

# FLIGHT SUMMARY REPORT

**Flight Number:** 94-097  
**Calendar/Julian Date:** 11 June 1994 • 162  
**Sensor Package:** Wild-Heerbrug RC-10  
Modis Airborne Simulator (MAS)  
Radiation Measurement System (RAMS)  
Cloud Lidar System (CLS)  
**Area(s) Covered:** Pacific Ocean

**Investigator(s):** King, GSFC

**Aircraft #:** 708

## SENSOR DATA

<b>Accession #:</b>	04737	-----	-----	-----
<b>Sensor ID #:</b>	031	108	112	113
<b>Sensor Type:</b>	RC-10	MAS	RAMS	CLS
<b>Focal Length:</b>	6" 153.05 mm	-----	-----	-----
<b>Film Type:</b>	Aerochrome IR SO-060	-----	-----	-----
<b>Filtration:</b>	Wratten 12	-----	-----	-----
<b>Spectral Band:</b>	510-900 nm	-----	-----	-----
<b>f Stop:</b>	8	-----	-----	-----
<b>Shutter Speed:</b>	1/175	-----	-----	-----
<b># of Frames:</b>	194	-----	-----	-----
<b>% Overlap:</b>	60	-----	-----	-----
<b>Quality:</b>	Good	Good	-----	-----
<b>Remarks:</b>	Processing abrasions throughout data. Camera clock offset 15 seconds from navigation data			

## 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.

### 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. Channel 1 is used to store additional bits which provide 10-bit resolution for Channels 9 through 12. The following MAS band combination (MAST1 configuration) was used on this flight:

<u>Data System Channel</u>	<u>MAS Channel</u>	<u>Band edges <math>\mu\text{m}</math></u>
1	---	LSBs for Channels 9-12
2	1	0.635 - 0.688
3	2	0.852 - 0.893
4	8	1.595 - 1.652
5	10	1.855 - 1.905
6	14	2.126 - 2.173
7	15	2.255 - 2.305
8	16	3.825 - 3.975
9*	31	3.659 - 3.810
10*	42	8.342 - 8.738
11*	44	10.791 - 11.239
12*	46	11.799 - 12.246

\*10-bit resolution

#### Sensor/Aircraft Parameters:

Spectral Channels:	50
Output Channels:	Seven 8-bit and four 10-bit
IFOV:	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.)

### Radiation Measurement System

The Radiation Measurement System (RAMS) is an integrated system of several radiometers. The system provides airborne measurements to support analysis and theoretical calculations of cloud properties and radiation fields and to provide validation of satellite radiance measurements. The airborne instruments consist of the following:

1. an electrically calibrated pyroelectric radiometer for hemispherical, broad spectral bandpass, radiative flux measurements in the solar spectral region (0.26 to 2.6  $\mu\text{m}$ ). This radiometer has two detectors;
2. an IR net flux radiometer (rotating) radiometer covering the spectral range from 5 to 40  $\mu\text{m}$ ;
3. a narrow field-of-view, narrow spectral bandpass IR radiometer (2 channels in the 5 to 40  $\mu\text{m}$  region). This radiometer uses a liquid nitrogen cooled black body reference. This instrument provides upwelling infrared intensities above cloud; and
4. a total-direct-diffuse multichannel narrow spectral bandpass (about 5 to 10 nm) flux radiometer. This radiometer is used for optical depth determinations and direct/diffuse ratios.

For additional information regarding this system contact Francisco P.J. Valero, Atmospheric Physics Research Branch, NASA-Ames Research Center, Mail Stop 245-4, Moffett Field, CA 94035-1000.

### Cloud Lidar System

The Cloud Lidar System (CLS) is flown on the ER-2 to conduct cloud radiation and severe storm field experiments. Designed to operate at high altitudes in order to obtain measurements above the highest clouds, the instrument provides the true height of cloud boundaries and the density structure of less dense clouds. The height structure of cirrus, cloud top density and multiple cloud layers may also be profiled. System specifications are as follows:

#### Transmitter

Laser Type:	Nd:YAG I,II
Wavelength:	1064, 532 nm
Pulse Energy:	90, 30 mJ
PRF:	10 Hz
Beamwidth:	1 mrad
Data Acquisition:	Measurements at 20m intervals at 200 m/sec aircraft speed

#### Receiver

Diameter:	0.15 m
Beamwidth:	1.4 mrad
Polarization:	v & h

### Data System

Range Resolution:	7.5 m
Number of Channels:	4
Samples per Channel:	3310
Record Capacity:	8 hours

For additional information regarding this instrument contact Dr. James Spinhirne, NASA-Goddard Space Flight Center, Code 917, Greenbelt, MD 20771.

