

## FLIGHT SUMMARY REPORT

**Flight Number:** 04-943  
**Calendar/Julian Date:** 28 July 2004 (210)  
**Sensor Package:** Wild-Heerbrugg RC-30  
MODIS Airborne Simulator (MAS)  
Cirrus Digital Camera System (DCS)  
**Area(s) Covered:** Colorado River / Imperial Valley /  
San Luis Obispo County / Sonoma County  
**Investigator(s):** Penberth; California Dept of Conservation      **Aircraft Number:** 809

### SENSOR DATA

<b>Accession #:</b>	05806	—	05820
<b>Sensor ID #:</b>	126	108	154
<b>Sensor Type:</b>	RC-30	MAS	DCS
<b>Focal Length:</b>	153.21 mm 6"	—	50mm
<b>Film Type:</b>	Aerochrome IR SO-734	—	—
<b>Filtration:</b>	Wratten 12 +2.2AV	—	Wratten 12
<b>Spectral Band:</b>	510-900 nm	—	510-990nm
<b>f-Stop:</b>	8	—	—
<b>Shutter Speed:</b>	1/300	—	Variable
<b># of Frames:</b>	94	—	162
<b>% Overlap:</b>	60	—	60
<b>Quality:</b>	Excellent		Excellent
<b>Remarks:</b>	No Offset to UTC		

## **Suborbital Science Program**

The Suborbital Science Program at NASA's Dryden Flight Research Center, Edwards, California, operates two ER-2 high altitude aircraft in support of NASA earth science research. 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.

## **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
  
- Cirrus Digital Camera System (DCS)
  - Natural color or false color infrared
  - 4072 x 4072 pixel CCD array
  - 50mm lens provides area coverage of 8 x 8 nautical miles from 65,000 feet
  - 80mm lens provides area coverage of 5 x 5 nautical miles from 65,000 feet

## 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 16-bit channels of multispectral data and is configured as follows:

Spectral Channel	Band center (μm )	Bandwidth (μm )	Spectral Range
1	0.4649	0.0397	0.4451-0.4848
2	0.5494	0.0417	0.5285-0.5703
3	0.6550	0.0511	0.6294-0.6805
4	0.7024	0.0415	0.6816-0.7231
5	0.7431	0.0420	0.7221-0.7641
6	0.8248	0.0427	0.8034-0.8461
7	0.8667	0.0414	0.8460-0.8874
8	0.9072	0.0409	0.8867-0.9276
9	0.9476	0.0397	0.9277-0.9674
10	1.6422	0.0519	1.6163-1.6682
11	1.6975	0.0505	1.6722-1.7228
12	1.7499	0.0506	1.7245-1.7752
13	1.8014	0.0491	1.7768-1.8259
14	1.8548	0.0489	1.8303-1.8792
15	1.9044	0.0487	1.8801-1.9288
16	1.9553	0.0483	1.9312-1.9794
17	2.0048	0.0487	1.9804-2.0291
18	2.0551	0.0484	2.0309-2.0793
19	2.1037	0.0486	2.0794-2.1280
20	2.1532	0.0483	2.1291-2.1774
21	2.2019	0.0481	2.1779-2.2259
22	2.2522	0.0486	2.2278-2.2675
23	2.3021	0.0487	2.2777-2.3265
24	2.3512	0.0476	2.3274-2.3750
25	2.4005	0.0483	2.3764-2.4246

