FLIGHT SUMMARY REPORT

Flight Number: 94-013

Calendar/Julian Date: 23 November 1993 • 327

Sensor Package: Wild-Heerbrug RC-10
Dual Hycon HR-732
Airborne Ocean Color Imager (AOCI)
Thermal Infrared Multispectral Scanner (TIMS)

Area(s) Covered: San Francisco Bay Area

Investigator(s): Functional Sensor Flight **Aircraft #:** 708

SENSOR DATA

Accession #:	04651	04653	04654
Sensor ID #:	026	020	039
Sensor Type:	RC-10	HR-732	HR-732
Focal Length:	12" 304.97 mm	24" 609 mm	24" 609 mm
Film Type:	High Definition Aerochrome IR SO-131	High Definition Aerochrome IR SO-131	High Definition Aerochrome IR SO-131
Filtration:	None	None	None
Spectral Band:	510-900 nm	510-900 nm	510-900 nm
f Stop:	4	8	8
Shutter Speed:	1/150	1/75	1/75
# of Frames:	32	14	12
% Overlap:	60	60	60
Quality:	Excellent	Excellent	Excellent
Remarks:	Camera clock offset 2.7 seconds from navigation data	Camera clock offset .9 seconds from navigation data	Camera clock offset 35.7 seconds from navigation data

94-013
SENSOR DATA continued

Accession #:	-----	-----
Sensor ID #:	090	086
Sensor Type:	AOCI	TIMS
Focal Length:	-----	-----
Film Type:	-----	-----
Filtration:	-----	-----
Spectral Band:	-----	-----
f Stop:	-----	-----
Shutter Speed:	-----	-----
# of Frames:	-----	-----
% Overlap:	-----	-----
Quality:	Excellent	Fair
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.

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:

Channel	Wavelength, *µm*
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

Thermal Infrared Multispectral Scanner

The Thermal Infrared Multispectral Scanner (TIMS) is a multispectral scanning system using a dispersive grating and a six element mercury cadmium telluride detector array to produce six discrete channels in the 8.2 μm to 12.2 μm region.

Channel	Wavelength, μm	NET
1	8.2 - 8.6	< 0.3° C
2	8.6 - 9.0	< 0.3° C
3	9.0 - 9.4	< 0.3° C
4	9.4 - 10.2	< 0.3° C
5	10.2 - 11.2	< 0.3° C
6	11.2 - 12.2	< 0.3° C

Sensor/aircraft parameters are as follows:

IFOV:	2.5 mrad
Ground Resolution:	163 feet (50 meters) at 65,000 feet
Total Scan Angle:	76.56°
Swath Width:	16.9 nmi (31.3 km) at 65,000 feet
Pixels/Scan Line:	638
Scan Rate:	7.3 (scans/second)
Ground Speed:	400 kts. (206 m/second)

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. 94-013

Check Points	Frame Numbers	Time (GMT-hr, min, sec) START	Time (GMT-hr, min, sec) END	Altitude, MSL feet/meters	Cloud Cover/Remarks
Accession # 04651 Sensor # 026					
B - D	2218-2224	19:38:51	19:41:46	63000/19200	Clear
E - G	2225-2233	19:43:44	19:47:36	65000/19800	Clear; oblique (frames 2229-2230)
H - I	2234-2249	19:52:38	19:59:54	"	Clear
Accession # 04653 Sensor # 020					
A - C	0001-0014	19:37:24	19:39:36	63000/19200	Clear; soft focus (frames 0009-0010); step-wedge overprint (frames 0013-0014)
Accession # 04654 Sensor # 039					
A - C	0001-0012	19:36:45	19:38:34	63000/19200	Clear; soft focus (frames 0009-0010); step-wedge overprint (frames 0011-0012)

