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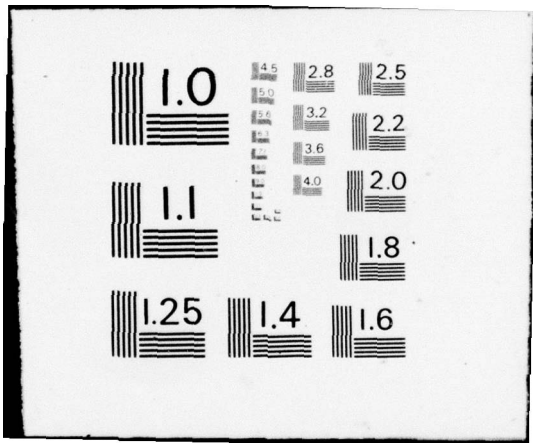
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AFGL-TR-76-0228

# SOUNDING ROCKET AND BALLOON SYSTEMS SUPPORT

by

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Final Report

May 1973 - July 1976

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The work performed under this contract consisted of the following; integrate, calibrate, and test, GFE range safety radar tracking beacon and parachute recovery systems; design and develop special devices as required; operate and maintain GFE telemetry station to support telemetry operations at WSMR, New Mexico; and calibrate equipment and perform analyses for air sampling balloon flights conducted at Holloman AFB, New Mexico.

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## 1.0 SCOPE OF WORK

The Physical Science Laboratory, New Mexico State University shall provide the necessary personnel, facilities and materials to operate, provide engineering assistance, and install flight and ground equipment in support of rocket flights at WSMR, New Mexico, and calibrate equipment and perform analyses for air sampling balloon flights at Holloman AFB, New Mexico, in accordance with the following:

1.1 Integrate GFE range safety systems into thirty (30) Government-owned sounding rockets. Calibrate and test systems, as part of pre-launch test procedures.

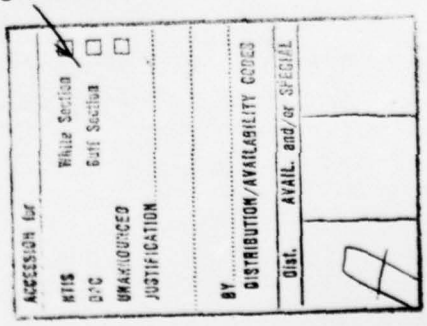
1.2 Integrate GFE radar tracking beacon systems into thirty (30) Government-owned sounding rockets. Conduct tests of tracking beacon as part of pre-launch tests.

1.3 Integrate GFE parachute recovery systems into thirty (30) Government-owned sounding rockets. Prepare all interconnecting and control circuitry. Conduct tests of recovery systems as part of prelaunch tests.

1.4 Design and fabricate special devices as required, to be used on the thirty (30) Government-owned sounding rockets, as part of the total integration of the rocket payloads.

1.5 Operate and maintain a portable telemetry station with GFE accountable under Facilities Contract F19628-71-C-0169, to support all prelaunch rocket payload tests, and to assist in the recovery of telemetry data during launch operations. Telemetry operations to be conducted at White Sands Missile Range, New Mexico unless rockets are re-scheduled to other launch facilities.

1.6 Calibrate GFE air samplers for ten (10) balloon flights in accordance with a handbook of instructions furnished by the government.



1.7 Analyze pre-flight and post-flight data and meteorological parameters to determine air flow rates, balloon trajectories and ambient atmospheric conditions.

1.8 Reports are required hereunder and shall be prepared in accordance with the "Outline of Reporting Procedures for Air Force Cambridge Research Laboratories Contractors."

