

FLIGHT SUMMARY REPORT

Flight #: 92-062
Date: 17 February 1992
Sensor Package: Stormfest Instrument Package
 Wild-Heerbrug RC-10
 Modis-N Airborne Simulator (MAS)
 Advanced Microwave Precipitation Radiometer (AMPR)
 Lightning Instrument Package (LIP)
 Microwave Thermal Sampler (MTS)
 High-Resolution Interferometer Sounder (HIS)

Area(s) Covered: Texas, Oklahoma, Arkansas, Mississippi, Tennessee,
 Kentucky, Missouri, Kansas, and Louisiana

Investigator(s): Heymsfield, NASA-GSFC **Aircraft #:** 706
Flight Request: 2P22029 **Julian Date:** 048

SENSOR DATA

| | | | | | | |
|-----------------------|--|------|------|------|------|------|
| Accession #: | 04377 | ---- | ---- | ---- | ---- | ---- |
| Sensor ID #: | 036 | 108 | 105 | 106 | 110 | 083 |
| Sensor Type: | RC-10 | MAS | AMPR | LIP | MTS | HIS |
| Focal Length: | 6" 153.19 mm | ---- | ---- | ---- | ---- | ---- |
| Film Type: | Panatomic-X Aerographic II, 2412 | ---- | ---- | ---- | ---- | ---- |
| Filtration: | 2.2 AV + Wratten 12 | ---- | ---- | ---- | ---- | ---- |
| Spectral Band: | 510-700 nm | ---- | ---- | ---- | ---- | ---- |
| f Stop: | 5.6 | ---- | ---- | ---- | ---- | ---- |
| Shutter Speed: | 1/300 | ---- | ---- | ---- | ---- | ---- |
| # of Frames: | 133 | ---- | ---- | ---- | ---- | ---- |
| % Overlap: | 60 | ---- | ---- | ---- | ---- | ---- |
| Quality: | Fair | Good | ---- | ---- | ---- | ---- |
| Remarks: | Photography under-exposed due to late data acquisition | | | | | |

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 sensors and camera system(s) used for data collection during this flight.

Modis-N Airborne Simulator

The Modis-N Airborne Simulator (MAS) is a modified Daedalus multispectral scanner. It records up to 12 8-bit channels, which can be selected from an array of 50 available spectral bands. The band selection is made prior to flight and the instrument is hard-wired to that configuration. Channel one can be used to store additional bits which provide 10-bit resolution for channels 9 through 12. The band configuration for the Stormfest deployment is as follows:

| <u>Channel</u> | <u>Band edges μm</u> |
|----------------|--|
| 1 | ----- |
| 2 | 0.675 - 0.685 |
| 3 | 1.605 - 1.655 |
| 4 | 1.955 - 2.005 |
| 5 | 3.675 - 3.825 |
| 6 | 4.325 - 4.575 |
| 7 | 4.575 - 4.725 |
| 8 | 9.000 - 9.400 |
| 9* | 9.400 - 9.800 |
| 10* | 9.800 - 10.200 |
| 11* | 10.700 - 11.200 |
| 12* | 12.200 - 12.700 |

* 10-bit resolution

Sensor/Aircraft Parameters:

| | |
|--------------------|-------------------------------------|
| Spectral Channels: | 50 |
| Output Channels: | 7 8-bit and 4 10-bit |
| I FOV: | 0.5 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.) |

Advanced Microwave Precipitation Radiometer

The Advanced Microwave Precipitation Radiometer (AMPR) is a scanning passive microwave radiometer operating at frequencies of 10, 19, 37, and 85 GHz. The AMPR is configured to fit into the Q-bay of the ER-2 and scans cross-track +/- 45° to the left and right of nadir. The instrument's principle use is for gathering microwave image data of cloud water and precipitation primarily over the ocean. Some data collected also will be used for studies of vegetation, ground moisture, sea surface state, and snow cover. The AMPR is sponsored by Dr. Roy W. Spencer, NASA-MSFC, ES43, Huntsville, Alabama 35812, FTS 824-1686.

Lightning Instrument Package

The Lightning Instrument Package (LIP) comprises a set of optical and electrical sensors with a wide range of temporal, spatial, and spectral resolution to observe lightning and investigate electrical environments within and above thunderstorms. The instruments provide measurements of the air conductivity and vertical electric field above thunderstorms and provide estimates of the storm electric currents. In addition, LIP will detect total storm lightning and differentiate between intracloud and cloud-to-ground discharges. This data will be used in studies of lightning/storm structure and lightning precipitation relationships. The LIP is sponsored by Dr. Richard Blakeslee, NASA-MSFC, ES43, Huntsville, Alabama 35812, FTS 824-1651.

