

FLIGHT SUMMARY REPORT

Flight Number: 93-111
Calendar/Julian Date: 25 May 1993 • 145
Sensor Package: Wild-Heerbrug RC-10
 Airborne Ocean Color Imager (AOCI)
 Airborne Visible and Infrared Imaging
 Spectrometer (AVIRIS)
 Electro Optic Camera System (EOC)
Area(s) Covered: Barco, NV/Utah/Arizona/Canyonlands

Investigator(s): Kieffer and Clark, USGS

Aircraft #: 708

SENSOR DATA

Accession #:	04562	-----	-----	-----
Sensor ID #:	034	090	099	111
Sensor Type:	RC-10	AOCI	AVIRIS	EOC
Focal Length:	12" 304.66 mm	-----	-----	-----
Film Type:	High Definition Aerochrome IR SO-131	-----	-----	-----
Filtration:	cc.10B	-----	-----	-----
Spectral Band:	510-900 nm	-----	-----	-----
f Stop:	4	-----	-----	-----
Shutter Speed:	1/150	-----	-----	-----
# of Frames:	131	-----	-----	-----
% Overlap:	60	-----	-----	-----
Quality:	Excellent	Good	-----	-----
Remarks:	Data offset 8.60 minutes from navigation data	Data offset 9.0 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.

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>Channel</u>	<u>Wavelength, μm</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