Spectral Channel	Band center (μm )	Bandwidth (μm )	Spectral Range
26	3.1192	0.1616	3.0384-3.2000
27	3.2809	0.1486	3.2066-3.3552
28	3.4330	0.1617	3.3521-3.5138
29	3.5940	0.1539	3.5170-3.6709
30	3.7449	0.1449	3.6724-3.8174
31	3.9069	0.1602	3.8267-3.9870
32	4.0707	0.1554	3.9929-4.1484
33	4.1699	0.0669	4.1365-4.2034
34	4.4029	0.1255	4.3401-4.4656
35	4.5404	0.1512	4.4648-4.6160
36	4.6979	0.1591	4.6184-4.7775
37	4.8536	0.1516	4.7778-4.9294
38	5.0033	0.1468	4.9298-5.0767
39	5.1588	0.1400	5.0888-5.2288
40	5.3075	0.1327	5.2412-5.3738
41	5.3977	0.0755	5.3590-5.4365
42	8.5366	0.3950	8.3391-8.7341
43	9.7224	0.5365	9.4541-9.9906
44	10.5071	0.4579	10.278-10.736
45	11.0119	0.4710	10.776-11.247
46	11.9863	0.4196	11.776-12.196
47	12.9013	0.3763	12.713-13.089
48	13.2702	0.4584	13.041-13.500
49	13.8075	0.5347	13.540-14.075
50	14.2395	0.3775	14.051-14.428

NOTE: Bandpass centers approximate

### 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 nmi (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.)

### **Data Availability**

The U.S. Geological Survey's EROS Data Center at Sioux Falls, South Dakota serves as the archive and product distribution facility for Airborne Science Program aircraft acquired photographic and digital imagery. The photographic archive consists of photography acquired by the program from 1971 to April 1996. 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).

As of April 1996 the EROS Data Center no longer receives an archive copy of newly acquired Airborne Science Program photography. Original photography is archived with the Airborne Sensor Facility at Ames Research Center. A user copy of the photography is provided to the principal investigators for each flight. Principal investigators are cited on the first page of their respective flight summary reports. For information regarding photography acquired from April 1996 to the present contact the Airborne Sensor Facility as follows:

### **Flight Documentation and Data Archive Searches**

The following is the web site for flight documentation as published by the Airborne Sensor Facility at NASA Ames Research Center: <http://asapdata.arc.nasa.gov/er-2fsr.html>

Additional information regarding flight documentation to include data archive searches, data availability, sensor parameters, and areas of coverage may be obtained from the following:  
Airborne Sensor Facility, MS 240-6, NASA Ames Research Center, Moffett Field, CA 94035-1000, Telephone: 650.604.6252 (FAX 4987).

**CAMERA FLIGHT LINE DATA  
FLIGHT NO. 04-943**

Accession # 05806

Sensor # 126

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	1140-1153	17:39:13	17:51:32	65300/19910	clear
C - D	1154-1163	17:57:53	18:06:21	65200/19880	clear; (frame 1154 oblique)
E - F	1164-1177	18:50:34	19:02:39	65200/19880	minor - 30% stratus frames 1164-1167; (frame 1164 oblique)
G - H	1178-1190	19:06:23	19:17:34	65300/19910	minor - 40% stratus frames 1187-1190; (frame 1178 oblique)
I - J	1191-1201	19:22:34	19:31:53	64900/19790	10 - 50% stratus frames 1191-1194
K - L	1202-1207	19:35:17	19:39:56	65100/19850	minor cumulus frame 1207
M - N	1208-1214	20:13:53	20:19:27	65600/20000	30 - 90% stratus
O - P	1215-1224	20:24:21	20:32:43	65300/19910	20 - 90% stratus frames 1222-1224; (frames 1215 and 1224 oblique)
Q - R	1225-1233	21:08:00	21:15:25	65200/19880	frame 1225 oblique with 10% cumulus

MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 28 Jul 2004  
 NASA FLIGHT NUMBER 04-943

