

FLIGHT SUMMARY REPORT

Flight Number: 93-156
Calendar/Julian Date: 01 September 1993 • 244
Sensor Package: Wild-Heerbrug RC-10
 Airborne Visible and Infrared Imaging Spectrometer (AVIRIS)
 Modis Airborne Simulator (MAS)
 Airborne Ocean Color Imager (AOCI)
Area(s) Covered: California/Nevada

Investigator(s): Ustin UC Davis; Landers, NRL; Green, JPL
Aircraft #: 709

SENSOR DATA

Accession #:	04625	----	----	----
Sensor ID #:	033	099	108	090
Sensor Type:	RC-10	AVIRIS	MAS	AOCI
Focal Length:	6" 153.17 mm	----	----	----
Film Type:	High Definition Aerochrome IR SO-131	----	----	----
Filtration:	cc.10B + 2.2 AV	----	----	----
Spectral Band:	510-900 nm	----	----	----
f Stop:	4	----	----	----
Shutter Speed:	1/175	----	----	----
# of Frames:	25	----	----	----
% Overlap:	60	----	----	----
Quality:	Excellent	----	Good	Good
Remarks:	Camera clock offset 8.3 seconds from navigation data; filter's wrinkled, soft focus			

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 sensor(s) and camera(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 μm).

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 μm
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 μm	31	9.4 nm
2	0.68 - 1.27 μm	63	9.4 nm
3	1.25 - 1.86 μm	63	9.7 nm
4	1.84 - 2.45 μm	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.

Modis Airborne Simulator

The Modis Airborne Simulator (MAS) is a modified Daedalus multispectral scanner. It records up to twelve 8-bit channels, which can be selected from an array of fifty available spectral bands. The band selection is made prior to flight and the instrument is hard-wired to that configuration. The following MAS band combination (configuration BOREAS) was used on this flight for BOREAS experiments:

<u>Data System Channel</u>	<u>MAS Channel</u>	<u>Band edges μm</u>
1	1	0.529 - 0.572
2	2	0.635 - 0.688
3	4	0.729 - 0.769
4	5	0.770 - 0.810
5	6	0.810 - 0.852
6	7	0.852 - 0.893
7	9	0.926 - 0.969
8	10	1.595 - 1.652
9	20	2.126 - 2.173
10	33	3.975 - 4.125
11	45	10.791 - 11.239
12	46	11.799 - 12.246

Sensor/Aircraft Parameters:

Spectral Channels:	50
Output Channels:	Twelve 8-bit
I FOV:	2.5 mrad
Ground Resolution:	163 feet (50 meters at 65,000 feet)
Total Scan Angle:	85.92°
Pixels/Scan Line:	716
Scan Rate:	6.25 scans/second
Ground Speed:	400 kts (206 m/second)
Roll Correction:	Plus or minus 3.5 degrees (approx.)

Airborne Ocean Color Imager

The Airborne Ocean Color Imager (AOCI) is a high altitude multispectral scanner designed for oceanographic remote sensing. It provides 10-bit digitization of eight bands in the visible/near-infrared region of the spectrum, plus two 8-bit bands in the near and thermal infrared. The bandwidths are as follows:

<u>Wavelength, μm</u>	<u>Channel</u>
1	0.436 - 0.455
2	0.481 - 0.501
3	0.511 - 0.531
4	0.554 - 0.575
5	0.610 - 0.631
6	0.655 - 0.676
7	0.741 - 0.800
8	0.831 - 0.897
9	0.989 - 1.054
10	8.423 - 12.279

Sensor/aircraft parameters are as follows:

IFOV:	2.5 mrad
Ground Resolution:	163 feet (50 meters) at 65,000 feet
Total Scan Angle:	85°
Swath Width:	19.6 nmi (36.3 km) at 65,000 feet
Pixels/Scan Line:	716
Scan Rate:	6.25 scans/second
Ground Speed:	400 kts (206 m/second)
Digitization:	8-bit channels 9-10 10-bit channels 1-8

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).

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). Additional information regarding ER-2 acquired photographic and digital data is also available through the Aircraft Data Facility.

**CAMERA FLIGHT LINE DATA
FLIGHT NO. 93-156**

Accession # 04625

Sensor # 033

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	0838-0841	19:42:16	19:44:40	65000/19800	10-20% cumulus (frames 0839-0841)
C - D	0842-0845	20:08:17	20:11:08	"	10% cumulus
E - F	0846-0849	20:23:17	20:25:26	"	10-30% cumulus
G - H	0850-0854	20:46:56	20:49:46	"	Clear
I - J	0855-0858	20:56:46	20:59:34	"	Clear
F - E	0859-0862	21:18:17	21:20:36	"	20-30% cumulus

AOCI SCANNER FLIGHT LINE DATA

FLIGHT NO. 93-156

DAL DALUE FLIGHT DATA
FLIGHT NUMBER: 93-156

Check Points	Actual		Attribute		Scan Speed (rps)	Total		Total	
	Time (GMT)	End	Scanline begin	End		Good scanlines	Interpolated scanlines	Repeated scanlines	
A-E	19:41:54.0	19:44:48.0	18367	17436	6.20	1090	0	0	0
C-D	20:07:46.0	20:10:56.0	28069	29257	6.20	1189	0	0	0
E-F	20:23:05.0	20:25:11.0	33811	34603	6.20	793	0	0	0
G-H	20:46:35.0	20:49:29.0	42622	43711	6.20	1090	0	0	0
I-J	20:56:21.0	21:00:02.0	46285	47671	6.20	1387	0	0	0
F-E	21:17:57.0	21:20:37.0	54386	55386	6.20	1001	0	0	0