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).

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.

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).

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

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. 93-111**

Accession # 04562

Sensor # 034

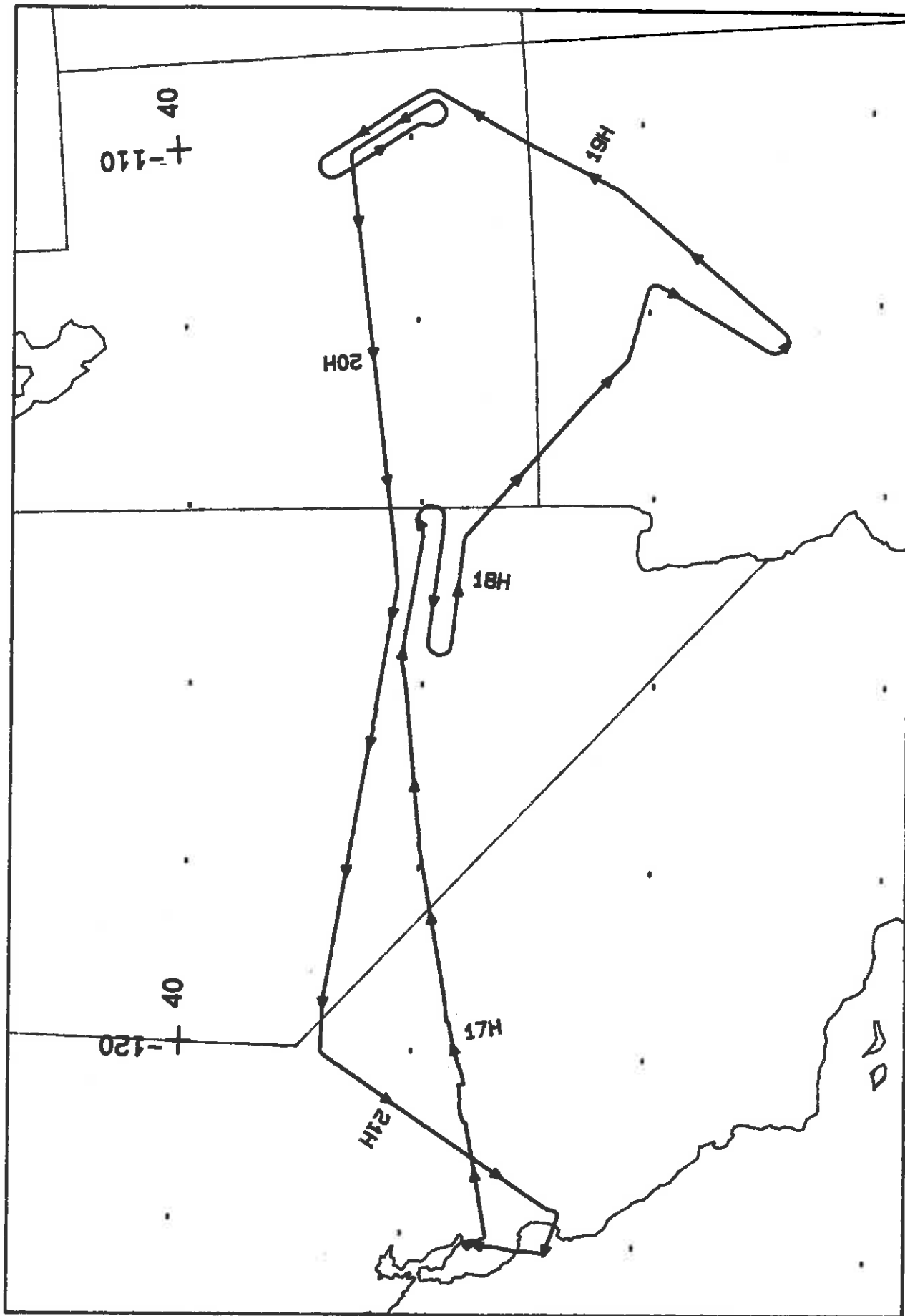
Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	7656-7671	17:22:26	17:29:29	65000/19800	Clear
C - D	7672-7686	17:35:13	17:41:49	"	Clear
E - F	7687-7701	17:47:26	17:54:01	"	Clear
G - H	7702-7710	18:14:36	18:18:03	"	Minor-10% cumulus
I - J	7711-7743	18:33:05	18:48:07	"	20% cumulus (frame 7711); minor-40% scattered cumulus (frames 7721-7729)
K - L	7744-7756	19:06:24	19:12:01	"	10-30% scattered cumulus (frames 7747- 7751); minor cumulus (frame 7756)
M - N	7757-7769	19:18:22	19:23:59	"	10% cumulus (frames 7767-7769)
O - P	7770-7782	19:29:27	19:35:01	"	10-20% scattered cumulus (frames 7771- 7777)
Q - R	7783-7786	20:43:12	20:44:36	"	30-50% cumulus