START OF FLIGHT LINE						END OF FLIGHT LINE					FLIGHT DATA		
FLTL	TIME	LAT	LON	SOLAR		TIME	LAT	LON	SOLAR		SCAN LINES	HEAD DEG	ALT M (MSL)
	HH:MM:SS	DEG	DEG	ZEN	AZIM		HH:MM:SS	DEG	DEG	ZEN			
1	17:26:38	34.142	-116.356	35.7	106.1	17:33:08	33.433	-116.166	34.1	106.7	2430	165.9	18795
2	17:33:26	33.400	-116.163	34.0	106.7	17:35:50	33.130	-116.189	33.5	106.9	897	183.3	19474
3	17:39:46	32.808	-116.059	32.5	107.4	17:52:21	32.800	-114.447	28.7	112.3	4703	90.2	19839
4	17:58:15	33.333	-114.735	28.0	114.6	18:06:27	34.199	-114.385	26.6	119.2	3062	20.9	19848
5	18:08:11	34.351	-114.497	26.5	119.9	18:34:58	34.795	-118.253	24.7	125.1	9999	278.9	19862
6	18:34:58	34.796	-118.254	24.7	125.1	18:42:07	34.894	-119.254	24.2	126.5	2672	277.3	19922
7	18:42:20	34.894	-119.285	24.2	126.6	18:49:52	34.812	-120.352	23.6	127.8	2812	264.3	19872
8	18:51:22	34.917	-120.472	23.5	128.4	19:03:49	36.309	-120.467	22.6	136.7	4648	2.4	19840
9	19:06:23	36.350	-120.724	22.4	137.5	19:18:13	34.997	-120.717	19.8	141.7	4418	178.5	19877
10	19:20:42	35.005	-120.949	19.6	142.7	19:32:45	36.347	-120.949	19.4	152.3	4497	359.5	19815
11	19:35:10	36.359	-121.189	19.3	153.3	19:40:34	35.744	-121.182	18.3	156.2	2014	177.7	19812
12	19:45:31	35.941	-121.645	18.2	158.7	20:05:48	37.973	-123.017	19.4	170.8	7573	331.8	19866
13	20:06:02	37.994	-123.035	19.4	171.0	20:09:01	38.250	-123.330	19.6	172.3	1116	317.7	19830
14	20:09:05	38.256	-123.336	19.6	172.4	20:11:42	38.493	-123.581	19.8	173.6	979	319.8	19841
15	20:12:38	38.591	-123.627	19.9	174.1	20:19:55	39.411	-123.634	20.7	179.2	2717	357.0	19958
16	20:24:22	39.342	-123.129	20.6	183.5	20:32:23	38.436	-123.135	19.9	189.3	2995	179.2	19846
17	20:33:36	38.323	-123.054	19.8	190.4	20:37:03	38.169	-122.615	19.9	194.0	1291	114.9	19730
18	20:37:12	38.162	-122.596	19.9	194.2	20:59:14	37.053	-119.863	21.7	216.1	8226	118.2	19784
19	20:59:26	37.044	-119.838	21.7	216.3	21:06:43	36.799	-118.874	23.0	222.5	2724	105.9	19918
20	21:08:04	36.681	-118.771	23.1	223.6	21:15:11	35.861	-118.765	23.6	228.3	2655	177.2	19804

