

FLIGHT SUMMARY REPORT

Flight Number: 94-045
Calendar/Julian Date: 24 February 1994 • 55
Sensor Package: Wild-Heerbrug RC-10
Modis Airborne Simulator (MAS)
Thematic Mapper Simulator (TMS)
Electro-Optic Camera System (EOC)
Area(s) Covered: S.F. Bay Area/Sierra Nevada Mountains

Investigator(s): Westerman, LMSC

Aircraft #: 708

SENSOR DATA

Accession #:	04699	-----	-----	-----
Sensor ID #:	026	108	111	074
Sensor Type:	RC-10	MAS	EOC	TMS
Focal Length:	12" 304.97 mm	-----	-----	-----
Film Type:	Aerochrome IR SO-060	-----	-----	-----
Filtration:	Wratten 12	-----	-----	-----
Spectral Band:	510-900 nm	-----	-----	-----
f Stop:	11	-----	-----	-----
Shutter Speed:	1/200	-----	-----	-----
# of Frames:	251	-----	-----	-----
% Overlap:	60	-----	-----	-----
Quality:	Excellent	Good		Good
Remarks:				

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.

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, μm</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 Aircraft Data Facility, NASA-Ames Research Center, Mail Stop 240-6, Moffett Field, California 94035-1000 (Telephone: 415-604-6252).

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 LMSC) was used on this flight:

<u>Data System Channel</u>	<u>MAS Channel</u>	<u>Band edges μm</u>
1	--	-----
2	1	0.529 - 0.572
3	2	0.635 - 0.688
4	8	0.896 - 0.927
5	10	1.595 - 1.652
6	14	1.805 - 1.855
7	15	1.855 - 1.905
8	17	1.955 - 2.005
9	31	3.659 - 3.810
10	42	8.342 - 8.738
11	44	10.259 - 10.725
12	46	11.799 - 12.246

Sensor/Aircraft Parameters:

Spectral Channels:	50
Output Channels:	Twelve 8-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.)

Electro-Optic Camera System

The NASA-Ames High Definition Electro-Optic Camera System (EOC) is an experimental sensor under development by the High Altitude Missions Branch at NASA-Ames Research Center. The system captures high resolution digitized images from a solid-state video camera and stores the imagery on magnetic tape. System characteristics are as follows:

CCD Video Camera

IFOV:	0.2 mrad
Ground Resolution:	15.8 feet (4.81 meters at 65,000 feet)
Total Scan Angle:	13.96°
Swath Width:	3.3 nmi (6.2 km) x 2.7 nmi (4.9 km) at 65,000 feet
Spectral Coverage:	400-900 nm

Frame Size:	1280 pixels x 1025 pixels
Lens (Interchangeable):	28 mm
Shutter Speed:	Selectable
Aperture:	f/2.8
Filtration:	4 and 6 position filter wheels (4 and 6 spectral filters) Polarizing Filter
Tracking Capability:	Tilt 45° fore and aft

Data Collection

Frame Rate:	1 image every 3 seconds
Frame Overlap:	90% (to 40% w/6 filters)
Data Storage:	Tape Cassette
Capacity:	5.0 Gbytes

For additional information contact Ted Hildum at NASA-Ames Research Center, Mail Stop 240-6, Moffett Field, California 94035-1000.

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. 94-045**

Accession # 04699

Sensor # 026

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	3335-3363	19:47:55	20:01:16	65000/19800	Clear
C - D	3364-3395	20:06:19	20:21:07	"	Clear
E - F	3396-3430	20:24:46	20:40:59	"	10% cumulus (frames 3402-3404)
G - H	3431-3467	20:46:47	21:03:56	"	Clear
I - J	3468-3497	21:08:01	21:21:50	"	10% cumulus (frames 3469-3472 and 3481-3483)
K - L	3498-3529	21:27:07	21:41:53	"	10-30% cumulus (frames 3524-3529)
M - N	3530-3559	21:49:22	22:03:10	"	Clear
O - P	3560-3585	22:22:47	22:34:39	"	10-40% cumulus (frames 3570-3583)