AOCI SCANNER FLIGHT LINE DATA

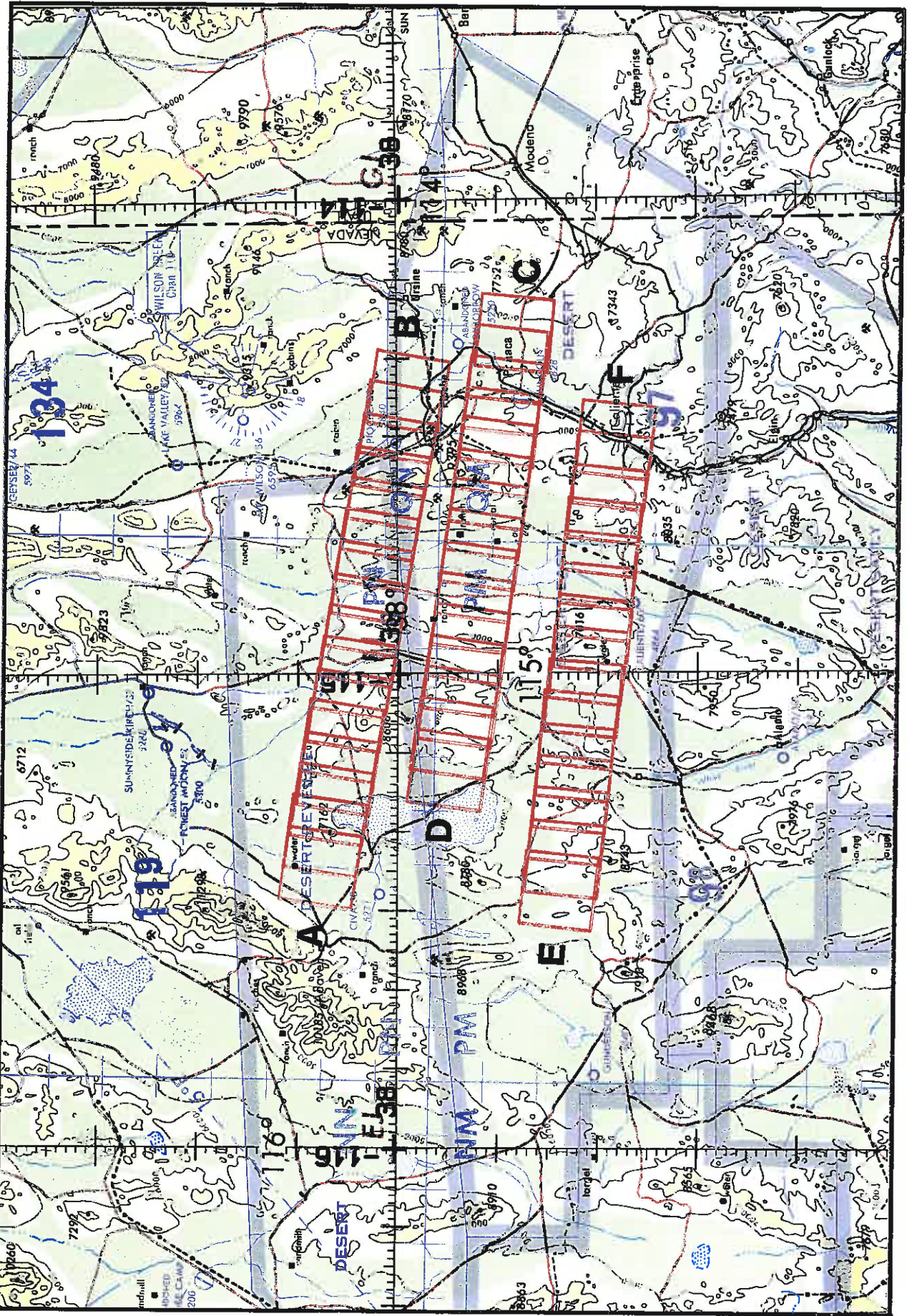
FLIGHT NO. 93-111

DR-DALUIS FLIGHT DATA
FLIGHT NUMBER: 93-111

Check Points	Actual Time (GMT)	Actual scanline begin end	Altitude feet/meter	Scan Speed (fps)	Total scanlines	Total interpolated scanlines	Total Repeated scanlines
A-O	17:20:33.0	17:27:13.0	65000/19812	6.20	3268	0	0
B-D	17:35:41.0	17:42:31.0	65000/19812	6.20	3169	0	0
E-F	17:47:13.0	17:54:41.0	65000/19812	6.20	2575	0	0
G-H	18:13:37.0	18:18:41.0	65000/19812	6.20	1684	0	0
I-J	18:52:21.0	18:57:35.0	65000/19812	6.20	3042	0	0
K-L	19:06:44.0	19:14:41.0	65000/19812	6.20	2971	0	0
M-N	19:17:46.0	19:24:30.0	65000/19812	6.20	2278	0	0
O-P	19:28:51.0	19:34:55.0	65000/19812	6.20	2278	0	0
Q-R	20:42:46.0	20:49:21.0	65000/19812	6.20	395	0	0



