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TWO-STAGE VEHICLE FOR  
UNIVERSITY OF CALIFORNIA RADIATION LABORATORY

PROGRESS REPORT NO. 9

For the period between  
1 July 1958 and 31 July 1958

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Subcontract No. 108  
Appendixes B, C, and D

Submitted by  
COOPER DEVELOPMENT CORPORATION  
Monrovia, California

PROGRESS REPORT NO. 9

1 July 1958 to 31 July 1958

Subcontract No. 108, Appendices B, C, and D

This informal monthly progress report is the ninth of a series submitted in partial fulfillment of Subcontract No. 108. The information is regarded as preliminary and subject to further verification and analysis.

I. Delivery

Complete.

II. Electronics

Complete.

III. Wind Tunnel Tests

Complete.

IV. Tests

A. Three heads were subjected to environmental tests at the M.D.D. test laboratory at North American Aviation during July. The tests included low temperature cycle, vibration, and acceleration.

For the low temperature test, the forward and aft seals were closed, and the programmer and can were removed. Thermocouples were placed on the "O" rings of the forward and aft seals. The head was brought to room temperature (75° F) and the cold chamber was stabilized at - 65° F. The head was placed in the cold chamber and allowed to stand for 5 minutes. At the end of that time, the forward seal "O" ring reading was - 10° F. The head was removed from the cold chamber and allowed to stand at room temperature (75° F) for 4 minutes, then was completely submerged in water for 1 minute and allowed to float at its normal level

for 4 minutes. When the head was removed from the water and disassembled, it was found that no leakage had occurred.

The head used for the vibration test was a complete flight-ready head except that the skin around the diffuser section was removed. The acceleration load was maintained at 5 g's while the vibration frequency was varied from 3 to 2000 cps. The frequency was held for 1 minute at each resonant frequency which was found during the scanning. The vibration was applied first in the plane parallel to the centerline of the head, then in the plane perpendicular to the centerline. No failures occurred.

For the acceleration tests a flight-ready head was separated at the filter joint into two sections. Both sections were placed on a spin table in the deceleration plane. The load was raised to 50 g's and held there for 1 minute. No failures occurred. The sections were then placed in the acceleration plane. At approximately 15 g's, the programmer started its functions. The load was increased to 50 g's and maintained at that level for 1 minute. All functions occurred properly, and there were no failures. The tests were then repeated, using the head which had been vibration tested. The results were the same.

The results of these tests, as determined by preliminary analysis by CDC, show that the head design appears adequate for the environmental conditions anticipated.

B. Further testing of the possible sources of leakage in the heads was conducted at the Morris Dam Small Calibre Range, Azusa, which is a facility of the Naval Ordnance Test Station, Pasadena, starting on 14 July 1958. Ten heads were dropped

into the water at various angles, and with various modifications. The first 8 tests were conducted by dropping the heads from a height of approximately 32 feet at angles of 75° and 90°. The breathe hole in the heads was left open. Other tests included drops of heads attached to parachutes from 100 feet, free fall drops with the breathe hole closed, and parachute drops of a head with a neoprene boot on the forward seal. The last six tests employed heads in which a vacuum (23 inches of Hg), similar to the near-vacuum of the upper atmosphere, had been induced. Examination of these heads after recovery showed that the vacuum remained when the breathe hole was sealed. Altogether, 27 tests using ten heads were conducted over a five-day period. These tests, and further testing at the CDC plant, indicated that certain points around the nose ball seal joint and the operating mechanism were susceptible to minute leaks when the pressure difference between the interior and exterior of the filter section increased. The neoprene boot covering the operating mechanism had proved, during the Pacific firings and later tests, to be particularly susceptible. Redesign of the boot greatly increased the reliability of the sealing. Following installation of the redesigned boots, only infrequent minute leaks were observed. These leaks were repaired as they occurred until the sealing was tight enough that a pressure difference of 23 inches of mercury was maintained for 10 minutes with no observable drop in the manometer.

C. Two flight test rounds were fired at NAMTC, Point Mugu, on 24 July. All programmer function times were as planned, and both rounds were judged to be quite successful. Since both rounds were acquired by the range radar, search aircraft pinpointed the impact areas by radar quickly. A rescue craft then recovered the heads. One head was completely dry, while the other contained

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only about 1 teaspoonful of water. When the heads were disassembled, it was observed that the dry head had a partial vacuum, whereas the other head had apparently leaked air to equalize the pressure. It is concluded, in view of the success of the flight tests, that the leakage problem has been sufficiently improved to justify firing the rounds which were returned from PPG.

#### V. Prototype Firings

The final shot in which participation was planned was cancelled. Therefore, the CDC field operations group prepared all equipment for return to the continental United States. All CDC personnel have returned from Eniwetok. Disposition of the remaining rounds will be arranged in the near future.