# FLIGHT SUMMARY REPORT

**Flight Number:** 99-079

**Calendar/Julian Date:** 9 June 1999 • 160

**Sensor Package:** Wild Heerbrugg RC-10
Airborne Visible and Infrared Imaging Spectrometer (AVIRIS)
Airborne Multi-angle Imaging Spectro Radiometer (AirMISR)

**Area(s) Covered:** Santiam Pass, OR

**Investigator(s):** Treuhaft, JPL
Conel, JPL

**Aircraft #:** 809

## SENSOR DATA

| | | | |
|---|---|---|---|
| **Accession #:** | 05355 | ----- | ----- |
| **Sensor ID #:** | 034 | 099 | 120 |
| **Sensor Type:** | RC-10 | AVIRIS | AirMISR |
| **Focal Length:** | 12”<br>304.66mm | ----- | ----- |
| **Film Type:** | Aerochrome IR<br>SO-134 | ----- | ----- |
| **Filtration:** | Wratten 12 | ----- | ----- |
| **Spectral Band:** | 510-900nm | ----- | ----- |
| **f Stop:** | 11 | ----- | ----- |
| **Shutter Speed:** | 1/275 | ----- | ----- |
| **# of Frames:** | 23 | ----- | ----- |
| **% Overlap:** | 60 | ----- | ----- |
| **Quality:** | Excellent | ----- | ----- |

**Remarks:**

## Airborne Science and Applications Program

The Airborne Science Program at NASA's Dryden Flight Research Center, Edwards, California, operates two ER-2 high altitude aircraft in support of NASA earth science research. The ER-2s are used as readily deployable high altitude sensor platforms to collect remote sensing and in situ data on earth resources, celestial phenomena, atmospheric dynamics, and oceanic processes. Additionally, these aircraft are used for electronic sensor research and development and satellite investigative support.

The ER-2s are flown from various deployment sites in support of scientific research sponsored by NASA and other federal, state, university, and industry investigators. Data are collected from deployment sites in Kansas, Texas, Virginia, Florida, and Alaska. Cooperative international scientific projects have deployed the aircraft to sites in Great Britain, Australia, Chile, and Norway.

Photographic and digital imaging sensors are flown aboard the ER-2s in support of research objectives defined by the sponsoring investigators. High resolution mapping cameras and digital multispectral imaging sensors are utilized in a variety of configurations in the ER-2s' four pressurized experiment compartments. The following provides a description of the digital multispectral sensor(s) and camera(s) used for data collection during this flight.

## Camera Systems

Various camera systems and films are used for photographic data collection. Film types include high definition color infrared, natural color, and black and white emulsions. Available photographic systems are as follows:

- Wild-Heerbrugg RC-10 metric mapping camera
  - 9 x 9 inch film format
  - 6 inch focal length lens provides area coverage of 16 x 16 nautical miles from 65,000 feet
  - 12 inch focal length lens provides area coverage of 8 x 8 nautical miles from 65,000 feet

- Hycon HR-732 large scale mapping camera
  - 9 x 18 inch film format
  - 24 inch focal length lens provides area coverage of 4 x 8 nautical miles from 65,000 feet

- IRIS II Panoramic camera
  - 4.5 x 34.7 inch film format
  - 24 inch focal length lens
  - 90 degree field of view provides area coverage of 2 x 21.4 nautical miles from 65,000 feet

## Data Availability

The U.S. Geological Survey's EROS Data Center at Sioux Falls, South Dakota serves as the archive and product distribution facility for Airborne Science Program aircraft acquired photographic and digital imagery. The photographic archive consists of photography acquired by the program from 1971 to April 1996. For information regarding photography and digital data (including areas of coverage, products, and product costs) contact EROS Data Center, Customer Services, Sioux Falls, South Dakota 57198 (Telephone: 605-594-6151).

As of April 1996 the EROS Data Center no longer receives an archive copy of newly acquired Airborne Science Program photography. Original photography is archived with the Airborne Sensor Facility at Ames Research Center. A user copy of the photography is provided to the principal investigators for each flight.

