

# FLIGHT SUMMARY REPORT

**Flight Number:** 93-137  
**Calendar/Julian Date:** 14 July 1993 • 195  
**Sensor Package:** Wild-Heerbrug RC-10  
Airborne Visible and Infrared Imaging  
Spectrometer (AVIRIS)  
Modis Airborne Simulator (MAS)  
**Area(s) Covered:** Mid-Atlantic Coast

**Investigator(s):** Kaufman, NASA-GSFC

**Aircraft #:** 708

## SENSOR DATA

<b>Accession #:</b>	04594	----	----
<b>Sensor ID #:</b>	034	099	108
<b>Sensor Type:</b>	RC-10	AVIRIS	MAS
<b>Focal Length:</b>	12" 304.66 mm	----	----
<b>Film Type:</b>	High Definition Aerochrome IR SO-131	----	----
<b>Filtration:</b>	cc.10B	----	----
<b>Spectral Band:</b>	510-900 nm	----	----
<b>f Stop:</b>	4	----	----
<b>Shutter Speed:</b>	1/150	----	----
<b># of Frames:</b>	109	----	----
<b>% Overlap:</b>	60	----	----
<b>Quality:</b>	Excellent	----	Good
<b>Remarks:</b>	Camera clock offset 54.4 seconds from navigation data		Data offset 1 hour 53 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.

### 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  $\mu\text{m}$ ).

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 $\mu\text{m}$
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 $\mu\text{m}$	31	9.4 nm
2	0.68 - 1.27 $\mu\text{m}$	63	9.4 nm
3	1.25 - 1.86 $\mu\text{m}$	63	9.7 nm
4	1.84 - 2.45 $\mu\text{m}$	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. Channel 1 is used to store additional bits which provide 10-bit resolution for channels 9 through 12. The following MAS band combination (configuration SCARP1) was used on this flight for Smoke, Cloud, and Radiation (SCAR) experiments:

<u>Data System Channel</u>	<u>MAS Channel</u>	<u>Band edges <math>\mu\text{m}</math></u>
1	--	-----
2	1	0.529 - 0.572
3	2	0.635 - 0.688
4	7	0.852 - 0.893
5	9	0.926 - 0.969
6	15	1.855 - 1.905
7	20	2.126 - 2.173
8	31	3.659 - 3.810
9*	42	8.342 - 8.738
10*	45	10.791 - 11.239
11*	48	13.023 - 13.375
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.)

### 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).

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. 93-137**

Accession # 04594

Sensor # 034

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	9143-9151	17:40:28	17:44:18	63000/19200	Clear
C - D	9152-9164	17:47:06	17:50:55	64000/19500	10% cumulus (frames 9152-9154)
G - H	9165-9172	18:09:28	18:11:21	65000/19800	10% cumulus (frames 9168-9172)
I - J	9173-9182	18:14:22	18:18:09	"	Clear
J - B	9183-9193	18:24:58	18:29:42	"	Clear
C - D	9194-9204	18:32:31	18:36:18	"	Minor-10% cumulus (frames 9194-9197)
L - M	9205-9213	18:48:24	18:51:14	"	Clear
A - I	9214-9218	19:05:23	19:07:15	"	Clear
G - D	9219-9222	19:13:15	19:14:39	"	10% cumulus
L - M	9223-9227	19:27:56	19:29:48	"	Clear

