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FINAL REPORT

ONGOING DATA REDUCTION, THEORETICAL STUDIES AND SUPPORTING RESEARCH IN MAGNETOSPHERIC PHYSICS

Principal Investigator: F. L. Scarf
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Contract NASW-3087
National Aeronautics & Space Administration
Washington, D.C. 20546

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1. INTRODUCTION

F. L. Scarf and E. W. Greenstadt have been conducting theoretical studies, ongoing data analysis programs, and supporting research and technology tasks under NASA Headquarters Contract NASW-3087. This contract expires on April 30, 1978, and the present report summarizes significant tasks completed and lists important studies initiated.

The present contract, and earlier ones in this series, provided support for theory, correlative data analysis and supporting research and technology. The data analysis tasks generally involve older spacecraft or multi-spacecraft and multi-instrument correlation studies which are not associated with any single, project-associated analysis program. F. L. Scarf is Principal Investigator or Co-Investigator for plasma wave investigations presently operating on ISEE-1, ISEE-2, Voyager-1, Voyager-2, IMP-7 (and Pioneer 8, Pioneer 9). E. W. Greenstadt has recently been appointed as Co-Investigator (without Project funds) for the magnetometer investigation on ISEE-1, ISEE-2. Many of the required analysis programs involve IMP-7, ISEE, and Voyager correlations, or studies based on IMP-7 and -8 and/or Voyager-Helios data comparisons. Thus, the generalized data analysis and reduction program has been used to support the coordination of various projects.

F. L. Scarf and E. W. Greenstadt have also been involved with NAS and NASA mission planning activities. Mr. Greenstadt was a member of the Panel on Plasma Processes of the National Academy of Sciences, and Dr. Scarf is a member of the Space Science Board, the Committee on Solar Terrestrial Research, and the Committee on Space Physics, in addition to his duties as Chairman.
of the CSTR Panel on the IMS. These NAS planning activities are related to many of the SR/T activities summarized below, and Dr. Scarf also serves as a member of the NASA Headquarters Atmospheric and Space Physics Management and Operations Working Group under Dr. E. R. Schmerling and Dr. D. P. Cauffman.

2. SUMMARY OF COMPLETED RESEARCH, OCTOBER 1977 TO PRESENT

We indicate our completed research activity, and the degree to which this research involves other groups, by the ensuing copies of the title pages from all relevant reports dated after October 1977. We divide reports into five categories:

1) Papers published
2) Papers completed and awaiting publication
3) Abstracts of results presented orally at scientific meetings
4) Workshop presentations
5) Related papers.

Title pages or suitable reproductions follow in the above order. Item 5 refers to a related subject of investigation supported by another agency (AFOSR), but demanding comprehensive integration of surface and satellite measurements and expected to involve ISEE as well as other spacecraft in the immediate future.
GROUP 1: PUBLISHED PAPERS
Magnetosphere Boundary Observations Along the Imp 7 Orbit

1. Boundary Locations and Wave Level Variations

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We discuss and analyze magnetosphere boundary phenomena observed by the Imp 7 magnetic field, plasma, and plasma wave instruments in 1972 and 1973. The spacecraft crosses the dawn and dusk boundaries near 25 R\(_E\) downstream, and the physical processes at the Imp 7 magnetopause appear to be intermediate between those observed over the poles and those observed at the lunar orbit. The Imp 7 orbit also traverses a downstream region near where fireball phenomena occur, and this indicates that it is especially important to investigate the range of magnetopause phenomena detected with the plasma and fields payload complement. This report contains a brief description of the relevant Imp 7 instrumentation, a survey of the boundary locations for a 15-month period, a discussion of the different types of crossings (essentially, sharp and diffuse), and an analysis of the electromagnetic wave modes being detected in the broad low-frequency channel of the wave instrument. The wave mode discussion, based on comparison of Imp 7 data with low-frequency plasma sheet and magnetosheath observations from other spacecraft, leads to the conclusion that the broad low-frequency channel is sensitive to oscillations in the lower hybrid resonance region of the spectrum. Details of the broad diffuse boundary crossings will be discussed in a separate report.

