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CALIFORNIA UNIV SAN DIEGO LA JOLLA DEPT OF PHYSICS  
FINAL REPORT ON ONR CONTRACT NUMBER N00014-77-MP-0018.(U)  
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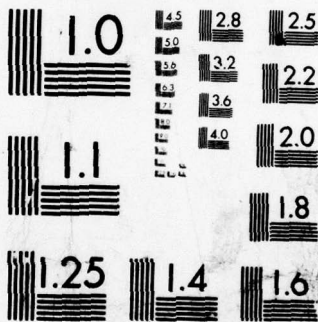
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TO: Dr. Henry Mullaney, ONR  
FROM: Dr. E. C. Whipple ~~and~~ Sherman DeForest UCSD  
SUBJECT: Final Report on ONR Contract #N-00014-77-MP-0018

Number

The above referenced contract provided partial funding through the Air Force (SAMSO) to UCSD to prepare, calibrate and fly a programmable low-energy particle detection instrument on board the SCATHA satellite. The period of time covered by this contract was from 1 April 1977 through 30 September 1977. Support for this project had been provided directly by ONR to UCSD prior to this period of time under contract #N-00014-76-C-0432. After September 1977, the project was and continues to be funded directly by the Air Force.

The SCATHA satellite is a joint effort by the Air Force, the Navy, and NASA to investigate spacecraft charging effects at high altitude. The impetus for this mission was the realization that spacecraft at synchronous orbit can acquire large electrostatic charges because of the very hot plasma that sometimes is present at this altitude. The large electrostatic charges and potentials can result in discharges and arcs between

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different parts of the spacecraft, with consequent material damage. A number of spacecraft operational anomalies are thought to be due to this effect.

UCSD was selected to provide a low energy particle instrument for the SCATHA satellite. The UCSD instrument consists of five particle detectors. Four of the detectors are in pairs, each pair consisting of one ion and one electron detector. These two pairs of detectors are mounted on rotating units which scan through a small solid angle of about  $1^\circ$  by  $2\frac{1}{2}^\circ$ . The fifth detector senses ions and is fixed in direction. Each detector steps through 64 energy steps which are logarithmically spaced in energy. The purpose of the detectors is to obtain particle energy distributions with good resolution in both energy and direction. The two rotating detectors are oriented such that the planes of rotation are at right angles to each other in the spacecraft reference system.

→ The work performed during the period of this contract consisted primarily of fabrication and assembly of the flight unit; assembly and testing of the engineering unit (to be used for preliminary checkout on the spacecraft and as a spare); assembly of the ground support equipment (GSE); and preparation of test plans and computer software. Table I gives the details of what was accomplished during each month of the contract period.

At the present time (June, 1978) the flight unit has been mounted on the SCATHA spacecraft at Martin Marietta Company in Denver, Colorado, and is functioning well. A critical design review of the spacecraft

and mission will be held 29 June 1978. The launch date for the spacecraft is January 25, 1979.

Elden Whipple  
Dr. Elden C. Whipple

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## TABLE I

### WORK ACCOMPLISHED ON SCATHA UNDER ONR #N00014-77-MP-0018

April through September 1977

#### April 1977

Special radiation-hardened Cmos components have been ordered from RCA, and some were delivered. The main harness for the engineering unit was completed and the housing for the engineering unit was gold-plated. Three power supplies were procured for the GSE. Test programs are being developed. The microprocessor block diagram was completed and the simulator board was completed.

#### May 1977

Fabrication was started on the flight unit. More RCA Cmos units were received. The engineering unit subassemblies were connected via the main harness and testing was begun. The GSE power supplies were integrated into the unit. The microprogrammer was completed.

#### June 1977

Fabrication of the flight unit was continued. The transmission shaft for the rotating detector assembly was rotated  $22^{\circ}$ . More RCA Cmos units were received. Testing of the engineering unit continued. Software development for the GSE continued. Schematics and wiring tests for the simulator were completed. The electromagnetic compatibility (EMC) test plan was started.

#### July 1977

The flight unit grid cones were redesigned. Fabrication continued of the flight unit. All the remaining RCA Cmos units were received. All the flight modules were kitted. All the engineering unit housing

## Table I-2

and subassemblies were fit-checked and the unit was partially assembled. All the GSE was completed except for the stimulus card. The EMC test plan was completed. Documentation for the all modes test was completed.

### August 1977

The flight unit grid cones were completed. Several stick assemblies were completed, and the housing and covers were completed for the flight unit. The engineering unit was completely assembled and operational. A motor problem with the engineering unit was solved. Design of the GSE stimulus card was nearly completed. GDE Company in San Diego was selected for performing the EMC tests. Approval was given for removing the high voltage supply on one assembly in order to get better low energy particle data during the flight.

### September 1977

Plating and painting of the flight unit housings and covers was under way. The engineering unit stepping motor was reworked. Interconnection of the engineering unit was completed. Test programs for the GSE were completed, and additional GSE units were approved. Removal of one high voltage supply from a rotating head was under way.