



THE ARMSTRONG XPRESS

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Solo flight

By **Rebecca Richardson**

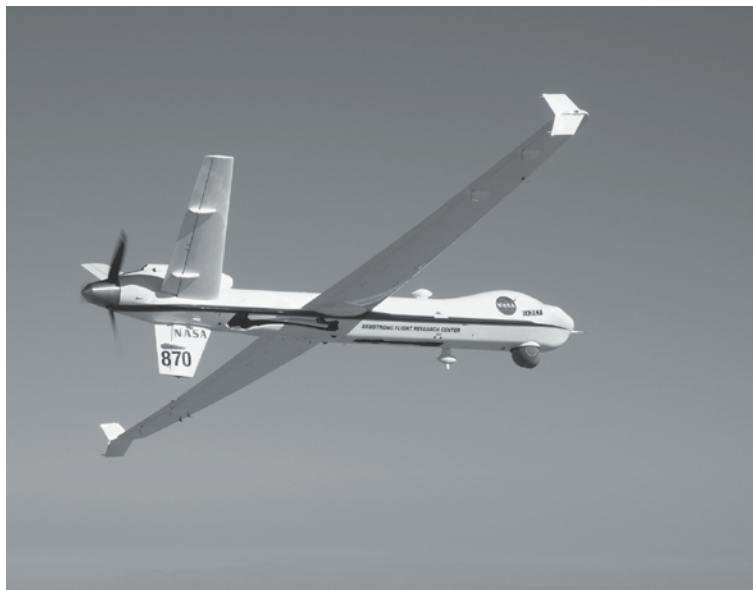
Armstrong Public Affairs

NASA's remotely-piloted Ikhana aircraft, based at Armstrong, successfully flew its first mission in the National Airspace System without a safety chase aircraft June 12. This historic flight moves the United States one step closer to normalizing unmanned aircraft operations in the airspace used by commercial and private pilots.

Flying these large remotely-piloted aircraft over the United States opens the doors to all types of services, from monitoring and fighting forest fires, to providing new emergency search and rescue operations. The technology in this aircraft could, at some point, be scaled down for use in other general aviation aircraft.

"This is a huge milestone for our Unmanned Aircraft Systems Integration in the National Airspace System project team," said Ed Waggoner, NASA's Integrated Aviation Systems Program director. "We worked closely with our Federal Aviation Administration colleagues for several months to ensure we met all their requirements to make this initial flight happen."

Flights of large craft like Ikhana have traditionally required a



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NASA/Carla Thomas

NASA's remotely-piloted Ikhana aircraft, based at Armstrong, is flown in preparation for its first mission in public airspace without a safety chase aircraft.

safety chase aircraft to follow the unmanned aircraft as it travels through the same airspace used by commercial aircraft. The Ikhana flew in accordance with the Federal Aviation Administration's (FAA) Technical Standard Order 211 – Detect and Avoid Systems – and Technical Standard Order 212 – Air-to-Air Radar for Traffic Surveillance.

The FAA granted NASA special permission to conduct this flight under the authority of a Certificate of Waiver or Authorization on March 30. The certificate permitted Ikhana's pilot to rely on the latest detect and avoid technology, enabling the remote pilot on the ground to see and avoid other aircraft during the flight.

NASA successfully worked with

its industry partners to develop a standard for Detect and Avoid technologies, complied with the requirements of the FAA Technical Standard Orders, and garnered flight approval from the FAA.

The Ikhana aircraft was equipped with detect and avoid technologies including an airborne radar developed by General Atomics Aeronautical Systems, Inc., a Honeywell Traffic Alert and Collision Avoidance System, a Detect and Avoid Fusion Tracker, and an Automatic Dependent Surveillance-Broadcast capability – a surveillance technology by which the aircraft determines its position via satellite navigation and periodically broadcasts this information so other aircraft can track it.

The flight took off from Edwards Air Force Base and entered controlled airspace almost immediately. Ikhana flew into the Class-A airspace, where commercial airliners fly, just west of Edwards at an altitude of about 20,000 feet. The aircraft then turned north toward Fresno, requiring air traffic control to be transferred from the Los Angeles Air Route Traffic Control Center to the Oakland Air

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Xodiac tests sample return tech

By Leslie Williams

Armstrong News Chief

Just a sample will do.

Honeybee Robotics in Pasadena, California, flight tested its pneumatic sampler collection system, PlanetVac, on Masten Space Systems' Xodiac rocket on May 24, launching from Mojave, California, and landing to collect a sample of more than 320 grams of topsoil from the surface of the desert floor.

