

FLIGHT SUMMARY REPORT

Flight Number: 96-088
Calendar/Julian Date: 02 April 1996 • 093
Sensor Package: Dual Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Radiation Measurement System (RAMS)
Cloud Lidar System (CLS)
Area(s) Covered: Mono Lake

Investigator(s): Wan, UCSB

Aircraft #: 706

SENSOR DATA

Accession #:	05054	05055	----	----
Sensor ID #:	035	076	108	112
Sensor Type:	RC-10	RC-10	MAS-50	RAMS
Focal Length:	6" 153.46 mm	12" 304.89 mm	----	----
Film Type:	Panatomic X Aerographic II, 2412	Aerochrome IR SO-060	----	----
Filtration:	Wratten 12	Wratten 12	----	----
Spectral Band:	510-700 nm	510-900 nm	----	----
f Stop:	8	11	----	----
Shutter Speed:	1/200	1/275	----	----
# of Frames:	37	70	----	----
% Overlap:	60	60	----	----
Quality:	Excellent	Excellent	----	----
Remarks:	Clock offset 2 minutes 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 configured to replicate the capabilities of the Moderate-Resolution Imaging Spectrometer (MODIS), an instrument to be orbited on an EOS platform. MODIS is designed for the measurement of biological and physical processes and atmospheric temperature sounding. The Modis Airborne Simulator records fifty 12-bit channels of multispectral data and is configured as follows:

Spectral Channel	Band center (mm)	Bandwidth (mm)	Spectral Range
1	0.549	0.044	0.527-0.571
2	0.658	0.053	0.631-0.684
3	0.704	0.042	0.683-0.725
4	0.745	0.041	0.725-0.766
5	0.786	0.041	0.765-0.807
6	0.827	0.042	0.806-0.848
7	0.869	0.042	0.848-0.891
8	0.909	0.033	0.893-0.926
9	0.947	0.046	0.924-0.970

Spectral Channel	Band center (mm)	Bandwidth (mm)	Spectral Range
26	2.958	0.136	2.889-3.026
27	3.119	0.123	3.058-3.181
28	3.265	0.146	3.192-3.338
29	3.437	0.142	3.366-3.509
30	3.565	0.144	3.493-3.637
31	3.747	0.138	3.668-3.816
32	3.893	0.156	3.815-3.971
33	4.064	0.143	3.992-4.135
34	4.156	0.065	4.124-4.189

10	1.608	0.053	1.582-1.635
11	1.670	0.052	1.644-1.695
12	1.723	0.05	1.698-1.748
13	1.775	0.05	1.750-1.800
14	1.825	0.046	1.802-1.849
15	1.88	0.045	1.856-1.901
16	1.93	0.45	1.909-1.954
17	1.98	0.048	1.955-2.003
18	2.03	0.048	2.005-2.053
19	2.08	0.047	2.056-2.103
20	2.128	0.047	2.105-2.152
21	2.177	0.047	2.154-2.201
22	2.227	0.047	2.203-2.250
23	2.276	0.047	2.253-2.300
24	2.326	0.047	2.303-2.350
25	2.375	0.047	2.351-2.398

35	4.389	0.113	4.332-4.446
36	4.514	0.140	4.444-4.584
37	4.647	0.144	4.575-4.720
38	4.823	0.179	4.734-4.913
39	4.992	0.145	4.919-5.064
40	5.139	0.122	5.078-5.120
41	5.275	0.124	5.214-5.337
42	8.557	0.396	8.359-8.755
43	9.711	0.509	9.457-9.966
44	10.473	0.441	10.252-10.693
45	10.976	0.439	10.757-11.196
46	11.929	0.421	11.719-12.140
47	12.822	0.376	12.634-13.010
48	13.190	0.447	12.966-13.413
49	13.661	0.587	13.368-13.954
50	14.155	0.395	13.957-14.352

Sensor/Aircraft Parameters:

Spectral Bands: 50 (digitized to 16-bit resolution)
IFOV: 2.5 mrad
Ground Resolution: 163 feet (50 meter at 65,000 feet)
Swath Width: 22.9 mi/19.9 nm (36 km)
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 μm). This radiometer has two detectors;
2. an IR net flux radiometer (rotating) radiometer covering the spectral range from 5 to 40 μm ;
- 3 a narrow field-of-view, narrow spectral bandpass IR radiometer (2 channels in the 5 to 40 μm 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 μm) 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 Spinhurne, 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-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