MIT Millimeter-wave Temperature Sounder

The Millimeter-wave Temperature Sounder (MTS) is a dual-band microwave radiometer system for the measurement of atmospheric temperature and other phenomena affecting transmission in the microwave absorption bands of molecular oxygen. MTS data has been used to produce images of temperature and precipitation structure, to infer precipitation cell top altitudes and to detect atmospheric waves.

The instrument is capable of either downward- or upward-viewing operation on the ER-2 as well as ground-based operation. One radiometer is an eight channel scanning spectrometer with its radiometer centered on the 118,75 GHz oxygen line. The second radiometer is a single-channel (Ch. 0) nadir (or zenith) viewing system with its local oscillator tunable under computer control from 52 th 54 GHz. Characteristics of the two radiometers are as follows:

| Channel | Center freq. (MHz) | Width (MHz) |
|---------|----------------------------------|-------------|
| | <u>Single Channel Radiometer</u> | |
| 0 | 115 | 170 |
| Channel | Center freq. (MHz) | Width (MHz) |
| | <u>Eight Channel Radiometer</u> | |
| 1 | 660 | 170 |
| 2 | 840 | 210 |
| 3 | 1040 | 240 |
| 4 | 1260 | 220 |

| | | |
|---|------|-----|
| 5 | 1470 | 240 |
| 6 | 1670 | 220 |
| 7 | 1900 | 270 |
| 8 | 500 | 125 |

For further information contact Michael Schwarz, Massachusetts Institute of Technology, MIT-RLE Mail Stop 26-357, 77 Massachusetts Ave., Cambridge, MA 02139.

High-Resolution Interferometer Sounder

The High-Resolution Interferometer Sounder (HIS) measures upwelling infrared spectral radiance at the aircraft altitude with high absolute accuracy using a passive Michelson interferometer and precision onboard blackbody calibration sources. The instrument has a single nadir staring field of view with observed spectra obtained every six seconds. The spectra cover the range 16.6 microns to 3.3 microns with a spectral resolution of 0.3 to 0.5 cm^{-1} . The primary use of the instrument is as an atmospheric sounder of temperature and water vapor. The spectra also contain important information on trace gases and surface properties. The HIS was developed by the University of Wisconsin at Madison and is a prototype instrument for advanced infrared satellite sounders.

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. 92-062**

Accession # 04377

Sensor # 036

| Check Points | Frame Numbers | Time (GMT-hr, min, sec) | | Altitude, MSL feet/meters | Cloud Cover/Remarks |
|--------------|---------------|-------------------------|----------|---------------------------|--|
| | | START | END | | |
| A - B | 9788-9846 | 21:25:08 | 22:20:36 | 65000/19800 | 60-10% strato-cumulus and cumulus (frames 9788-9796); 10% cirrus (frames 9807-9812); 10-100% cirrus (frames 9873-9841) 10-100% cirrus transitioning to cumulus (frames 9842-9846) |
| B | 9847-9848 | 22:21:33 | 22:22:30 | " | Oblique frames in turn; 10-100% cirrus transitioning to cumulus (frames 9847-9848) |
| B - C | 9849-9852 | 22:23:37 | 22:26:17 | " | 10-100% cirrus transitioning to cumulus (frames 9849-9852) |
| C | 9853 | 22:27:14 | ----- | " | 10-100% cirrus transitioning to cumulus |
| C - D | 9854-9920 | 22:28:11 | 23:30:13 | " | 10-100% cirrus transitioning to cumulus (frames 9854-9859); extremely thin photography beyond frame 9868 due to waning solar illumination |

NOTE: REMAINING PHOTOGRAPHY ON ROLL WITHOUT IMAGE DUE TO LACK OF LIGHT (AFTER SUNSET) AND NOT KEPT.