Introduction

Although theoretical fluid dynamic predictions of the average shape and the mean location of the magnetopause are generally in very good agreement with observations, there remain large gaps in our understanding of the important microscopic physical processes that develop at the magnetosphere boundary. Several years ago, Willis [1972] emphasized the fact that many theories of the small-scale internal structure of the magnetopause are controversial, and he tabulated 10 outstanding questions to be resolved in future studies of the magnetopause. This 1972 listing included a number of problem areas involving the local physics of the magnetosphere boundary on the flanks of the geomagnetic tail. Specifically, Willis noted that we had, at that time, little definitive information on (1) the nature of the tangential drag on the magnetopause and its importance with respect to tail formation, (2) the consequences of periodic wave motions of the magnetopause, (3) the extent to which the magnetopause remains well defined as a function of downstream distance, and (4) the degree to which the interplanetary and geomagnetic fields are interconnected across the boundary.

In the years since this article appeared considerable progress has been achieved in providing partial answers to these and related questions, especially for the dayside and polar sections of the magnetosphere boundary. For instance, the observations of the plasma mantle [Rosenbauer et al., 1975; Paschmann et al., 1976] are of considerable importance in terms of the dynamics of the entire magnetosphere [see, for instance, Haerendel and Paschmann [1975]], but to date the majority of reports on the physics of the magnetosphere boundary come from local measurements made on the dayside [Russell et al., 1974; Eastman et al., 1976] or at high latitudes just over the poles or from the region of the dayside cusp [see Reiff et al., 1977].

In this series of papers we describe different types of magnetosphere boundary phenomena observed by the Imp 7 plasma wave, plasma, and magnetic field instruments in 1972 and 1973. This first report contains a brief description of the relevant Imp 7 instrumentation, a survey of the boundary locations for a 15-month period, a discussion of the different types of crossings (essentially, sharp and diffuse), and an analysis of the electromagnetic wave modes being detected in the broad low-frequency channel of the wave instrument. The second paper in this series will be concerned with the physics of the diffuse magnetosphere boundary layers. In this second paper we will assess the role of the plasma mantle in terms of the propagation of magnetosheath turbulence into the magnetosphere, and we will evaluate the possible roles of the local wave-particle interactions in terms of tangential drag and viscosity effects.

Imp 7 Orbit and Instrumentation

The spacecraft Imp 7 (also known as Imp H and Explorer 47) was launched on September 23, 1972, into a nearly circular low-inclination orbit with a mean geocentric radial distance of 35 R\(_E\) and an orbital period of 12.5 days. Detailed Imp 7 trajectory plots for the period September 1972 through December 1975 are contained in a recent report by King and Teague [1976], and these plots show that in late 1972 the spacecraft generally crossed the magnetosphere boundary (as defined by Fairfield's [1971] average magnetopause location) at downstream distances near 25 R\(_E\), with the successive inbound and outbound crossings separated by about 25 days. On Imp 7, simultaneous measurements of the ambient mag-
9. THE VENUS IONOSPHERE AND SOLAR WIND INTERACTION

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Abstract. The current state of knowledge of the chemistry, dynamics and energetics of the upper atmosphere and ionosphere of Venus is reviewed together with the nature of the solar wind-Venus interaction. Because of the weak, though perhaps not negligible, intrinsic magnetic field of Venus, the mutual effects between these regions are probably strong and unique in the solar system. The ability of the Pioneer Venus Bus and Orbiter experiments to provide the required data to answer the questions outstanding is discussed in detail.

1. Introduction

The interaction of the solar wind with each of the presently explored planets appears, in many respects unique, but at the same time forms part of a continuum of possible interactions. In the terrestrial interaction, the solar wind is deflected by the magnetic field far above the ionosphere, and the flow associated with the drag
The ISEE-C Plasma Wave Investigation

F. L. SCARF, R. W. FREDRICKS, D. A. GURNETT, and F. J. SMITH

Abstract The ISEE-C plasma wave investigation is designed to provide comprehensive information on interplanetary wave-particle interactions. Three spectrum analyzers with a total of nineteen bandpass channels cover the frequency range 0.1 Hz to 100 kHz. The main analyzer, which uses 16 continuously active amplifiers, gives two complete spectral scans per second in each of 16 filter channels. The instrument sensors include a high-sensitivity magnetic search coil, and electric antennas with effective lengths of 0.6 and 45 m.