**CAMERA FLIGHT LINE DATA  
FLIGHT NO. 93-137**

Accession # 04594

Sensor # 034

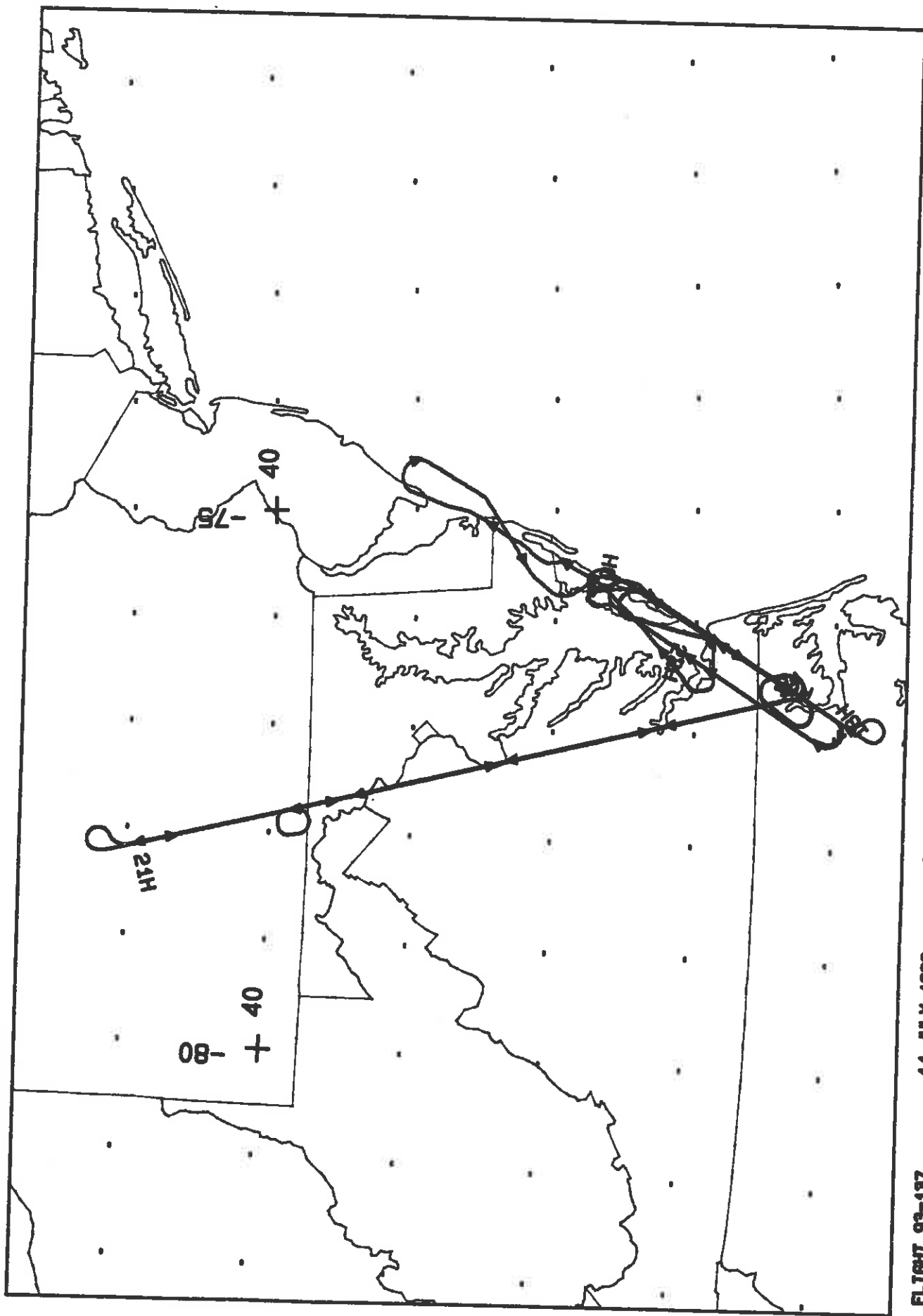
Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	9228-9233	19:42:28	19:44:19	65000/19800	Clear
G - D	9234-9238	19:50:02	19:51:54	"	10-30% scattered cumulus
O - P	9239-9250	20:44:14	20:49:19	"	100% cumulus
Q	9251	20:52:34	_____	"	90% scattered cumulus; oblique frame

# MAS SCANNER FLIGHT LINE DATA

## FLIGHT NO. 93-137

DAEDALUS FLIGHT DATA  
FLIGHT NUMBER: 93-137

Check Points	A c t u a l t i m e b e g i n	(GMT) 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	Scan S p e e d ( r p s )	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
H-E	16:39:19.0	16:54:43.0	17160	22902	65000/19812	6.25	5743	0	0
F-J	17:04:32.0	17:18:20.0	26565	31713	65000/19812	6.25	5149	0	0
J-E	17:24:10.0	17:39:49.0	33891	39732	65000/19812	6.25	5842	0	0
K-N	17:43:16.0	17:54:56.0	41019	45375	65000/19812	6.25	4357	0	0
A-E	18:04:45.0	18:18:00.0	49038	53988	65000/19812	6.25	4950	1	0
L-N	18:24:06.0	18:33:07.0	56265	59631	65000/19812	6.25	3367	0	0
A-F	18:41:37.0	18:52:45.0	62799	66957	65000/19812	6.25	4159	0	0
O-P	19:42:38.0	19:51:24.0	85569	88836	65000/19812	6.25	3268	0	0



