Smooth flow

Above, NASA’s F-15 research test bed will expose the Swept Wing Laminar Flow test article to speeds up to Mach 2, matching conditions presented during wind tunnel testing at NASA’s Langley Research Center.

At right, The Swept Wing Laminar Flow test article, integrated to the underside of a NASA F-15, will examine the effectiveness of different configurations of small dots, called distributed roughness elements, to extend smooth, laminar airflow over a wing’s depth, reducing friction drag.

Research begins on laminar flow concept

By Matt Kamlet
Armstrong Public Affairs

NASA is set to begin a series of supersonic flights that will examine efforts to improve the efficiency of future supersonic aircraft.

The flights, which are expected to begin in April from NASA Armstrong, will follow developments identified by high-speed wind tunnel testing conducted at NASA’s Langley Research Center in Virginia.

As NASA proceeds toward the possible development of a proposed Low-Boom Flight Demonstration aircraft, or LBFD, research done by the agency’s Commercial Supersonic Technology project, or CST, continues to investigate ways to mitigate or minimize the disruptive sonic boom associated with supersonic flight, as well as approaches to overcome other technical barriers to innovation in commercial supersonic flight.

One such barrier is fuel efficiency. At supersonic speeds, the force of
ADATS moves huge data sets fast

By Jay Levine
X-Press editor

A network and communication architecture that can more efficiently move data from research aircraft, while using half the bandwidth of traditional methods, could eventually enable data collection of precise measurements needed for testing the next generation of X-planes.

Called the Advanced Data Acquisition and Telemetry System, or ADATS, researchers at NASA Armstrong Flight Research Center in California integrated the new systems into a NASA King Air recently for a series of three flights following extensive ground testing.

The new system can move 40 megabits per second, which is the equivalent of streaming eight high-definition movies from an online service each second, said Otto Schnarr, principal investigator.

“All of this capability is gained without new architecture and using the advanced modulation technique to save spectral bandwidth, time and research dollars,” said electrical engineer Matthew Waldersen. In addition, the system allows people to participate in the flight test from wherever a secure network is available. As many as 3.5 million sensor measurements per second can be acquired, or a focused data set can be targeted to free up bandwidth for other tasks, like streaming high-definition video simultaneously, he added.

ADATS aims to advance flight test data acquisition and telemetry systems using an Ethernet via telemetry subsystem that wirelessly transmits test data and an advanced data acquisition system that allows remote researchers to command experiments and receive data collection during flight.

“The main components are a ground station, a transceiver on the airplane and the instrumentation systems that tie everything together,” said Tom Horn, ADATS project manager. “The tests explored what this system does and how it behaves. We wanted to make sure we understood the nuances and determine if additional testing is required for researchers to feel comfortable using it.”

The flights capped a three-year effort to fill in existing gaps in the technology, such as range, instrumentation and system design challenges. ADATS team members have made well-received presentations at the center that led to additional brainstorming sessions on potential uses for the technology. “People were not having trouble coming up with how they could put it to use,” Waldersen explained. “Having more data allows researchers to do what they do better. Everyone at the sessions agreed the technology is worth pursuing. You know a project is a success when you take questions from engineers like, ‘have you considered using it for this case, or could we do this with it?’”

Building up the capability is the next step.

“In any electronics project there is a hardware and a software component,” Waldersen said. “We have completed a lot of work with the hardware component to see what it can do and now it’s a matter of the software aspect and how it integrates with ground operations, which projects will put it to use immediately and what other systems can work around it to fully utilize the capability.”

Mature data collection could be useful for upcoming X-plane testing. For example, measurements of airflow data along the entire face of a fan engine could be efficiently researched, Horn explained. Another advantage is an unlike traditional data collection that can experience loss of data, or “dropouts,” ADATS can mitigate the loss with this data collection method. However, delays can still occur and researchers are looking into understanding the ramifications of that for safety.

In addition, the system also could have implications for unmanned air vehicles and systems for uplinks and bandwidth management. For example, airline-like the IFAE Global Hawk could gain efficiencies. ADATS also could work in combination with an Ethernet-based fiber optic sensing system to streamline data collection.

The ADATS effort can be traced back to ADATS, page 11

DC-8 survey mission is ongoing

By Ellen Gray
NASA’s Earth Science News Team

Earth is a planet that “breathes” with the seasons. In winter months atmospheric gases and air pollution accumulate, waiting dormant until spring and summer bring sunshine and plant life, sparking transformations that change the make-up of gases in the atmosphere.