TMS SCANNER FLIGHT LINE DATA

FLIGHT NO. 94-045

DALLAS FLIGHT DATA
FLIGHT NUMBER: 94-045

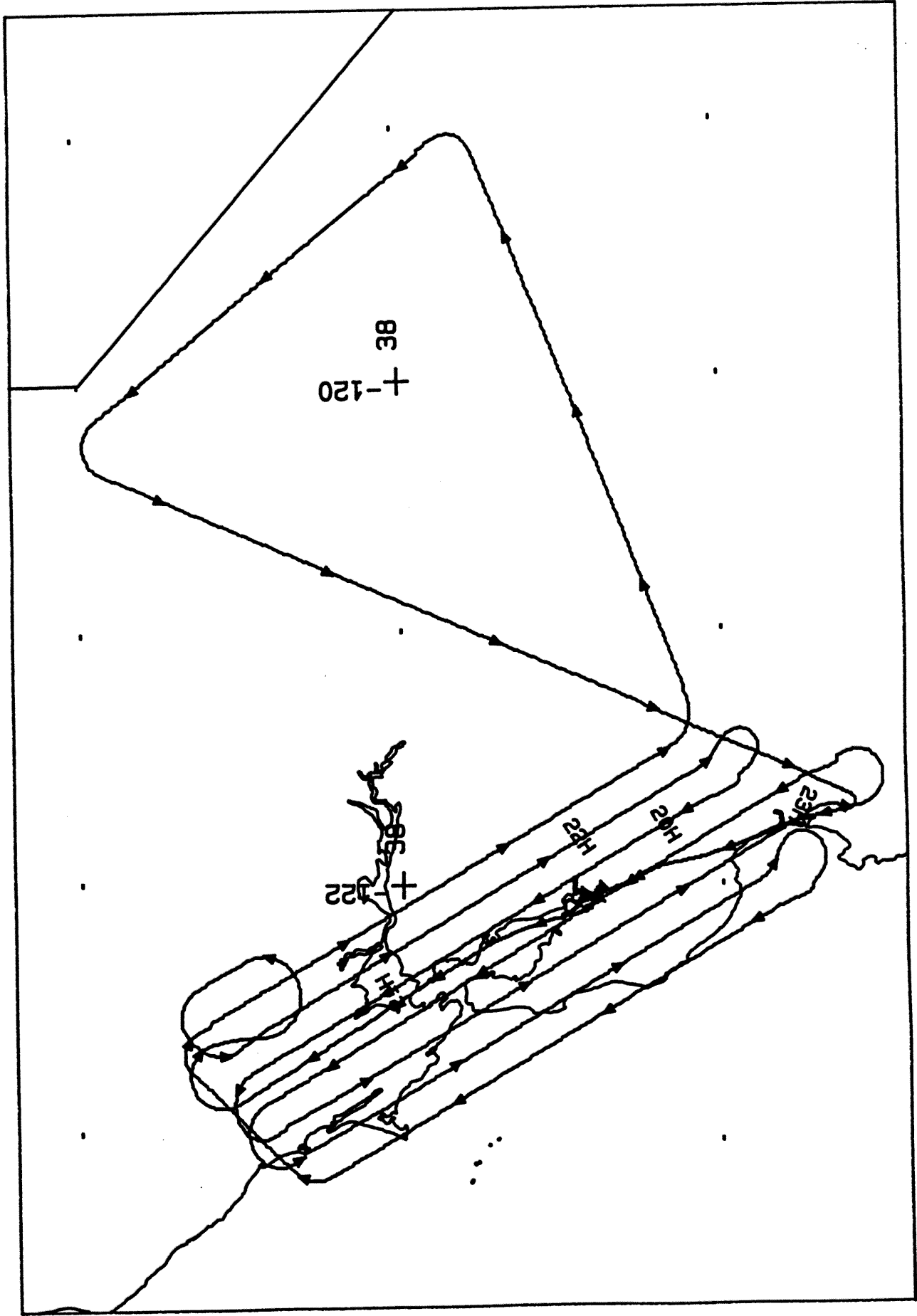
Check Points	A c t u a l t i m e b e g i n e n d	A c t u a l s c a n l i n e b e g i n e n d	A l t i t u d e f e e t / m e t e r	S c a n S p e e d (r p s)	t o t a l s c a n l i n e s	t o t a l I n t e r p o l a t e d s c a n l i n e s	t o t a l R e p e a t e d s c a n l i n e s
A-G	19:47:21.0 20:01:12.0	41775 33571	65000/19812	12.50	10396	0	0
C-D	20:06:13.0 20:21:0.0	56133 67320	65000/19812	12.50	11168	0	0
E-F	20:24:42.0 20:41:4.0	69793 82269	65000/19812	12.50	12276	1	0
G-H	20:46:29.0 21:04:26.0	86328 99792	65000/19812	12.50	13464	1	0
I-J	21:07:20.0 21:21:32.0	101770 113360	65000/19812	12.50	10890	1	0
K-L	21:26:53.0 21:41:56.0	116622 127908	65000/19812	12.50	11287	0	0
M-N	21:48:24.0 22:03:11.0	132739 143947	65000/19812	12.50	11089	0	0
O-P	22:22:19.0 22:34:44.0	158202 167508	65000/19812	12.50	9306	1	0

MAS SCANNER FLIGHT LINE DATA

FLIGHT NO. 94-045

DAEDALUS FLIGHT DATA FLIGHT NUMBER: 94-045

Check Points	A c t u a l t i m e b e g i n	A c t u a l (GMT) e n d	A c t u a l s c a n l i n e b e g i n	A c t u a l e n d	A l t i t u d e f e e t / m e t e r	Scan S p e e d (rps)	t o t a l G o o d s c a n l i n e s	t o t a l I n t e r p o l a t e d s c a n l i n e s	t o t a l R e p e a t e d s c a n l i n e s
A-B	19:47:27.0	20:01:13.0	20753	25901	65000/19812	6.25	5149	0	0
C-D	20:06:15.0	20:21:06.0	27782	33326	65000/19812	6.25	5545	0	0
E-F	20:24:48.0	20:40:58.0	34712	40751	65000/19812	6.25	6039	1	0
G-H	20:46:32.0	21:04:17.0	42830	49463	65000/19812	6.25	6634	0	0
I-J	21:07:28.0	21:21:46.0	50651	55997	65000/19812	6.25	5346	1	0
K-L	21:26:49.0	21:41:55.0	57878	63521	65000/19812	6.25	5644	0	0
M-N	21:48:32.0	22:03:06.0	65996	71441	65000/19812	6.25	5446	0	0
O-P	22:22:27.0	22:34:38.0	78668	83222	65000/19812	6.25	4555	0	0



RC-10 / MAS / TMS / EOC

A/C 708

24 FEBRUARY 1984

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