## 2.0 TECHNICAL PROGRESS

### 2.1 Rocket Launches Supported During the Contract Period

| Launch Date | Launch No. | Vehicle Type | TM System | Launch Station |
|---|---|---|---|---|
| 8/10/73 | A03.211-1 | Aerobee 150 | FM/FM | WSMR |
| 9/11/73 | A09.214-1 | Ute-Tomahawk | FM/FM/PCM | WSMR |
| 10/3/73 | A03.311-1 | Astrobee "D" | FM/FM | WSMR |
| 10/3/73 | A03.311-2 | Astrobee "D" | FM/FM | WSMR |
| 10/3/73 | A03.311-3 | Astrobee "D" | FM/FM | WSMR |
| 11/2/73 | A04.104-2 | Aerobee 170 | FM/FM/PCM | WSMR |
| 2/16/74 | A35.191-2 | Aerobee 350 | PCM/FM | WSMR |
| 2/16/74 | A09.400-1 | Ute-Tomahawk | FM/FM | WSMR |
| 4/23/74 | A04.208-2 | Aerobee 170 | FM/FM/PCM | WSMR |
| 6/29/74 | A04.028-1 | Aerobee 170 | Wiring Support Only | Wallops |
| 8/16/74 | A09.214-2 | Ute-Tomahawk | FM/FM/ PAM/PCM | WSMR |
| 9/4/74 | A05.391-1 | Aerobee 200 | PCM/FM | Australia |
| 9/11/74 | A05.391-2 | Aerobee 200 | PCM/FM | Australia |
| 9/17/74 | A05.391-3 | Aerobee 200 | PCM/FM | Australia |
| 10/17/74 | AF4.0400 | Nike-Hidak | FM/FM | WSMR (Sulf Site) |
| 12/13/74 | A09.407-1 | Ute-Tomahawk | FM/FM FM/FM | WSMR |
| 6/10/75 | A03.103-1 | Aerobee 150 | FM/FM/PCM | WSMR |
| 8/6/75 | A04.308-1 | Aerobee 170 | PCM/FM | WSMR |
| 9/18/75 | A010.304-1 | Paiute-Tomahawk | FM/FM | WSMR |

| Launch Date | Launch No. | Vehicle Type | TM System | Launch Station |
|---|---|---|---|---|
| 9/18/75 | A010.304-2 | Paiute-Tomahawk | FM/FM | WSMR |
| 10/14/75 | A031.320-2 | Astrobee "F" | FM/FM | WSMR |
| 10/16/75 | A010.000-2 | Paiute-Tomahawk | FM/FM | WSMR |
| 12/2/75 | A30.311-8 | Astrobee "D" | FM/FM | WSMR |
| 12/2/75 | A30.311-5 | Astrobee "D" | FM/FM | WSMR |
| 12/2/75 | A30.311-7 | Astrobee "D" | FM/FM | WSMR |
| 12/2/75 | A30.413-5 | Astrobee "D" | FM/FM | WSMR |
| 12/2/75 | A30.205-7 | Astrobee "D" | FM/FM | WSMR |
| 12/2/75 | A30.413-4 | Astrobee "D" | FM/FM | WSMR |
| 12/3/75 | A35.191-1 | Aerobee 350 | PCM/FM | WSMR |
| 2/24/76 | A04.305-1 | Aerobee 170 | PCM/PAM/ FM/FM | WSMR |
| 5/18/76 | A03.410-1 | Aerobee 150 | FM/FM/PCM | WSMR |

## 2.2 Balloon Flights Supported During the Contract Period

| Date | Flight No. | Project | Location | Bln Size ($\times 10^6 ft^3$) | Alt (Kft) |
|---|---|---|---|---|---|
| 10/9/75 | H75-41 | Gamma Ray | Holloman NM | 26.600 | 128 |
| 10/15/75 | H75-42/H-69 | Ash Can | Holloman NM | 0.803 | 70 |
| 10/20/75 | H75-43/H-70 | Ash Can | Holloman NM | 0.803 | 80 |
| 10/29/75 | H75-44/H-71 | Ash Can | Holloman NM | 0.859 | 90 |
| 10/31/75 | H75-45/H-72X | Ash Can | Holloman NM | 0.127 | 60 |
| 11/5/75 | H75-46/H-73 | Ash Can | Holloman NM | 0.274 | 70 |
| 11/7/75 | H75-47/H-74 | Ash Can | Holloman NM | 0.516 | 80 |
| 11/14/75 | H75-49/H-75 | Ash Can | Holloman NM | 0.028 | 5 |
| 12/2/75 | H75-54/H-76X | Ash Can | Holloman NM | 0.127 | 60 |
| 2/8/76 | H76-5/H-77X | Ash Can | Holloman NM | 0.450 | 90 |
| 2/12/76 | H76-6 | 6687 | Holloman NM | 0.074 | 50 |
| 2/13/76 | H76-7/H-78X | Ash Can | Holloman NM | 1.840 | 105 |
| 2/15/76 | H76-8/H-79X | Ash Can | Holloman NM | 0.516 | 80 |
| 2/17/76 | H76-9/H-80X | Ash Can | Holloman NM | 0.274 | 70 |
| 2/18/76 | H76-10/H-81X | Ash Can | Holloman NM | 0.859 | 98 |
| 2/23/76 | H76-11/H-82X | Ash Can | Holloman NM | 0.859 | 90 |