INTRODUCTION

The ISEE-C plasma wave instrument will provide high-sensitivity measurements of interplanetary wave phenomena over the spectral range extending from below 1 Hz to 100 kHz. The wave electric-field and magnetic-field components are detected using a long body-mounted electric dipole (90 m, tip-to-tip), a short boom-mounted electric dipole (0.6 m, effective length), and a high-sensitivity magnetic search coil. The signal processing units in the plasma wave electronics box and in the dc magnetometer utilize three distinct spectrum analyzers that cover a total of 19 different frequency channels with varying time resolution. The main analyzer, with 16 continuously active channels, provides two complete spectral scans per second.

The primary scientific objectives of the ISEE-C plasma wave investigation can be summarized as follows:

1) To determine the roles that plasma waves play at inter-planetary discontinuities and at stream-stream interaction fronts. Some wave energy must propagate away from the discontinuity, and this provides a nonlocal wave-particle interaction mechanism.

2) To analyze the basic interplanetary instabilities associated with thermal anisotropy and heat conduction that cause the solar wind to behave as an effective fluid even when the mean free path becomes large near 1 AU.

3) To study the energy loss and wave-wave conversion mechanisms for suprathermal electrons and protons by correlating particle distribution data with wave measurements. This study will involve effects associated with solar radio bursts.

4) To determine the effective transport coefficients (heat conductivity, electrical conductivity, viscosity) associated with wave-particle scattering in the solar wind.

5) To search for local wave-particle acceleration processes in the solar wind.

We will also try to evaluate local plasma parameters by analyzing plasma wave data, search for interplanetary whistler-mode signals that should develop whenever \( F_i/F_e \) exceeds unity, and study the dynamical energy dissipation processes that can cause large amplitude MHD waves in the solar wind to steepen into collisionless shocks.

Manuscript received April 3, 1978.

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Space Plasma Physics:
The Study of Solar-System Plasmas

Volume 1
Reports of the Study Committee and Advocacy Panels

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8.3.6 Collisionless Shock Waves

The sudden air-pressure changes, or sonic booms, associated with the flights of supersonic jet aircraft are familiar examples of shock waves. These shocks in the earth's relatively dense, collisional atmosphere have their counterparts in the tenuous plasmas of space, where they are in fact common and have an appreciable effect on the space environment. The shock that forms in a collisionless plasma directs fluxes of gas into new directions of flow, transforms coherent, directed motion into heat, raises individual ion energies to cosmic-ray energies, and emits particle and wave energy into space far from the shock location.

The fundamental problems of the collisionless shock derive from its inherent nonlinearity, which makes closed mathematical representation difficult, and from the complexity of the plasma—a multicomponent gas of electrons and one or more ion species, pervaded by a magnetic field of sufficient energy density so that individual particle motion and wave-mode propagation and dispersion are governed by the field. In essence, the objectives of collisionless shock research are to determine (a) how nature selects the particular combinations of field and plasma parameters that fashion them; (b) how the shocks, once formed, behave; and (c) how they influence the parameters of the space environment.

Collisionless shock waves have been found on the sunward side of all five of the planets of the solar system visited thus far. In addition to the shocks at the planets, spacecraft instrumentation has measured collisionless plasma shocks traveling through the solar wind away from solar flares and ahead of plasma streams originating on the sun; the existence of such shocks has been inferred in the solar atmosphere as well as in distant parts of the universe. Particles are reflected from, and energized by, shocks. Waves are generated in the solar wind both upstream and behind them. In the case of the earth's bow shock, a portion of the energy of the downstream waves is transferred to the surface of the earth. Such an energy transference may well occur at other planets as well.

The study of natural plasma shocks in space has benefited from traditional methodology. Laboratory experiments, for example, have played an important role in defining collisionless shock phenomenology. Such laboratory shocks have been observed in oscillatory motion: upstream standing whistler waves have been observed that destabilize and are damped; some laboratory shock thickness scales have been measured.

