FLIGHT SUMMARY REPORT

Flight Number: 93-158

Calendar/Julian Date: 02 September 1993 • 245

Sensor Package: Wild-Heerbrug RC-10
Airborne Visible and Infrared Imaging Spectrometer (AVIRIS)
Modis Airborne Simulator (MAS)
Aerosol Particulate Sampler (APS)

Area(s) Covered: Canada

Investigator(s): Goodenough, Pacific Forestry Centre **Aircraft #:** 708

SENSOR DATA

Accession #:	04626	-----	-----	-----
Sensor ID #:	076	099	108	024
Sensor Type:	RC-10	AVIRIS	MAS	APS
Focal Length:	12" 304.89 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:	39	-----	-----	-----
% Overlap:	60	-----	-----	-----
Quality:	Excellent	-----	Good	-----
Remarks:	Camera clock offset 11.6 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 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

Spectrometer	Wavelength Range	Number of Bands	Sampling Interval
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.

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 BOREAS) was used on this flight for BOREAS experiments:

Data System Channel	MAS Channel	Band edges µm
1	1	0.529 - 0.572
2	2	0.635 - 0.688
3	4	0.729 - 0.769
4	5	0.770 - 0.810
5	6	0.810 - 0.852
6	7	0.852 - 0.893
7	9	0.926 - 0.969
8	10	1.595 - 1.652
9	20	2.126 - 2.173
10	33	3.975 - 4.125
11	45	10.791 - 11.239
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.)

Aerosol Particulate Sampler

The Aerosol Particulate Sampler (APS) has been developed and is operated by Dr. Guy Ferry of the NASA-Ames Research Experiments Branch. The sampler is a non-imaging sensor designed to gather high altitude dust particles for laboratory research.

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. 93-158

Accession # 04626

Sensor # 076

Check Points	Frame Numbers	Time (GMT-hr, min, sec) START	Time (GMT-hr, min, sec) END	Altitude, MSL feet/meters	Cloud Cover/Remarks
A - B	0866-0874	21:12:39	21:16:23	65000/19800	10-30% cumulus (frames 0871-0874)
C - D	0875-0882	22:01:26	22:04:40	"	Clear
E - F	0883-0890	22:10:30	22:13:45	"	Clear
G - H	0891-0897	22:26:02	22:28:49	"	10% coastal stratus (frame 0891)
I - J	0898-0904	22:34:29	22:37:15	"	Clear

