

# FLIGHT SUMMARY REPORT

**Flight #:** 92-093  
**Date:** 30 May 1992  
**Sensor Package:** Airborne Visible and Infrared Imaging Spectrometer (AVIRIS)  
Thematic Mapper Simulator (TMS)  
Thermal Infrared Multispectral Scanner (TIMS)  
Wild-Heerbrug RC-10  
**Area(s) Covered:** Southern California

**Investigator(s):** Green, JPL; Wickland, NASA

**Aircraft #:** 708

**Flight Request:** 2P32007, 2P32035

**Julian Date:** 151

## SENSOR DATA

|                       |        |      |      |  |
|-----------------------|--------|------|------|--|
| <b>Accession #:</b>   | ----   | ---- | ---- | 04399                                      |
| <b>Sensor ID #:</b>   | 099    | 074  | 086  | 036  |
| <b>Sensor Type:</b>   | AVIRIS | TMS  | TIMS | RC-10                                      |
| <b>Focal Length:</b>  | ----   | ---- | ---- | 6"<br>153.19 mm                            |
| <b>Film Type:</b>     | ----   | ---- | ---- | High Definition<br>Aerochrome IR<br>SO-131 |
| <b>Filtration:</b>    | ----   | ---- | ---- | 2.2 AV + cc.10B                            |
| <b>Spectral Band:</b> | ----   | ---- | ---- | 510-900 nm                                 |
| <b>f Stop:</b>        | ----   | ---- | ---- | 4  |
| <b>Shutter Speed:</b> | ----   | ---- | ---- | 1/100                                      |
| <b># of Frames:</b>   | ----   | ---- | ---- | 52   |
| <b>% Overlap:</b>     | ----   | ---- | ---- | 60   |
| <b>Quality:</b>       | ----   | Fair | Good | Excellent                                  |
| <b>Remarks:</b>       |        |      |      |  |

## Airborne Science and Applications Program

The Airborne Science and Applications Program (ASAP) is supported by three ER-2 high altitude Earth Resources Survey aircraft. These aircraft are operated by the High Altitude Missions Branch at NASA-Ames Research Center, Moffett Field, California. 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 sensors and camera system(s) used for data collection during this flight.

## 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  $\mu\text{m}$ ).

AVIRIS parameters are as follows:

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

| <u>Spectrometer</u> | <u>Wavelength Range</u>   | <u>Number of Bands</u> | <u>Sampling Interval</u> |
|---------------------|---------------------------|------------------------|--------------------------|
| 1                   | 0.41 - 0.70 $\mu\text{m}$ | 31                     | 9.4 nm                   |
| 2                   | 0.68 - 1.27 $\mu\text{m}$ | 63                     | 9.4 nm                   |
| 3                   | 1.25 - 1.86 $\mu\text{m}$ | 63                     | 9.7 nm                   |
| 4                   | 1.84 - 2.45 $\mu\text{m}$ | 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.

### Thematic Mapper Simulator

The Daedalus Thematic Mapper Simulator (TMS) is a multispectral scanner flown aboard the ER-2 aircraft which simulates spatial and spectral characteristics of the seven Landsat-D Thematic Mapper bands. The specific bands are as follows:

| <u>Daedalus Channel</u> | <u>TM Band</u> | <u>Wavelength, <math>\mu m</math></u> |
|-------------------------|----------------|---------------------------------------|
| 1                       | A              | 0.42 - 0.45                           |
| 2                       | 1              | 0.45 - 0.52                           |
| 3                       | 2              | 0.52 - 0.60                           |
| 4                       | B              | 0.60 - 0.62                           |
| 5                       | 3              | 0.63 - 0.69                           |
| 6                       | C              | 0.69 - 0.75                           |
| 7                       | 4              | 0.76 - 0.90                           |
| 8                       | D              | 0.91 - 1.05                           |
| 9                       | 5              | 1.55 - 1.75                           |
| 10                      | 7              | 2.08 - 2.35                           |
| 11                      | 6              | 8.5 - 14.0 low gain                   |
| 12                      | 6              | 8.5 - 14.0 high gain                  |

Sensor/aircraft parameters are as follows:

|                    |                                    |
|--------------------|------------------------------------|
| IFOV:              | 1.25 mrad                          |
| Ground Resolution: | 81 feet (25 meters) at 65,000 feet |
| Total Scan Angle:  | 43°                                |
| Swath Width:       | 8.4 nmi (15.6 km) at 65,000 feet   |
| Pixels/Scan Line:  | 716                                |
| Scan Rate:         | 12.5 scans/second                  |
| Ground Speed:      | 400 kts (206 m/second)             |

Information on data tape format, logical record format, and scanner calibration data may be obtained from the NASA-Ames Aircraft Data Facility at (415) 604-6252 or FTS 464-6252.