FIGURE 8.6 Ecliptic-plane, cross-section schematic view of the earth's shock system with an approaching solar-wind shock. The interplanetary magnetic field lies in the plane of the paper. The numbers refer to phenomena discussed in Section 8.3.e.
GROUP 2: COMPLETED REPORTS, PENDING PUBLICATION
ION ACOUSTIC STABILITY ANALYSIS
OF THE EARTH'S BOW SHOCK

by

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October 1977

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PLASMA FLOW PULSATIONS IN
EARTH'S MAGNETIC TAIL

by

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October 1977

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THE ISEE-C PLASMA WAVE INVESTIGATION

by

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and E. J. Smith³

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*Prepared for the special ISEE issue of Geoscience Electronics

November 1977

Space Sciences Department
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CONNECTIONS BETWEEN COMETS AND PLASMAS
IN SPACE*

by

Frederick L. Scarf

December 1977


Space Sciences Department
TRW Defense & Space Systems Group
One Space Park
Redondo Beach, California 90278
The ISEE-1 and -2 Plasma Wave Investigation*  

by  

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March, 1978  

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*To be published in the special ISEE issue of Geoscience Electronics.
The Heliocentric Radial Variation of Plasma Oscillations Associated with Type III Radio Bursts†

by

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January, 1978

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Submitted to J. Geophys. Res.

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GROUP 3: PRESENTATIONS
SOLAR FLARE MODIFICATION OF THE THUNDERSTORM RELATION ELECTRIC FIELD

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University of Calif., Berkeley, CA 94720

A direct observation of solar flare modification of thunderstorm driven electric fields is presented. The electric fields are determined from satellite observations of the vertical atmospheric electric field in the stratosphere decreased by at least an order of magnitude during the flare. This effect is attributed to the absence of current which is conduction produced by the solar proton events. A global model of the atmosphere which shows a large increase at the time of the solar proton maximum, thereby indicating a possible world-wide high altitude enhancement in thunderstorm activity. Models of thunderstorm triggering mechanisms which are supported by these data will be discussed.

DUST FROM CATASTROPHIC METEORITE COLLISIONS; AGENT OF CLIMATIC CHANGE

Frank T. Mott (Department of Geosciences, The Pennsylvania State University, University Park, Pennsylvania 16802)

An impressive frequency of meteorite impacts, especially on the largest impact structures, of about 3000 å, presents the earth's atmosphere with a large flux of ablated meteoroids, or ablated, which have collided with the earth. The impact structure has been studied for about a century. Dust from collisions, suspended in the earth, will reduce ionization. Substantial reductions would result from collisions with mass greater than 10⁻³ ergs, explosively 2.8 x 10⁻³ ergs and 1.8 x 10⁻³ ergs, which represent a 2.8 x 10⁻³ ergs collision, and 1.8 x 10⁻³ ergs collision, respectively. An analytical approach of W. J. Mott (1967) and W. J. Mott (1972) have used to evaluate temperature changes to be expected from dust produced by collisions. Assumptions made are 1) the dust amounts to only 0.003 to 0.01 of the impacting mass, 2) the air is uniformly dispersed through the atmosphere and particles for an indefinitely long time. Thus, a colliding mass of 10⁻³ ergs, or a satellite, 2.8 x 10⁻³ ergs, would generate 10⁻³ ergs of dust. The dust produced by a 2.8 x 10⁻³ ergs collision, would lead to a change of 20% decrease in ionization and a decrease by 500°C of the temperature of the air. While the dust mechanism appears to be effective for heating temperatures for short periods, it cannot account for the average temperature of the atmosphere, 273°C, and the climate system. These limitations will be discussed along with the implications for climate.
The present paper from the University of Maryland experiment on 2034-1 was launched on October 1973 into a highly eccentric orbit with an apogee of 4,005 km and a perigee of 220 km. The spacecraft consists of a center, an electronic subsystem, and a pointable solid-state detector. The position of the center, which determines the energy of the charged particles, is measured by a pair of four quadrants. In addition to the primary mission objective, a variety of experiments are performed in the transverse energy region between 1,000 keV and 10 GeV. Each of the experiments is covered in this section.

**MICROPROCESSOR BASED SCIENTIFIC INSTRUMENTS IN SPACE**

H. Sandekey

D. F. Swords

D. H. Warren

V. T. Norman

R. E. Shellhat (Space Sci. Lab., Univ. of California, Berkeley, CA 94720)

The first microprocessor controlled scientific instruments flown in space is the Geostationary Electric Field Experiment carried aboard the 2034-1 spacecraft, which was launched on October 1973. The microprocessor is used to control the spacecraft's electric field measurements and to store the data obtained. The microprocessor also allows the spacecraft to perform additional tasks, such as communicating with ground stations and autonomously maneuvering in orbit. The spacecraft is equipped with a variety of instruments that will be described below.

