AFCRL-70-0529

EXPERIENCES WITH BALLOON-BORNE TELESCOPES

Alvin H. Howell

Tufts University
Department of Electrical Engineering
Medford, Massachusetts 02155

Contract F19628-69-C-0167

Project No. 8602
Task No. 860205
Work Unit No. 86020501

FINAL REPORT

Period Covered: 1 February 1969 through 31 January 1970

21 September 1970

Contract Monitor: John W. Salisbury
Space Physics Laboratory

Prepared
for

AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
BEDFORD, MASSACHUSETTS 01730

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ABSTRACT

The 24-inch telescope that had been designed and nearly completed under the preceding contract, AF 19(628)-4958, was finished and used in four balloon flights. A number of improvements were incorporated in the system as the flight program developed. A major effort was also applied toward the design and initial fabrication of a new balloon-borne telescope of 50-inch size.

I. DISCUSSION OF CONTRACT ACTIVITIES

Work under this contract was directed primarily toward improving and using the 24-inch telescope that had been designed and nearly completed under the preceding contract, AF 19(628)-4958, and the design of a balloon-borne telescope of 50-inch size. Effort was also applied toward a number of field problems concerned with system safety and with the development of a means for rather quickly lowering balloons to altitudes around 70,000 feet prior to terminating the flight.

Four flights of the 24-inch telescope were made during the period 1 February 1969 through 31 January 1970. Results of these are detailed in the status reports. The reports also indicate the major modifications that have been made to the system during the flight program, and the reasons for making them. One principal change concerned the introduction of preregulators on all voltage supplies to eliminate the need for "despiking" the nickle-silver type batteries whose initial voltage starts 25% above normal and does not reach a rated plateau until 15-20% of the battery energy has been used. Withdrawing this amount of energy prior to flight not only decreases the available battery supply, but does not completely solve the problem because the voltage of a despiked battery climbs while standing so the battery exhibits high voltage for a very brief period; this may endanger electronic components when the system is first turned on. A second major change in the system was the change in ballast material from the conventional steel dust to fine-grain lead shot. This switch eliminated two troublesome problems. Most important was that steel ballast particles collected on the mirror surface during parachute descent and caused rust spots that were very difficult to remove from the silver surface without degrading the surface itself. During descent the steel dust also collected on magnetic devices, particularly motors, and made clean-up unnecessarily difficult. The handy magnetic valves that had been used for dispensing the steel dust had to be replaced by a control mechanism that necessarily involved moving parts. A design was produced that was jam-proof and which allowed positive control with a very small amount of power.

A great deal of effort was applied to the multitude of problems associated with designing a balloon-borne telescope of 50-inch size. During the life of the contract the plans for the guidance system were fully worked out and so were the problems of supporting a large, thin, metal mirror. Procurement of many of the items necessary for fabricating the new telescope was accomplished,

and some parts were manufactured.

II. LIST OF CONTRIBUTORS

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III. RELATED CONTRACTS AND PUBLICATIONS

This contract was a follow-on of contract AF 19(628)-4958, but there are no other related contracts or publications.

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lead shot						
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