NASA Facts

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035-1000
415 604-9000

92/4-ARC-FS-004

KUIPER AIRBORNE OBSERVATORY

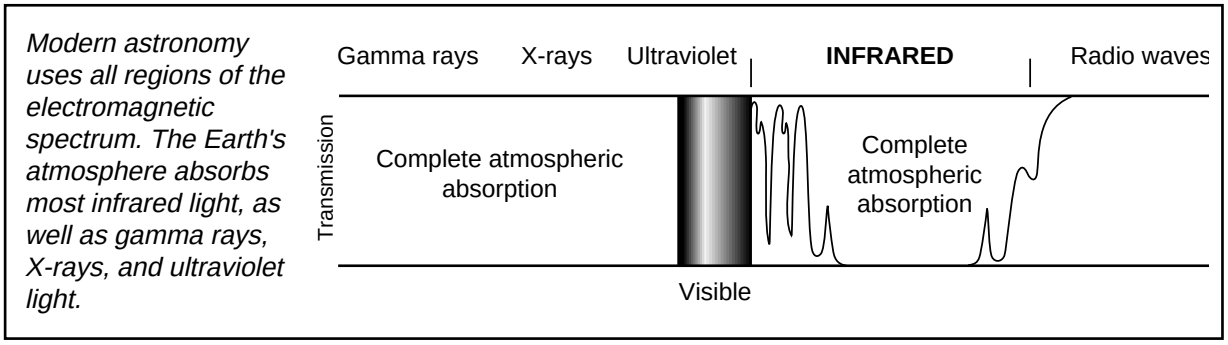
NASA's Kuiper Airborne Observatory (KAO) is the world's only airborne astronomical research facility. This unique observatory allows astronomical observations from anywhere on Earth with freedom from cloud cover.

The KAO, based at NASA Ames Research Center in Mountain View, California is a converted C-141 military cargo plane carrying a 36-inch reflecting telescope. Since beginning operation, the KAO has been the scene of several major discoveries, including the first sightings of the rings of Uranus and a definitive identification of an atmosphere on Pluto.

NASA's Kuiper Airborne Observatory (KAO) is shown here in flight with an open telescope port. The KAO is a national facility that is available, like many ground-based observatories, to any organization having a valid research effort.

The KAO, flying at 41,000 feet, is above 85 percent of the Earth's atmosphere and more than 99 percent of the Earth's water vapor. In this clear, dry environment, astronomers can study radiant heat patterns from stars, planets and other celestial sources — radiation normally absorbed by atmospheric water vapor before reaching the Earth's surface.

The heat patterns are detected as infrared and far-infrared radiation, invisible electromagnetic wavelengths longer than visible light and shorter than radiowaves. Infrared detection can locate cosmic sources that are not hot enough to emit visible light. It is most powerful in observing relatively cool sources with temperatures in the 3 – 3,000 degrees Kelvin range. (On this scale, the Sun's temperature is 6,000 K and room temperature on Earth is 300 K.)



Modern astronomy uses all regions of the electromagnetic spectrum. The Earth's atmosphere absorbs most infrared light, as well as gamma rays, X-rays, and ultraviolet light.

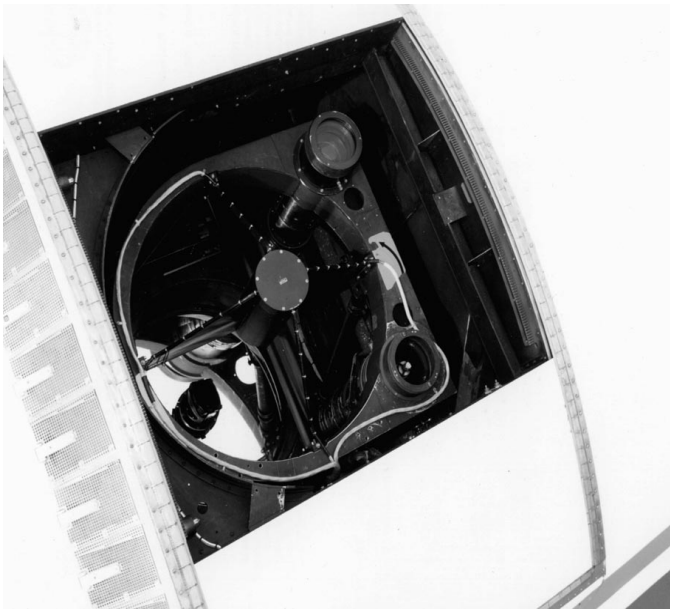
Infrared radiation can also penetrate the thick dust clouds that obscure visible light throughout much of space. Infrared detectors can thus spot the cores of newborn and dying stars enshrouded by dust and sight giant dusty galaxies beyond our own galaxy, the Milky Way.

The airborne observatory can react quickly to study rare, transient events like solar eclipses, stellar occultations, comet passages, nova eruptions and supernova explosions. A wide range of instruments can be rapidly installed, and the observatory can be deployed worldwide to take advantage of the best viewing conditions.

The KAO's 36-inch-aperture Cassegrain reflecting telescope is installed in front of the aircraft's left wing. Its two curved mirrors focus incoming radiation into a small beam and a third flat mirror reflects the focused beam into the airplane's pressurized cabin through an air bearing.

The astronomer mounts a detection instrument at the end of the bearing and operates the telescope from the cabin. The telescope is isolated from aircraft vibrations and is stabilized by gyroscopes and a video tracking system.

In 1977, astronomers onboard the KAO discovered the nine thin rings of Uranus as the rings occulted a faint star. The star's light was periodically blocked from the astronomers' view — nine times as the star approached the planet and nine corresponding times as the star receded from the other side of the planet.