### 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).

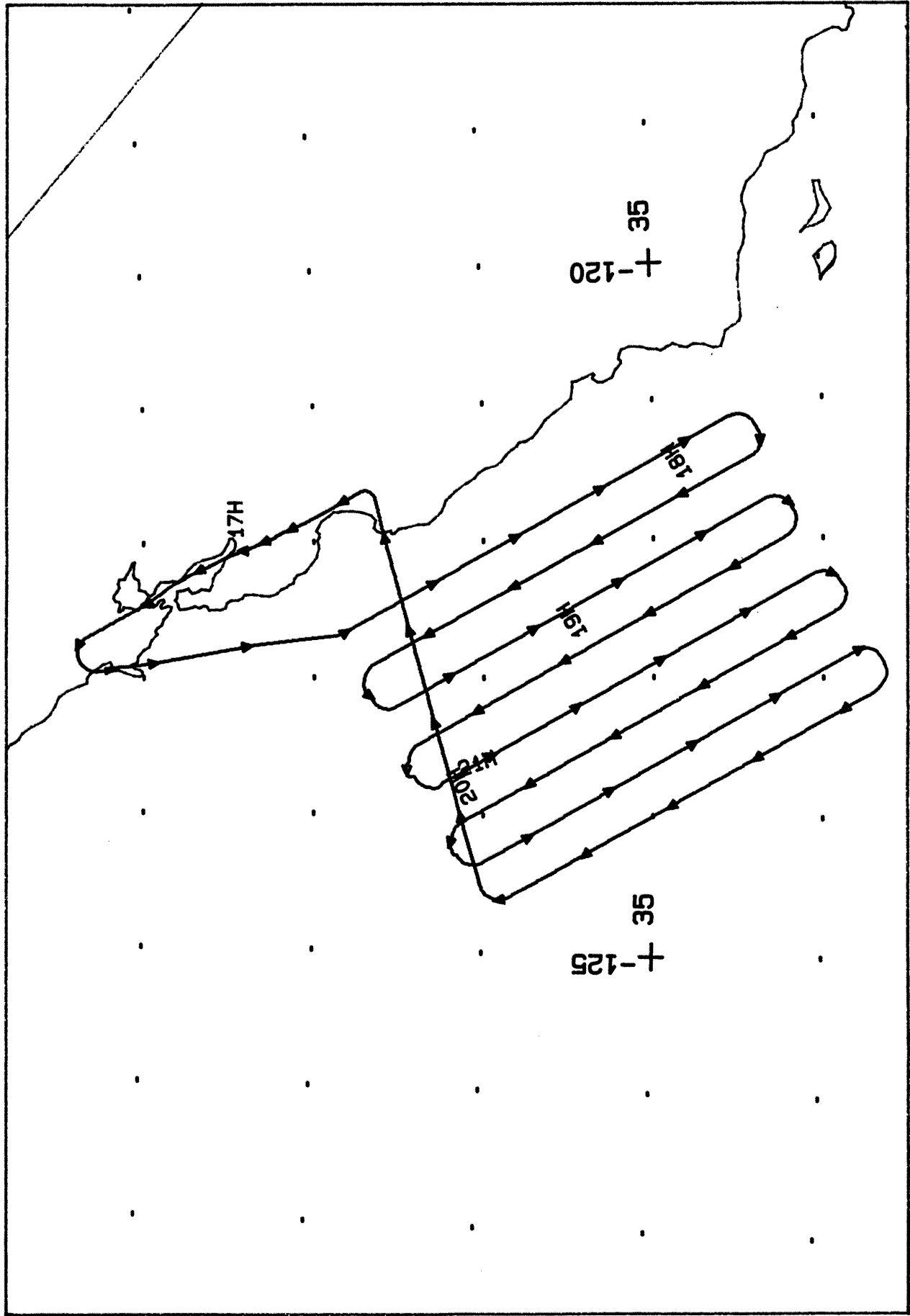
For specific information regarding flight documentation, sensor parameters, and areas of coverage contact the Aircraft Data Facility, NASA-Ames Research Center, Mail Stop 240-6, Moffett Field, California 94035-1000 (Telephone: 415-604-6252). Additional information regarding ER-2 acquired photographic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