| Date | Flight No. | Project | Location | Bln Size ($\times 10^6 ft^3$) | Alt (Kft) |
|---|---|---|---|---|---|
| 2/26/76 | H76-12/H-83X | Ash Can | Holloman NM | 2.010 | 98 |
| 3/29/76 | H76-14/P-144 | Ash Can | Panama CZ | 0.516 | 80 |
| 4/1/76 | H76-15/P-145 | Ash Can | Panama CZ | 0.274 | 80 |
| 4/2/76 | H76-16/P-146 | Ash Can | Panama CZ | 0.859 | 90 |
| 4/3/76 | H76-17/P-147X | Ash Can | Panama CZ | 1.840 | 105 |
| 4/4/76 | H76-18/P-148X | Ash Can | Panama CZ | 4.890 | 120 |
| 4/19/76 | H76-19/H-84X | Ash Can | Holloman NM | 0.145 | 60 |
| 5/11/76 | H76-22/A-130X | Ash Can | Eielson AK | 4.850 | 120 |
| 5/13/76 | H76-23/A-131X | Ash Can | Eielson AK | 2.010 | 105 |
| 5/14/76 | H76-24 | 6687 | Eielson AK | 0.274 | 66 |
| 5/16/76 | H76-25/A-132 | Ash Can | Eielson AK | 0.274 | 70 |
| 5/17/76 | H76-26/A-133 | Ash Can | Eielson AK | 0.516 | 80 |
| 5/18/76 | H76-27/A-134 | Ash Can | Eielson AK | 0.859 | 90 |
| 5/19/76 | H76-28 | 6687 | Eielson AK | 0.127 | 49 |
| 5/19/76 | H76-38 | 6687 | Eielson AK | 0.803 | 49 |
| 5/20/76 | H76-39/A-135 | Ash Can | Eielson AK | 0.516 | 70 |
| 6/17/76 | H76-37/H-85 | Ash Can | Holloman NM | 0.355 | 70 |
| 6/21/76 | H76-40/H-86 | Ash Can | Holloman NM | 0.628 | 80 |
| 6/23/76 | H76-41/H-87 | Ash Can | Holloman NM | 1.110 | 90 |
| 6/25/76 | H76-42/H-88 | Ash Can | Holloman NM | 0.274 | 70 |
| 6/29/76 | H76-43/H-89X | Ash Can | Holloman NM | 2.010 | 105 |
| 7/7/76 | H76-44/H-90X | Ash Can | Holloman NM | 4.890 | 120 |

## 2.3 Summary of Work Performed

Telemetry, beacon and command receiver antennas were installed as required for each launching.

Beacon, telemetry and command receiver units were installed as required.

Parachutes and associated recovery components were installed to permit recovery of special scientific payloads.

Wire and coaxial cable harnesses were fabricated and installed.

Flight and spare battery packs were prepared for each rocket.

Laboratory personnel checked and installed fuel squibs and detonator blocks and assisted with the installation of the associated pyrotechnic train.

Engineering services were provided as required for each flight.

Laboratory personnel participated in all horizontal and vertical missile systems tests.

Ground stations were operated to facilitate recovery of scientific data from the rockets.

Realtime and playback records were processed as required by the project scientists.

Air sampler calibrations for GFE sensors were performed and analyses of atmospheric conditions were made prior to each balloon flight.

Analyses to determine actual air flow rates, balloon trajectories and ambient atmospheric conditions, were made following each balloon flight.

## 2.4 General

Laboratory personnel participated in the recovery system installation in Rocket A04.2081 at Wallops Island, Virginia in June 1974.

Engineering and instrumentation support was provided as required for Aerobee A09.3911, A09.3912 and A09.3913 launches at Woomera Range, Australia in September 1974.

Engineering and instrumentation support was provided in an attempted launch in August 1974 and launch in October 1974 of the Nike-Hidak AF4.0400 at WSMR Sulf Site.

Two periods of travel were required to support the high altitude balloon research effort. The first was to the Panama Canal Zone in March 1976 and the second to Fairbanks, Alaska in May 1976.

## 2.5 Equipment Acquired During the Contract Period

| | | | |
|---|---|---|---|
| 2 each | Multimeter, digital | Scientific Devies, Model 7050 | $ 598.00 |
| 2 each | Power Supplies | Hewlett Packard, Model 6291A | 790.00 |
| 1 each | PCM Bit Synchronizer | EMR, Model 720-02-0-3-4 | 6,184.50 |
| 1 each | Receiver, telemetry with accessories | International Engineering Model TR-711 | 8,630.00 |
| 1 each | Scope, mobile | Tektronix, Model 200-1B | 120.00 |
| 1 each | Oscilloscope, Dual Trace | Tektronix, Model 475 | 2,500.00 |
| 1 each | DC Inverter | Tektronix | 75.00 |
| 1 each | Signal Generator | Hewlett Packard, Model 8641A | 2,544.30 |
| 2 each | Channel Selector | EMR, Model 210B | 600.00 |
| 2 each | Output Filter | EMR, Model 210 | 200.00 |