Principal investigators are cited on the first page of their respective flight summary reports. For information regarding photography acquired from April 1996 to the present contact the Airborne Sensor Facility as follows:

**Flight Documentation and Data Archive Searches**

The following is the web site for flight documentation as published by the Airborne Sensor Facility at NASA Ames Research Center: http://asapdata.arc.nasa.gov/er-2fsr.html

Additional information regarding flight documentation to include data archive searches, data availability, sensor parameters, and areas of coverage may be obtained from the following:
Airborne Sensor Facility, MS 240-6, NASA Ames Research Center, Moffett Field, CA 94035-1000, Telephone: 650.604.6252 (FAX 4987).

**Airborne Visible and Infrared Imaging Spectrometer**

The Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) is the second in the series of imaging spectrometer instruments developed at the Jet Propulsion Laboratory (JPL) for earth remote sensing. This instrument uses scanning optics and four spectrometers to image a 614 pixel swath simultaneously in 224 contiguous spectral bands (0.4-2.4 mm).

AVIRIS parameters are as follows:

| | |
|---|---|
| IFOV: | 1 mrad |
| Ground Resolution: | 66 feet (20 meters) at 65,000 feet |
| Total Scan Angle: | $30^{o}$ |
| Swath Width: | 5.7 nmi (10.6 km) at 65,000 feet |
| Spectral Coverage: | 0.41-2.45 ?m |
| Pixels/Scan Line: | 614 |
| Number of Spectral Bands: | 224 |
| Digitization: | 10-bits |
| Data Rate: | 17 MBPS |

| Spectrometer | Wavelength Range | Number of Bands | Sampling Interval |
|---|---|---|---|
| 1 | 0.41 - 0.70 ?m | 31 | 9.4 nm |
| 2 | 0.68 - 1.27 ?m | 63 | 9.4 nm |
| 3 | 1.25 - 1.86 ?m | 63 | 9.7 nm |
| 4 | 1.84 - 2.45 ?m | 63 | 9.7 nm |

All AVIRIS data is decommutated and archived at JPL and not currently available for public distribution. For further information contact Rob Green at Jet Propulsion Laboratory, 4800 Oak Grove Drive, Mail Stop 183-501, Pasadena, California 91109-8099.

**Airborne Multi-angle Imaging SpectroRadiometer**

The Airborne MISR (AirMISR) is currently flown aboard the ER-2 to facilitate the development and test the capabilities of the satellite MISR before it is launched in orbit in 1999.
The spaceborne Multi-angle Imaging SpectroRadiometer (MISR) is a new type of instrument, designed to view the Earth with cameras pointed in nine different directions. MISR is being built for NASA by the Jet Propulsion Laboratory in Pasadena, California. MISR is one of five instruments scheduled to be launched into polar orbit aboard the first Earth Observing System spacecraft (EOS-AM1) in June 1999, as part of NASA's Mission to Planet Earth. The spacecraft will fly in a "sun-synchronous" orbit, designed so that it crosses the

equator every 98 minutes, always at 10:30 a.m. local time, as the Earth rotates below. As the instrument flies overhead, each piece of the Earth's surface below is successively imaged by the nine cameras comprising the MISR system, in each of four wavelengths (blue, green, red, and near-infrared).

In addition to improving our understanding of scattering of sunlight in the Earth environment, MISR data can also distinguish different types of clouds, particles, and surfaces. Specifically, MISR will monitor the monthly, seasonal, and long-term trends in:

- The amount and type of atmospheric particles (aerosols), including those formed by natural sources and by human activities
- The amounts, types, and heights of clouds
- The distribution of land surface cover, including vegetation canopy structure

To accomplish its scientific objectives, the MISR instrument will measure the Earth's brightness in four spectral bands, at each of nine look angles spread out in the forward and aft directions along the flight path. Spatial samples are acquired every 275 meters. Over a period of seven minutes, a 360 km wide swath of Earth comes into view at all nine angles. Special attention has been paid to providing highly accurate absolute and relative calibration, using on-board hardware consisting of deployable solar diffuser plates and several types of photodiodes. To complement the on-board calibration effort, a validation program of *in situ* measurements is planned, involving field instruments, one of which is the "PARABOLA III", which automatically scans the sky and ground at many angles. The aircraft camera, AirMISR will continue to operate on the ER-2 also as a complement to the orbiting MISR. Global coverage with the satellite MISR will be acquired about once in nine days at the equator; the nominal mission lifetime is six years.

