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

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FINAL REPORT

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SALES NO: 31219.000 DATE: 7/03/80

PROJECT TITLE: Ongoing Data Reduction, Theoretical Studies, and Supporting Research in Magnetospheric Physics

PROJECT ASSIGNMENTS:

PROJECT MANAGER: Fredrick L. Scarf

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I. INTRODUCTION

In August 1979, we anticipated that NASW-3087 would come to an end, and we submitted a report (No. 31219-6013-RU-00) entitled "Final Report". It turned out that NASW-3087 was extended to September 30, 1982, and the present "Final Report" covers the period October 1979 through September 1982.

This second contractual period was an extremely busy and productive one. The TRW investigators (Scarf, Greenstadt, Fredricks, Taylor) published a very large number of space science research papers, and in almost all cases these papers involved correlative multi-spacecraft studies that were supported in part by NASW-3087. Thus, the main part of our Final Report consists of a tabulation of these research papers (Section II).

We also include as Section III copies of our regular Quarterly Progress Reports for the second contractual period.

II. SPACE SCIENCE RESEARCH PAPERS

Scientific Papers Published

Scientific Papers In-Press

Abstracts of Oral Presentations

SCIENTIFIC PAPERS PUBLISHED

(October 1979 through September 1982)

F. L. SCARF

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(As of September 1982)

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ABSTRACTS OF ORAL PRESENTATIONS

(October 1979 through September 1982)

F. L. SCARF

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Detection of Lower Hybrid Emissions in the Io Plasma Torus: Bounds on Anomalous Electron Heating Rates (D.D. Barbosa, F.V. Coroniti, and W.S. Kurth, 1st, 2nd, & 3rd authors), to be presented to the Fall Meeting of the American Geophysical Union, San Francisco, December 1982.

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Whistler Mode Waves in the Solar Wind Near the Bow Shock (R.W. Fredricks, C.T. Russell, F.L. Scarf, R.R. Anderson, and D.A. Gurnett, 2nd, 3rd, 4th, 5th, & 6th authors), EOS, 61, 349, 1980.

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A Storm-Time, Dusk Pc 5 Event Observed in the Outer Magnetosphere by ISEE 1 and 2 (R.L. McPherron, M. Hoppe, C.T. Russell, R.R. Anderson, and F.L. Scarf, 2nd, 3rd, 4th, 5th, & 6th authors), IAGA Bulletin No. 45, 430, 1981.

ISEE Observations of Foreshock Modification by Solar Wind Discontinuities (M. Hoppe and C.T. Russell, 2nd & 3rd authors), IAGA Bulletin No. 45, 515, 1981.

Foreshock Structure: Upstream ULF Waves and Their Association with Backstreaming Ion Populations (M.M. Hoppe, C.T. Russell, L.A. Frank, and T.E. Eastman, 1st, 2nd, 3rd, & 4th authors), IAGA Bulletin No. 45, 513, 1981.

Correlation Lengths of ULF Magnetic Waves Observed by ISEE 1 and 2 in the Earth's Foreshock (M. Hoppe and C.T. Russell, 2nd & 3rd authors), EOS, 62, 1004, 1981.

Advances in Shock Physics, XXIV COSPAR Abstracts, 216, 1982.

Computer Constructed Imagery of Distant Plasma Interaction Boundaries (H.D. Schurr and R.K. Tsugawa, 2nd & 3rd authors), XXIV COSPAR Abstracts, 345, 1982.

Upstream Waves in Front of Interplanetary Shocks (C.T. Russell, M.M. Hoppe, B.T. Tsurutani, E.J. Smith, J.T. Gosling, and S.J. Bame, 1st, 2nd, 3rd, 4th, 5th, & 6th authors), XXIV COSPAR Abstracts, 44, 1982.

A Storm-Time, Pc 5 Event Observed in the Outer Magnetosphere by ISEE 1 and 2: Wave Properties (R.L. McPherron, M. Hoppe, R.R. Anderson, and F.L. Scarf, 2nd, 3rd, 4th, & 5th authors), for presentation to the Fall Meeting of the American Geophysical Union, San Francisco, December 1982.

Laminar and Quasi-Laminar Bow Shocks: Upstream and Downstream Waves (M.M. Mellott [Hoppe] and C.T. Russell, 1st & 2nd authors), for presentation to the Fall Meeting of the American Geophysical Union, San Francisco, December 1982.

R. W. FREDRICKS

Comparison of Plasma Wave Levels and IMF Orientations Preceding Observations of Interplanetary Shocks by ISEE-3 (E.W. Greenstadt and F.L. Scarf, 2nd & 3rd authors), EOS, 62, 984, 1981.

Correlated Whistler and Plasma Wave Bursts Detected on ISEE-3 (C.F. Kennel, F.V. Coroniti, F.L. Scarf, D.A. Gurnett, and E.J. Smith, 1st, 2nd, 3rd, 4th, and 6th authors), EOS, 60, 932, 1979.

Whistler Mode Waves in the Solar Wind Near the Bow Shock (E.W. Greenstadt, C.T. Russell, F.L. Scarf, R.R. Anderson, and D.A. Gurnett, 2nd, 3rd, 4th, 5th, & 6th authors), EOS, 61, 349, 1980.

The Waves in Space Plasmas Program, Proc. of the Symposium on the Effect of the Ionosphere on Radio Wave Systems, Alexandria, Va., April 1981.

Theoretical Model for the VLF Sheath Admittance of a Monopole or Dipole Antenna in a Plasma, URSI Trans., URSI Program and Abstracts, H1-4, 24, 1981.

W. W. L. TAYLOR

Atmospheric Refraction and Lightning on Venus (F.L. Scarf, 2nd author), EOS, 61, 1017, 1980.

III. QUARTERLY PROGRESS REPORTS

(for 2nd Contractual Period)

TRW

TRW 31219.000
P241-82-6218
10 August 1982

National AEronautics & Space Administration
Headquarters, Bldg. F, Rm. 5039
Washington, D.C. 20546

Attention: Dr. Michael J. Wiskerchen, Code ST-5

Subject: Contract No. NASW-3087
Quarterly Progress Report

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 10th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 9 August 1982, covering the quarter ending 31 July 1982. Additional distribution is indicated below.

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SPACE & TECHNOLOGY GROUP

M. E. Moss /bc

M. E. Moss
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Applied Technology Division
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TRW Program Manager:
F. L. Scarf

Quarterly Progress Report

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087

NASA Headquarters
Washington, D.C. 20546

9 August 1982
(Covering Quarter Ending 31 July 1982)

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Redondo Beach, California 90278
(213) 536-2015

NASW-3087

Quarterly Progress Report

During this quarter, there were many activities that inyolved joint data analysis programs, mission definition, and supporting research.

In May, Dr. Scarf returned from the Soviet Union and prepared a trip report which was circulated to numerous personnel at NASA Headquarters. Also in May, Dr. Scarf attended the Saturn Conference at Tucson and presented a talk entitled "Plasma Distributions and Wave-Particle Interactions in Saturn's Inner Magnetosphere". Mr. Greenstadt attended the May COSPAR Meeting held in Ottawa, at which he presented two talks on the subjects "Advances in Shock Physics" and "Computer Constructed Imagery of Distant Plasma Interaction Boundaries".

In June, Dr. Scarf attended a second meeting at NASA Headquarters on ISEE reprogramming to the Earth's tail and to Comet Giacobini-Zinner; he also participated in a presentation on this subject at the National Academy of Sciences. During this month, Dr. Scarf attended the AMPTE Joint Science Working Group meeting held in Munich; Mr. Greenstadt attended the National Computer Graphics Association meeting in Anaheim, and he presented a talk on Bow Shock Structure at the Workshop on Space and Astrophysical Plasmas at the University of California, Santa Barbara.

Several papers were completed or published during the past quarter, as follows:

Sounds from Space (F.L. Scarf), submitted to The Planetary Report, June, 1982.

