NASAfacts

Western States Fire Mission

With a thermal-infared sensor pod under its left wing, NASA's Ikhana unmanned aircraft cruises over California during a Western States Fire Mission flight in 2007. (NASA / Jim Ross)

NASA and the U.S. Forest Service successfully demonstrated technologies that improved real-time wildfire imaging and mapping capabilities during the Western States Fire Mission flight series by unmanned research aircraft from 2006 through 2009.

The first flights of this NASA campaign were flown with General Atomics Aeronautical Systems' Altair unmanned aircraft system in 2006.

In late October, the California Governor's Office of Emergency Services, the Esperanza Fire Incident Command Center and the National Interagency Fire Center requested NASA's imaging and fire-mapping assistance when Santa Ana winds in Southern California were fanning a number of wildfires. For a 16-hour period, Altair flew over the arson-caused fire that claimed the lives of five firefighters. The wildfire sensor collected and transmitted more than 100 images and 20 data files containing the location of the fire perimeter. These data were used to map fire behavior and direct resources to critical areas.

The Autonomous Modular Sensor, developed by scientists at NASA's Ames Research Center at Moffett Field, Calif., was an important tool for this activity with its capability to peer through thick smoke and haze to record hot spots and the progression of the fires over a lengthy period. The flights, averaging about nine hours each, were a real-world extension of earlier Western States Fire Mission demonstration flights.

NASA's Ikhana, a remotely piloted Predator B unmanned aircraft system adapted for civilian science missions, flew the first 2007 flights in late summer from NASA's Dryden Flight Research Center at Edwards Air Force Base, Calif. The flights demonstrated various aircraft, sensor and data-dissemination technologies related to improving real-time wildfire observations. Each flight built upon results of the previous ones to expand the aircraft and sensor system's capabilities in endurance and range, number of observations made, and flexibility in mission and sensing reconfiguration.

The Autonomous Modular Sensor, carried in a specialized pod under Ikhana's wing, operates like a digital camera with specialized filters to detect light energy at visible, infrared and thermal wavelengths. The data were downlinked in near real-time to NASA Ames, overlaid on Google Earth maps, relayed over the Internet to the National Interagency Fire Center in Boise, Idaho, and then to fire

incident commanders in the field to aid in allocation of firefighting resources.

The data were geo- and terrain-rectified for ease of use in geographic information systems or data visualization packages and were essential for operations in areas where blinding smoke obscured normal fire observations. The images were used to position fire-fighting resources, assess effectiveness of containment operations, and remove critical personnel and equipment from hazardous fire situations.

During the 2007 mission, ground-based pilots flew the aircraft between 23,000 feet and 25,000 feet altitude. Ikhana was airborne for a total of 56 hours over eight Western states and covered more than 8,900 nautical miles. Twenty wildfires in six states were imaged.

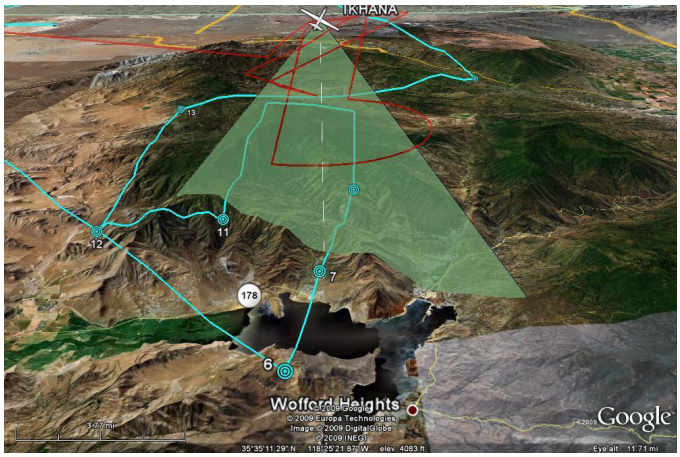
Several of these fires were revisited on long-duration flights to provide time-induced fire progression data. Post-fire imagery aided teams working a Burned Area Emergency Response that included area stabilization and ecosystem rehabilitation.

The Western States Fire Mission also gathered data with satellite sensor systems orbiting overhead, allowing for comparison and calibration of those resources with the more sensitive instrument on the Ikhana. The aircraft flew precisely timed cross-calibration underpasses of NASA's Terra and Aqua satellites. Ikhana's data, verified through comparison with sensor collections aboard the satellites, will prove valuable in applications for new space-based methodologies for fire observations and will enhance current space-based capabilities and measurements.

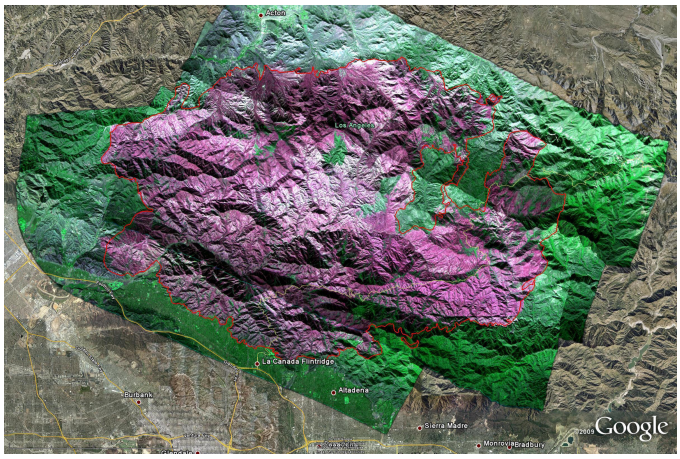
Ikhana continued imaging wildfires within the state of California during the 2008 and 2009 fire seasons at the request of California's Department of Forestry and Fire Protection, the California Governor's Office of Emergency Services and the National Interagency Fire Center.

NASA Dryden worked closely with the Federal Aviation Administration to obtain its approval for and coordination of the Altair and Ikhana unmanned aircraft system flights within the National Airspace System.

More recently, the Autonomous Modular Sensor was installed on a modified NASA King Air B200 to support the U.S. Forest Service and the California Department of Forestry and Fire Protection. This enabled greater ease of operation in the National Airspace System than can be had with the remotely operated aircraft.



This 3-D image shows the flight track of NASA's Ikhana remotely piloted aircraft over Southern California's Lake Isabella on Nov. 19, 2009. The green swath below the Ikhana graphic depicts the scanning profile of NASA's Autonomous Modular Sensor, which operates like a digital camera with specialized filters to detect light energy at visible, infrared and thermal wavelengths. (NASA Image)



NASA's Autonomous Modular Sensor, carried in a pod under the wing of the NASA's remotely piloted Predator B Ikhana, collected this post-fire Burned Area Emergency Response, or BAER, image on Nov. 19, 2009. The various purple hues show the differences in burn severity within the area. (NASA Image)

National Aeronautics and Space Administration

Dryden Flight Research Center
P.O. Box 273
Edwards, California 93523

www.nasa.gov