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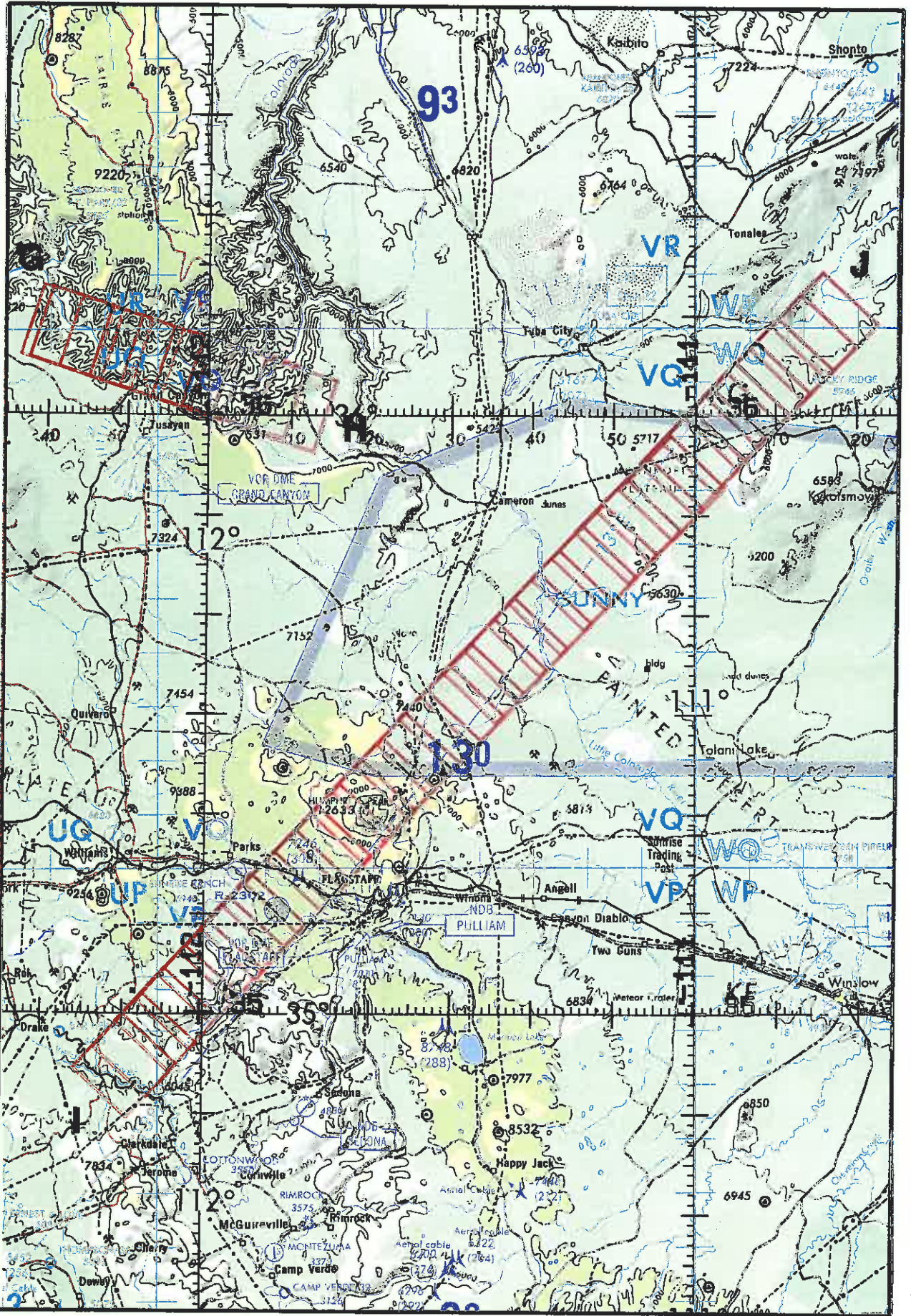


