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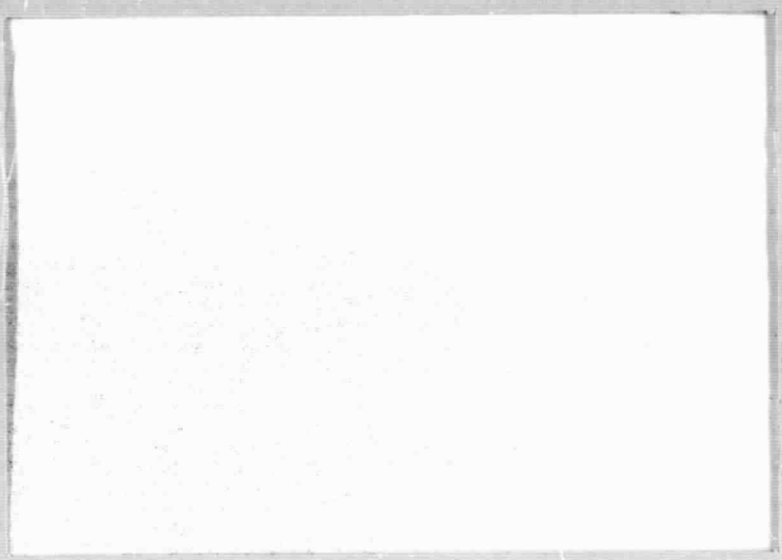
# THE UNIVERSITY OF MICHIGAN
# RADIO ASTRONOMY OBSERVATORY







DEPARTMENT OF ASTRONOMY

# RESULTS FROM
# ORBITING GEOPHYSICAL OBSERVATORY I

Fred T. Haddock
Principal Investigator

NASA Contract NA 5-2051
Final Scientific Report

# PREFACE

The scientific research described herein was performed under the direction of Professor Fred T. Haddock, Principal Investigator for NASA Contract NA 5-2051. This document constitutes the final scientific report for the OGO-I(OGO-A) portion of the contract. The final scientific report for the OGO-III(OGO-B) portion of the contract has been published separately as:

"Dynamic Spectra of 4-2 MHz Solar Bursts: Results from Orbiting Geophysical Observatory III." by Thomas E. Graedel. NASA Contract NA 5-2051 Final Report, Part I. Scientific

The engineering aspects of this program will be published separately, as Part II of the final contract report.

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## I. INTRODUCTION

OGO-I (OGO-A) was the first spacecraft of the Orbiting Geophysical Observatory (OGO) series. It was placed in a highly eccentric orbit on 9/4/64. Appendage deployment difficulties prevented the operation of this spacecraft to take place in a normal manner. The changes in the plan of operation resulted in the deployment of the antenna portion of the University of Michigan Radio Astronomy Experiment (4918) after approximately 100 hours in orbit instead of the two hours originally planned. The antenna erection motor ran for 126 seconds during the first attempt to deploy the antenna on 9/8/64. Further deployment attempts have yielded a total erection motor running time of 9 minutes and 28 seconds. The nominal erection time for this antenna was 7 1/4 minutes. Periodic attempts to erect the antenna further have not been successful. The antenna has not been fully deployed as evidenced by the absense of the deployment indicator actuation.

Five units of the antenna assembly successfully completed the environmental tests for experiments at GSFC without any indication of failure. The prototype and flight units were integrated with their respective spacecraft and tested successfully, again without any indication of failure. The most likely cause of the failure of the antenna to erect properly is the loss of motor torque caused by the commutator/brush combination as observed in subsequent thermal vacuum testing at GSFC. The loss of motor torque would have been agravated by the increased torque loading caused by sublimation of the gear train lubricant. The motor torque appeared to have

dropped considerably as exhibited by the slowing down of the motor speed at 16 second intervals after 1 minute of deployment and sporadic motor response thereafter.

The total antenna element erection length is estimated at four to six feet.

## II. SCIENTIFIC OBJECTIVES

There are several scientific objectives of this experiment because of the nearly complete lack of knowledge of the natural radio emissions in interplanetary space in the frequency band between 2 and 4 MHz. The prime objective is the measurement of the dynamic radio spectra of solar bursts. The parameters of interest for the various types of solar bursts are; intensity, frequency-drift rate, bandwidth, and duration. Such data in the 2 to 4 MHz range can give information on the coronal electron temperature, electron-ion collision frequency, and electron density gradient in the corona out to perhaps eight or more solar radii from the sun's center. This region of the solar corona is nearly inaccessable by other techniques and little is known about it. Another important scientific objective is the attempt to detect radio bursts from Jupiter at 2.0 MHz. The intensity of these bursts at higher frequencies are comparable to solar bursts but are distinctly different in spectral character. The mechanism, and even the exciting agency, for these intense bursts are not known.

## III. INSTRUMENT DESCRIPTION

Basically, the radiometer consists of an antenna and a sweep-frequency receiver. The 30-foot monopole antenna was to be erected after the spacecraft was in orbit. The

receiver, which sweeps the 4 to 2 MHz band every two seconds, is divided into two separated parts because of spacecraft requirements. The sensitivity of the receiver is sufficient to detect a change in background noise level of a few decibels in any 20 KHz interval in the above band. The experiment weighs 4.5 lbs, consumes 1.7 watts and is contained in less than 1/10 cubic foot. A comprehensive report on this instrument will be issued in the near future.

## IV. SCIENTIFIC RESULTS

The OGO-I spacecraft encountered difficulties shortly after launch and the antenna erection command for this instrument was delayed for some time. When the erection attempt was made the antenna only erected an estimated four to six feet instead of the intended 30 feet. Since the rest of the instrument appeared satisfactory we did not request the complete shut down of our experiment since there existed, in our judgement, a chance that a very large solar flare event would be observed with our greatly reduced antenna sensitivity. However, reduction of the data tapes for 1/1/66 (Type 3B Solar Flare), 3/19/66 (Type 4B Solar Flare), and 3/25/66 (Type 4B Solar Flare) have yielded nothing. We were delayed in data tape reduction by computer costs until our SDS-930 computer installation (purchased under OGO-II and IV funding) was available for rapid and relatively inexpensive data reduction. This experiment was finally judged a scientific failure. The OGO-III (OGO-B) experiment performed satisfactorily and provided good scientific results. The final scientific report

for the OGO-III (OGO-B) portion of the contract has been published separately as:

"Dynamic Spectra of 4-2 MHz Solar Bursts: Results From Orbiting Geophysical Observatory III".
Thomas E. Graedel, NASA Contract NA5-2051
Final Report, Part I: Scientific

The engineering aspects of this program will be published separately, as Part II of the final contract report.