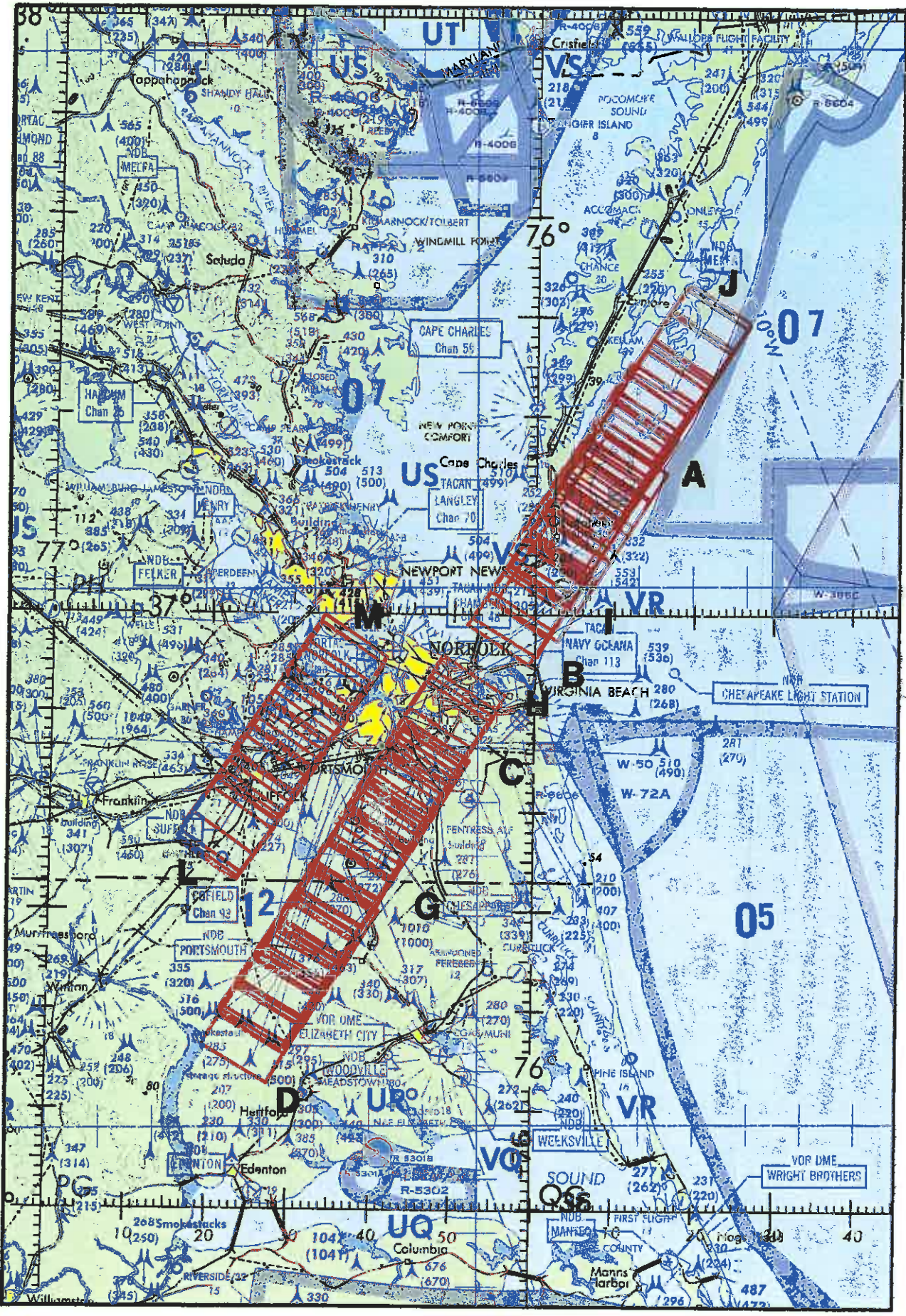
FLIGHT 93-137

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RC-10 / MAS / AVIRIS





ONC 0-21