FLIGHT 99-111

25 MAY 1993

RC-10 / AVIRIS / AGCI

ONC 6-18

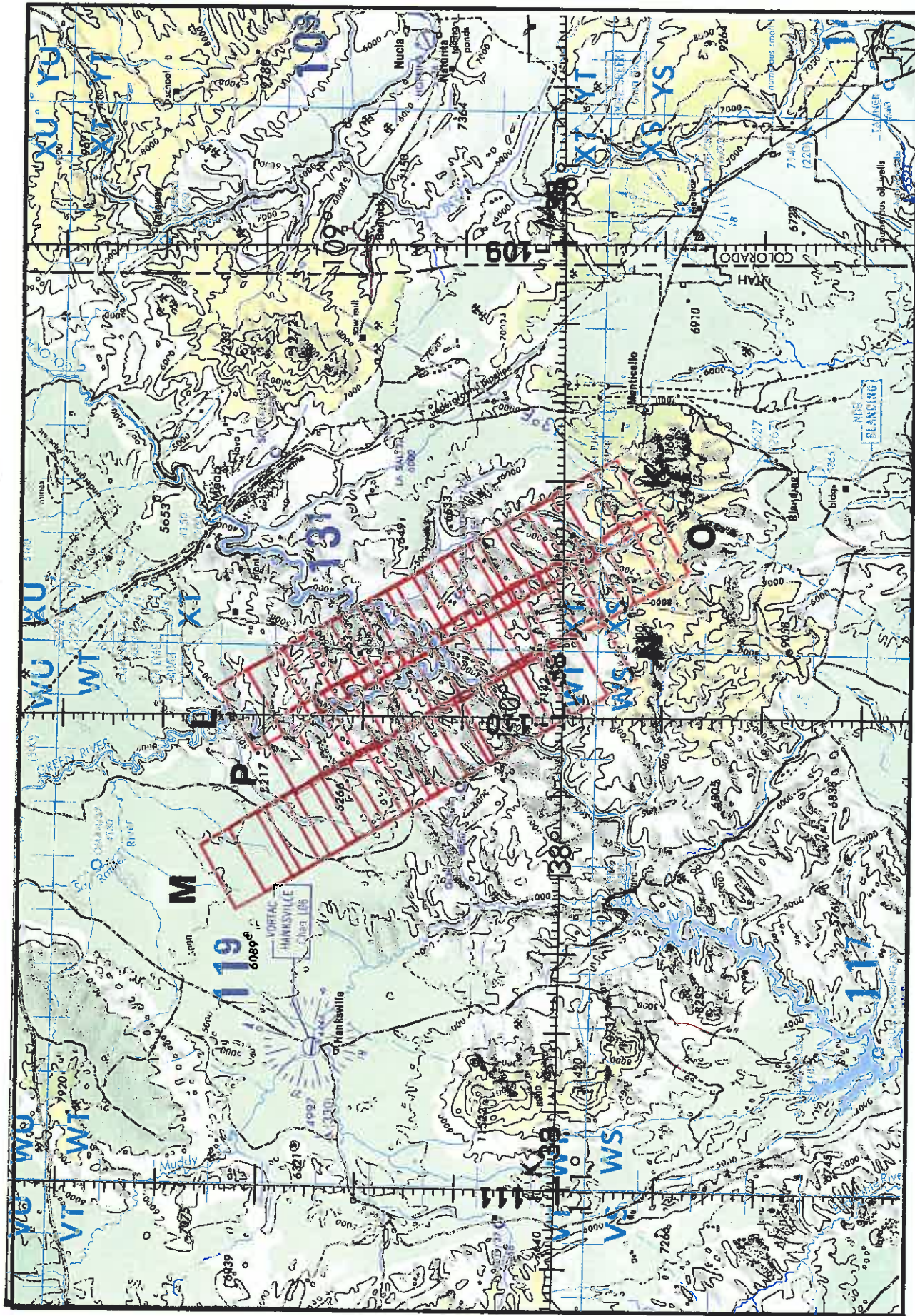


ONC 8-18

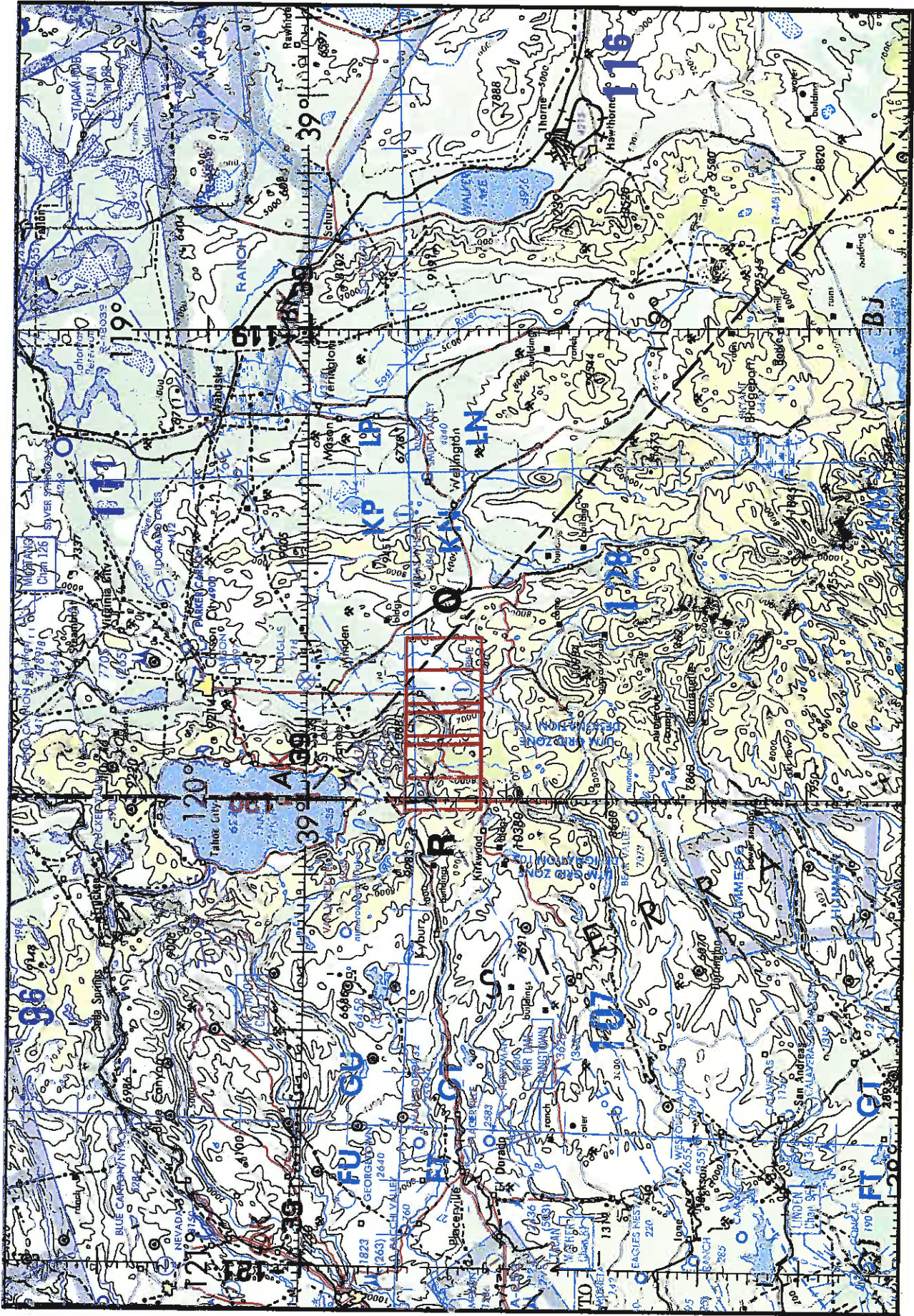
RC-10 / AVIRIS / AOCI

28 MAY 1993

FLIGHT 88-111



FLIGHT 89-111 25 MAY 1989 RC-10 / AVIRIS / AOCI ONC 8-19



FLIGHT 99-111

25 MAY 1983

RC-10 / AVIRIS / AOCI

ONC 6-16