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FLIGHT NO. 92-063

Accession # 04378

Sensor # 036

| Check Points | Frame Numbers | Time (GMT-hr, min, sec) | | Altitude, MSL feet/meters | Cloud Cover/Remarks |
|--------------|---------------|-------------------------|----------|---------------------------|--|
| | | START | END | | |
| A - B | 0006-0048 | 19:08:17 | 19:47:44 | 65000/19800 | 100% cloud cover |
| B - C | 0049-0052 | 19:48:40 | 19:51:29 | " | 100% cloud cover; oblique frames in turn |
| C - D | 0053-0055 | 19:52:25 | 19:54:17 | " | 100% cloud cover |
| D | 0056 | 19:55:13 | ----- | " | 100% cloud cover; oblique frame in turn |
| D - E | 0057-0058 | 19:56:10 | 19:57:06 | " | 100% cloud cover |
| E | 0059 | 19:58:02 | ----- | " | 100% cloud cover; oblique frame in turn |
| E - F | 0060-0073 | 19:58:58 | 20:11:07 | " | 100% cloud cover |
| F - G | 0074-0077 | 20:12:03 | 20:14:51 | " | 100% cloud cover; oblique frames in turn |
| G - H | 0078-0089 | 20:15:47 | 20:26:03 | " | 100% cloud cover |
| H | 0090 | 20:26:59 | ----- | " | 100% cloud cover; oblique frame in turn |
| H - B | 0091-0093 | 20:27:55 | 20:29:47 | " | 100% cloud cover |

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FLIGHT NO. 92-063**

Accession # 04378

Sensor # 036

| Check Points | Frame Numbers | Time (GMT-hr, min, sec) | | Altitude, MSL feet/meters | Cloud Cover/Remarks |
|--------------|---------------|-------------------------|----------|---------------------------|--|
| | | START | END | | |
| B | 0094-0095 | 20:30:43 | 20:31:39 | 65000/19800 | 100% cloud cover; oblique frame in turn |
| B - I | 0096 | 20:32:35 | ----- | " | 100% cloud cover |
| I | 0097-0098 | 20:33:31 | 20:34:27 | " | 100% cloud cover; oblique frames in turn |
| I - J | 0099-0105 | 20:35:23 | 20:40:58 | " | 100% cloud cover |
| J | 0106 | 20:41:54 | ----- | " | 100% cloud cover; oblique frame in turn |
| J - K | 0107-0111 | 20:42:50 | 20:46:34 | " | 100% cloud cover |
| K - C | 0112-0116 | 20:47:30 | 20:51:14 | " | 100% cloud cover |
| C - E | 0117-0120 | 20:52:10 | 20:54:57 | " | 100% cloud cover |
| E | 0121-0122 | 20:55:53 | 20:56:49 | " | 100% cloud cover; oblique frames in turn |
| E - L | 0123-0129 | 20:57:45 | 21:03:20 | " | 100% cloud cover |
| L - A | 0130-0161 | 21:04:16 | 21:33:07 | " | 100% cloud cover |