APS ON/OFF TIME 19:32:00/00:12:00

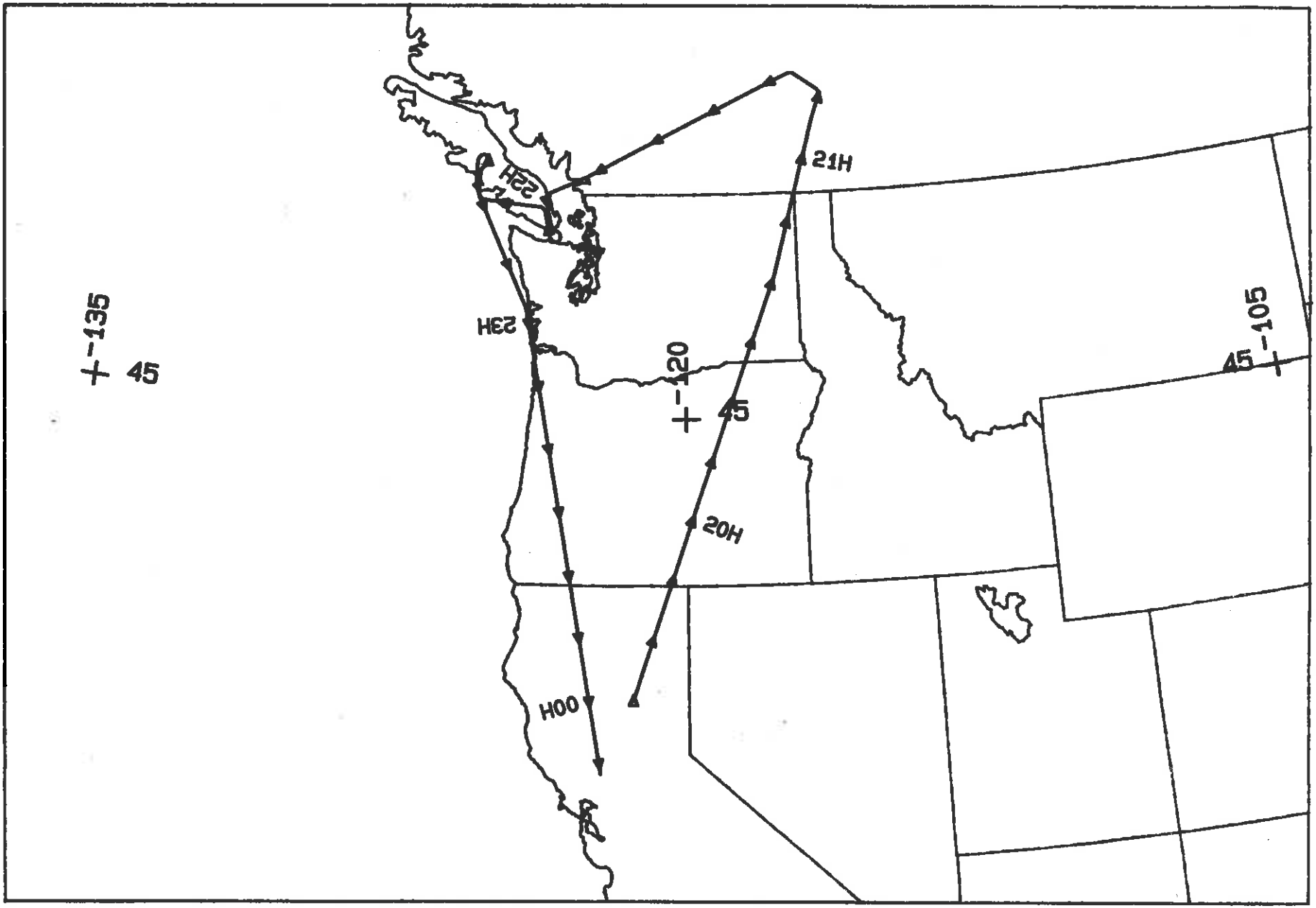
MAS SCANNER FLIGHT LINE DATA

FLIGHT NO. 93-158

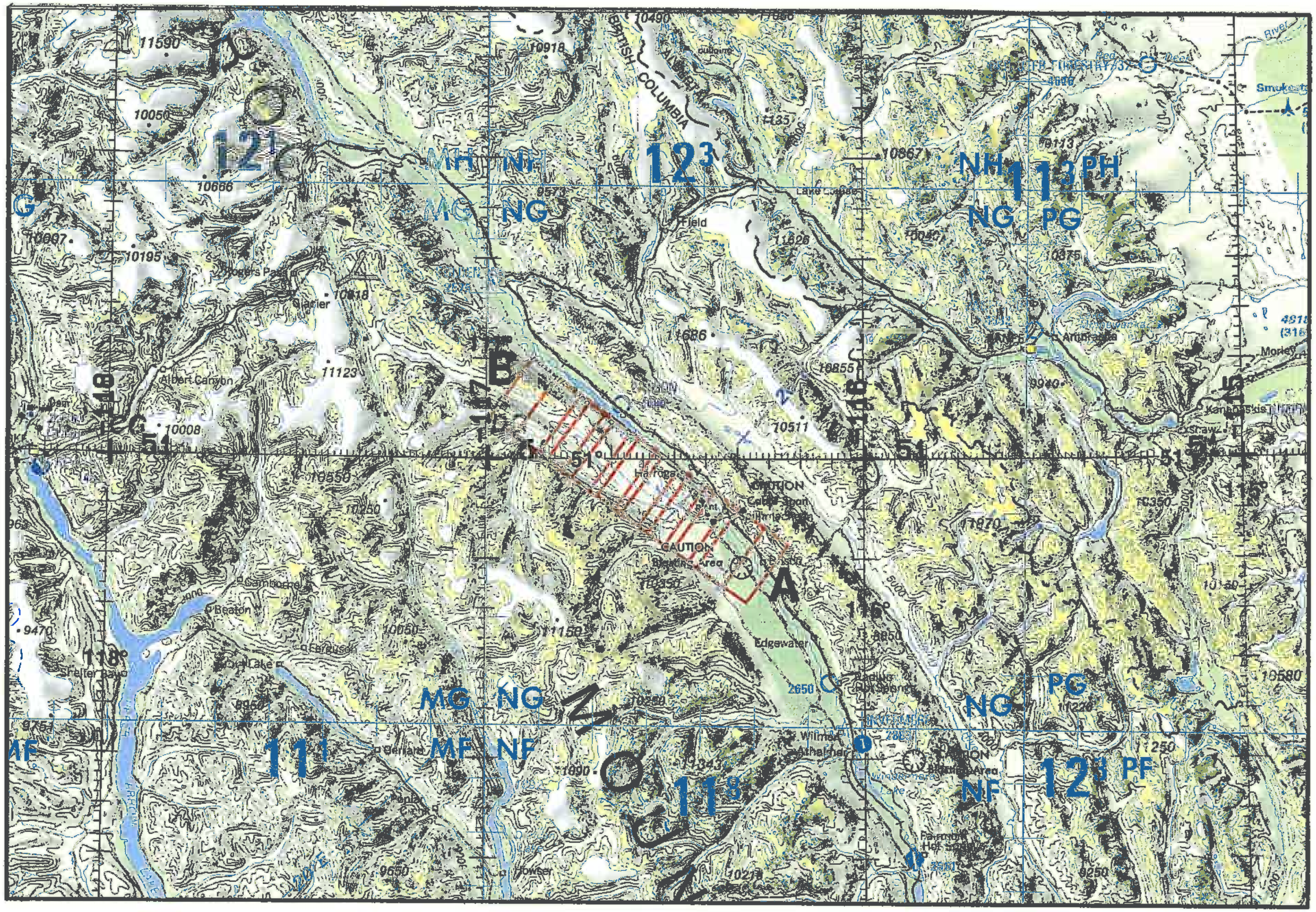
DAEDALUS FLIGHT DATA
FLIGHT NUMBER: 93-158

Check Points	Actual time (GMT) begin	Actual time (GMT) end	Actual scanline begin	Actual scanline end	Altitude feet/meter	Scan Speed (rps)	total Good scanlines	total Interpolated scanlines	total Repeated scanlines
A-B	21:12:46.Ø	21:16:13.Ø	53Ø52	54339	65ØØØ/19812	6.2Ø	1288	Ø	Ø
C-D	22:ØØ:44.Ø	22:Ø4:27.Ø	7Ø971	72357	65ØØØ/19812	6.2Ø	1387	Ø	Ø
E-F	22:1Ø:33.Ø	22:13:44.Ø	74634	75822	65ØØØ/19812	6.2Ø	1189	Ø	Ø
G-H	22:25:55.Ø	22:28:34.Ø	8Ø376	81366	65ØØØ/19812	6.2Ø	991	Ø	Ø
I-J	22:34:24.Ø	22:37: 3.Ø	83544	84534	65ØØØ/19812	6.2Ø	991	Ø	Ø

