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ENGINEERING REVIEW OF THE ASSEMBLY AND  
PREPARATION OF SOUNDING ROCKETS

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Final Report for Period 1 July 1975 - 30 June 1977

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Engineering field personnel provide support for launch of twenty-four sounding rockets from five launch sites. Six engineering tasks were performed.		

1. INTRODUCTION

Contract F19628-76-C-0038 provided for engineering launch support to review for technical adequacy and compliance with policies and procedures the assembly and preparation for flight of the sounding rockets listed in the "AFGL Rocket Probe Program" schedule issued quarterly.

Where technical adequacy was in question, analytical and emperical studies were to be performed to verify new or alternate methods or develop devices as directed by the contracting officer.

This final report is being submitted in compliance with Line Item 0002 of the Contract Statement of Work.

II. FIELD SUPPORT

For period from 1 July 1975 through 30 June 1977, engineering field support was provided for the preparation and launch of twenty-four (24) sounding rockets. All field activities originate from ALRC Field Office located at White Sands Missile Range, New Mexico. Launch support was provided by Messrs. Ed Highfield and Ray Petracek. Support was provided for launches at Western Test Range in California, Wallops Island in Virginia, Poker Flats in Alaska, and Churchill Research Range in Canada, as well as at White Sands Missile Range.

A total of twenty-four (24) vehicles of the following types were prepared and launched:

Aerobee 150	-	1
Aerobee 170	-	3
Aerobee 350	-	2
Astrobee D	-	6
Astrobee F	-	1
Nike-Tomahawk	-	1
Ute-Tomahawk	-	2
Paiute-Tomahawk	-	8

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III. IN-PLANT SUPPORT

Six tasks under Line Item 0001a were authorized.

A. TASK NO. 1

Refurbish one (1) Aerobee 150 recovery system. Estimated cost is \$1,000.

The recovery system (P/N 1111266-1) was refurbished as directed and shipped to AFGL via WSMR on 28 May 1976.

B. TASK NO. 2

Prepare a plot of the percent change in apogee versus payload diameter, for a Castor-Lance vehicle for the range of 15 to 22 inch diameters. Estimated cost is \$500.

The payload diameter sensitivity study was performed and the results, including the plot, were transmitted to AFGL. (Ref: ALRC letter 9590:SR0-0090, R.W. Johnson to Roy Walters, dated 10 March 1976).

Drag tables were prepared for payload diameters of 15, 18, 20, and 22 inches, assuming a 10 degree half-angle nose cone with a 10 degree boattail fairing at the end of the payload. 2-D trajectories were run for the different payload diameters, using a 500 lb payload weight launched from sea level at 85 degrees QE. A plot of peak altitude and time above 300,000 ft versus payload diameter was prepared and transmitted to AFGL. Copies of the 2-D computer printouts were also sent.

C. TASK NO. 3

Evaluate the static aerodynamic stability for a ZIP payload on a Castor-Lance, determine the pitch natural frequency versus time, and select

III, C, Task No. 3 (cont.)

the optimum Lance fin setting. Perform three (3) 6-D trajectory calculations for three (3) payload weights, 675, 775, 875 lb. Estimated amount is \$3,500.

The static aerodynamic stability of a Castor-Lance with the proposed ZIP payload configuration (AFGL Sketch No. RFW-38) was analyzed. Several problem areas were identified and corrective changes were recommended. (Ref: ALRC Letter 9590:SR0-0206, R.W. Johnson to Roy Walters, dated 30 August 1976).

D. TASK NO. 4

Perform one (1) 2-D trajectory analysis for a payload for an Aerobee 170 with nozzle extension. The payload weight is estimated at 520 lb. Estimated amount is \$1,000.

The 2-D trajectory analysis was performed and copies of the computer run were transmitted to AFGL. A brief discussion of the loads anticipated for the payload was also included in the letter. (Ref: ALRC Letter 9590:SR0-0178, R.W. Johnson to Ed McKenna, dated 12 July 1976).

E. TASK A

Prepare 2-D trajectories for Aerobee 170 payload with a nozzle extension, based on AFGL Sketch C-77-119.

Drag coefficients were calculated based on AFGL Sketch C-77-119. An "all-up" dry weight estimate was performed for the vehicle-payload in the launch condition.

Several 2-D trajectory computer simulations were performed, as requested. The results were transmitted to AFGL in the form of computer printouts plus a curve of predicted peak altitude and impact range versus QE

## III, E, Task A (cont.)

for the estimated net payload weight. Nominal QE values were selected to provide impact ranges of approximately 40 and 50 st. mi. 2-D trajectory calculations were made at those QE values with the estimated net payload weight and with an assumed 10-lb payload increase.

The results were transmitted to AFGL. (Ref: ALRC Letter 9590:SRO-0356, J.A. Mattice to Roy F. Walters, dated 31 May 1977).

## F. TASK B

Evaluate the payload configuration per AFGL Sketch RFW-45 with regard to rigid body static margin. Evaluate pitch and roll frequencies for a selected configuration. The selected configuration will be coordinated between AFGL and the contractor.

The static aerodynamic stability of a Castor-Lance with a revised ZIP payload configuration (AFGL Sketch RFW-45) was analyzed. The static margin was improved (compared to the Task 3 analysis based on AFGL Sketch RFW-38); however, there were still indications of potential problems. These were discussed and recommendations were made in correspondence with AFGL. (Ref: ALRC Letter 9590:SRO-0353, D.K. Hawkins to Roy F. Walters, dated 24 May 1977).

IV. REPORTS

Launch reports for the following flights were submitted:

2888LR-01	-	A04.308-1
2888LR-02	-	A10.406-2
2888LR-03	-	A10.304-1
2888LR-04	-	A10.304-2
2888LR-05	-	A31.320-2

## IV, Reports (cont.)

2888LR-06	-	A10.000-2
2888LR-07	-	A09.406-1
2888LR-08	-	A35.191-1
2888LR-09	-	A08.608-1
2888LR-10	-	A09.402-2
2888LR-11	-	A30.311-8
2888LR-12	-	A30.311-5
2888LR-13	-	A30.311-7
2888LR-14	-	A30.413-5
2888LR-15	-	A30.205-7
2888LR-16	-	A30.413-4
2888LR-17	-	A04.305-1
2888LR-18	-	A10.504-1
2888LR-19	-	A10.507-1
2888LR-20	-	A10.403-4
2888LR-21	-	A10.001-2
2888LR-22	-	A03.410-1
2888LR-23	-	A35.191-4
2888LR-24	-	A04.410-2

Vehicle Code

03	Aerobee 150
04	Aerobee 170
08	Nike-Tomahawk
09	Ute-Tomahawk
10	Paiute-Tomahawk
30	Astrobee D
31	Astrobee F
35	Aerobee 350

V. LEVEL OF EFFORT

The required level of effort was:

Inplant	-	315	±	5%
Outplant	-	3637	±	5%

Level of effort provided was:

Inplant	-	333
Outplant	-	3281