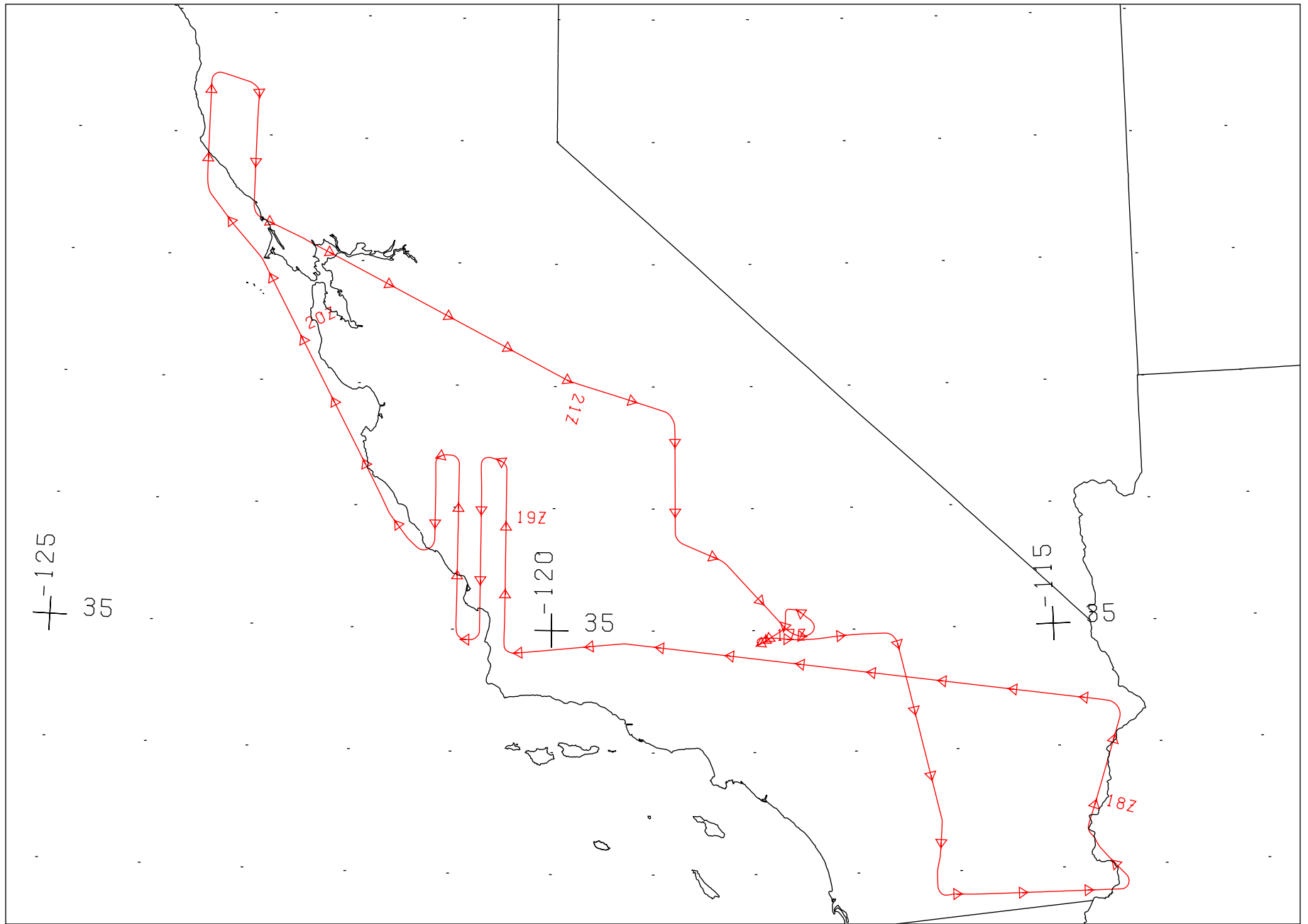
NUMBER OF FILES FOR THIS FLIGHT = 20  
 TOTAL NUMBER OF SCAN LINES = 72428  
 DATE THESE FILES WERE PROCESSED = 29-Nov-2004  
 DATE THIS LIST WAS CREATED = Tue Nov 30 15:09:47 PST 2004  
 GRANULE VERSION = 1

**CAMERA FLIGHT LINE DATA**  
**FLIGHT NO. 04-943**

Accession # 05820

Sensor # 154

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, GPS feet/meters	Flight Direction / Heading
		START	END		
A - B	1906-1931	17:39:36	17:51:57	66600/20300	91° ; east
C - D	1932-1948	17:58:17	18:06:12	66500/20270	21° ; northeast
E - F	1949-1973	18:50:57	19:02:52	66600/20300	2° ; north - frame 1974 does not exist
G - H	1975-1995	19:07:17	19:18:12	66600/20300	178° ; south
I - J	1996-2014	19:22:58	19:31:54	66200/20180	3° ; north
K - L	2015-2024	19:35:41	19:40:09	66400/20240	178° ; south
M - N	2025-2035	20:14:17	20:19:15	67000/20430	1° ; north
O - P	2036-2053	20:24:45	20:33:12	66600/20300	179° ; south
Q - R	2054-2068	21:08:24	21:15:21	66500/20270	178° ; south