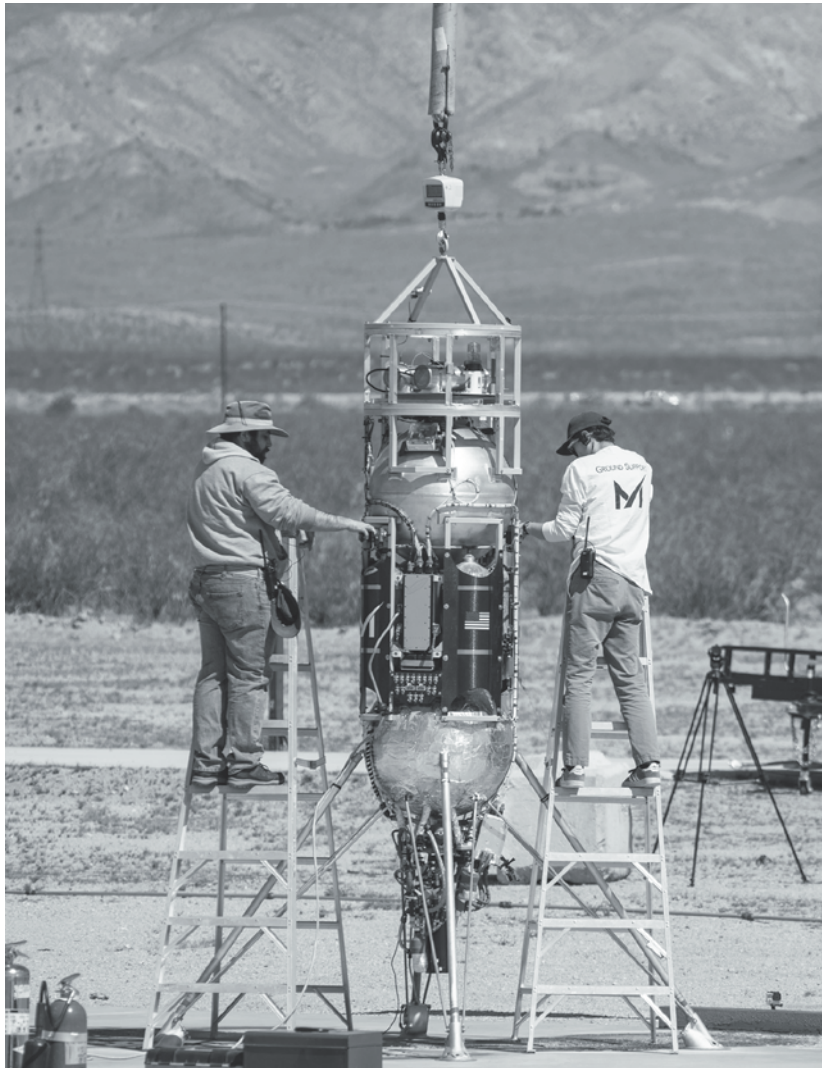
"The opportunity to test a technology on Earth before it is destined for another planet allows researchers and mission planners to have confidence that once the technology arrives to its space destination it will work," said Ryan Dibley, NASA Flight Opportunities program campaign manager. The Flight Opportunities program funded the test flight.

PlanetVac is a surface soil collection system for a sample return mission. The configuration tested would replace a foot pad of a planetary lander spacecraft. The goal is to bring back a sample of surface soil from a celestial body.

"Bringing something back from another planet or a celestial body is the Holy Grail of planetary science," said Justin Spring, senior project engineer for Honeybee Robotics. "It allows you to have something from another world, here, so Earth instruments can analyze it. We're still analyzing what we collected from the moon years ago!"

The pneumatic sampler foot pad starts operation after the lander touches down on a surface. Compressed gas is injected into the foot pad enclosure, lofting the soil into a cyclone separator for collection.

"What it does is kind of like your vacuum," said Spring. "It creates an area of high pressure in the front and uses an area of low pressure in the back to suck up the sample. The best thing about PlanetVac is how simple it is. Aside from a single



AFRC2018-0107-019

NASA/Lauren Hughes

At left, Masten Space Systems' technicians prepare their Xodiac rocket to flight test the Honeybee Robotics pneumatic sampler collection system, PlanetVac, in the Mojave Desert.

Below, Masten Space Systems' Xodiac rocket flight tests the Honeybee Robotics pneumatic sampler collection system, PlanetVac.



AFRC2018-0107-40

NASA/Lauren Hughes

A whole lot of shakin' going on

Martin Munday, left, and Kyle Dauk prepare a SOFIA power unit for a vibration test in Armstrong's Environmental Laboratory.



AFRC2018-0109-5

NASA/Lauren Hughes

News at NASA

NEO plan released

A new multiagency report outlines how the U.S. could become better prepared for near-Earth objects (NEOs) – asteroids and comets whose orbits come within 30 million miles of Earth.

While no known NEOs currently pose significant risks of impact, the report is a key step toward addressing a nationwide response to any future risks.

NASA, along with the Office of Science and Technology Policy, the Federal Emergency Management Agency and several other governmental agencies collaborated on the NEO plan.

The 20-page document is titled "The National Near-Earth Object Preparedness Strategy and Action Plan," and was developed to help organize and coordinate efforts related to NEO efforts within the federal government during the next 10 years. The plan seeks to ensure the nation can more effectively respond in case this type of very low-probability but very high-consequence natural disaster should occur.