A NASA airborne mission took a world-wide survey of these seasonal transformations by flying from the heart of winter in the Northern Hemisphere, down into the sunny summer in the Southern Hemisphere and back again.

This was the second atmospheric survey made by the Atmospheric Tomography, or ATom, mission, which the first flew in July and August 2016. The science team measured more than 200 gases as well as airborne particles aboard NASA DC-8 flying laboratory, which is based at NASA Armstrong. In particular, scientists are interested in greenhouse gas pollutants such as methane and tropospheric ozone as well as poorly understood particulate matter, like black carbon. How these pollutants interact and move around the planet will help scientists better understand air pollution and climate change now and in the future.

“We went to the northern polar regions at the very best time,” said Steven Wolff, an atmospheric scientist at Harvard University in Cambridge, Massachusetts, and PI for the mission. “These observations will help us understand how emissions from different areas of the world are transported and what the implications of these transport processes are.”

This year’s mission is in its second week and will continue through mid-October.

Eliseo Ochoa, director of NASA’s Goddard Space Flight Center in Greenbelt, Maryland, and NASA’s chief scientist, said the missions are part of a larger effort to study pollution and climate change.

“This mission is a critical component of NASA’s scholarly approach to understanding our planet’s atmosphere,” Ochoa said. “Our observations are designed to improve our models and our understanding of Earth’s climate.”

The mission is based at NASA Armstrong’s Dryden Flight Research Facility in California and will involve nine research flights using several measurement packages. A sister flight will be based in Ireland.

“NASA’s Earth Science Enterprise provides an invaluable service to the global community,” Ochoa said. “The results of these surveys will play a critical role in our ability to better understand the Earth system.”

A third possibility is that a medium-sized black hole shedded a white dwarf star. A mysterious flash of X-rays has been discovered by NASA’s Chandra X-ray Observatory in the deepest X-ray image ever obtained. This source likely comes from some sort of destructive event, but may be of a variety that scientists have never seen.

The X-ray source, located in a region of the sky known as the Chandra Deep Field-South, has remarkable properties. Prior to October 2014, this area was not detected in X-rays, but then it erupted and became at least a factor of 1,000 brighter in a few hours. After about a day, the source faded completely.

Thousands of hours of legacy data from the Hubble and Spitzer Space Telescopes helped determine that the event likely came from a faint, small galaxy about 10.7 billion light years from Earth. For a few minutes, the X-ray source produced a thousand times more energy than all the stars in this galaxy. “Ever since discovering this source, we’ve been struggling to understand its origin,” said Franz Bauer of the Pontifical Catholic University of Chile in Santiago, Chile. “It’s like we have a jigsaw puzzle but we don’t have all of the pieces.”

One of the three main possibilities to explain the X-ray source involve gamma-ray burst (GRB) events, GRBs are fleeting explosions triggered either by the collapse of a massive star or by the merger of a neutron star with another neutron star or a black hole. If the jet is pointing towards the Earth, a burst of gamma rays is detected.

A second possibility is that a medium-sized black hole shedded a white dwarf star.
The March flights included two slightly different Prandtl-M aerodynamic models that were air launched from a remotely piloted Carbon Cub. The research validated the airframe that will be the basis for a potential Mars aircraft and the Weather Hazard Alert and Awareness Technology Research Radiosonde (WHAATRR) Glider on Earth.

In addition to confirming the aircraft’s shape, the first flight data was collected on the Prandtl-M. HaseenNaz, an intern at Armstrong pursuing a master’s degree in aerospace engineering from California State Polytechnic University in Pomona, was especially excited by the data collection he hasn’t learned a lot during his dynamic models. That’s not to say excited by the data collection he was collected on the Prandtl-M.

The selections were made for NASA Flight Opportunities program that organizes chances to fly and selects experiments for NASA support twice each year.

The program selects promising space technologies to test through relatively low-cost ways that simulate spaceflight or just reach the edge of space on commercial launch vehicles. The program is a valuable platform for NASA to mature cutting-edge technologies to test on low-gravity-tna.

"These selections allow companies and academia to demonstrate technologies of interest to NASA in a much more realistic environment than what they could get in ground-based simulation facilities," said Stephan Ond, the program technology manager for NASA’s Flight Opportunities program. "This program is a valuable platform for NASA to mature cutting-edge technologies that have the potential of supporting future agency mission needs."