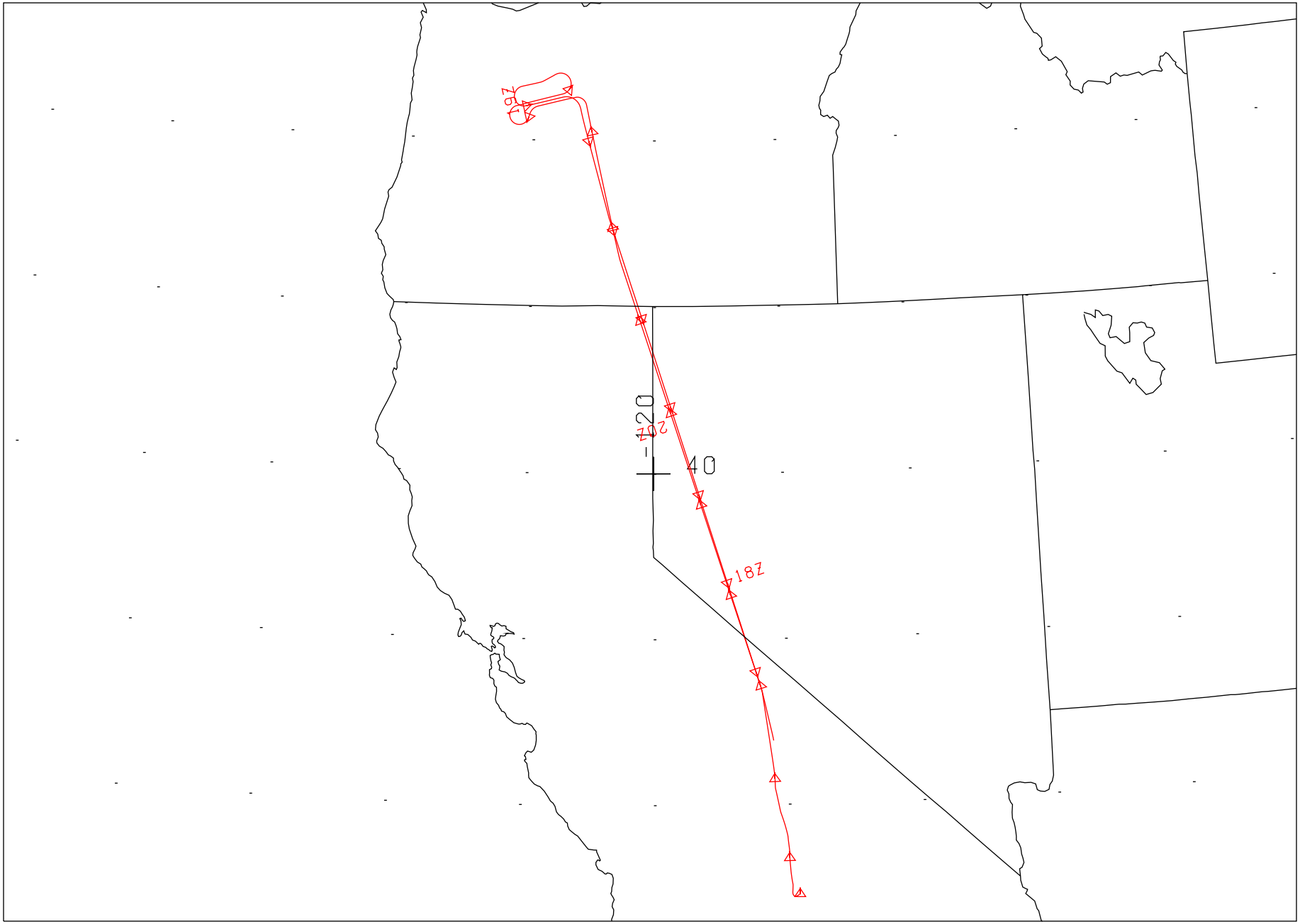
Further information regarding MISR is available on the following web page: http:www-misr.jpl.nasa.gov