Large-Amplitude Magnetic Variations in Quasi-Parallel Shocks: Correlation Lengths Measured by ISEE 1 and 2 (E.W. Greenstadt, M.M. Hoppe, and C.T. Russell), Geophys. Res. Lett., 9, 781, 1982.

Plasma Wave Levels and IMF Orientations Preceding Observations of Interplanetary Shocks by ISEE-3 (E.W. Greenstadt, F.L. Scarf, C.F. Kennel, E.J. Smith, and R.W. Fredricks), Geophys. Res. Lett., 9, 668, 1982.

The paper "Sounds from Space" was prepared in association with the production of a TRW record entitled "Sounds of Saturn". 15,000 copies of this record have been donated to The Planetary Society, and they will be given away during the next quarter.

SOUNDS FROM SPACE*

by

Frederick L. Scarf

June 1982

NASA Headquarters Contract No. NASW-3087

*To be submitted to The Planetary Report

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GEOPHYSICAL RESEARCH LETTERS, VOL. 9, NO. 7, PAGES 781-784, JULY 1982

LARGE-AMPLITUDE MAGNETIC VARIATIONS IN QUASI-PARALLEL SHOCKS: CORRELATION LENGTHS MEASURED BY ISEE 1 AND 2

E. W. Greenstadt

Space Sciences Department
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M. M. Hoppe

C. T. Russell

Institute of Geophysics and Planetary Physics
University of California at Los Angeles
Los Angeles, California 90024

Abstract. Wide separations up to more than 1 R_E between ISEE 1 and 2 during the second half of 1978 have been used to measure the correlation length of magnetic pulsations in quasi-parallel shocks. When the two spacecraft were less than a few hundred km apart, magnetic oscillations measured by magnetometers on both spacecraft exhibited virtually identical waveforms, but at distances of several thousand km, the two time series of field variation showed no detailed similarity at all. The correlation coefficients of the pulsations dropped from close to 1.0 for spacecraft separations of less than 100 km to 0.2 for separations of greater than 800 km. A correlation length of several hundred km may be related to the gyroradius of return protons with energy typical of the peaks of diffuse and beam ion distributions.

Introduction

Simultaneous measurements by two or more instruments at different locations within the Earth's bow shock and foreshock regions constitute the essential tool for distinguishing temporally from spatially varying structures. So far, analysis of data from the satellite pair ISEE 1 and 2 has emphasized the mutual consistency of their measurements. Indeed, one of the striking features of the earliest data from the magnetometers of ISEE 1 and 2 was the detailed similarity, under normal conditions, of wavetrains at the two vehicles even in the highly-irregular, large-amplitude perturbations of the quasi-parallel shock, of which examples are shown in this report. A high β, of course, even the quasi-perpendicular profile differs from one spacecraft to the other [Russell and Greenstadt, 1979]. Signal correlation, because of its obvious application to timing the motions of waves and boundaries between the satellites, has therefore received much attention, and, in fact, one study has successfully defined propagation vectors and velocities of ULF waves in the foreshock [Hoppe and Russell, 1980; Hoppe *et al.*, 1981]. The limits of correlation are equally of interest, however.

In contrast to most of the early data from the ISEE project, which were obtained when the satellites were close together (i.e., within a few hundred km of each other), the data from the second half of 1978 offer the first opportunity to examine directly the extent of signal correlation, hence spatial variation, in the local plasma environment when the two spacecraft passed through bow shock distances at varying separations up to several thousand km. This report presents the first documented change of correlation with distance for a magnetic constituent of the shock structure and discusses a possible relationship of correlation length to ion gyroradius. Our examples are all quasi-parallel, by which we mean the angle between the interplanetary magnetic field and the local model shock normal was less than about 50° and large-amplitude field oscillations were recorded.

Paper number 2L0295.
0094-8276/82/002L-0295$3.00

Variable Correlation

Figure 1 offers a visual display of the variations in wave correlation observable in the running 12-second averages (plotted every four seconds) between ISEE 1 and ISEE 2. In 1(a), the two traces of magnetic-field magnitude exhibit almost identical waveforms. Moreover, the similarities of changing field pattern occurred in both the ULF foreshock waves (e.g., around 0015 and 0030) and in the larger-amplitude waves and pulses defining the outer edges of the quasi-parallel shock structure, as seen between 0020 and 0024. The fidelity of wave duplication at the two spacecraft persists at higher resolution, illustrated in Figure 2, where we see unaveraged data with samples recorded every 0.25 second. A segment of the data from Figure 1(a) is shown in Figure 2(a). While not identical in every detail, or exactly alike in amplitude, the two waveforms shared essentially the same pattern for periods of a few seconds or longer, and the occurrence of higher-frequency bursts was almost simultaneous at both satellites in the illustrated examples. Figure 2(b) is an overlay of ISEE 1 and ISEE 2 data for a section of 2(a), showing clearly the close similarity of the two signals, albeit with slightly variable delay from one satellite to the other.

Returning to Figure 1, we note that in 1(b) the similarity of the two field plots is considerably less pronounced than in 1(a). Indeed,

GEOPHYSICAL RESEARCH LETTERS, VOL. 9, NO. 6, PAGES 668-671, JUNE 1982

PLASMA WAVE LEVELS AND IMF ORIENTATIONS PRECEDING OBSERVATIONS OF INTERPLANETARY SHOCKS BY ISEE-3

by

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E. J. Smith[3], and R. W. Fredricks[1]

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Abstract. Some interplanetary shocks detected by ISEE-3 are preceded by many hours of strongly-enhanced plasma wave noise at a few kHz, while others have essentially no wave precursors above background. It has been shown that these extremes correspond to quasi-parallel and quasi-perpendicular shocks, respectively, based on the instantaneous orientation angle θ_{Bn} of the interplanetary magnetic field (IMF) to the shock normal at the time the shocks cross the spacecraft. We show that precursor wave noise level is correlated with field orientation and an extrapolated θ_{Bn} throughout the preshock observation interval for two contrasting active and quiet cases, and that intermediate, variable noise levels correspond to intermediate, variable IMF orientations. We infer that foreshocks are an intrinsic part of the structure of quasi-parallel interplantary shocks.

Introduction

Knowledge of the macrostructure of the Earth's bow shock helps to organize one class of solar wind events; namely, the enhancement of kilohertz-range plasma wave electrical signals upstream (ahead) of quasi-parallel, but not quasi-perpendicular, interplanetary (IP) shocks [Kennel et al., 1982]. We perceive these events as interplanetary counterparts of analogous extended bow shock structures, and as a potential tool for illuminating an unsettled question in bow shock phenomenology.

Figure 1 displays four of the examples of Kennel et al. [1982] spanning the range of preshock conditions, from noise-free (25 December) to almost continuously noisy (12 November), with two intermediate cases of fluctuating noise levels, one occasionally above background (8 November) and one consistently above background (27 August). The multiband signatures of these examples, displayed by Kennel et al., showed that the average electric field in the 3 kHz channel is a representative diagnostic for plasma waves in the 1-10 kHz frequency range. The number at the upper left in each panel gives the angle θ_{Bn} between the local shock normal and the IMF at the time each interplanetary shock crossed the spacecraft. The normals were determined by the combined field and plasma method of Abraham-Schraumer and Yun [1976]. The correspondence of small θ_{Bn} with enhanced upstream <E> suggests that the presence or absence of plasma wave noise was related to the quasi-parallel or quasi-perpendicular structure of the approaching shock, implying the existence of interplanetary foreshocks similar to the foreshock outside the Earth's curved, non-uniform bow shock [Greenstadt and Fredricks, 1979].

The distinctions among plasma wave activity levels visible in Figure 1 depended however on the presence or absence of noise for hours preceding shock encounter, while the lone θ_{Bn} calculated for each shock was based on the instantaneous IMF immediately before shock encounter. Since the IMF direction is variable, it does not necessarily follow that the field line containing enhanced plasma waves, say, three hours before encounter was traceable to a connection with the oncoming shock at the same θ_{Bn}. Also, it is always possible, unless demonstrated to the contrary, that plasma wave noise at ISEE-3 was simply a manifestation of the Earth's foreshock resulting from downwind connection of the IMF to the bow shock. We attempt, here, to add confidence to the structural explanation by filling in the pattern of preshock field behavior in several cases.