**MEASUREMENTS OF DISSIPATION AND LOW FREQUENCY TANGENTIAL ELECTRIC FIELD: EFFECTIVE DOUBLE PROBES IN THE 2034-1 SPACECRAFT**

E. K. Oppenheimer

C. C. Finch (Space Sciences Laboratory, Univ. of California, Berkeley, CA 94720)

D. S. Pappalardo

C. C. Finch (Space Sciences Laboratory, Univ. of California, Berkeley, CA 94720)

T. P. Pendleton

A. Pedersen (Space Physics Department, European Space Agency, Noordwijk, Netherlands)

The spherical double probe electric field experiment on the 2034-1 spacecraft is described. It is shown that the instrument measures the tangential electric field and that the electric field is effectively zero within about 100,000 km. The design features and diagnostic capability of this instrument are discussed.

**IEEE MAGNETIC FIELD OBSERVATIONS: INITIAL OBSERVATIONS OF MAGNETIC VARIATIONS AT THE GROENWALD SATELLITE**

C. E. Romrell

C. E. Romrell (Space Sciences Laboratory, Univ. of California, Los Angeles, CA 90024)

The 2034-1 spacecraft was successfully launched on October 1973 into a highly elliptical orbit with an apogee of 4,005 km and a perigee of 220 km. The spacecraft is equipped with a variety of instruments that will be described below.

**Plasmas in Space: 5 Micro pulsations, 1 Napoleon 1 (D), Wednesday 0830h L. J. Lanzneretti (Bell Laboratories, Presiding)**

**MULTIPLE SIMULTANEOUS OBSERVATIONS OF INTERGEOVARIANCE WAVES AT GEOSTATIONARY ORBIT**

W. J. Hughes (Bell Laboratories, Imperial College, London 9547, 1.)

We review the results obtained by studying simultaneous data sets from the ICA and WMA magnetometers on board a geostationary satellite (Ica, 1971). A large number of pulsation events were observed during the period of time when the satellites were close together. The data was compared with theoretical and empirical models for the effect of the Earth's magnetic field on the plasma waves. The results suggest that the event is a complex interaction of various processes, including solar wind and interplanetary magnetic field effects.

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**REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR**
SOLAR WIND STREAM STRUCTURE DURING THE EARLY PHASE OF SOLAR CYCLES 20 AND 21

J. M. Davis (both at: American Science and Engineering, Inc., Cambridge, MA 02139)
A. J. Ingerson
J. D. Sullivan (both at: Center for Space Research and Department of Physics, MIT, Cambridge, MA 02139)

We have extended the investigation of the variation of the solar wind flow associated with the solar cycle by comparing solar wind stream parameters for periods of 1 year shortly after the minimum preceding solar cycles 20 and 21. During the first year of Cycle 20, solar wind data are available from the NFI detector on Mariner 4, and average stream parameters have been determined by Nees et al. [1976]. Ap: 1077 [1976] using near-Earth streams. All streams with amplitudes \( \geq 150 \text{ km/s} \), the average amplitude \( A \approx (494 \pm 13) \text{ km/s} \), average maximum velocity \( V \approx (194 \pm 14) \text{ km/s} \), and average half-width \( W \approx (3.3 \pm 0.5) \text{ days} \), all derived from the Mariner 4 data for January - July 1975, are not significantly different from the Mariner 4 solar wind data for the same period. The slight increase in average maximum velocity may be due to development of higher-speed streams with heliocentric distance. We have used data from the 510 instruments on IMP 7 and 8 during the comparable period of Cycle 21 (June 1976 - May 1977). The average \( A \approx (291 \pm 13) \text{ km/s} \) and \( W \approx (6 \pm 2) \text{ days} \) were not significantly different. However, \( V \approx (587 \pm 12) \text{ km/s} \) was \( 38 \% \) higher than the value for 1975, indicating that higher-speed streams are more frequent during the following year. The above significant differences in the solar wind parameters for Cycle 21 may be due to the development of higher-speed streams with heliocentric distance. The average solar wind parameters for Cycle 21 were not significantly different from those for Cycle 20.