# CAMERA FLIGHT LINE DATA
# FLIGHT NO. 99-079

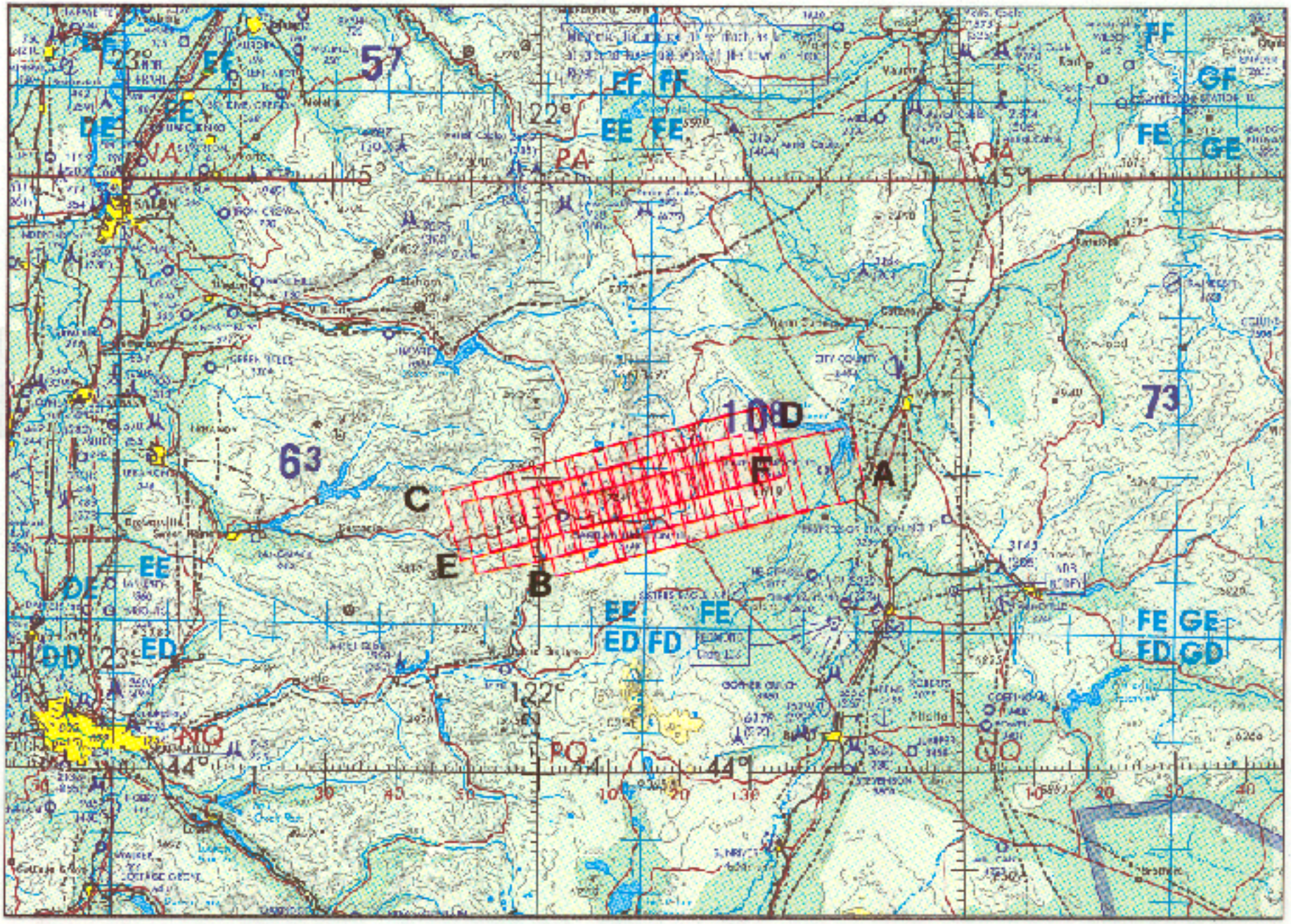
**Accession #** 05355

**Sensor #** 034

| Check Points | Frame Numbers | Time (GMT-hr, min, sec) | | Altitude, MSL feet/meters | Cloud Cover/Remarks |
|---|---|---|---|---|---|
| | | START | END | | |
| A - B | 0629-0637 | 18:53:27 | 18:57:10 | 67500/20574 | 30-90% cumulus |
| C - D | 0638-0648 | 19:04:00 | 19:07:56 | 67500/20574 | 70-90% cumulus |
| E - F | 0649-0656 | 19:19:00 | 19:22:15 | 67500/20574 | 50-90% cumulus |




FLIGHT 99-079 9 JUNE 1999 A/C 809 RC-10 / AVIRIS / AIRMISR




FLIGHT 99-079 9 JUNE 1999 A/C 809 RC-10 / AVIRIS CNC F-16