Method of Analysis

We have used the ISEE-3 data pool tapes, together with computational graphic techniques, to illustrate the approximate relationships of spacecraft, IMF, wave noise, IP shocks, and bow shock. The data pool supplies plasma wave fields, IMF vectors, and solar wind velocity, among other measurements, averaged every 128-seconds. In a given 128-second interval, we take the average IMF as a single vector to represent the field segment B_i during that interval, but we wish to represent it as a small vector $\underline{B}_i$ in metric space whose length is proportional to B_i. The metric vector's

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TRW

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P241-82-6137
12 May 1982

National AEronautics & Space Administration
Headquarters, Bldg. F, Rm. 5039
Washington, D.C. 20546

Attention: Dr. Michael J. Wiskerchen, Code ST-5

Subject: Contract No. NASW-3087
Quarterly Progress Report

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 10th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 11 May 1982, covering the quarter ending 30 April 1982. Additional distribution is indicated below.

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TRW Program Manager:
F. L. Scarf

NASW-3087

Quarterly Progress Report

11 May 1982

During this quarter, there were many activities that involved joint data analysis programs, mission definition, and supporting research.

On March 23-24, 1982, Dr. Scarf participated in a presentation at NASA Headquarters involving the possible diversions of ISEE-3 to the Earth's geomagnetic tail and to Comet Giacobini-Zinner.

On April 18, 1982, Dr. Scarf left the United States for a two-week visit with Soviet scientists at the Institute for Cosmic Research in Moscow. The discussions to be held during this trip involved ISEE data, analysis of Venus lightning and solar wind interaction measurements, and Voyager observations at Jupiter and Saturn.

From February 8-10, 1982, Mr. Greenstadt attended the ISEE SWT Meeting at Goddard Space Flight Center, and he was responsible for having prepared the Agenda for the Shock Workshop held on February 10.

During this period, two manuscripts were revised: "Plasma Wave Levels and IMF Orientations Preceding Observations of Interplanetary Shocks by ISEE-3 (Greenstadt Scarf, Kennel, Smith, and Fredricks)," which has been returned to Geophysical Research Letters for publication; and "Large-Amplitude Magnetic Variations in Quasi-Parallel Shocks: Correlation Lengths Measured by ISEE 1 and 2 (Greenstadt, Hoppe, and Russell)," which is being prepared for publication in Geophysical Research Letters.

Throughout the quarter, Mr. Greenstadt prepared material for an invited review paper to be presented at the IMS Symposium of COSPAR to be held in May, 1982, at Ottawa.

TRW Tech. Report No. 23499-6026-UT-00

PLASMA WAVE LEVELS AND IMF ORIENTATIONS PRECEDING OBSERVATIONS OF INTERPLANETARY SHOCKS BY ISEE-3

by

E. W. Greenstadt[1], F. L. Scarf[1], C. F. Kennel[2],

E. J. Smith[3], and R. W. Fredricks[1]

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[3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109

November 1981

(Revised February 1982)

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(Submitted for publication in Geophysical Research Letters)

TRW Tech. Report No. 31219-6021-UT-00

LARGE-AMPLITUDE MAGNETIC VARIATIONS IN QUASI-PARALLEL SHOCKS: CORRELATION LENGTHS MEASURED BY ISEE 1 AND 2

by

E. W. Greenstadt

Space Sciences Department
TRW Space and Technology Group
Redondo Beach, California 90278

M. M. Hoppe

C. T. Russell

Institute of Geophysics and Planetary Physics
University of California at Los Angeles
Los Angeles, California 90024

January 1982

(Revised March 1982)

(submitted to Geophysical Research Letters)

Space Sciences Department
Bldg R-1, Rm 1176
TRW Space & Technology Group
One Space Park
Redondo Beach, California 90278

TRW

TRW 31219.000
P241-82-6038
11 February 1982

National AEronautics & Space Administration
Headquarters, Bldg. F, Rm. 5039
Washington, D.C. 20546

Attention: Dr. Michael J. Wiskerchen, Code ST-5

Subject: Contract No. NASW-3087
Quarterly Progress Report

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 10th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 11 February 1982, covering the quarter ending 31 Jan. 1982. Additional distribution is indicated below.

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W. G. Sanders/pc

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Contract Administrator
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TRW Program Manager:
F. L. Scarf

Quarterly Progress Report

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087
NASA Headquarters
Washington, D.C. 20546

11 February 1982
(Covering Quarter Ending 31 January 1982)

Applied Technology Division
Bldg R-1, Rm 1176
TRW Space and Technology Group
One Space Park
Redondo Beach, California 90278

NASW-3087

Quarterly Progress Report

11 February 1982

During this quarter, Dr. Scarf attended the Space Science Advisory Committee Meeting held at NASA Headquarters (November 16-19, 1981); the OPEN Science Working Group Meeting held at NASA Goddard Space Flight Center (January 13-15, 1982); and the Annual Meeting of the American Physical Society held in San Francisco (January 25-28, 1982).

Dr. Scarf and Dr. Taylor both attended the International Conference on the Venus Environment held in Palo Alto (November 4-6, 1981), and the Pioneer Venus Science Steering Group Meeting held at NASA Ames Research Center (January 24-27, 1982).

Dr. Scarf, Dr. Fredricks, and Mr. Greenstadt all attended the Winter Meeting of the American Geophysical Union held in San Francisco (December 7-9, 1981).

A number of talks were given at the scientific meetings, and their titles appear on the list attached.

During this period, six scientific papers were completed, and their titles are also listed on the attachment.

Five abstracts were submitted for the upcoming COSPAR Meeting and for the International Conference on Cometary Exploration. Details are covered on the attachment.

PRESENTATIONS

1. "Venus Lightning: A Review of Pioneer Orbiter Whistler Measurements" - given by F. L. Scarf at the Venus Conference.

2. "Voyager-2 Plasma Wave Observations at Saturn" - given by F. L. Scarf at the Winter AGU Meeting.

3. "Comparison of Plasma Wave Levels and IMF Orientations Preceding Observations of Interplanetary Shocks by ISEE-3" - given by E. W. Greenstadt at the Winter AGU Meeting.

4. "Correlation Lengths of ULF Magnetic Waves Observed by ISEE-1 and -2 in the Earth's Foreshock" - given by E. W. Greenstadt at the Winter AGU Meeting.

5. "The Magnetosphere of Saturn" - given by F. L. Scarf at the Annual Meeting of the American Physical Society.

COMPLETED PAPERS

1. "Plasma Wave Levels and IMF Orientations Preceding Observations of Interplanetary Shocks by ISEE-3" (E.W. Greenstadt, F.L. Scarf, C.F. Kennel, E.J. Smith, and R.W. Fredricks), November 1981, submitted to Geophysical Research Letters.

2. "Large-Amplitude Magnetic Variations in Quasi-Parallel Shocks: Correlation Lengths Measured by ISEE 1 and 2" (E.W. Greenstadt, M.M. Hoppe, and C.T. Russell), January 1982, submitted to Geophysical Research Letters.

3. "Whistler Mode Turbulence in the Disturbed Solar Wind (F.V. Coroniti, C.F. Kennel, F.L. Scarf, and E.J. Smith), November 1981, submitted to Journal of Geophysical Research.

4. "Disappearing Ionospheres on the Nightside of Venus" (T.E. Cravens, L.H. Brace, H.A. Taylor, Jr., C.T. Russell, W.L. Knudsen, K.L. Miller, A. Barnes, J.D. Mihalov, F.L. Scarf, S.J. Quenon, and A.F. Nagy), January 1982, Proceedings of The Venus Conference.

5. "Observations of Energetic Ions Near the Venus Ionopause" (W.T. Kasprzak, H.A. Taylor. L.H. Brace, H.B. Niemann, and F.L. Scarf), January 1982, submitted to Planetary and Space Science.