### Thermal Infrared Multispectral Scanner

The Thermal Infrared Multispectral Scanner (TIMS) is a multispectral scanning system using a dispersive grating and a six element mercury cadmium telluride detector array to produce six discrete channels in the 8.2  $\mu m$  to 12.2  $\mu m$  region.

| <u>Channel</u> | <u>Wavelength, <math>\mu m</math></u> | <u>NET</u> |
|----------------|---------------------------------------|------------|
| 1              | 8.2 - 8.6                             | < 0.3° C   |
| 2              | 8.6 - 9.0                             | < 0.3° C   |
| 3              | 9.0 - 9.4                             | < 0.3° C   |
| 4              | 9.4 - 10.2                            | < 0.3° C   |

|   |             |          |
|---|-------------|----------|
| 5 | 10.2 - 11.2 | < 0.3° C |
| 6 | 11.2 - 12.2 | < 0.3° C |

Sensor/aircraft parameters are as follows:

|                    |                                     |
|--------------------|-------------------------------------|
| IFOV:              | 2.5 mrad                            |
| Ground Resolution: | 163 feet (50 meters) at 65,000 feet |
| Total Scan Angle:  | 76.56°                              |
| Swath Width:       | 16.9 nmi (31.3 km) at 65,000 feet   |
| Pixels/Scan Line:  | 638                                 |
| Scan Rate:         | 7.3 (scans/second)                  |
| Ground Speed:      | 400 kts. (206 m/second)             |

### 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-Heerbrug 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

The U.S. Geological Survey's EROS Data Center at Sioux Falls, South Dakota serves as the archive and product distribution facility for NASA-Ames aircraft acquired photographic and digital imagery. 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).

Additional information regarding ER-2 acquired photographic and digital data is available through the Aircraft Data Facility at Ames Research Center. For specific information regarding flight documentation, sensor parameters, and areas of coverage contact the Aircraft Data Facility, NASA-Ames Research Center, Mail Stop 240-6, Moffett Field, California 94035-1000 (Telephone: (415) 604-6252).

**CAMERA FLIGHT LINE DATA**  
**FLIGHT NO. 92-093**

Accession # 04399

Sensor # 036

| Check Points | Frame Numbers | Time (GMT-hr, min, sec) |          | Altitude, MSL feet/meters | Cloud Cover/Remarks                                |
|--------------|---------------|-------------------------|----------|---------------------------|--|
|              |               | START                   | END      |                           |  |
| A - B        | 1168-1176     | 18:21:35                | 18:28:57 | 65000/19800               | Clear  |
| C - D        | 1177-1180     | 18:44:15                | 18:46:56 | "                         | Clear  |
| E - F        | 1181-1184     | 18:54:14                | 18:56:19 | "                         | Clear  |
| E - F        | 1185-1188     | 19:10:06                | 19:12:25 | "                         | Clear  |
| E - F        | 1189-1192     | 19:23:36                | 19:26:11 | "                         | Clear  |
| E - F        | 1193-1196     | 19:37:07                | 19:39:23 | "                         | Clear  |
| E - F        | 1197-1200     | 19:49:48                | 19:52:34 | "                         | Clear  |
| G - H        | 1201-1209     | 20:02:36                | 20:09:36 | "                         | 10-30% cirrus and cirro-cumulus (frames 1201-1209) |
| I - J        | 1210-1214     | 20:14:07                | 20:17:04 | "                         | 10-20% cirrus (frames 1210-1214)                   |
| K - L        | 1215-1219     | 20:29:23                | 20:33:07 | "                         | 10% cumulus (frames 1217-1219)                     |

