



ENGINEERING RESEARCH INSTITUTE  
UNIVERSITY OF MICHIGAN  
ANN ARBOR

PROGRESS REPORT

for

1 April 1953 to 1 July 1953

UPPER ATMOSPHERE TEMPERATURE AND PRESSURE MEASUREMENT

REPORT NO. C-3

by

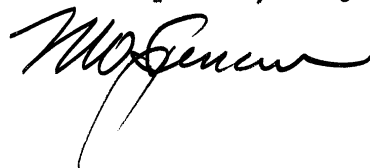
H. F. Schulte

PROJECT DIRECTOR: W. G. DOW

Submitted to the Geophysics Research Division, Air Force  
Cambridge Research Center, Cambridge, Massachusetts. The  
work reported herein is of a preliminary nature and the  
results are not necessarily in final form.

Approved by:

N. W. Spencer, Project Engineer



Project 2096

U.S. AIR FORCE, AIR FORCE CAMBRIDGE RESEARCH CENTER  
CONTRACT NO. AF 19(604)-545

July, 1953

PERSONNEL EMPLOYED DURING PERIOD OF REPORT

W. G. Dow	Project Director	
K. W. Cannestra	Technician	Part-time (student)
D. G. Dow	Assistant in Research	
J. A. Foster	Research Assistant	
H. V. Green	Technician	Part-time (student)
P. A. Hogan	Technician	Part-time (student)
W. G. Kartlick	Research Technician	
A. A. Kirsons	Technician	
D. L. McCormick	Machinist	Part-time
H. F. Schulte	Research Engineer	Part-time
H. S. Sicinski	Research Physicist	
N. W. Spencer	Project Engineer	

## ABSTRACT

Preliminary results of the October 1952 "T" day firing have been completed for the regions where the missile velocity data appears valid. Factors which influence the completion date of the final ambient temperature and pressure data are discussed.

Modification of the Bendix J-8 gyroscope is almost complete and future plans for its use are stated.

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"T" DAY FLIGHT RESULTS

Missile velocity and position data arrived from the Holloman Air Development Center and was immediately utilized in the ambient temperature computations.

The tabulated velocity versus time data shows an apparent lack of consistency at altitudes above burnout. This situation seriously hampers the temperature determination because errors in velocity cause appreciable errors in computed ambient temperature.

An attempt was made to resolve the uncertainties and consideration was also given to the use of a computed vacuum trajectory in regions where the velocity data is believed to be questionable. At the time of this report, no definite conclusions have been reached concerning the problem. It is expected that a member of this group will visit the Flight Determination Laboratory at Holloman in order to become more familiar with the reduction procedure, and thus be in a better position to evaluate present uncertainties.

In regions where the velocity data appears to be correct, ambient temperatures have been computed. These data were informally presented to

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Mr. R. A. Minzner of the Air Force Cambridge Research Center pending the receipt of final velocity data at which time a final compilation of ambient temperature and pressure for the "T" day firing will be accomplished.

MISSILE INSTRUMENTATION

Modification of the Bendix J-8 gyroscope for missile use is nearing completion. Although this gyro is similar to the old Sperry F4-A, it differs sufficiently in detail to require a complete redesign of the latching mechanism. Similarly, the vernier indicator and the automatic erection mechanism have required changes in the modification procedure which was developed for the Sperry gyro. All steps in the procedure have been completed with the exception of engraving the gyro sphere.

After completion of this work it is planned to take the gyro to the manufacturer for installation of new bearings if necessary and final balancing. A series of laboratory tests will then be run to determine precession and other pertinent performance factors.

As a phase of the program to refine all sections of the data telemetering and recording system, the telemetering limiters used in past flights will be reevaluated. The objective is to determine if more effective and reliable limiters can be developed. Preliminary experiments show promise, and it is expected that a final design will be obtained within the next reporting period.

The photographic data recording system has also been reconsidered, and it is expected that development of a new lighting system will be undertaken.



MEETINGS

On June 15, Mr. R. A. Minzner and Mr. M. Dubin from the Air Force Cambridge Research Center visited this project. The purpose of the conference was to discuss the method of analysis and the results obtained to date from the October 1952 "T" day Aerobee (USAF 31) firing.

Factors affecting the accuracy of the temperature determinations were listed and the influence of missile velocity and position data supplied by the Holloman Air Development Center was considered. Since there is some uncertainty as to the accuracy of the present velocity data for "T" day, the following data will be submitted as an interim report on the "T" day firing.

1. Altitude versus:
  - a. Cone surface pressure
  - b. Impact gage pressure
  - c. Mach number
  - d. Ambient pressure (in regions where velocity data is valid)
  - e. Ambient temperature (in regions where velocity data is valid)
  - f. Calculated density (this is limited by item e)
2. Numerical examples of temperature computation
3. Statement of experimental errors.

The use of a gyroscope to determine missile altitude was discussed, and it was agreed that the University of Michigan should participate in the GRD altitude missile firing which will take place later this year. It is expected that one and possibly two gyroscopes and photographic recording systems will be included in the instrumentation section supplied by this project.

PERSONNEL AND FISCAL INFORMATION

Two new members were added to the project staff during this period. Mr. A. A. Kirsons is a graduate student in Electrical Engineering and will assist in computation and data analysis. He will work full-time during the summer and part-time during the school year. Mr. H. V. Green is a senior Electrical Engineering student and will assist on a part-time basis in general laboratory work.

Two student employees, P. A. Hogan and K. W. Canestra, terminated their work here at the end of the regular spring semester.

No capital property was acquired during this reporting period.