6. Pioneer Venus Observations of Plasma and Field Structure in the Near Wake of Venus" (J.G. Luhmann, C.T. Russell, L.H. Brace, H.A. Taylor, W.C. Knudsen, D.S. Colburn, A. Barnes, and F.L. Scarf), submitted to Journal of Geophysical Research.

ABSTRACTS SUBMITTED

1. "Pc 3 Amplitude at Onagawa: Joint Correlation with Solar Wind Parameters Measured by ISEE and IMP" (E.W. Greenstadt, T. Saito, and C.T. Russell), for presentation at the 24th Plenary Meeting of COSPAR, May 1982, Ottawa, Canada.

2. "Upstream Waves in Front of Interplanetary Shocks" (C.T. Russell, M.M. Hoppe, B.T. Tsurutani, E.J. Smith, J.T. Gosling, S.J. Bame, and E.W. Greenstadt), for presentation at the 24th Plenary Meeting of COSPAR, May 1982, Ottawa, Canada.

3. "Advances in Shock Physics" (E.W. Greenstadt), for presentation at the 24th Plenary Meeting of COSPAR, May 1982, Ottawa, Canada.

4. "Computer Constructed Imagery of Distant Plasma Interaction Boundaries" (E.W. Greenstadt, H.D. Schurr, and R.K. Tsugawa), for presentation at the 24th Plenary Meeting of COSPAR, May 1982, Ottawa, Canada.

5. "Science Return from ISEE-3 at Comet Giacobini-Zinner" (F.L. Scarf, E.J. Smith, and R.W. Farquhar), for presentation at the International Conference on Cometary Exploration, November 1982, Budapest, Hungary.

TRW

TRW 31219.000
1788.5.81-6571
12 November 1981

National AEronautics & Space Administration
Headquarters, Bldg. F, Rm. 5039
Washington, D.C. 20546

Attention: Dr. Michael J. Wiskerchen, Code ST-5

Subject: Contract No. NASW-3087
Quarterly Progress Report No. 10

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 10th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 12 NOV 1981, covering the quarter ending 31 OCT 1981. Additional distribution is indicated below.

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TRW Program Manager:
F. L. Scarf

TRW Tech. Report No. 31219-6020-UT-00

Quarterly Progress Report

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087

NASA Headquarters
Washington, D.C. 20546

12 November 1981
(Covering Quarter Ending 31 October 1981)

Applied Technology Division
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NASW-3087

Quarterly Progress Report

12 November 1981

During this period, F. L. Scarf gave a report at the APS Plasma Physics Division Meeting in New York, and he participated in activities of the US/USSR Working Group on Near Earth, Space, and Planets; the ISEE Comet Working Group; and the SSAC subcommittee on the Space Platform. E. W. Greenstadt met with ISEE co-investigators and ground magnetic-observatory scientists in Edinburgh and London to plan some joint programs of satellite and surface data analysis.

A report comparing "Plasma Wave Turbulence at Planetary Bow Shocks" by Scarf, Gurnett, and Kurth was published in Nature (292, 747, 20 Aug 1981). Audio techniques were developed by Scarf for synthesizing sounds of plasma waves and were applied to data from ISEE-3, Pineer Venus, and Voyager to produce recordings of interplanetary shocks, planetary shocks, Jovian and Saturnian magnetospheric phenomena, and the Saturnian ring-plane crossing. It was shown by Greenstadt that interplanetary shocks have plasma wave foreshocks compatible with quasi-perpendicular/quasi-parallel distinction at $\theta_{Bn} \approx 50°$ in local shock geometry familiar at the earth's bow shock, and that the sudden appearance of the earth's ULF foreshock immediately after a tangential discontinuity in the solar wind is explained as enclosure of the observation point in a pre-existing upstream region exposed

when the discontinuity sweeps across the bow shock. Also, Greenstadt and co-workers discovered and measured a correlation length of about 1000 km for large-amplitude quasi-parallel bow shock pulsations. The length seems to be related to the distributions of gyroradii of reflected ions.

Quarterly Progress Report

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087

National Aeronautice & Space Administration
Washington, D.C. 20546

12 August 1981
(Covering Quarter Ending 31 July 1981)

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Quarterly Progress Report

12 August 1981

During this period, E. W. Greenstadt attended the Gordon Research Conference on Collisionless Shocks and the IAGA General Assembly, while F. L. Scarf participated in meetings of the NASA Space Science Advisory Council and the ISEE Science Working Team and Workshop on TYPE II Solar Radio Bursts and Interplanetary Shocks.

A number of new and promising multi-spacecraft investigations were recently initiated. Scarf and his co-workers identified interplanetary shocks detected on ISEE-3 and the Pioneer Venus Orbiter (see Figure 1) and they showed that the corresponding foreshock regions contained very similar ion acoustic wave turbulence. Greenstadt started to apply his terrestrial ISEE-1,2 three-dimensional foreshock program to analyze interplanetary shock phenomena. Figure 2 shows one important example in which this analysis demonstrates that the B-Field in front of the solar wind shock never intersected the earth's magnetosphere; thus the ISEE-3 measurements of plasma waves certainly represented detection of interplanetary shock precursors, rather than observations related to the earth's foreshock.