NASA's Near-Earth Object Observation Program funds asteroid detection and tracking efforts at observatories across the U.S. and in space, and collaborates with other observatories around the world.

NASA's Center for Near-Earth Object Studies (CNEOS) at the agency's Jet Propulsion Laboratory in Pasadena maps and publishes the orbits of all detected objects to show the potential risk. NASA also is studying approaches for deflecting (turning aside) or disrupting (breaking up) asteroids.



AFRC2018-0134-8

NASA/Lauren Hughes

Parts are made with 3D assist

David Rios at Building 703 in Palmdale is working on a fiberglass vertical tail navigation light cover for the high altitude ER-2 aircraft. The part was made from a mold created by a 3D printer.



Preserving Armstrong's documentation

Photo courtesy of Renee Marchiano

Armstrong library technician Renee Marchiano and support specialist Lori Hernandez readied more than 500,000 pages of center documentation, some dating back to the Center's beginning, for digitization. Six pallets of materials – 240 boxes – were sorted, filed, organized and sent to the National Archives and Records Administration. The documents also were assigned preliminary metadata – information that will be used to catalog the electronic versions of the documents so they can be accessed by a search engine – which also ensures Armstrong will have access to the documents.

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Route Traffic Control Center. On the return trip, the pilot headed south toward Victorville, California, requiring communication control to be transferred back to Los Angeles.

During the return flight, the pilot began a gentle descent over Tehachapi, California, into Class E airspace – about 10,000 feet – where general aviation pilots fly. The pilot initiated an approach into Victorville airport at 5,000 feet, coordinating in real time with air traffic controllers at the airport. After successfully executing all of these milestones, the aircraft exited the public airspace and returned to its base at Armstrong.

“We are flying with a suite of sophisticated technology that greatly enhances the safety capabilities of pilots flying large unmanned aircraft in the National Airspace System,” said Scott Howe, Armstrong test pilot. “We took the time to mitigate the risks and to ensure that we, as a program, were prepared for this flight.”

The June 12 flight was the first remotely-piloted aircraft to use airborne detect and avoid technology to meet the intent of the FAA’s “see and avoid” rules, with all test objectives successfully accomplished.



AFRC2018-051B

NASA/Ken Ulbrich

Armstrong engineers monitor the remotely-piloted Ikhana aircraft from a mission control room during a test flight June 12.

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actuator to trigger the gas flow, the system is entirely pneumatic, which reduces complexity and risk.”

“There are other ways to collect samples,” he adds. “The Mars Curiosity rover uses a drill. The Mars Phoenix lander had a scoop. But to keep it simple when all you need is surface dirt then using this pneumatic system can bring the sample back.”

“The Flight Opportunities program allowed us to take the PlanetVac idea and actually strap it on to Masten’s rocket putting it in a situation more realistic to what it might encounter in a space mission,” said Spring. “This reduces the risk since we now know it can survive both landing and heating loads as

well as the rocket environment and still collect the sample and retain it to come back.”

Through the Flight Opportunities program, the Space Technology Mission Directorate (STMD) selects promising technologies from industry, academia and government for testing on commercial launch vehicles and enables public-private partnerships for the agency. The program is funded by STMD and managed at Armstrong.

The STMD is responsible for developing the crosscutting, pioneering, new technologies and capabilities needed by the agency to achieve its current and future missions.

Of note at Armstrong

- Armstrong employees proved to have a step up on the rest of the agency in NASA’s 2018 NASA Moves! annual fitness challenge. Armstrong placed first in the category of the most steps per center population.

- Center staff are set to celebrate Neil Armstrong’s 88th birthday Aug. 8 with a picnic from 11 a.m. to 1 pm. at the ISF with hot dogs, chips, water and cake for \$3. In addition, a talent contest is planned.

- Outstanding co-workers and managers can be nominated for an Armstrong Peer Award.

The process can begin by filling out a nomination form located on the AFRCShare internal internet site. Forms can be submitted until Aug. 31 with the awards presentation set for Nov. 9. Staff members interested in volunteering to help organize the peer awards ceremony can contact John Takas at ext. 6088.

- Some like it hot, but in the summer some get heat-related illness.

In addition to limiting outdoor activities during the hottest part of the day, the Centers for Disease Control recommends drinking more fluids; wearing loose, lightweight clothing and a hat; replacing salt lost from sweating by drinking fruit juice or sports drinks; and using sunscreen.

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Address: P.O. Box 273,
Building 4800, MS 1422
Edwards, California, 93523-0273
Phone: 661-276-3449
FAX: 661-276-3167

Editor: Jay Levine,
Logical Innovations, ext. 3459

Managing Editor: Steve Lighthill, NASA

Chief, Strategic Communications:
Kevin Rohrer, NASA

National Aeronautics and
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NASA Armstrong Flight
Research Center
P.O. Box 273
Edwards, California, 93523-0273

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