Two topics were included in this call for research. Under the first topic, which requested demonstration of space technology payloads, NASA selected four proposals:

- **Protein-Drop Pinning in Microgravity**
  - **Principal Investigator:** Amir Hira, principal investigator, Rensselaer Polytechnic Institute, Troy, New York
  - **Research:** Demonstration of a system for maintaining protein solutions in liquid samples involved in the study of diseases such as Parkinson’s and Alzheimer’s without using a container, which often influences scientific measurements.

- **Evaluating the Behavior of Regolith Particles**
  - **Principal Investigator:** Daniel O’Connell, principal investigator, Airborne Systems, Pennsauken, New Jersey
  - **Research:** Demonstration of an automated microgravity environment that can be used for precision delivery or mid-air retrieval of scientific payloads, tested from a high-altitude balloon. Once the balloon is deployed at 60,000-foot altitude, it will select its landing point and perform an automatic precision landing.

- **Guided Parafoil High-Altitude Research**
  - **Principal Investigator:** Garrett “Storm” Dunker, principal investigator, Airborne Systems, Pennsauken, New Jersey
  - **Research:** Demonstration of a regolith compression mechanism with transparent tubes, which contain heads and pebbles that simulate regolith, to evaluate behavior at various gravity levels duringsuborbital flight.

- **Guided Parafoil High-Altitude Research II**
  - **Principal Investigator:** Amir Hira, principal investigator, Rensselaer Polytechnic Institute, Troy, New York
  - **Research:** Demonstration of an automated microgravity environment that can be used for precision delivery or mid-air retrieval of scientific payloads, tested from a high-altitude balloon. Once the balloon is deployed at 60,000-foot altitude, it will select its landing point and perform an automatic precision landing.

Awards will be made for payload integration and flight costs, as well as limited payload development costs. These investments take technologies from the laboratory to a relevant flight environment, facilitate technology maturation, validate feasibility and reduce technical risks and enable infusion of key space technologies into multiple future space missions.
Above, Armstrong pilot Hernan Posada responds to a request for a selfie. At right, an ER-2 flies by the crowd.

Above, Armstrong pilot Jim Less delivers the F/A-18 for static display at the Los Angeles County Air Show. At right, Sam Habbal explains aspects of the King Air aircraft.

Above, Matt Kamlet, right, shows some features of the X-57 Maxwell X-plane. At left, Kassandra Bell, left, and Michael Woodworth answer questions about the Stratospheric Observatory for Infrared Astronomy.

Spectacular!

Armstrong participation strong at Los Angeles County Air Show
Armstrong’s contractors win NASA SBA honors

NASA Armstrong research led to a number of technical publications.

October
Shun-Fat Lung and William L. Ko co-authored “Applications of Displacements Transfer Functions to Deformed Shape Predictions of the G-III Swept-wing Structure,” a meeting paper prepared for presentation at the 90th Congress of the International Council of the Aeronautical Sciences (ICAS), Daegu, South Korea, Sept. 25-30.

December

Peter M. Suh, Alexander Chin and Dimitre N. Mavis collaborated on “Robust Modal Filtering and Control of the X-56A Model with Simulated Fiber Optic Sensor Failures,” NASA/ TM-2016-219430.

January


Research page 11

Prandtl-M...from page 4

Logical Innovations Inc. was selected as the 2016 NASA Armstrong Small Business Prime Contractor of the Year. The company demonstrated its commitment by continually providing excellent written and oral communication in all its contracts, according to the nomination letter. The contractor maintains the utmost professionalism and courtesy to relay information and provide the support necessary to accomplish the tasks assigned. From left to right are Kari Alvarado, Rebecca Lopez, David McBride, Denise Nazarn and Robert Medina.

Jacobi Technology Inc. was named the 2016 Armstrong Large Business Prime Contractor of the Year. The company provided engineering services to eight different codes for Armstrong projects. Its support is pivotal in advancing NASA’s research and research from industry, academic institutions, and other NASA centers, according to the nomination letter. Jacobi engineering support was vital in accomplishing some first-ever NASA achievements in aeropace. From left are Alex McBride, Brian Edington, Robert Gauman and Medina.

The Armstrong 2016 Subcontractor of the Year is Solution One Industries Inc. The company is a subcontractor to Jacobi Technology and performed exceptionally in the areas of instruction, training, flight line operations, mission planning, logistics support and program management for Unmanned Aircraft Systems, according to the nomination letter. From left are Robert Swain, Alvarado, McBride, Tyrone McLeaur, Dawn Snyder and Medina.

