

ENGINEERING RESEARCH INSTITUTE
UNIVERSITY OF MICHIGAN
ANN ARBOR

PROGRESS REPORT

for

1 January 1953 to 1 April 1953

UPPER ATMOSPHERE TEMPERATURE AND PRESSURE MEASUREMENT

REPORT NO. C-2

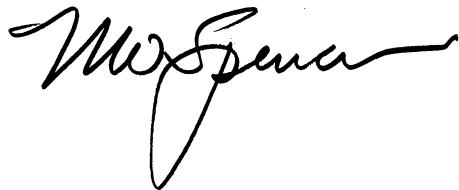
by

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
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April, 1953

PERSONNEL EMPLOYED DURING PERIOD OF REPORT

W. G. Dow	Project Director	
K. W. Cannestra	Technician	Part-time (student)
J. A. Foster	Research Assistant	
P. A. Hogan	Technician	Part-time (student)
W. G. Kartlick	Research 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

Progress in the reduction of data obtained from the October 1952 Aerobee is outlined in this report.

Changes in the present instrumentation design for the next firing are also discussed.

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DATA PROCESSING

The reduction of data obtained from the 22 October 1952 Aerobee (USAF No. 31) proceeded on schedule during this reporting period. Progress can be reported on both the telemetering film reduction and the missile-borne camera film reduction as follows:

A. Missile-Borne Camera Data

1. Information from the aircraft instrument panel clock, the motor-driven counter clock and the incremental accelerometers provided a time base for the camera data and an indication of missile take-off time. These same data also afforded a means for correlating take-off time between the telemetering film and the missile camera film.
2. The Alphanon panel meter data have been reduced to local impact and surface pressures throughout the useful portion of the flight.
3. The gyroscope indications have been converted to Eulerian aspect angles as a function of time from takeoff to zenith (62 miles). These angles will be used in conjunction with the missile trajectory data supplied

by the Holloman Flight Determination Laboratory to compute missile yaw angles.

B. Telemetering Film Data

1. The telemetering film record has been reduced to voltage with respect to time for each commutated information channel.

2. Data from the commutated channel assigned for the measurement of Alpatron-gage wall temperature have been reduced. No variation of gage wall temperature was noted during flight.

3. Although it was not apparent from the Alpatron panel meters, the telemetering film shows some interference present on two of the three commutated channels used for recording Alpatron cone-wall gage pressure. Since a preliminary investigation indicated that the variations were not produced by electrical interference from equipment in the instrumentation section of the missile, it was deemed advisable to transfer the data from the telemetering film to a series of graphs which magnify and reproduce in detail the observed fluctuations. This task is now nearing completion and will facilitate analytical study of the phenomena.

INSTRUMENT DESIGN CHANGES

A review of the preliminary results from the October 1952 Aerobee has indicated that changes in the present instrumentation design will afford better system performance in future firings.

Of primary importance is the use of a solid forward section nose cone in place of the present cone, which is cut into quadrants. This will eliminate any possibility of gage contamination caused by internal air streaming out along the four slits which run the full length of the "pure" cone section. The use of a solid cone, however, severely reduces the accessibility in this area. A further complication is the substantial quantity of radium contained in each Alpatron gage, which limits the amount of time personnel can work in proximity to the gages. Since at least four and perhaps five gages, valves, and gage electrometer stages as well as other equipment for new experiments must be placed inside the cone, an altered mechanical design of the present Alpatron system components seemed desirable. It is expected also that the resulting system will be less sensitive to electrical interference and mechanical shock and vibration.

The program was initiated at the beginning of this period and satisfactory progress can be reported.

A series of experiments to investigate means for improving the Alpatron seal-off valves is also in progress. A determination of the gage outgassing characteristics and possible radon gas escape from the radium source will be made.

The attitude gyroscope used in past firings has always been mounted with its longitudinal axis perpendicular to the longitudinal axis of the

missile. Since it seems desirable to mount the new Bendix J-8 gyroscope with its axis parallel to the missile axis to simplify data analysis, the theory has been reconsidered in order to determine whether the gyroscope, if mounted in this position, would provide, as anticipated, the necessary data for computation of the required Eulerian angles. An affirmative answer was obtained and it is therefore expected that the new mounting position will be utilized.

REPORTS AND MEETINGS

At the request of the Air Force Cambridge Research Center, the following information was provided:

1. a summary of specifications and modifications as applied by this project to the type B-1 16-mm motion-picture camera, and
2. a summary of the performance and limitations of the Sperry F4A Gyro as an aspect instrument when modified for rocket use.

Mr. N. W. Spencer addressed a joint student, Detroit section meeting of the Institute of Radio Engineers held in Ann Arbor on March 20, 1953. Electronic and other features of the rocket instrumentation were discussed and the general objective of this research sponsored by the Air Force was explained.

The national convention of the Institute of Radio Engineers held in New York City on March 23-26, 1953, was attended by Mr. N. W. Spencer. Considerable time was spent discussing various Alphasatron problems with representatives of the National Research Corporation. Representatives of other concerns whose products are used in the instrumentation were also contacted.

PERSONNEL AND FISCAL INFORMATION

Three new members were added to the project during this period. Mr. K. W. Canestra is a senior Electrical Engineering student and Mr. P. A. Hogan is a senior majoring in Physics. Both are part-time employees and will assist in computation and data analysis.

Mr. J. A. Foster received his M.S.E. degree in Mechanical Engineering from the University of Michigan in June, 1952. Mr. Foster is employed as a Research Assistant and will be concerned primarily with the mechanical design, development, and construction of various portions of the instrumentation.

A low-voltage high-current power supply (24 volts, 15 amperes) was acquired during the period. It will be designated as a capital equipment item.