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. 96-088**

Accession # 05054

Sensor # 035

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	8028-8040	21:33:16	21 44 14	64238/19580	10% cumulus (frames 8028-8030 and 8033-8034), 20-70% cumulus (frames 8035-8040)
C - D	8041-8051	21 47 43	21 56 42	64736/19732	20-70% cumulus (frames 8041-8047), 10% cumulus (frames 8048 and 8050-8051)
E - F	8052-8064	22 03 32	22 14 26	64908/19784	Minor-10% cumulus (frames 8052-8055), 20-70% cumulus (frames 8058-8064)

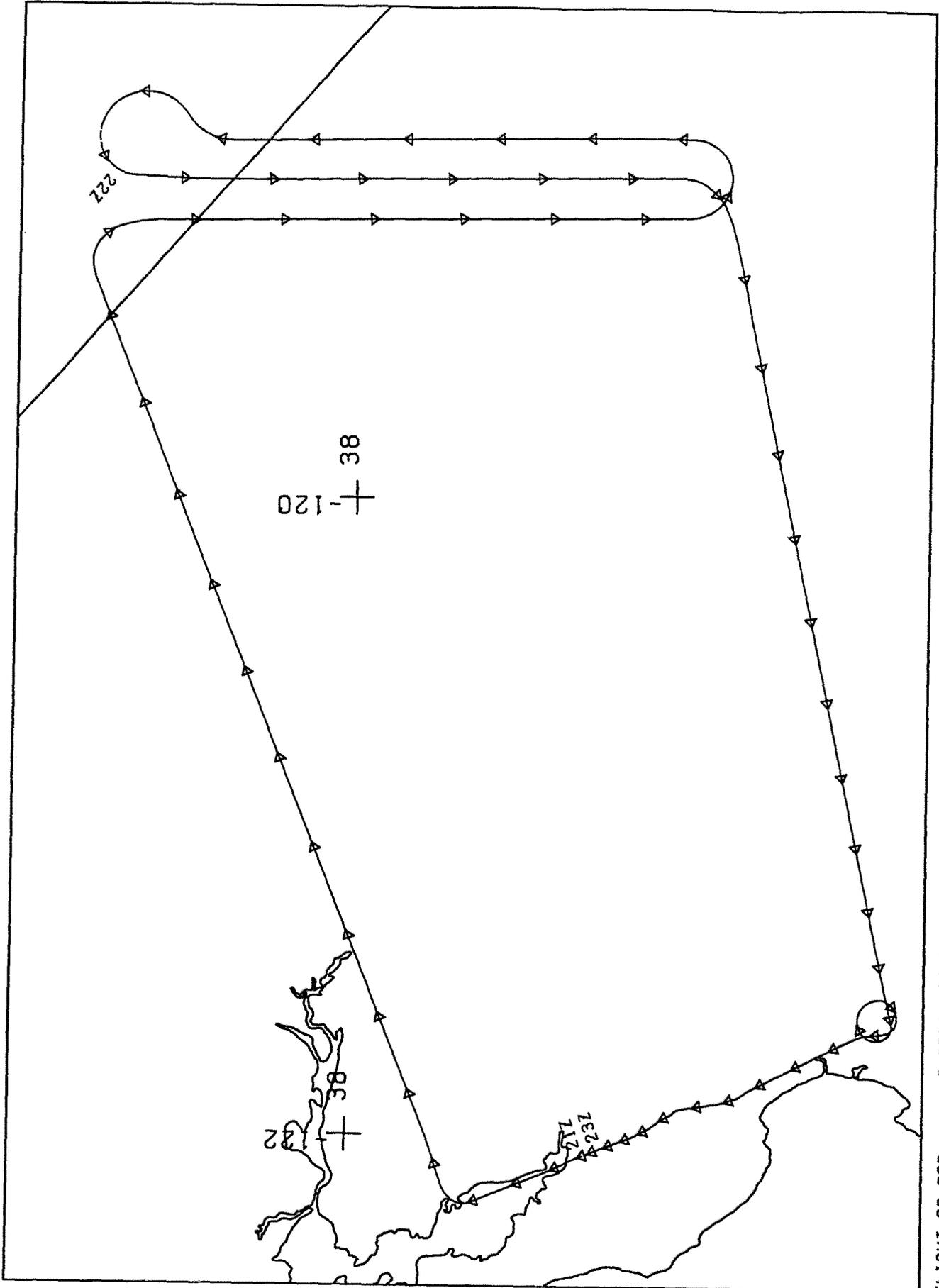