**CAMERA FLIGHT LINE DATA  
FLIGHT NO. 94-097**

Accession # 04737

Sensor # 031

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	3000-3023	17:30:59	17:52:57	65000/19800	100% cumulus
C - D	3024-3046	17:57:20	18:19:05	"	100% cumulus
E - F	3047-3069	18:23:16	18:44:55	"	100% cumulus
G - H	3070-3091	18:49:05	19:09:42	"	100% cumulus
I - J	3092-3114	19:14:40	19:36:14	"	100% cumulus
K - L	3115-3136	19:39:55	20:00:30	"	100% cumulus (frames 3115-3132); 70-80% cumulus (frames 3133-3136)
M - N	3137-3160	20:05:04	20:27:35	"	20-70% cumulus (frames 3137-3141); 80-100% cumulus (frames 3142-3160)
O - P	3161-3182	20:31:23	20:51:56	"	80-100% cumulus (frames 3161-3175); 10-60% cumulus (frames 3176-3181)
P - Q	3183-3193	20:54:44	21:04:31	"	10-60% cumulus (frames 3184-3186); 80-100% cumulus (frames 3187-3193)

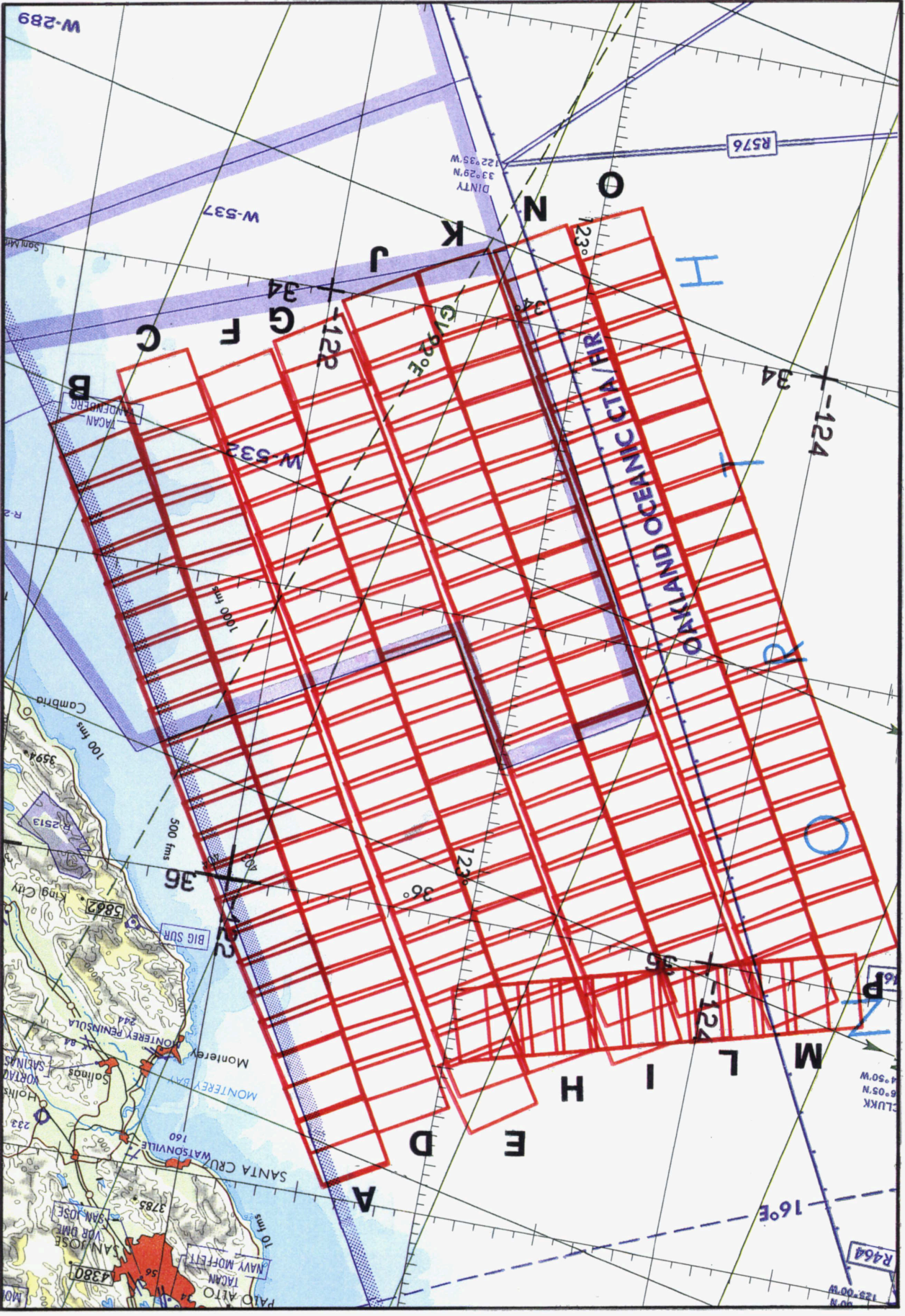


11 JUNE 1984

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