# TMS SCANNER FLIGHT LINE DATA

FLIGHT NO. 92-093

DAEDALUS FLIGHT DATA  
FLIGHT NUMBER: 92-093

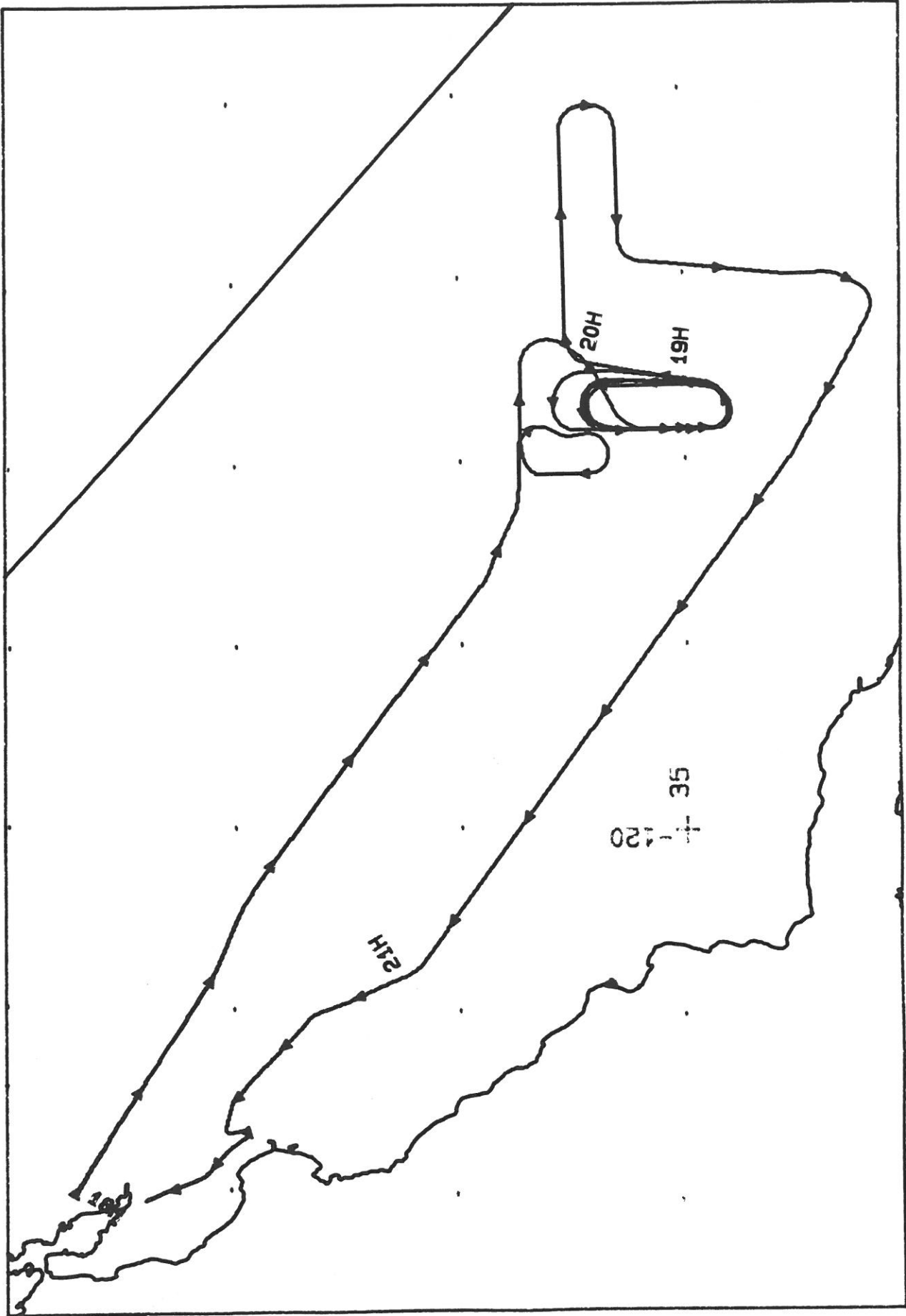
| Check Points | A c t u a l                   |   | Scan Speed (rps) | Altitude feet/meter | total                     |   | total Repeated scanlines |
|--------------|-------------------------------|---|------------------|---------------------|---------------------------|---|--------------------------|
|              | t i m e (GHT) b e g i n e n d | A c t u a l s c a n l i n e b e g i n e n d |                  |                     | G o o d s c a n l i n e s | I n t e r p o l a t e d s c a n l i n e s |                          |
| A - B        | 18:21:36.0 18:28:51.0         | 29279 34724                                 | 12.50            | 65000/19812         | 5440                      | 0   | 6                        |
| C - D        | 18:44:12.0 18:46:52.0         | 46229 48233                                 | 12.50            | 65000/19812         | 2003                      | 0   | 2                        |
| E - F        | 18:54:13.0 18:56:13.0         | 53745 55247                                 | 12.50            | 65000/19812         | 1497                      | 0   | 6                        |
| E - F        | 19:10: 8.0 19:12:24.0         | 65675 67375                                 | 12.50            | 65000/19812         | 1701                      | 0   | 0                        |
| E - F        | 19:23:36.0 19:26: 9.0         | 75785 77687                                 | 12.50            | 65000/19812         | 1901                      | 0   | 2                        |
| E - F        | 19:37: 6.0 19:39:22.0         | 85902 87608                                 | 12.50            | 65000/19812         | 1699                      | 1   | 7                        |
| E - F        | 19:49:50.0 19:52:30.0         | 95454 97456                                 | 12.50            | 65000/19812         | 2001                      | 0   | 2                        |
| G - H        | 20:02:39.0 20:09:37.0         | 105070 110285                               | 12.50            | 65000/19812         | 5210                      | 0   | 5                        |
| I - J        | 20:14: 9.0 20:17: 5.0         | 113693 115896                               | 12.50            | 65000/19812         | 2189                      | 0   | 15                       |
| K - L        | 20:29:23.0 20:33: 7.0         | 125116 127919                               | 12.50            | 65000/19812         | 2796                      | 0   | 8                        |