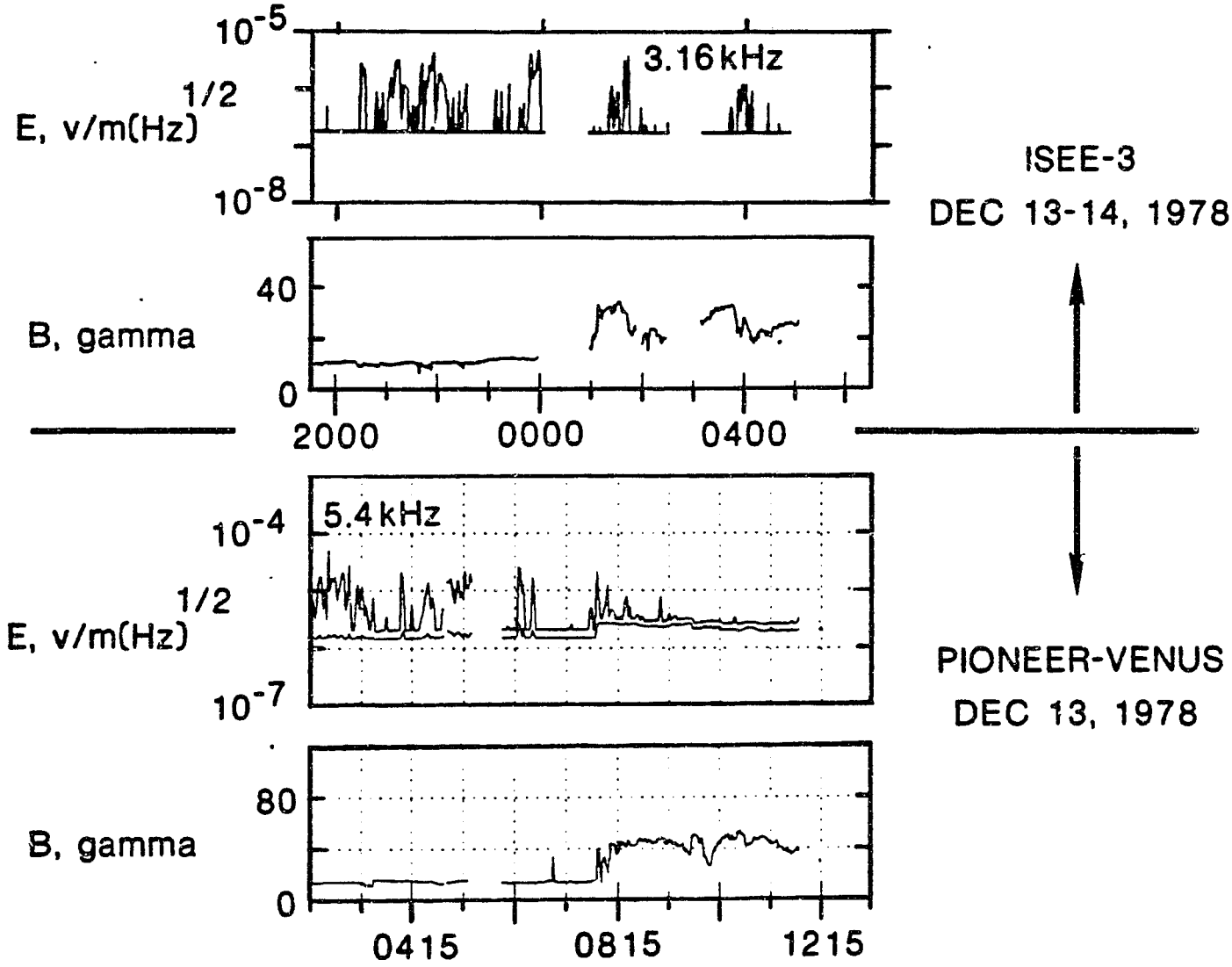

FIGURE 1

11 NO 78 3.1[illegible] DCM 20:0:7→24:24:33
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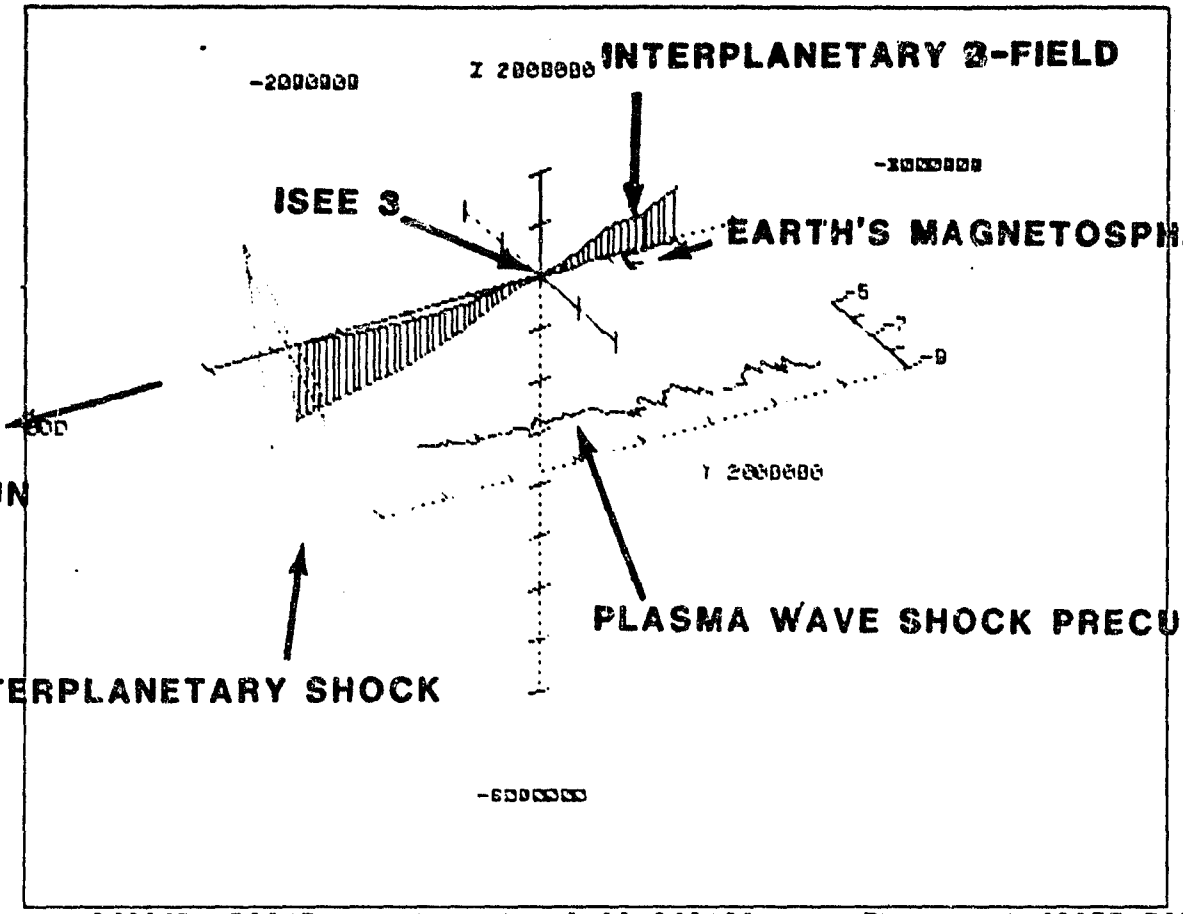
X,Y,Z tics=1.00E+06,1.00E+06,1.00E+06 X,Y,Z maxs=1.00E+07 ,1.00E+07 ,1.00E+07
IP shock X-speed=910.0 IP Shock Normal nx,ny,nz=-.957,.276,.093
Obs srt time=21:40:0 Sector direction:
Earth Pos wrto Sat: GSE_X=-191.9 GSE_Y=45.4 GSE_Z=13.3



Xb_end= 3690674.53947 Yb_end=-19402.2691201 Zb_end=-1462855.78596
PHANTOM SHOCK INTERSECTION WITH X-AXIS AT 3836426.57748
IP SHOCK INTERSECTION WITH X-AXIS AT 9113984.03801

FIGURE 2

TRW

TRW 31219.000
1780.5.81-6221
15 May 1981

National AEronautics & Space Administration
Headquarters, Bldg. F, Rm. 5039
Washington, D.C. 20546

Attention: Dr. Michael J. Wiskerchen, Code ST-5

Subject: Contract No. NASW-3087
Quarterly Progress Report No. 10

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 10th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 13 May 1981, covering the quarter ending 30 April 1981. Additional distribution is indicated below.

TRW INC.
DEFENSE & SPACE SYSTEMS GROUP

W. G. Sanders
Contract Administrator
Applied Technology Division
Telephone: 213/536-3837
Mail Station: R1/2004

WGS:bc

Encl.

cc: NASA/S&TIF (Repro + 2)
NASA/HQ/Code KT (1)
AFPRO/TRW (w/o encl)
NASA/HQ/D. Andreotta (w/o encl)

TRW Program Manager:
F. L. Scarf

Quarterly Progress Report

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087

National Aeronautics & Space Administration
Washington, D.C. 20546

13 May 1981

(Covering Quarter Ending 30 April 1981)

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

NASW-3087

Quarterly Progress Report

13 May 1981

Several projects are in progress at the end of this quarter:

1. We are examining the geometrical relationship between the orientations of interplanetary shocks, their plasma wave forerunners, and their pre-shock interplanetary field directions.

2. We are studying an apparent resonant geomagnetic pulsation in the dusk sector to determine both the local conditions governing the pulsation and the circumstances responsible for its occurrence. The study includes observations from three satellites and several stations on the earth's surface.

3. We are studying the response of the foreshock and shock to rapid changes, particularly tangential discontinuities in the interplanetary magnetic field.

4. We are investigating the details of plasma and field behavior under conditions of transition between quasi-perpendicular and quasi-parallel shock structure.

During the quarter, we completed several papers which have been submitted for publication (see Appendix 1). We attended meetings listed on Appendix 2. Preparation for the IAGA Assembly to be held in Edinburgh (August 1981) and for the Gordon Conference on Collisionless Shocks which will meet next month was made in this quarter.

APPENDIX 1

Completed Papers:

Waves in Space Plasmas Program (R. W. Fredricks), presented at the NRL Ionosphere Conference Symposium on the Effect of the Ionosphere Radio Wave System (April 1981).

Plasma Waves in the Jovian Magnetosphere (D. A. Gurnett and F. L. Scarf), submitted for publication in Physics of the Jovian Magnetosphere, ed. by A. J. Dessler.

Non-Local Plasma Turbulence Associated with Interplanetary Shocks (C. F. Kennel, F. L. Scarf, F. V. Coroniti, E. J. Smith, and D. A. Gurnett), submitted for publication in Journal of Geophysical Research.