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Sensor # 036

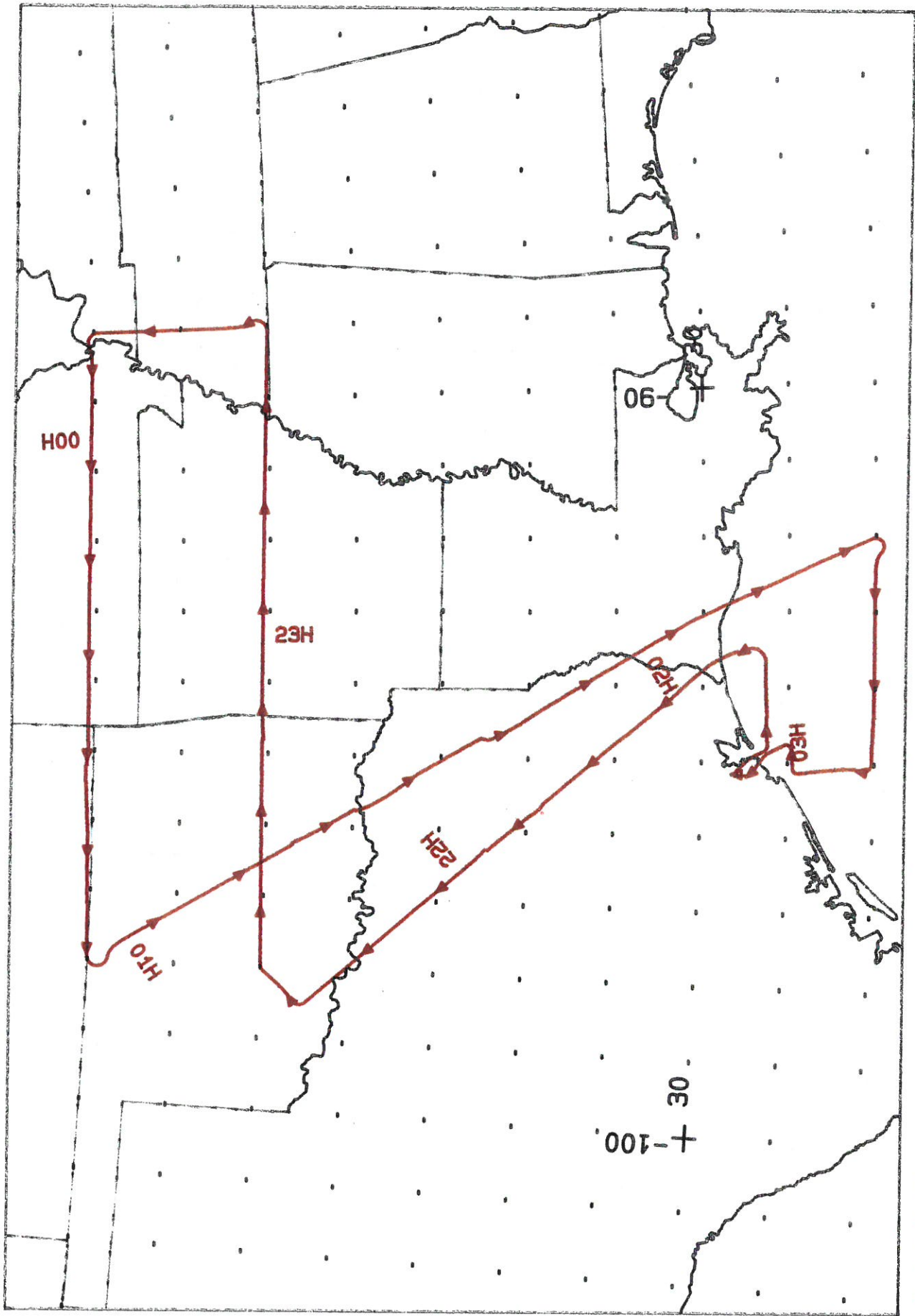
| Check Points | Frame Numbers | Time (GMT-hr, min, sec) | | Altitude, MSL feet/meters | Cloud Cover/Remarks |
|--------------|---------------|-------------------------|----------|------------------------------|--|
| | | START | END | | |
| A | 0162 | 21:34:03 | ----- | 65000/19800 | 100% cloud cover; oblique frame in turn |
| A - M | 0163-0169 | 21:34:59 | 21:40:34 | " | 100% cloud cover |
| M | 0170-0171 | 21:41:29 | 21:42:25 | " | 100% cloud cover |
| M - N | 0172-0191 | 21:43:21 | 22:01:01 | " | 100% cloud cover except 40-90% cloud cover (frames 0174-0179) |
| O - P | 0192-0209 | 22:10:01 | 22:25:46 | " | 100% cloud cover |

MAS SCANNER FLIGHT LINE DATA

FLIGHT NO. 92-062

DAEDALUS FLIGHT DATA
FLIGHT NUMBER: 92-062

| Check Points | A c t u a l t i m e b e g i n 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 | S c a n 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 |
|--------------|---|---|--|-----------------------------------|---|---|---|
| A-a | 21:31: 5.0 21:49:35.0 | 12109 19015 | 65000/19812 | 6.25 | 6901 | 0 | 6 |
| a-B | 21:50:23.0 22:21:29.0 | 19315 30927 | 65000/19812 | 6.25 | 11601 | 0 | 12 |
| B-C | 22:24:26.0 22:26:51.0 | 32029 32929 | 65000/19812 | 6.25 | 901 | 0 | 0 |
| C-c | 22:28:44.0 23:08:42.0 | 33629 48553 | 65000/19812 | 6.25 | 14901 | 0 | 24 |
| c-D | 23:08:42.0 23:30:25.0 | 48554 56663 | 65000/19812 | 6.25 | 8100 | 0 | 10 |
| D-E | 23:36: 5.0 23:48:42.0 | 58777 63487 | 65000/19812 | 6.25 | 4701 | 0 | 10 |
| E-F | 23:54: 3.0 00:24:38.0 | 65489 76907 | 65000/19812 | 6.25 | 11401 | 0 | 18 |
| F-G | 00:24:38.0 00:54:23.0 | 76908 88017 | 65000/19812 | 6.25 | 11100 | 0 | 10 |
| G-H | 01:01:21.0 01:19:51.0 | 90619 97523 | 65000/19812 | 6.25 | 6901 | 0 | 4 |
| H-I | 01:20:23.0 01:45:37.0 | 97723 107143 | 65000/19812 | 6.25 | 9401 | 0 | 20 |
| I-J | 01:46: 9.0 02:26:36.0 | 107343 122453 | 65000/19812 | 6.25 | 15101 | 0 | 10 |

