Sept. 20.*

**See Endeavour, page 8**

## Endeavour... from page 7

government leadership commitment to human spaceflight after the tragic loss of the crew of Challenger,” he said.

The landings of shuttles were all special, as everyone wanted to see the orbiters return to land at Edwards.

“Although I was director of Dryden when Endeavour returned, I was just one of thousands watching the skies for the thruster bursts about 50,000 feet right above us and anticipating the double sonic boom,” Szalai recollected. “I joined in the involuntary cheer when we spotted the orbiter on a steep final approach. As an engineer, I looked down, and up, and knew they had the runway made!

“I watched Buck Rogers and other fantasy rockets on TV and on the silver screen as a kid,” he added. “But this was a REAL spacecraft returning from orbit. Wow!”

Like the sea-faring ship for which Endeavour was named, Szalai noted

similarities between the two ships and their mission.

“Capt. Cook commanded the H.M.S Endeavour on a lengthy worldwide scientific expedition. Capt. Dan Brandenstein commanded the first flight of USA’s Endeavour,” he recalled. “It was a fantastic spacecraft, which did remarkable things that could not be imagined when the sailing ship left port in the 18th Century. But some things were the same. [Both ships] had a visionary leader who commissioned the voyage, scientific curiosity, a strong commander and a courageous crew,” Szalai said.

Endeavour’s new home at the California Science Center in Los Angeles will provide opportunities for Californians to see the vehicle designated as orbital vehicle OV-105.

“We will be able to take our children and grandchildren to see Endeavour, to talk of Wernher

von Braun, Alan Shepherd, John Glenn, Neil Armstrong, Dan Brandenstein, all those who explore the unknown, and the voyages of Endeavour,” Szalai reflected. “Perhaps one of these children will open their eyes wide, imagine, dream, and [someday] lead a crew to an unknown place in the starry sky in the future.”

Dryden space shuttle operations manager George Grimshaw supported Endeavour’s first space mission in 1992, the 36<sup>th</sup> shuttle landing at Edwards.

“I was the driver/technician in the convoy command vehicle,” Grimshaw recalled. “Endeavour was the first orbiter to use a drag chute during landing and the first orbiter with improved nose wheel steering – both recommendations from the Rogers Commission following (the) Challenger (accident). As Endeavour touched down on the runway, we were

closely watching as the chute deployed. A couple of years earlier we had used NB-52B 008 to test the drag chute system, so it was great to see it in use on the shuttle,” Grimshaw said.

Endeavour returned from space and landed at Dryden seven times, its last appearance on Nov. 30, 2008. But as with all good things, the Space Shuttle Program came to an end.

“Endeavour’s first flight, landing and ferry were exciting, not just because it was a new orbiter, but because it owed its existence (and legacy) to Challenger,” Grimshaw reflected.

“As always, it was great to see Endeavour again (on its final ferry flight stopover), but this time with mixed emotions, knowing this was the last time,” he said. “I think it will be even more difficult the first time I see Endeavour as a museum piece. Even so, I’m glad she will be on display here in Southern California for millions of people to see and experience up close – for the first time for most of them.

“I have supported the shuttle program in varying capacities with the Air Force and NASA since 1979,” Grimshaw added. “It was a great program to be a part of and to be associated with.

“The shuttle was an inspiration to the world and a symbol of the greatness and capability of America and will hopefully continue to inspire current and future generations of Americans as we continue to work in and explore space,” Grimshaw concluded.

## Social Media ... from page 2

extended to three days, attendees were happy that they had an extra ‘bonus’ day to learn about Dryden. It is important to present these opportunities to social media members to get NASA’s messages out to a wide range of people. There are some participants with as many as 43,000 followers and there is a multiplier factor for people who receive the messages and send them to their followers,” she said.

“We also had an opportunity to show participants what’s next for

NASA. Yes, it is sad the shuttle program is coming to an end, but NASA still is in the business of space and aeronautics research,” Mattox added.

Cindy Chin, a management consultant from New York City, said she was happy to be a part of history.

“The space shuttle means so much to everyone. Its appeal reaches across generations and excites our inner astronaut,” she said.

Closer to home, Cariann

Higginbatham of Anaheim, Calif., said she likes seeing behind the curtains at NASA.

“We were shown the backstage and how NASA works. It was special because we saw what other people don’t see. NASA is not faceless. We were able to see the other side of NASA – its people,” she said.

While participants were sad to see the final flights of NASA’s Space Shuttle Program, they learned the agency’s future is as bright as ever.

National Aeronautics and  
Space Administration

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

Official Business  
Penalty for Private Use, \$300



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