NOTE: Scan Speed (rps) is 6.25 NOT 6.20

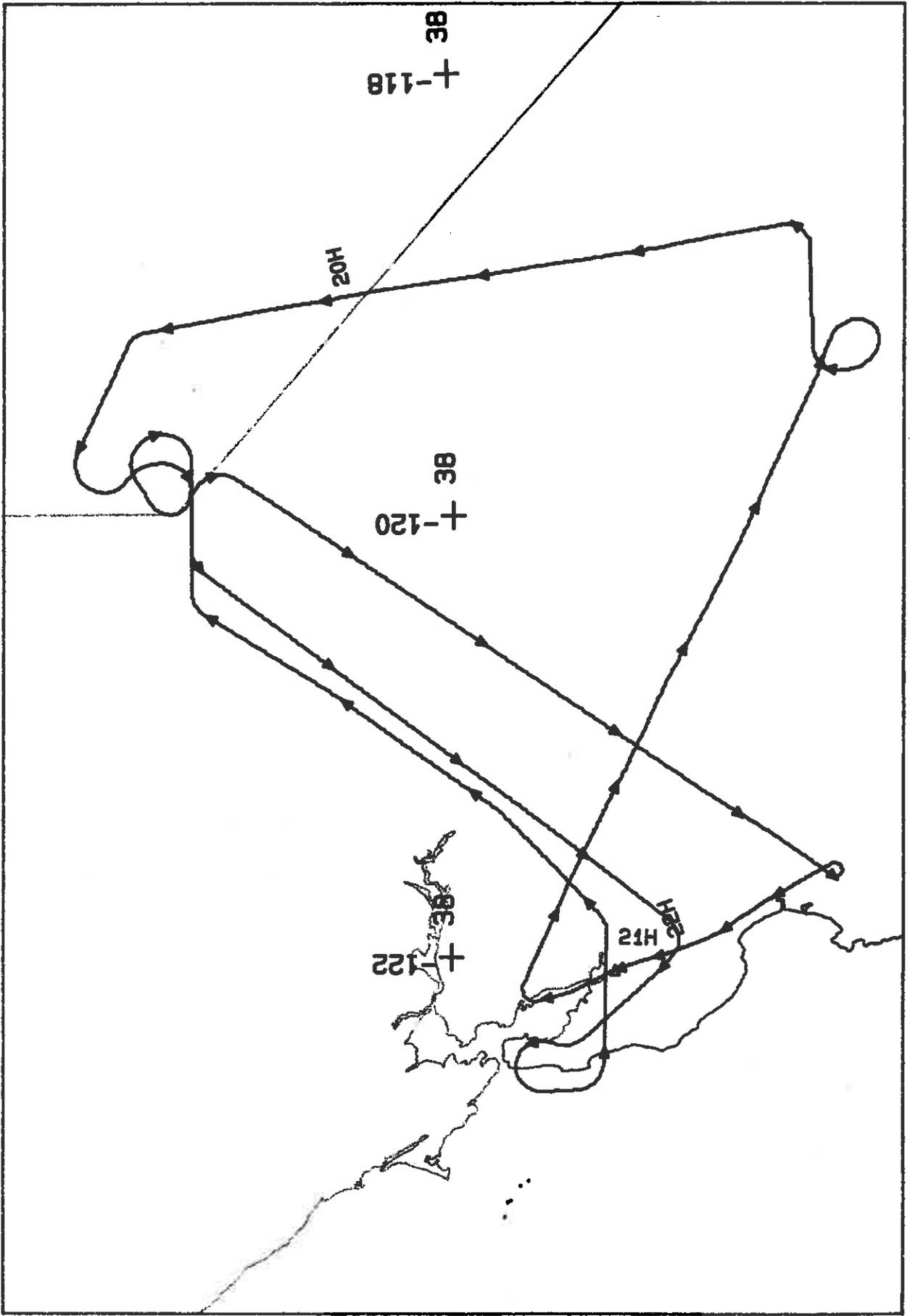
MAS SCANNER FLIGHT LINE DATA

FLIGHT NO. 93-156

DIALYSIS FLIGHT DATA
FLIGHT NUMBER: 93-156

Check Points	Actual Time (GMT)	Actual scanline begin end	Altitude feet/meter	Scan Speed (rps)	total Good scanlines	total Interpolated scanlines	total Repeated scanlines
A-B	19:41:57.0 19:44:56.0	18193 19185	65000/19812	6.20	991	0	0
C-D	20:07:46.0 20:10:51.0	27798 28986	65000/19812	6.20	1169	0	0
E-F	20:23:33.0 20:26:26.0	35340 36431	65000/19812	6.20	892	0	0
G-H	20:46:39.0 20:49:34.0	42351 43440	65000/19812	6.20	1090	0	0
I-J	20:56:11.0 21:00:10.0	45915 47400	65000/19812	6.20	1486	0	0
F-E	21:17:52.0 21:20:31.0	54012 55802	65000/19812	6.20	991	0	0

NOTE: Scan Speed (rps) is 6.25 NOT 6.20



FLIGHT 99-156 1 SEPTEMBER 1983 A/C 709 RC-10 / AVIRIS / MAS / AOCC