LOW FREQUENCY ELECTRON DENSITY FLUCTUATIONS
IN THE SOLAR WIND MEASURED BY SPACECRAFT RADIO FREQUENCY MICROWAVE OBSERVATIONS

R. A. Armstrong (both at: Jet Propulsion Laboratory, Pasadena, CA 91101)

Interplanetary electron density fluctuations were observed using the 10", 10", and 10", 10" antennas on the IMP 8 spacecraft. The fluctuations were observed using the 10", 10", and 10", 10" antennas. The maximum electron density fluctuations observed were less than 10 cm/s. The spectrum of the fluctuations was consistent with the prediction that the fluctuations are caused by the interaction of the solar wind with the interplanetary magnetic field. The fluctuations were observed near the Earth, and the fluctuations were observed near the Earth. The spectrum of the fluctuations was consistent with the prediction that the fluctuations are caused by the interaction of the solar wind with the interplanetary magnetic field. The fluctuations were observed near the Earth, and the fluctuations were observed near the Earth.
The plasma wave experiments on the ISEE 1 and 2 spacecraft are operating satisfactorily and have now provided a wide variety of measurements of plasma and radio wave phenomena in the magnetosphere, magnetosheath and solar wind. Essentially every crossing of the earth's bow shock can be associated with an intense burst of electrostatic and whistler-mode turbulence at the shock, with substantial wave intensities in both the upstream and downstream regions. Usually the electric and magnetic field spectrums at the shock are quite similar for both spacecraft, although small differences in the detailed structure are sometimes apparent upstream and downstream of the shock, probably due to changes in the motion of the shock or propagation effects. Upstream of the shock emissions are often observed at both the fundamental, \( f_p \), and second harmonic, \( 2f_p \), of the electron plasma frequency. In the magnetosphere high resolution spectrograms of the electric field show an extremely complex distribution of plasma and radio emissions, with numerous resonance and cutoff effects. Electron density profiles can be obtained from emissions near the local electron plasma frequency. Comparisons of high resolution spectrograms of whistler-mode emissions such as chorus usually show a remarkably close similarity between the two spacecraft with small propagation delays. Other types of locally generated waves, such as the \( (n + 1/2)f_p \) electron cyclotron waves, show more pronounced differences between the two spacecraft. High resolution spectrograms of kilometric radio emissions are also presented which show an extremely complex frequency-time structure with many closely spaced narrow-band emissions.
GROUP 4: WORKSHOPS
NOTICE OF ISEE WORKING GROUP MEETING NO. 1

TIME: 9:00 a.m., 10 December 1977
PLACE: Room 160 (The Library)
Space Sciences Laboratory
University of California, Berkeley
ATTENDANCE: Principal Investigators, Co-Investigators, and Invitees of Principal Investigators

AGENDA

<table>
<thead>
<tr>
<th>Time</th>
<th>Agenda Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-9:45</td>
<td>&quot;The Present State of Knowledge with Respect to the Structure and Motions of the Earth's Bow Shock,&quot; by G. Greenstadt</td>
</tr>
<tr>
<td>10:15-11:00</td>
<td>&quot;The Present State of Knowledge of the Magnetopause,&quot; by B. Sonnerup</td>
</tr>
<tr>
<td>11:30-12:00</td>
<td>Aims of Magnetosphere and Bow Shock Workshop</td>
</tr>
<tr>
<td>12:30</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00-2:00</td>
<td>Experimenter Reports--if needed</td>
</tr>
<tr>
<td>2:00-5:00</td>
<td>Discussion of:</td>
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<td></td>
<td>Review of dates for special study</td>
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<tr>
<td></td>
<td>Arrangements for next meeting</td>
</tr>
<tr>
<td></td>
<td>Discussions of data</td>
</tr>
</tbody>
</table>

Experimenter who wish to work together informally on Friday 9 December are invited to use the Space Sciences Laboratory. Work space is available, as well as office support (e.g., travel arrangements, secretarial, xerox, etc.).