FLIGHT 04-943

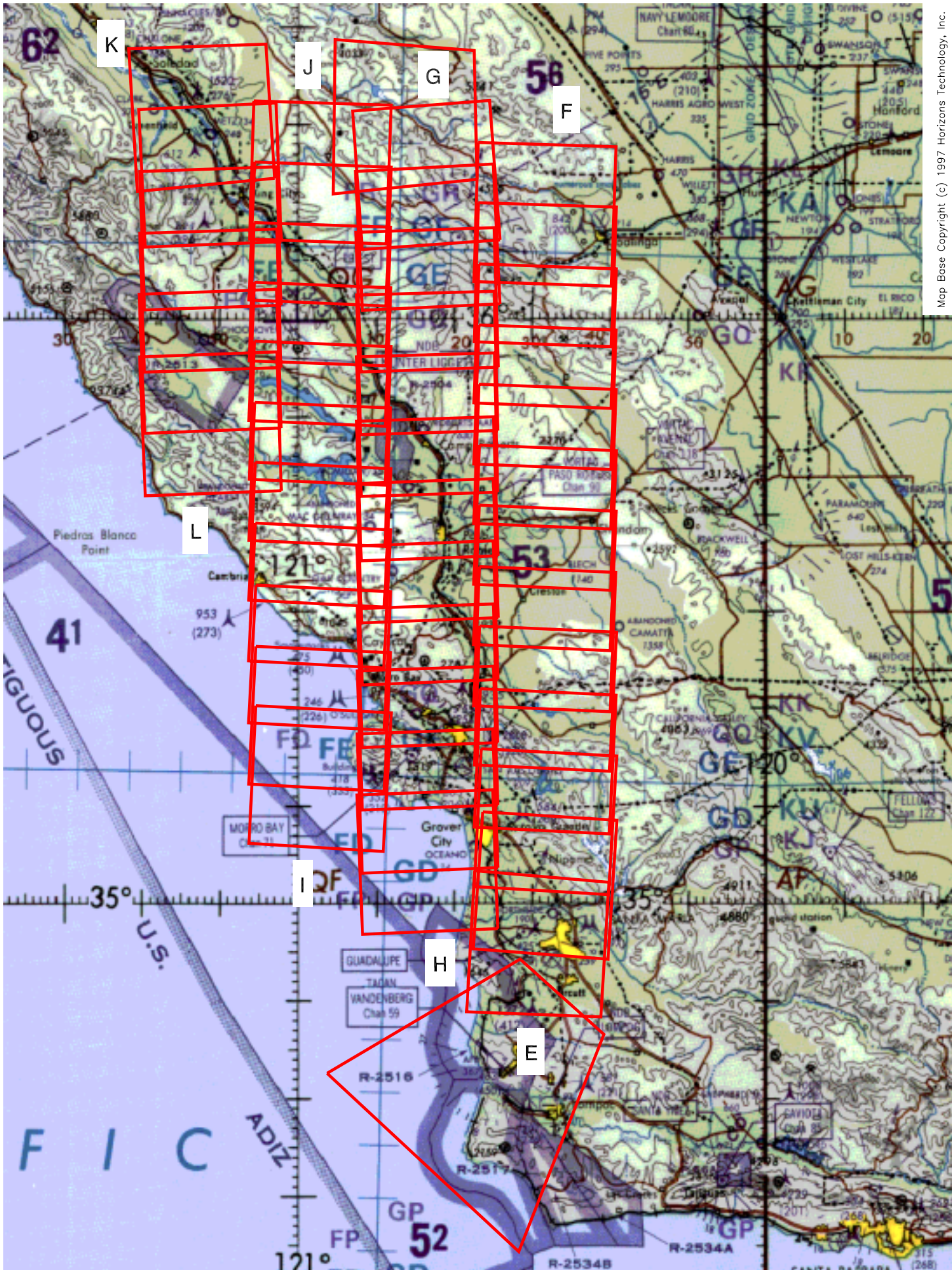
28 JULY 2004

A/C 809

MAS / RC-30







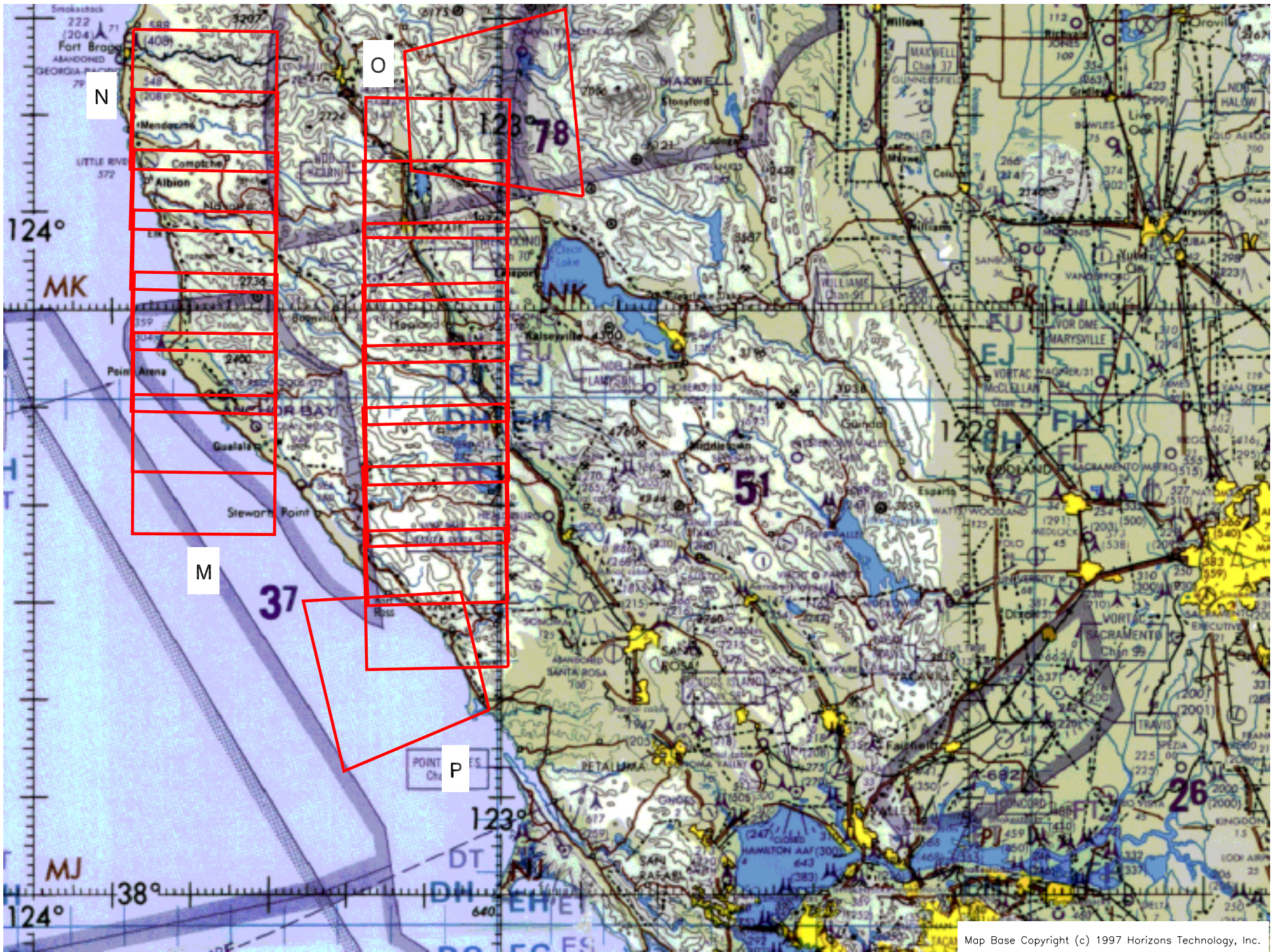
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Flight 04-943



Flight 04-943

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