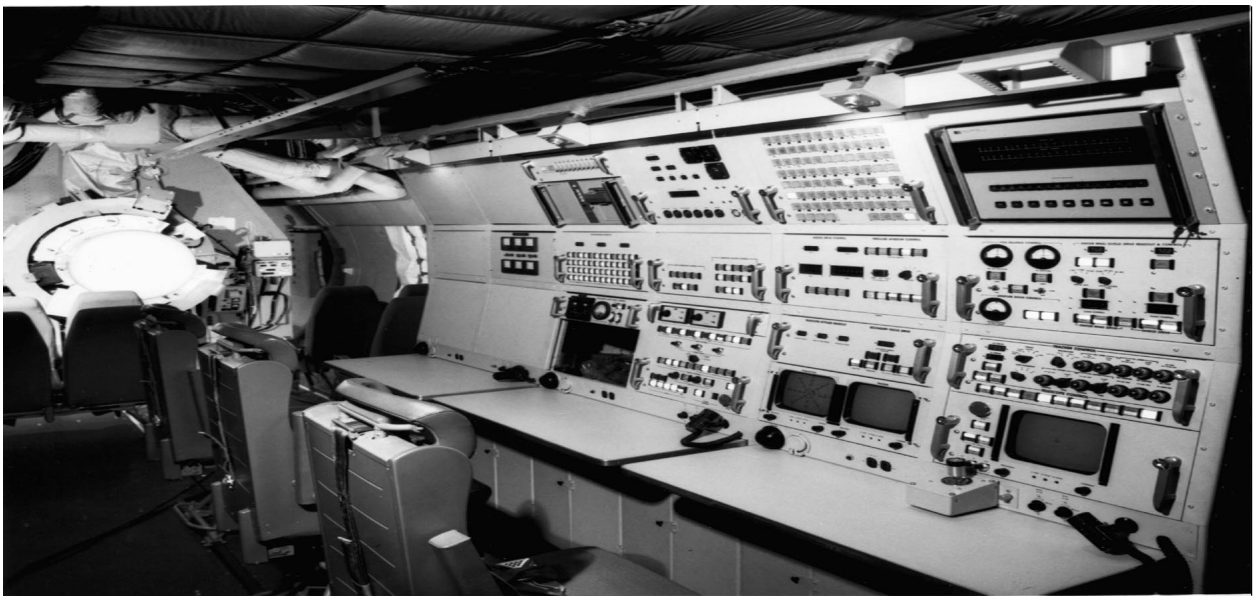


The 36-inch telescope during pre-flight checks by a KAO technician. Two apertures for the guidance cameras are visible at the right corners of the main telescope opening. A third guidance camera (not shown) is located at the telescope focus.

KAO astronomers have also probed the atmospheres of distant planets – discovering water in Jupiter's and Saturn's thick atmospheres. Scientists have also found that Jupiter, Neptune and Saturn have intrinsic energy sources like very small-scale stars.

In recent years, astronomers have used the KAO to study the origin and distribution of water and organic molecules, materials essential for life to exist, in regions of star formation and in the vast spaces between the stars. Kuiper astronomers have also studied the recently discovered disks surrounding certain stars that may be related to the formation of planetary systems around these stars.

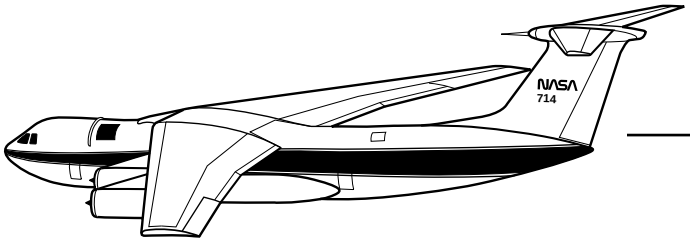
Peering still deeper into space, KAO astronomers have studied powerful far-infrared emissions from the center of our galaxy and other galaxies. Scientists onboard the KAO also tracked the formation of heavy elements like iron, nickel and cobalt from the massive fusion reactions of Supernova 1987A.



A view of the interior of the KAO showing the control panel for the telescope along the right side of the aircraft. During observing flights, four Ames crewmembers control the operation of the telescope. The television monitors are used in flight to display navigation maps, system status and video pictures of stars from the telescope's three cameras.

In July 1994, the KAO flew seven missions, each over nine hours long, to observe the impact of Comet Shoemaker-Levy with the giant planet Jupiter. Scientific teams on-board the aircraft made infrared measurements of the fireballs exploding after four fragments of the comet slammed into Jupiter. The KAO made the comet impact observations from a base in Melbourne, Australia to obtain maximum viewing opportunites.

The KAO's converted C-141 cargo plane is a four-engine long-range jet transport with a wing span of 160 feet, length of 145 feet and height of 39 feet. Its empty weight, with the Cassegrain telescope, is 137,000 pounds. At a cruising speed of 506 miles per hour, it routinely provides up to six and one-half hours of observing time on a stable platform. The KAO, based at NASA Ames Research Center, Moffett Field, Calif., is managed by the Airborne Science and Flight Research Division for the Office of Space Science, NASA Headquarters, Washington, D.C.



Crew:	Two pilots, one flight engineer, one navigator
Passengers:	In addition to the crew, the aircraft can carry a maximum of eight investigators and guests
Altitude:	30,000-42,000 ft. (cruise), 45,000 ft. (max.)
Range:	4,800 nautical miles
Duration:	11 hours (nominal mission time 7.5 hours)

Sensors at the telescope focus are provided and operated by the investigator. Navigational and environmental data are recorded automatically for each flight and made available to investigators.

For further informtation, contact:
NASA Ames Research Center
External Affairs Office, MS 204-12
Moffett Field, CA 94035-1000

5/95