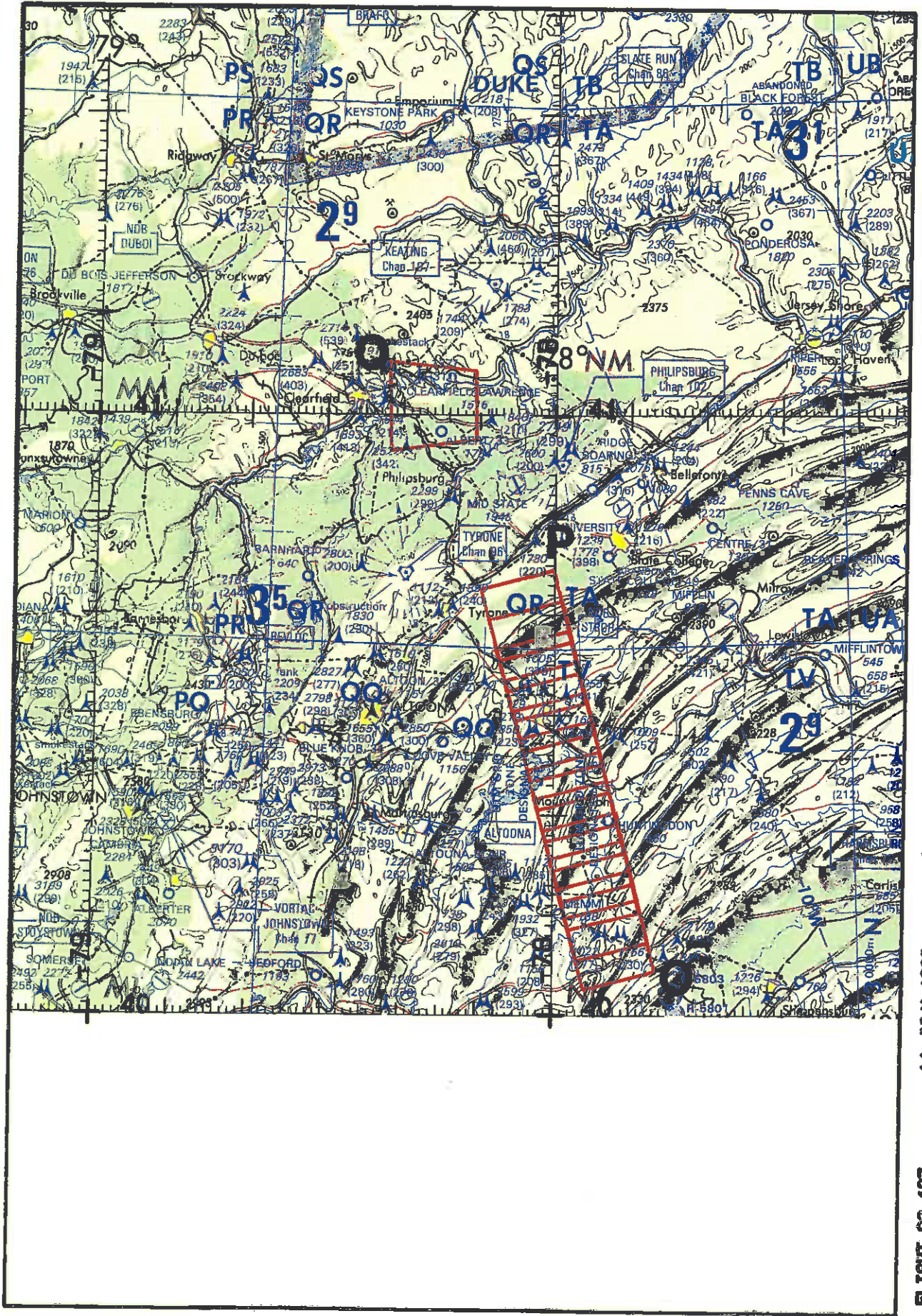
RC-10 / AVIRIS

A/C 708

14 JULY 1993

FLIGHT 89-137





ONC F-16

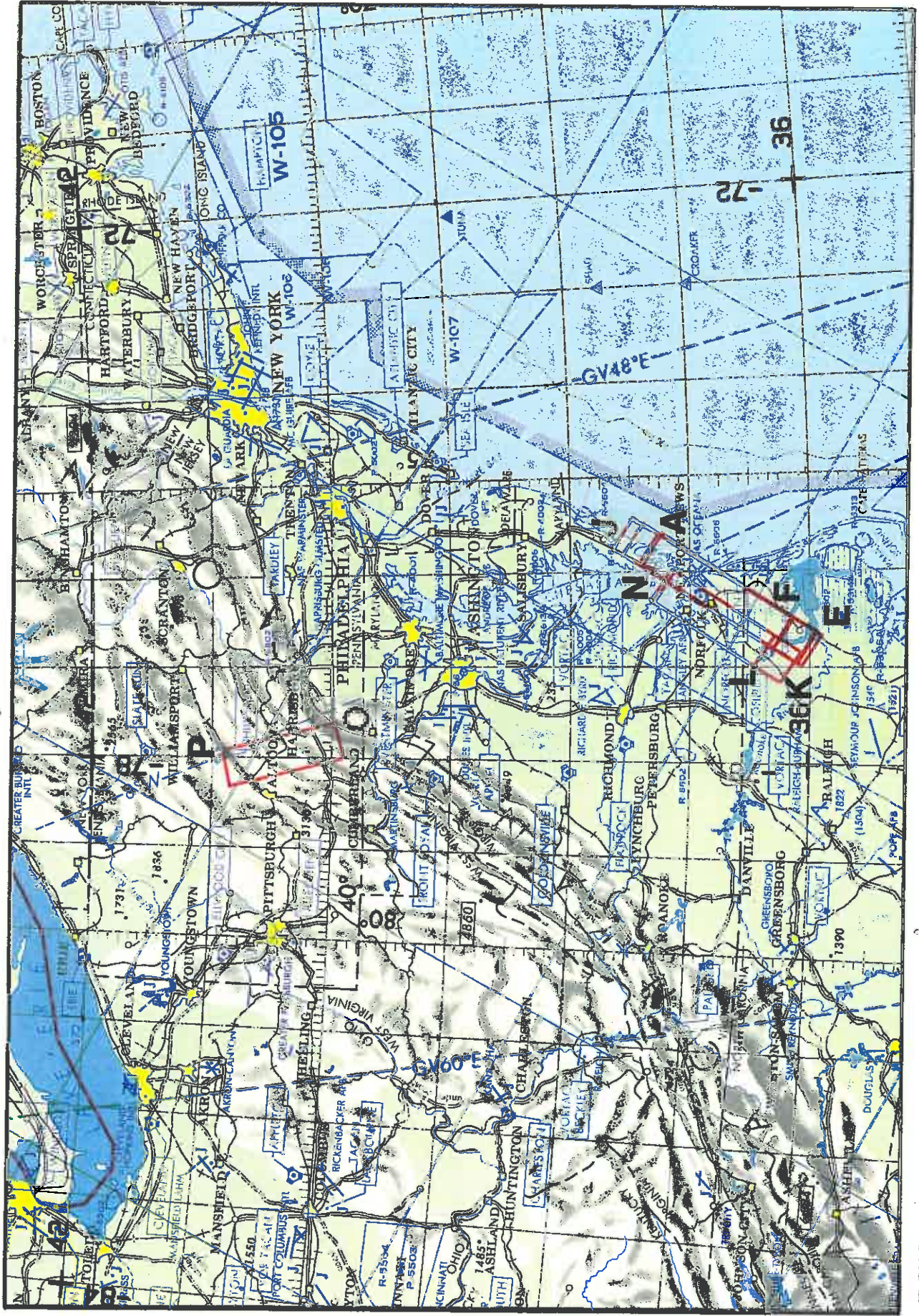
RC-10 / AVIRIS

A/C 708

14 JULY 1969

FLIGHT 93-197





FLIGHT 89-197

14 JULY 1983

A/C 708

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