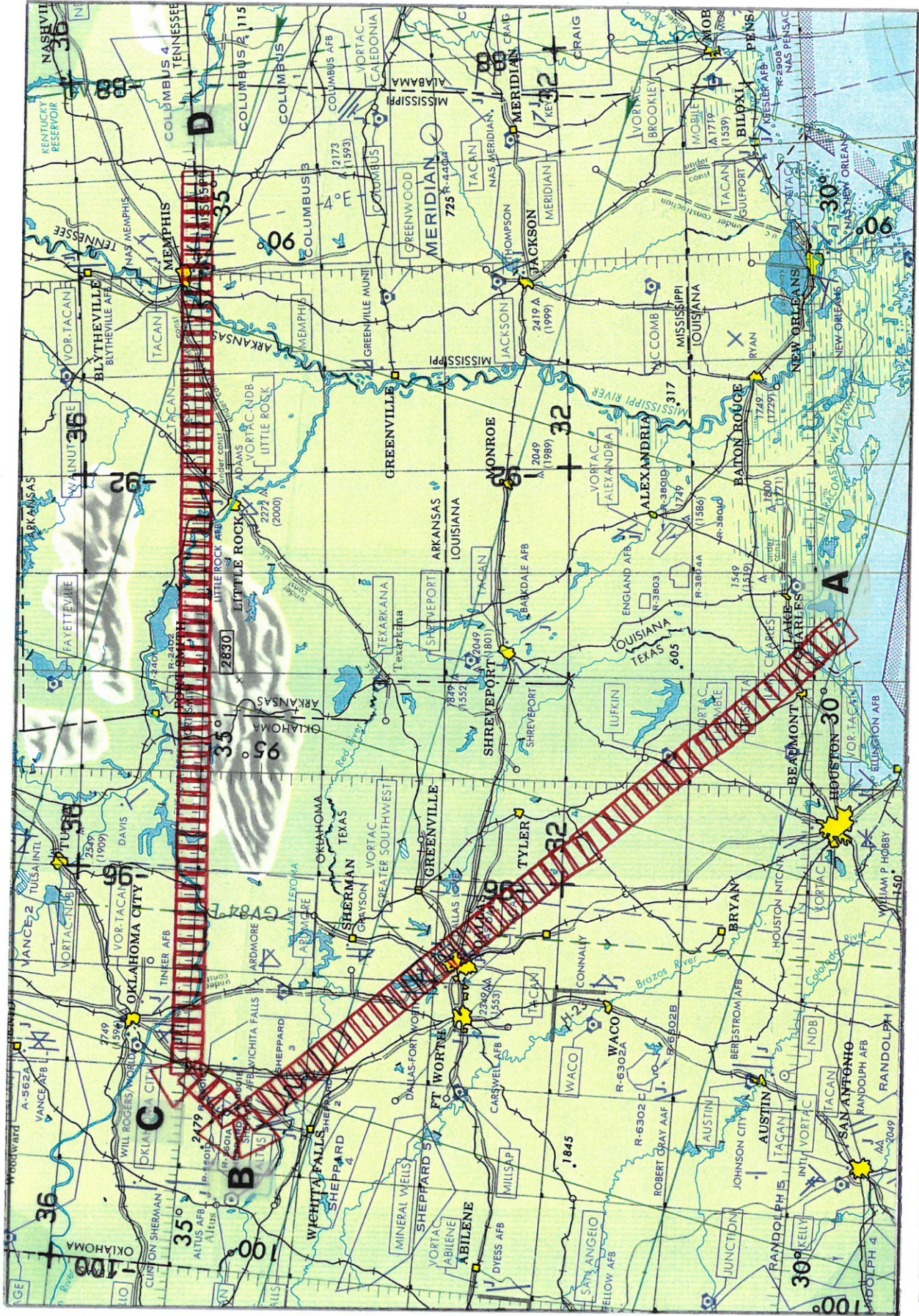


FLIGHT 92-062

17 February 1992

A/C 706

Stormfist Flight



FLIGHT 92-062 17 February 1992 A/C 706 RC-10 (2412) Accession # 04377 GNC 2