Atomics project scientist.
This winter, they observed the accumulation of pollutants from Europe, the United States, Canada, northern China, and Russia, which get trapped in the cold dome of the wintertime circulation until spring. “We watched this chemistry using instrumentation that nobody has had before, and we realized that we were understanding what happens as this stuff builds up,” Wofsy said.

The photochemical accumulation of gases sets the stage for the chemical processes that occur in the atmosphere when sunlight returns to the Arctic.

Sunlight is energy, and in the same way that it supports life on Earth through plant photosynthesis, it also drives the chemical system in the atmosphere. Incoming ultraviolet radiation provides high energy photons that can tear apart gas molecules, and some of the resulting high-energy reactive fragments.

One of Atomics science goals is to understand these photochemical processes, which help remove pollutants and greenhouse gases from the atmosphere.

These photochemical processes were in full swing as the mission headed to the Pacific Ocean to New Zealand and the Southern Hemisphere in summer. The Southern Hemisphere holds fewer land masses and less of the world’s population, so the atmospheric chemistry is generally cleaner than that of the Northern Hemisphere. As a result, the relatively warm humid air above the ocean surface as well as the colder, dry air at its peak altitude of 35,000 feet and everything in between.

After an initial flight from Armstrong to the equator and back, the DC-8 made nine stops over the course of 28 days, departing from California for the North Pole, then on to the tropics, the Southern Ocean around Antarctica, and across to the southern tip of South America before flying north over the Atlantic Ocean toward Greenland, then across the Arctic Ocean back to Alaska. The final leg returned the science team to California.

Atomics winter mission was the second of four deployments scheduled through 2018. It is funded by NASA’s Earth Venture program and managed by the Earth Science Project Office at Ames. A team of over 100 people – scientists, engineers, flight crew and staff – across government agencies and universities supported the mission in the air and on the ground.

For more information about the Atomics mission, visit: https://www.nasa.gov/content/2016-earth-expeditions-atom

Stop Shopping Initiative, or OSSI (https://intern.nasa.gov), as a system for the recruitment, application, selection and career development of high school, undergraduate, and graduate students primarily in science, technology, engineering and mathematics disciplines for projects such as the Prandtl-M. Opportunities for students in other disciplines are available.

The Prandtl-M completes a successful research flight.

AFCRC2017-0048-32                                       NASA/Lauren Hughes

The design is starting to gel and the target is a stable airplane and fine tuning the autopilot. We will see if the Prandtl-M flies from a weather balloon at increasing altitudes to test the systems later this year.”

“Our vision is that the Prandtl-M project will target flights from a weather balloon to the Arctic. The ultimate proof of concept is a flight from a balloon at 100,000 feet altitude or more to demonstrate radiosonde replacement capabilities and returning to the launch site for reuse,” said Scott Wiley, Armstrong WHATTR Glider project manager.

“Every flight of the Prandtl-M is a success,” said Tyronne McLaurin, Dawn Snyder, Robert Swain, Alvarado, McBride, and Rebecca Lopez. The flights looked at replacement capabilities and return to the launch site for reuse, said Scott Wiley, Armstrong WHATTR Glider project manager. The flights were in full swing as the mission headed to the Pacific Ocean to New Zealand and the Southern Hemisphere in summer. The Southern Hemisphere holds fewer land masses and less of the world’s population, so the atmospheric chemistry is generally cleaner than that of the Northern Hemisphere. As a result, the relatively warm humid air above the ocean surface as well as the colder, dry air at its peak altitude of 35,000 feet and everything in between.

For more information about the Atomics mission, visit: https://www.nasa.gov/content/2016-earth-expeditions-atom
Campaign filled that gap.

This winter’s HyspIRI Hawaii field observational capabilities, but not conceptual design phase. The Imager called the possible future satellite mission carrying airborne prototypes of research flights over California, on how reefs are changing."

an urgent need to get a handle now also subject to sediment and other hazards.

to uncover the practical limits of... mission planning for the future HyspIRI mission – and powerful data for current coral reef research. Six coral reef-related projects with diverse objectives are using imagery that AVIRIS and MASTER collected around the Hawaiian archipelago in January through early March.

• Under principal investigator Steven Ackelson (U.S. Naval Research Laboratory, Washington), a team investigated how coral reefs and water quality vary, in both space and time, over the large distance encompassed by the Hawaiian Islands and the 1,200-mile-long (2,000-kilometer-long) Papahanaumokuakea Marine National Monument north of the main islands. Ackelson’s team used the airborne instruments and in-water observations to collect data on reef condition and water quality and compared them with data collected from 2010 to 2014 from a different hyperspectral imager.