CAMERA FLIGHT LINE DATA

FLIGHT NO. 96-088

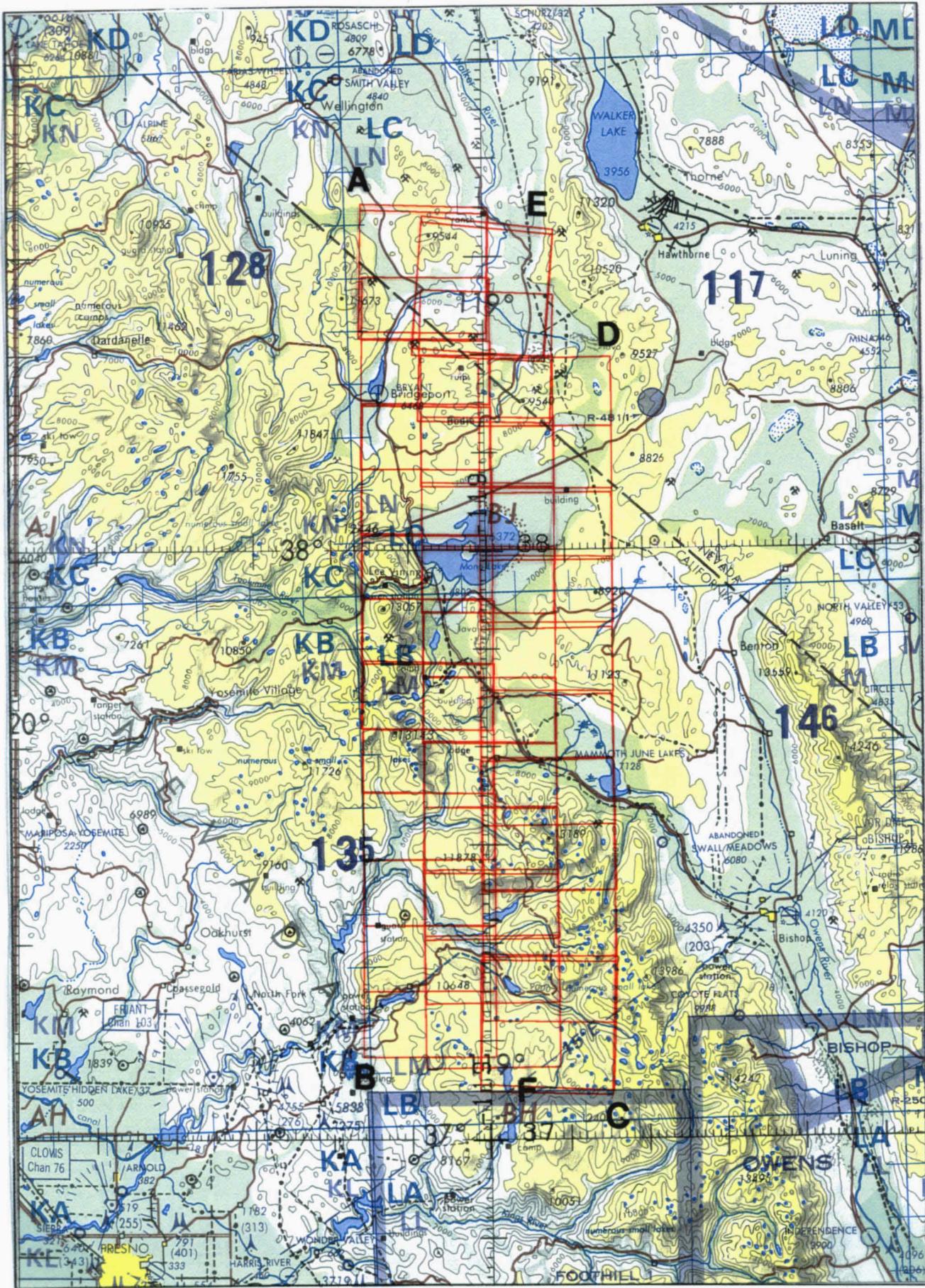
Accession # 05055

Sensor # 076

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	4798-4822	21:31:43	21:43 06	64400/19629	10-20% cumulus (frames 4799-4801 and 4808-4811), 30-70% cumulus (frames 4812-4822), emulsion defect (frame 4813)
C - D	4823-4843	21 46 10	21 55 38	64695/19719	20-70% cumulus (frames 4823-4834), 10% cumulus (frames 4835 and 4840-4842)
E - F	4844-4867	22 01 58	22 12 50	64958/19799	10% cumulus (frames 4844-4846), 20-70% cumulus (frames 4855-4867)