TIMS SCANNER FLIGHT LINE DATA

FLIGHT NO. 94-013

TIMS FLIGHT DATA
FLIGHT NUMBER: 94-013

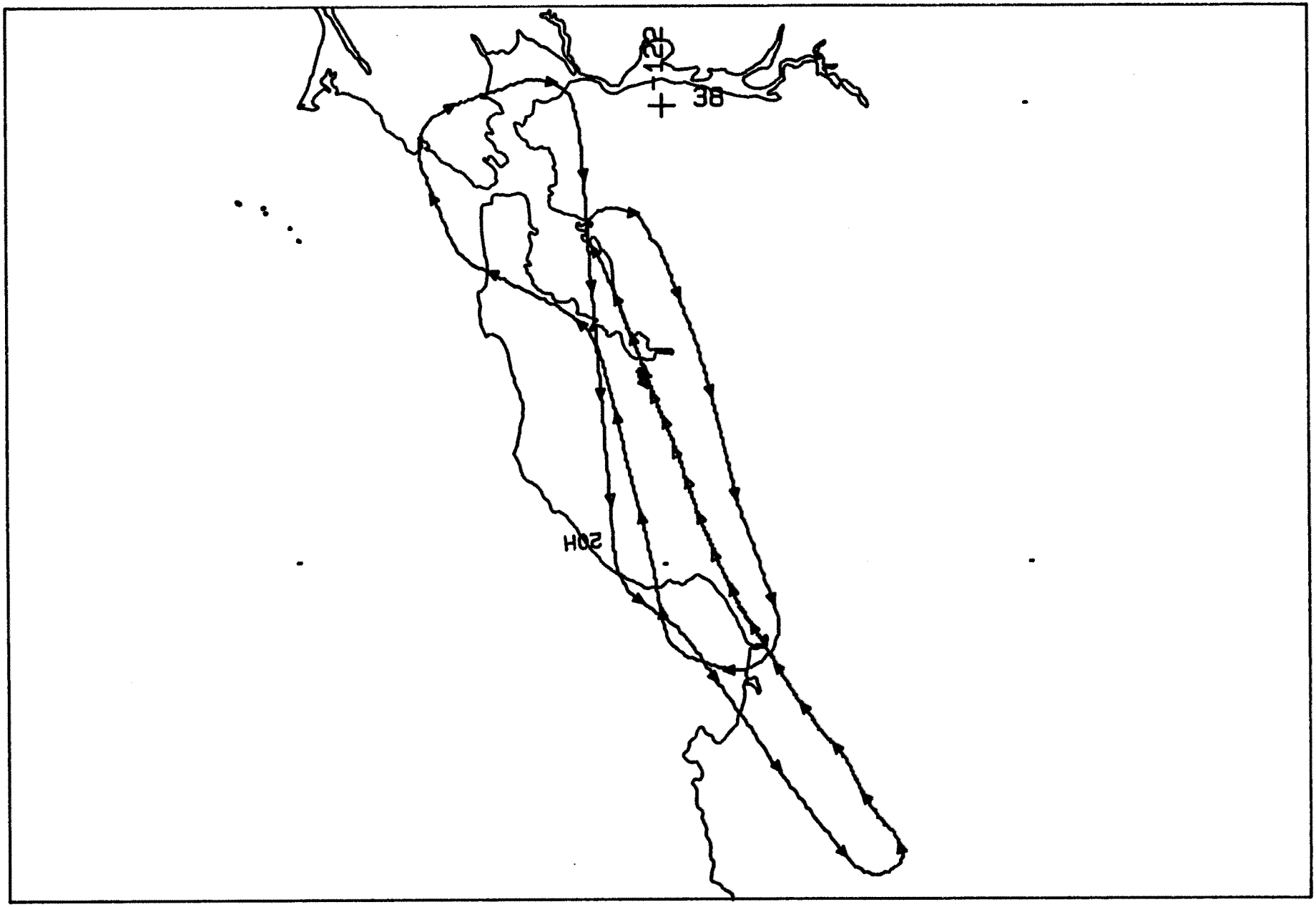
Check Points	Actual time (GMT) begin	Actual time (GMT) end	Actual scanline begin	Actual scanline end	Altitude feet/meter	Scan Speed (rps)	total Good scanlines	total Interpolated scanlines	total Repeated scanlines
A-D	17:36:41.0	19:41:58.0	19926	22244	65000/19812	7.30	2319	0	0
E-F	19:43:33.0	19:45: 8.0	22938	23633	65000/19812	7.30	696	0	0
F-G	17:16:11.0	17:17:50.0	24093	24671	65000/19812	7.30	579	0	0
H-I	19:52:31.0	20:00:26.0	26871	30343	65000/19812	7.30	3473	0	0