# TIMS SCANNER FLIGHT LINE DATA

## FLIGHT NO. 92-093

TIMS FLIGHT DATA  
FLIGHT NUMBER: 92-093

| Check Points | A c t i v a l           |            | A c t u a l scanline begin end | Altitude feet/meter | Scan Speed (fps) | total             |                        | total                    |    |
|--------------|-------------------------|------------|--------------------------------|---------------------|------------------|-------------------|------------------------|--------------------------|----|
|              | t i m e (GMT) begin end | Scan Speed |                                |                     |                  | G o o d scanlines | Interpolated scanlines | total Repeated scanlines |    |
| A - B        | 18:22:19.0              | 18:28:57.0 | 17448 20359                    | 65000/19812         | 7.30             | 2731              | 0                      | 0                        | 10 |
| C - D        | 18:44:13.0              | 18:46:57.0 | 27058 28258                    | 65000/19812         | 7.30             | 1291              | 0                      | 0                        | 0  |
| E - F        | 18:54:15.0              | 18:56:18.0 | 31458 32358                    | 65000/19812         | 7.30             | 901               | 0                      | 0                        | 0  |
| E - F        | 19:10:13.0              | 19:12:30.0 | 38458 39458                    | 65000/19812         | 7.30             | 1001              | 0                      | 0                        | 0  |
| E - F        | 19:23:40.0              | 19:26:10.0 | 44358 45458                    | 65000/19812         | 7.30             | 1101              | 0                      | 0                        | 0  |
| E - F        | 19:37: 8.0              | 19:39:27.0 | 50264 51279                    | 65000/19812         | 7.30             | 1001              | 0                      | 0                        | 15 |
| E - F        | 19:49:43.0              | 19:52:27.0 | 55782 56982                    | 65000/19812         | 7.30             | 1201              | 0                      | 0                        | 0  |
| G - H        | 20:02:42.0              | 20:09:33.0 | 61482 64482                    | 65000/19812         | 7.30             | 3001              | 0                      | 0                        | 0  |
| I - J        | 20:14: 7.0              | 20:17: 5.0 | 66487 67787                    | 65000/19812         | 7.30             | 1301              | 0                      | 0                        | 0  |
| K - L        | 20:29:37.0              | 20:33: 3.0 | 73287 74792                    | 65000/19812         | 7.30             | 1591              | 0                      | 0                        | 5  |



FLIGHT 92-093      30 May 1992      A/C 708      AVIRIS / TMS / TMS / RC-10