Maps are enclosed for those who wish to drive. You can also use BART. That service begins about 8:00 a.m. from San Francisco. If you get the first or second train you will be at SLL by 9:00. (Take BART to downtown Berkeley, Humphrey Co-BART to the Central Campus; the SSL shuttle bus stops in the parking lot at the north end of the carillon plaza at 8:40, 9:10, 9:40, etc.)

On Saturday we will meet the first two trains with SSL vans. Look for them in front of the Bank of America across the street from the Downtown Berkeley BART station.

While most people will probably choose to stay in San Francisco, anyone who would like accommodations in Berkeley for the nights of 9 and 10 December should contact Dr. Kinsey Anderson (415/642-1313) or Terry Kelley (415/642-7297).
### Visitor Control Pass

**Page 25**

#### Visitor Control Pass

**Name:** Green, E. W.

<table>
<thead>
<tr>
<th>Badge No.</th>
<th>Date</th>
<th>Time Issued</th>
<th>Purpose of Visit</th>
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<tbody>
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<td>1476</td>
<td>4/14/78</td>
<td>10:00 AM</td>
<td>SEE WORKSHOP</td>
</tr>
</tbody>
</table>

**Visitor Carrying:**
- Package
- Briefcase

**VISITOR PLEASE READ AND SIGN**

I understand that I shall: wear the badge in plain view, return this pass, the badge and auto permit at the Visitor Control Point and not visit employees or offices without prior approval.

**Signature of Visitor:**

---

#### Visitor Control Pass

**Name:** Green, E. W.

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<tr>
<td>1423</td>
<td>4/14/78</td>
<td>9:30 AM</td>
<td>SEE WORKSHOP</td>
</tr>
</tbody>
</table>

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**Signature of Visitor:**
GROUP 5: RELATED REPORTS
CORRELATION OF GEOMAGNETIC PULSATION SIGNALS
IN THE 10 TO 150-SECOND PERIOD RANGE
WITH CONCENTRATION OF IMF ORIENTATIONS
NEAR THE SUN-EARTH LINE

by

E. W. Greenstadt
Space Sciences Department
TRW Defense & Space Systems Group
Redondo Beach, California 90278

and

J. V. Olson
Institute of Earth & Planetary Physics
University of Alberta
Edmonton 7, Alberta, Canada

30 June 1977
Submitted for clearance: 10 March 1978

Prepared for Session LSR III-8, Third General IAGA
Assembly, Seattle, Washington, August 1977

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Space Sciences Department
TRW Defense & Space Systems Group
One Space Park
Redondo Beach, California 90278
SIGNALS: A JOINT DISTRIBUTION

Interplanetary data coverage for local daytime hours for a fifteen day interval in 1975 when good interplanetary data coverage from large solar proton events was sampled. Preliminary data for 

N. A. Kistler

The seven-station magnetometer network of the Air Force Geophysics Laboratory, Hanscom AFB, MA, has been in continuous operation. Five data-collection stations are located at New York, New Delhi, Tokyo, Diego Su. Foto, Mount Vernon, MA, and Suchee, MA, and a sixth station, near New York, is also used. The data are transmitted to Hanscom and controlled remotely from the data-acquisition station at AFGL in Massachusetts.

M. A. Soter

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IMF ORIENTATION, SOLAR WIND VELOCITY, AND
Pc 3-4 SIGNALS: A JOINT DISTRIBUTION

by

E. W. Greenstadt¹, H. J. Singer²
C. T. Russell², and J. V. Olson³

¹Space Sciences Staff, TRW Defense & Space Systems Group,
One Space Park, Redondo Beach, California 90278

²Institute of Geophysics & Planetary Physics, University
of California, Los Angeles, Los Angeles, California 90024

³Institute of Earth & Planetary Physics, University of
Alberta, Edmonton, Alberta, Canada T6G2J1

April 1978

Space Sciences Staff
TRW Defense & Space Systems Group
One Space Park
Redondo Beach, California 90278
3. NEW RESEARCH

We list below additional projects initiated under this contract but still awaiting completion.

1. IMP-7 diffuse boundary crossings.
2. IMP-7,8 interplanetary shock observations.
6. Fireball phenomena, IMP-7 and other spacecraft.
7. Foreshock dynamics, IMP-7,8 observations, July 1974.