AOCI SCANNER FLIGHT LINE DATA

FLIGHT NO. 94-013

DAEDALUS FLIGHT DATA
FLIGHT NUMBER: 94-Ø13

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-D	19:36:41.Ø	19:41:58.Ø	17ØØ5	18985	65ØØØ/19812	6.25	1981	Ø	Ø
E-F	19:43:33.Ø	19:45: 8.Ø	19579	2Ø173	65ØØØ/19812	6.25	594	1	Ø
F-G	19:46:11.Ø	19:47:3Ø.Ø	2Ø569	21Ø64	65ØØØ/19812	6.25	496	Ø	Ø
H-I	19:52:31.Ø	2Ø:ØØ:26.Ø	22945	25915	65ØØØ/19812	6.25	2971	Ø	Ø



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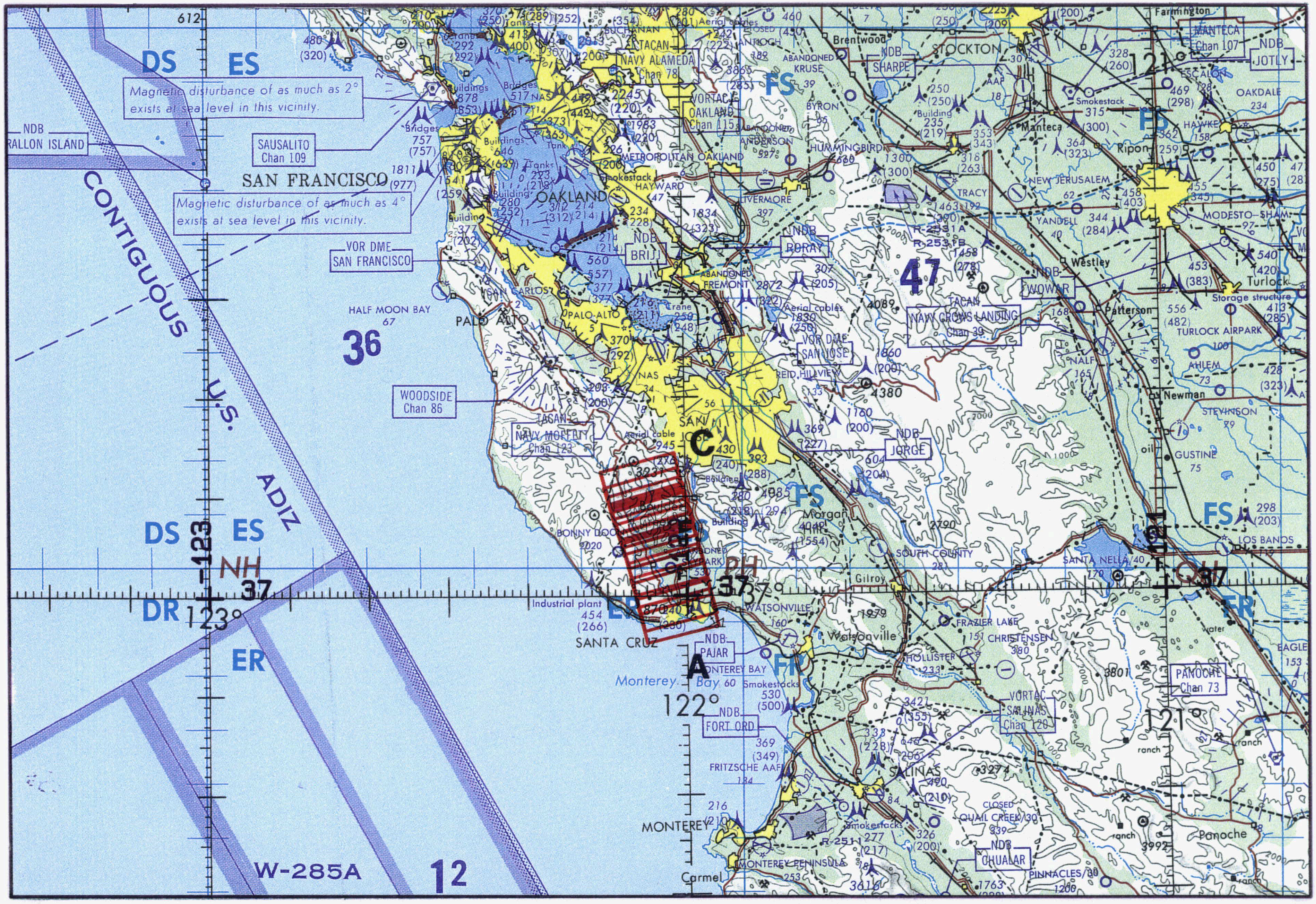
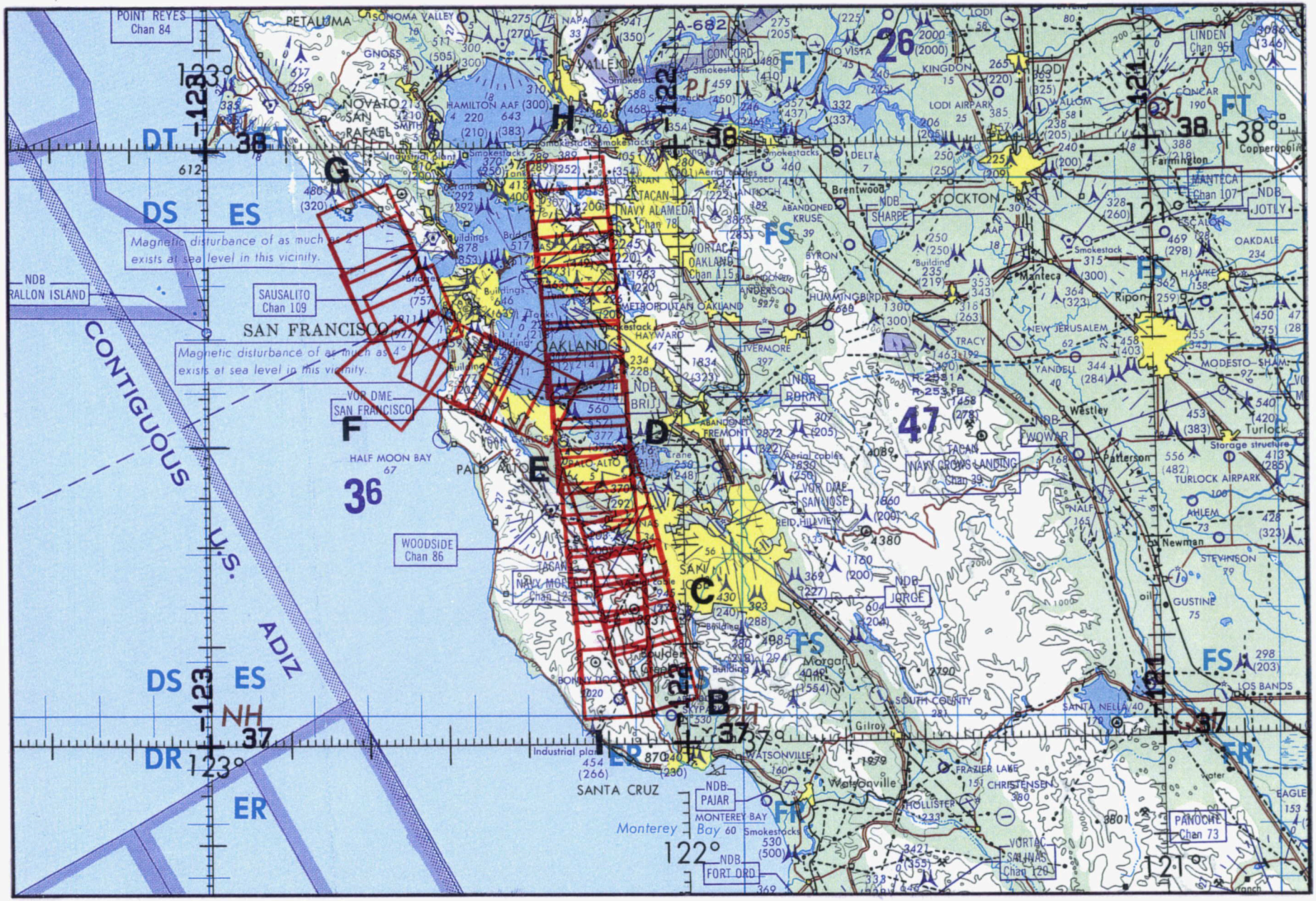


FLIGHT 94-013 23 NOVEMBER 1993 A/C 708 DUAL HR-732 ONC 6-18



FLIGHT 94-013 23 NOVEMBER 1993 A/C 708 RC-10 / AOCI / TIMS ONC G-18