• To study reefs’ responses to stress, Kyle Cavanaugh (UCLA) led a study of the composition of shallow reefs (coral, algae and sand) and the extent of their bleaching. The team hopes to uncover the practical limits of different biological characteristics and responses to environmental change – can be detected from an airborne platform and ultimately from space.

To determine how changes in a reef’s environment – cloudiness, water temperature, water murkiness – might affect coral health, and how these environmental factors themselves might be influenced by changing land use on the islands.

Paul Havens (supported by Cramer Fish Sciences, West Sacramento, California) will be comparing this year’s AVIRIS data with observations from AVIRIS campaigns flown between 2000 and 2007. The study focuses on reefs in Kaohehe Bay, Oahu, and Kealakekua Bay, Hawaii.

• Eric Houchberg (Bermuda Institute of Ocean Sciences) and his team will compare this year’s AVIRIS water measurements with AVIRIS data from 2006 to 2007 to study whether the proposed HyspIRI instrument in observing these features. Like Ackelson’s and most of the other investigators’ projects, this study combined airborne imagery and ocean measurements.

• Heidi Dierson (University of Connecticut) used in-water spectrometers to study the composition of shallow reefs and to determine the degree to which differences in pigmentation – which reef-to-reef differences of algae with the proposed HyspIRI instrument... changes. The team hopes... program this year’s AVIRIS data on the islands, and local human threats to investigate how the reef’s ecosystem changes and natural hazards.

The advantages of studying active volcanoes from the air rather than the ground are obvious. Coral reefs may not offer the same risks in a close encounter that volcanoes do, but there’s another good reason to study them by remote sensing: reefs are dotted across thousands of square miles of the globe. It’s simply not feasible to survey such a large area from a boat. NASA has been monitoring coral reefs by satellite and aircraft for several decades. Recent airborne efforts have used sensors that provide better spatial and spectral resolution than currently available from NASA satellite systems. 

Reefs are threatened by bleaching due to rising sea surface temperatures as well as, to some degree, by increasing acidification of ocean waters,” said Woody Turner of NASA Headquarters, the program scientist for the recent Hawaii study. “On top of that, since they’re coastal ecosystems, they are also subject to sediment and other effluents running offshore. We have an urgent need to get a handle now on how reefs are changing.”

Over the past four years, NASA has flown a series of research flights over California, carrying airborne prototypes and instruments in preparation for a possible future satellite mission called the Hyperspectral Imager (HyspIRI), now in the conceptual design phase. The Golden State has many diverse landscapes to test the instruments’ observational capabilities, but not coral reefs or erupting volcanoes. This winter’s HyspIRI Hawaii field campaign filled that gap.

to the next best thing to a satellite’s point of view, HyspIRI Hawaii used a high-altitude ER-2 aircraft from NASA Armstrong. During the study, the aircraft was based at Marine Corps Base Hawaii on the island of Oahu. Flying at approximately 60,000 feet (18,000 meters) and thus above most of Earth’s atmosphere, the ER-2 carried the Airborne Visible and Infrared Imaging Spectrometer (AVIRIS), developed by NASA’s Jet Propulsion Laboratory, and the MODIS-ASTER Airborne Simulator (MASTER), developed by NASA Ames Research Center.

AVIRIS is an imaging spectrometer that observes the complete reflected spectrum of light in the visible and shortwave infrared wavelengths. MASTER has multiple observational channels in the thermal infrared wavelengths. Together AVIRIS and MASTER provide the same combination of spectral bands planned for the future HyspIRI mission – and powerful new current coral reef research.

The advanced data acquisition and telemetry system team includes front row from left Mario Soto, Sam Habbel, Tiffany Tsui, Richard Hang, Randy Torres, Thang Quach, Otto Schnarr, Matthew Waldersen, Karen Litz, Andy Olvera, Stanley Wienerberger and Rick Corde. In the second row from left are John Ashley, Doug Beaton, Tom Horn, Brady Benson, Chris Birdsong, Jim McNally, Martin Munday and Tony Lavre.

NASA’s Flight Demonstrations and Capabilities project, which is part of the Integrated Aviation Systems program, is funding the current effort.
drag that must be overcome is large. Due to the interaction of flow with the aircraft’s surface, this friction drag contributes about half of the total drag at supersonic speeds. This particular series of flights will explore ways of reducing friction drag and increasing efficiency through new and innovative methods of achieving swept wing laminar flow.