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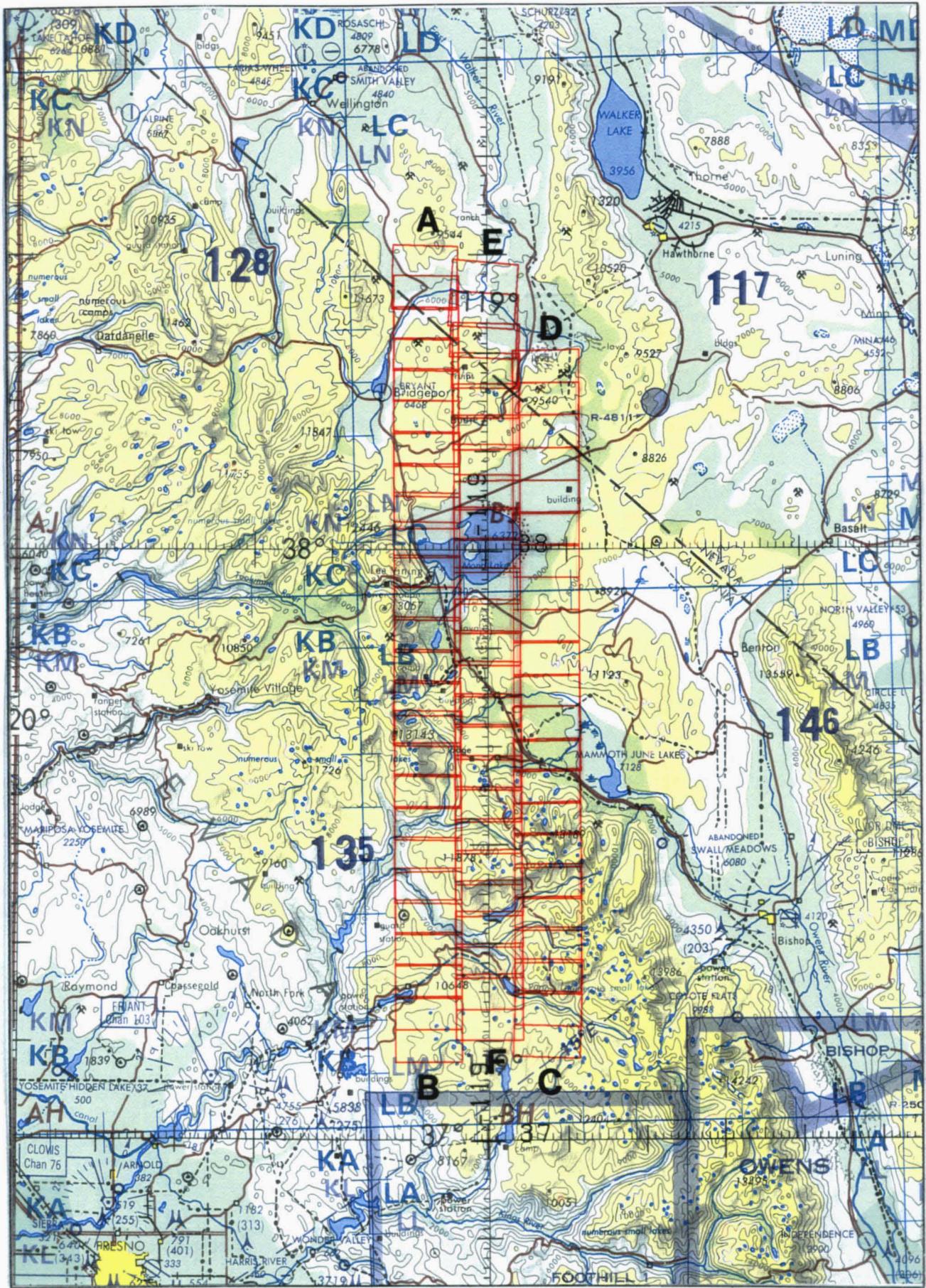
ONC G-18

RC-10 (B/W) / MAS-50

R/C 709

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FLIGHT 96-088



ONC G-18

RC-10 (SO-060)

A/C 709

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