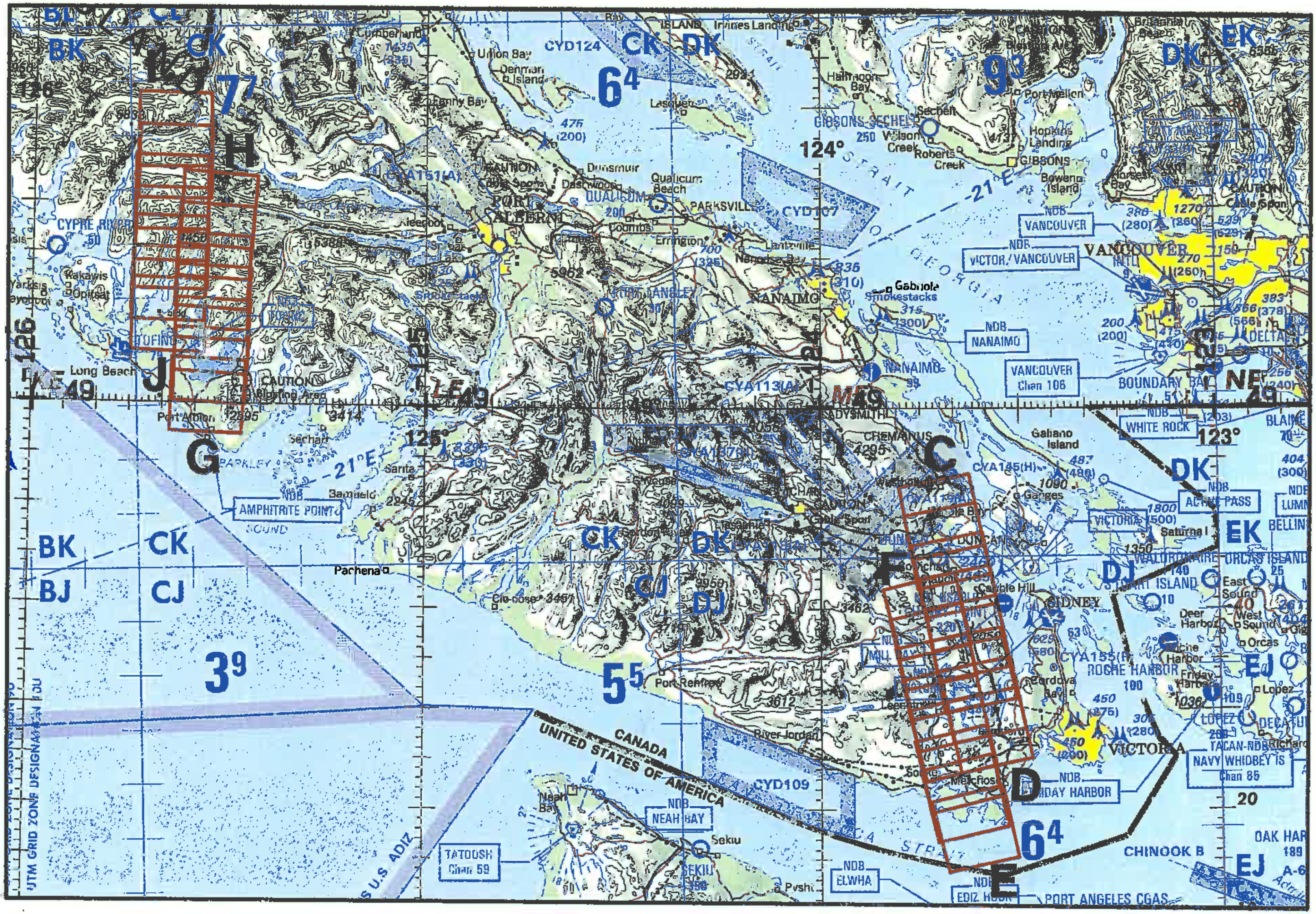
NOTE: Scan Speed (rps) is 6.25 NOT 6.20



FLIGHT 93-158 2 SEPTEMBER 1993 A/C 708 RC-10 / AVIRIS / MAS



FLIGHT 93-158 2 SEPTEMBER 1993 A/C 708 RC-10 / AVIRIS / MAS ONC E-15



FLIGHT 93-156   2 SEPTEMBER 1993   A/C 708   RC-10 / AVIRIS / MAS   ONC E-15