As an aircraft flies, there is a thin layer of air, called the boundary layer, which exists between the surface of a wing and the fast-moving air around it. This boundary layer generally begins as a smooth or laminar flow, which creates minimal friction drag. However, as air flow progresses over the aircraft’s surfaces, tiny disturbances begin to affect the boundary layer, and it eventually transitions into a more turbulent flow, which produces much more friction drag. On swept wing aircraft, this turbulence presents the aerodynamic challenge of overcoming crossflow on the wing. Crossflow is a name for air flow disturbances that run along the span of the wing, resulting in turbulent flow, increased drag, and ultimately, higher fuel consumption.

Future supersonic aircraft seeking to achieve a low-boom, such as NASA’s proposed LBFD, will rely on a swept wing design in order to fly at supersonic speeds without producing a loud sonic boom. The swept wing design generally produces crossflow. NASA believes this obstacle may be overcome through the use of an array of small dots, called distributed roughness elements, or DREs.

“We swept wings do not have much laminar flow naturally at supersonic speeds, so in order to create a smoother flow over the wing, we’re putting the DREs along the leading edge of the wing,” says CST subproject manager Brett Pauer. “These DREs can create small disturbances that lead to a greater extent of laminar flow.”

The DREs work by alleviating crossflow and delaying the transition to turbulent air flow. The crossflow is essentially crowded out and is not allowed to grow. The boundary layer flow eventually does transition, but it occurs much further along the path of the wing and thus maintains laminar flow for a longer period of time and over more of the wing. The more laminar flow, the lower the overall drag, leading to a more efficient aircraft.

A different configuration of the DREs than that which was expected to work at these high-speed conditions was recently discovered during wind tunnel testing of a wing model at NASA Langley. “We recently completed testing the 65-degree swept wing model at Langley.” NASA Armstrong principal investigator Dan Banks said. “Part of the purpose for the flight tests will be to document the differences in crossflow transition between that which occurs in the wind tunnel and that occurring in flight. Flight testing the exact same test article that was tested in the wind tunnel gives us the best possible comparison.”

NASA engineers have integrated the 65-degree wing test article that had been previously tested in the wind tunnel, to the underside of a NASA F-15. The swept wing model will test several configurations of DREs along the test article’s leading edge at speeds up to Mach 2. This will allow researchers to examine how different configurations of DREs impact laminar flow.

This will be done by monitoring the flow during flight through the use of an infrared camera mounted under the right inlet of the F-15, which will help interpret which DRE configurations produce the most laminar flow. The camera will monitor flow by picking up signatures of heat produced by air flow, with more heat indicating more friction.

A different configuration of the DREs than that which was expected to work at these high-speed conditions was recently discovered during wind tunnel testing of a wing model at NASA Langley. The DREs are a much simpler and elegant solution. The wind tunnel tests and NASA Langley were instrumental in discovering the potential for DREs to increase the fuel efficiency of future supersonic aircraft.

“In these wind tunnel tests, we studied a large number of DRE patterns based on subsonic research approaches and none worked at supersonic speeds,” NASA Langley principal investigator Lewis Owens said. “The real breakthrough came when we finally abandoned the idea that DRE heights needed to be kept very small and this counter-intuitive approach opened the door to new DRE patterns with the potential to produce the desired supersonic boundary layer control effect.”

Swept wing laminar flow technology allows NASA to consider wing designs that have low boom characteristics, yet can be more efficient. In the past, a large extent of laminar flow had only been practically achieved on wing designs with very little sweep. Such designs however are not workable in NASA’s efforts to produce a soft thump in place of the sonic boom. The direction of future supersonic aircraft also depends in part on their potential to be more fuel efficient.

If environmental noise standards are identified and met, and are acceptable to the community, the future could be opened to commercial supersonic flight over land, which is currently restricted due to the loud sonic boom.

“Swept laminar flow allows something of an elusive holy grail for aerodynamicists,” states CST project manager Peter Coen. “This test, while still exploring fundamentals, is an important step toward achieving CST’s fuel efficiency goals for quiet supersonic overland airliners.”

Flights are expected to continue through May.

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

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National Aeronautics and Space Administration
NASA Armstrong Flight Research Center
P.O. Box 273, Edwards, California, 93523-0273
Official Business Penalty for Private Use, $300

X-Press March 2017