Plasma Waves Near Saturn: Initial Results from Voyager 1 (D. A. Gurnett, W. S. Kurth, and F. L. Scarf), submitted for publication in Science.

An Upper Bound to the Lightning Flash Rate in Jupiter's Atmosphere (F. L. Scarf, D. A. Gurnett, W. S. Kurth, R. R. Anderson, and R. R. Shaw), submitted for publication in Science.

Energetic Electrons and Plasma Waves Associated with a Solar Type III Radio Burst (R. P. Lin, D. W. Potter, D. A. Gurnett, and F. L. Scarf), submitted for publication in Astrophysical Journal.

Jupiter and Io: A Binary Magnetosphere (F. L. Scarf, F. V. Coroniti, C. F. Kennel, and D. A. Gurnett), submitted for publication in special Jupiter issue of Vistas in Astronomy.

The Distant Bow Shock and Magnetotail of Venus: Magnetic Field and Plasma Wave Observations (C. T. Russell, J. G. Luhmann, R. C. Elphic, and F. L. Scarf), submitted for publication in Geophysical Research Letters.

Plasma Wave Turbulence at Planetary Bow Shocks: Saturn, Jupiter, Earth, and Venus (F. L. Scarf, D. A. Gurnett, and W. S. Kurth), submitted for publication in special Saturn issue of Nature.

Narrowband Electromagnetic Emissions from Saturn's Magnetosphere (D. A. Gurnett, W. S. Kurth, and F. L. Scarf), submitted for publication in special Saturn issue of Nature.

The Control of Saturn's Kilometric Radio Emission by Dione (W. S. Kurth, D. A. Gurnett, and F. L. Scarf), submitted for publication in special Saturn issue of Nature.

Detection of Jupiter Tail Phenomena Upstream from Saturn (F. L. Scarf, W. S. Kurth, D. A. Gurnett, H. S. Bridge, and J. D. Sullivan), submitted for publication in special Saturn issue of Nature.

APPENDIX 2

Meetings:

March 1-5, 1981 - Dr. Scarf attended the Space Science Advisory Committee Meeting at NASA Headquarters, Washington, D.C.

March 16-18, 1981 - Dr. Taylor participated in the Active Experiments Working Group Meeting at the University of Alabama, Huntsville.

April 13-14, 1981 - Dr. Scarf took part in the Space Science Advisory Committee's Subcommittee on Space Platforms Meeting at the University of Alabama, Huntville.

April 14-17, 1981 - Dr. Taylor presented a paper at the NRL Ionosphere Conference Symposium on the Effect of the Ionosphere Radio Wave System in Washington, D.C.

TRW

TRW 31219.000
1780.5.81-6084
13 February 1981

National Aeronautics & Space Administration
Headquarters, Bldg. F, Rm. 5039
Washington, D.C. 20546

Attention: Dr. Michael J. Wiskerchen, Code ST-5

Subject: Contract No. NASW-3087
Quarterly Progress Report No. 9

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 9th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 12 February 1981, covering the quarter ending 31 January 1981. Additional distribution is indicated below.

Don Andreotta is requested to advise me by letter as to whether the current addressees of this report and the copied recipients noted below will be the same for future submittals of the subject report.

TRW INC.
DEFENSE & SPACE SYSTEMS GROUP

W. G. Sanders
Contract Administrator
Applied Technology Division
Telephone: 213/536-3837
Mail Station: R1/2004

WGS:bc

Encl.

cc: nasa/S&TIF (Repro + 2)
NASA/HQ/Code KT (1)
AFPRO/TRW (w/o encl)
NASA/HQ/D. Andreotta (w/o encl)

TRW Program Manager:
F. L. Scarf

TRW Tech. Report No. 31219-6017-UT-00

Quarterly Progress Report

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087

National Aeronautics & Space Administration
Washington, D.C. 20546

12 February 1981

(Covering Quarter Ending 31 January 1981)

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

NASW-3087

Quarterly Progress Report

12 February 1981

The funding for this extension arrived at TRW in mid-January, 1981, and by the week ending January 23, we had set up the Project Plan and Schedule for the proposed supporting research and technology activities.

In the few weeks since January 23, very little has been accomplished that merits detailed reporting. We are analyzing plasma wave and magnetometer data from a number of operating spacecraft and performing multi-spacecraft correlation studies. We are also investigating new techniques for processing data in space and on the ground. More details will appear in the next report.

TRW

TRW 31219.000
1780.5.80-6973
10 October 1980

National Aeronautics & Space Administration
Headquarters
Washington, DC 20546

Attention: D. P. Cauffman, Code ST

Subject: Contract No. NASW-3087
Quarterly Progress Report No. 8

In accordance with Article III of the subject contract, enclosed herewith are four (4) copies of the 8th Quarterly Progress Report for Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics, dated 9 October 1980, covering the period 1 July through 30 September 1980.

TRW INC.
DEFENSE & SPACE SYSTEMS GROUP

W. G. Sanders
Contracts Administrator
Applied Technology Division
Telephone: 213/536-3837
Mail Station: R1/2004

WGS:bc

cc: NASA/S&TIF (Repro + 2)
NASA/HQ/Code KT (1)
AFPRO/TRW (w/o encl)
NASA/HQ/D. Martin (w/o encl)

TRW Program Managers:

F. L. Scarf
E. W. Greenstadt

TRW No. 31219-6015-UT-00

Quarterly Report No. 8

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

Principal Investigator: F. L. Scarf
Co-Investigator: E. W. Greenstadt

Contract NASW-3087
National Aeronautics & Space Administration
Washington, D.C. 20546

(Covering Period 1 July through 30 September 1980)

9 October 1980

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

During the last quarter, Dr. Scarf participated in presentations on ISEE, OPEN, and other solar-terrestrial programs at NASA Headquarters. The presentations were primarily directed toward Dr. Mutch and Dr. Frosch.

During this time there was also a considerable amount of research on the flight programs, ISEE, Pioneer Venus, and Voyager.

In addition, Dr. Scarf has been preparing to participate in the Space Science Advisory Committee meeting in October, 1980.

Mr. Greenstadt attended a MOWG meeting at Goddard Space Flight Center, and he participated in the Data Systems Users Working Group meeting in Huntsville, Alabama. He also gave a presentation at the UCLA Institute of Geophysics and Planetary Physics Workshop on Space Plasma Physics at Los Alamos Scientific Laboratory.

During this period Mr. Greenstadt continued investigation of the earth's foreshock, including comparison of ISEE and IMP-8 ion data, and attempted to integrate recent results from numerous investigators into a single comprehensive phenomenology.

ISSUE DATE 17 May 1982
PAGE 1 OF 1

TRW

CONTRACT AUTHORIZATION

SALES NUMBER: 31219
CONTRACT NO.: NASW-3087

JOB NUMBER(S): 5079-73, 3372-96, 3473-58
REVISION NO.: 15

CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies & Supporting Research in Magnetospheric Physics

BASIS FOR ISSUANCE: Change of Administrator

SPONSOR: GROUP ST&G PC CA DIV ATD OPS RTO

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

Effective 17 May 1982 the Contract Administrator for this contract is changed as follows:

from M. E. Moss
01/1050
x55506

to K. P. Stidham
01/1050
x63837

DISTRIBUTION:

STANDARD DISTRIBUTION LIST ☐ 01 ☐ 02 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. Scarf	R1/1176
J. Calhoun	R1/1096
J. Friichtenicht	R1/1096
M. Chapman	R1/1096
P. Gentile	01/1230
P. Herbert	01/2044
W. Sun	01/1170

W. E. Meyers
CONTRACT ADMINISTRATOR

ISSUE DATE 23 April

TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219

CONTRACT NO.: NASW-3087

JOB NUMBER(S): 5079-73, 3372-96, 3473-58

REVISION NO.: 14

CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies & Suppo-ting Research in Magnetospheric Physic

BASIS FOR ISSUANCE: Modification No. 9

SPONSOR: GROUP S&TG PC CA DIV ATD OPS RTO

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

This modification amends the Statement of Work to authorize TRW personnel to participate in activities with the Soviet Academy of Sciences. This modification increases the estimated cost and cost share as follows:

	Previous	This Mod.	New Totals
Estimated Cost	$568,000	$2,079	$570,079
TRW Share	5,737	21	5,758
Total Cost	$573,737	$2,100	$575,837

Fully funded. All other terms and conditions remain the same.

DISTRIBUTION:

STANDARD DISTRIBUTION LIST ☐ 01 ☐ 02 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. Scarf	R1/1176
L. Calhoun	R1/1086
J. Friichtenicht	R1/1096
M. Chapman	R1/1096
P. Gentile	01/1230
P. Herbert	01/2044
W. Sun	01/1170

M. E. Moss

CONTRACT ADMINISTRATOR

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED PROC REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 1

1 AMENDMENT/MODIFICATION NO	2 EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO	4 PROJECT NO (If applicable)
NINE (9)	APR 16 1982	10-26482	

5 ISSUED BY (CODE: HWC-2)

NASA Headquarters
Contracts & Grants Division
Washington, DC 20546
Attention: Donald J. Andreotta

6 ADMINISTERED BY (If other than block 5) (CODE)

AFPRO, TRW, Inc.
One Space Park
Redondo Beach, CA 90278

7 CONTRACTOR NAME AND ADDRESS (CODE) (FACILITY CODE)

(Street, city, county, state, and ZIP Code)

TRW, Inc.
Defense Space Systems Group
One Space Park
Redondo Beach, CA 90278

RECEIVED
APR 23 1982
CONTRACTS

8. AMENDMENT OF SOLICITATION NO.

DATED (See block 9)

MODIFICATION OF CONTRACT/ORDER NO NASW-3087

DATED 7-1-77 (See block 11)

9 THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods

(a) By signing and returning _____ copies of this amendment, (b) By acknowledging receipt of this amendment on each copy of the offer submitted, or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified

10 ACCOUNTING AND APPROPRIATION DATA (If required)

R&D(82) 802/30108 188-36-55-18 ($832)
OBLIGATION: $2,079 154-10-80-26 ($1,247)

Estimated Cost: $2,079
Cost Share : 21
Total Cost : $2,100

11 THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____

The Changes set forth in block 12 are made to the above numbered contract/order

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of 10 U.S.C. 2304(a)(3).

It modifies the above numbered contract as set forth in block 12.

12 DESCRIPTION OF AMENDMENT/MODIFICATION

This Modification amends the Statement of Work and increases the estimated cost and cost share totals.

a. ATICLE I is amended to add, "The Contractor shall provide the personnel, facilities and material to participate in discussions on ISEE 1, 2, 3, Voyager 1, 2, the Pioneer Venus Orbiter and other NASA activities with the Soviet Academy of Sciences, placing special emphasis on the interchange of Venus lightning data and discussions of the US-Soviet Working Group on Near-Earth, the Moon and Planets. Such discussions shall be conducted during a visit to the Soviet Academy of Sciences in the USSR not later than May 15, 1982."

b. ARTICLE V is amended to increase the estimated cost of the contract to the Government by $2,079 from $568,000 to $570,079; the cost share amou by $21 from $5,737 to $5,758; and the total contract estimate by $2,100 from $573,737 to $575,837.

c. All other terms and conditions remain unchanged.

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect

13 ☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO ISSUING OFFICE

14 NAME OF CONTRACTOR/OFFEROR

BY J. P. Hebert
(Signature of person authorized to sign)

17. UNITED STATES OF AMERICA

BY Donald J. Andreotta
(Signature of Contracting Officer)

15 NAME AND TITLE OF SIGNER (Type or print)	16 DATE SIGNED	18 NAME OF CONTRACTING OFFICER (Type or print)	19 DATE SIGNED
J. P. HEBERT	13 APR 1982	Donald J. Andreotta	ADD 16 82

ISSUE DATE 8 MAR 82
PAGE 1 OF 1

TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219
CONTRACT NO.: NASW-3087

JOB NUMBER(S): 5079-73, 3372-96, 97, 3467-76, 3473-58
REVISION NO.: 13

CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies & Supporting Research in Magnetospheric Physics

BASIS FOR ISSUANCE: Change of Administrator

SPONSOR: GROUP S&TG PC CA DIV ATD OPS RTO

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

Effective 15 March 1982 the Contract Administrator for this contract is changed as follows:

from W. G. Sanders
R1/2004

to: M. E. Moss
01/1050
x63837

DISTRIBUTION:

STANDARD DISTRIBUTION LIST ☐ 01 ☐ 02 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. Scarf (PM)	R1/1176
L. Calhoun	R1/1086
M. Chapman	R1/1096
J. Friichtenicht	R1/1096
P. Gentile	01/ 1230
P. Herbert	01/2044
W. Sun	01/1170

W. E. Meyers

TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219

JOB NUMBER: 5079-73, 3372-96, 97 3467-76, 3473-58

ISSUE DATE: 8 SEP 81 | REVISION NO. 12 | PAGE 1 OF 1

CONTRACT NO.: NASW-3087

BASIS FOR ISSUANCE: Amendment No. 7

CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies & Supporting Research in Magnespheric Physics

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

This authorization is being issued to correct C/A Rev. #11 to show the issue date thereon as 8 SEP 81 and the basis for issuance as Amendment No. 7. All other data remains the same as follows:

	Previous	This modification	New Totals
Total Cost	$442,424	$131,313	$573,737
Total TRW Share	(4,424)	(1,313)	(5,737)
Total NASA Share Funded	$438,000	$130,000	$568,000

Contract is now fully funded.

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. Scarf	R1/1176
L. Calhoun	R1/1086
Friichtenicht	R1/1096
Chapman	R1/1096
P. Gentile	E1/4048
P. Herbert	E1/5052
D. Edwards	01/1260
A. Williams	R1/2104

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

SYSTEMS 144C REV. 8-76

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 1

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3 REQUISITION/PURCHASE REQUEST NO	4 PROJECT NO (If applicable)
EIGHT (8)	14 SEP 1981	D-04989	

5. ISSUED BY (CODE HWC-2)
NASA Headquarters
Contracts & Grants Division
Washington, DC 20546
Attention: D. Andreotta

6. ADMINISTERED BY (If other than block 5) (CODE)
AFPRO, TRW
One Space Park
Redondo Beach, CA 90278

7. CONTRACTOR NAME AND ADDRESS (CODE) (FACILITY CODE)
(Street, city, county, state and ZIP Code.)
TRW, Inc.
Defense Space Systems Group
One Space Park
Redondo Beach, CA

☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ (See block 9)
☒ MODIFICATION OF CONTRACT ORDER NO. NAS8-30687
DATED 7-1-77 (See block 10)

9 THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment, (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10 ACCOUNTING AND APPROPRIATION DATA (If required)
N/A

11, THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to: _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☒ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12, effective immediately.

(c) ☐ This Supplemental Agreement is entered into pursuant to authority of:

It modifies the above numbered contract as set forth in block 12.

12 DESCRIPTION OF AMENDMENT/MODIFICATION

Block 3 of Modification No. 7, dated 8-31-81, is corrected to delete, "D-04977", and substitute instead, "10-26170".

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13. ☒ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☐ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN _____ COPIES TO ISSUING OFFICE

14 NAME OF CONTRACTOR/OFFEROR

BY _____ (Signature of person authorized to sign)

15 NAME AND TITLE OF SIGNER (Type or print)

16 DATE SIGNED

15 NAME OF CONTRACTING OFFICER (Type or print)
Donald L. ANDREOTTA

16 DATE SIGNED
14 SEP 81

20-101

TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219

JOB NUMBER: 5079-73, 3372-96, 97 3467-76, 3473-58

ISSUE DATE: 8 OCT 81 | REVISION NO. 11 | PAGE 1 OF 1

CONTRACT NO.: NASW-3087

BASIS FOR ISSUANCE: Modification No. 2

CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies & Supporting Research in Magnespheric Physics

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

This modification adds funding as follows:

	Previous	This Modification	New Totals
Total Cost	$442,424	$131,313	$573,737
Total TRW Share	(4,424)	(1,313)	(5,737)
Total NASA Share Funded	$438,000	$130,000	$568,000

The contract is now fully funded.

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. Scarf	R1/1176
L. Calhoun	R1/1086
J. Friichtenicht	R1/1096
J. Chapman	R1/1096
P. Gentile	E1/4048
P. Herbert	E1/5052
D. Edwards	R1/1120
A. Williams	R1/2104

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

SYSTEMS 144C REV. 8-76

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 1

1. AMENDMENT/MODIFICATION NO.	2 EFFECTIVE DATE	3 REQUISITION/PURCHASE REQUEST NO	4 PROJECT NO. (If applicable)
SEVEN	8-31-81	D-04973	

5. ISSUED BY (CODE) HWC-2
NASA Headquarters
Contracts & Grants Division
Washington, DC 20546
Attention: D. Andreotta

6 ADMINISTERED BY (If other than block 5) (CODE)
AFPRO, TRW
One Space Park
Redondo Beach, CA 90278

7. CONTRACTOR NAME AND ADDRESS (CODE) (FACILITY CODE)
(Street, city, county, state, and ZIP Code)
TRW, Inc.
Defense Space Systems Group
One Space Park
Redondo Beach, CA

☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ (See block 9)

☒ MODIFICATION OF CONTRACT/ORDER NO NASW-3087
DATED 7-1-77 (See block 11)

9 THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10 ACCOUNTING AND APPROPRIATION DATA (If required)
R&D(81) 801/20108 170-36-55-18 ($60,000)
385-36-01-10 ($70,000)

INCREASE OBLIGATION $130,000

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to: _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☒ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☐ This Supplemental Agreement is entered into pursuant to authority of: _____
It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

This Modification increases the amount of funds obligated under the subject contract. The contract is now fully funded.

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13 ☒ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☐ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN _____ COPIES TO ISSUING OFFICE

14 NAME OF CONTRACTOR/OFFEROR
BY _____ (Signature of person authorized to sign)

15 NAME AND TITLE OF SIGNER (Type or print)

16 DATE SIGNED

17 UNITED STATES OF AMERICA
BY Donald J. Andreotta (Signature of Contracting Officer)

18 NAME OF CONTRACTING OFFICER (Type or print)
Donald J. ANDREOTTA

19 DATE SIGNED
8-31-81

TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219			
JOB NUMBER: 5079-73, 3372-96, 97, 3467-76, 3473-58			
ISSUE DATE: 7 APR 81	REVISION NO. 10	PAGE 1 OF 1	CONTRACT NO.: NASW-3087
BASIS FOR ISSUANCE: Amendment No. 6		CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies, & Supporting Research in Magnetospheric Physics	

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

Allowable expenditure of cost is related to funding on this cost sharing contract as follows:

Total Cost	$442,424
Total TRW Share	(4,424)
Total NASA Share Funded	$438,000

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. Scarf	R1/1176
L. Calhoun	R1/1086
Friichtenicht	R1/1096
Staudhammer	R1/1096
P. Gentile	E1/4048
H. Wilkinson	E1/5052
D. Edwards	R1/1120
A. Williams	R1/2104

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

5079-73

TRW CONTRACT AUTHORIZATION

SALES NUMBER 31219			
JOB NUMBER 3372-96 97, 3467-76, 3473-58			
DUE DATE 8 JAN 81	REVISION NO. 9	PAGE 1 OF 1	CONTRACT NO. NASW-3087 5079-73
BASIS FOR ISSUANCE Amendment No. 6			CONTRACT TITLE Ongoing Data Reduction, Theoretical Studies, & Supporting REsearch in Magnetospheric Physics

This revision is issued to modify only the following block numberr of the CONTRACT AUTHORIZATION:

(11) The period of performance is extended to 30 SEP 82.

(14, 15, 16) Cost, TRW Share, Total:

	Previous Totals	This Amend.	New Totals
Total Cost	$321,192	$252,545	$573,737
Total TRW Share:	(3,192)	(2,545)	(5,737)
Total NASA Share	$318,000	$250,000	$568,000
Funding	$318,000	$120,000	$438,000

The contract is now funded through 9/30/81.

Reporting Requirements: "Quarterly" Progress Reports Repro + 7 12-18-81 thru 9-15-82

Final Report Repro + 7 9-30-82*

*This date is changed from 12/31/80. The final report is to cover the period 25 June 1980 through 30 September 1982.

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.	
F. Scarf	R1/1176	M. Wong
L. Calhoun	R1/1086	R1/2104
. Friichtenicht	R1/1096	
. Staudhammer	R1/1096	
r. Gentile	E1/4048	
H. Wilkinson	E1/5052	
D. Edwards	R1/1120	
A. Williams	R1/2104	

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

SYSTEMS 144C REV. 8-76

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
Six (6)	12-31-80	10-25012	

5. ISSUED BY CODE HWC-2
NASA Headquarters
Contracts and Grants Division
Washington, DC 20546

6. ADMINISTERED BY (If other than block 5) CODE
AFPRO; TRW, Inc.
One Space Park
Redondo Beach, CA 90278

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) CODE FACILITY CODE
TRW, Inc.
Defense and Space Systems Group
One Space Park
Redondo Beach, CA 90278

8.
☐ AMENDMENT OF SOLICITATION NO. _____
DATED _____ (See block 9)
☒ MODIFICATION OF CONTRACT/ORDER NO. NASW - 3087
DATED 7-1-77 (See block 11)

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA (If required)
R&D (80) 800/10108 170-36-55-18 ($60,000)
Obligation: $120,000 385-36-01-19 ($60,000)

Estimated Cost-$250,000
Cost Share - 2,545
Total Cost -$252,545

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of 10 U.S.C. 2304(a)(11)
It modifies the above numbered contract as set forth in block 12.

DESCRIPTION OF AMENDMENT/MODIFICATION

The purpose of this Modification is to continue research under contract NASW 3087; to amend the Statement of Work; to increase the estimated cost; to extend the period of performance; to revise the reporting requirements for the final report; and to restate the contract in accordance with current NASA procurement regulations.

(Continued on the next page)

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13.
☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR	17. UNITED STATES OF AMERICA
H. D. Wilkinson (Signature of person authorized to sign)	BY Anthony Martoccia (Signature of Contracting Officer)
15. NAME AND TITLE OF SIGNER (Type or print)	**16. DATE SIGNED**
H. D. Wilkinson Div. Manager of Contracts (ATD)	12-31-80
18. NAME OF CONTRACTING OFFICER (Type or print)	**19. DATE SIGNED**
Anthony Martoccia	12-31-80

a. Article I is amended to add the following:

"During the period of performance specified for Modification No. 6 to this contract, the contractor shall continue on going data reduction, theoretical studies and supporting research in magnetospheric physics initiated under Modification No. 3, and as more particularly described in the contractor's proposal nos31219.003, and 31219.004,dated July 1980 and September 1980, respectfully, both of which are incorporated herein by reference."

b. Article II is amended to add the following:

"The work to be performed under this modification shall be completed no later than September 30, 1982."

c. Article III is amended to add the following:

"The final report for the work to be performed under this modification and modification No. 3 shall be delivered no later than September 30, 1982."

d. Article V is amended by changing the total cost of performing the work under this contract and the total estimated cost to the Government from $321,192 and $318,000 to $573,737 and $568,000, respectively.

e. The work to be performed under this modification shall not be subject to the provisions and operations of Article XII, notwithstanding language in the Article to the contrary. References in the Article to a contract expiration date and completion of contract performance shall be construed to mean August 31, 1979, the end of performance date for Modification No. 2 to this contract.

f. Article XV, Options, is deleted.

g. Article XIV is amended to (1) Incorporate Modification No2 to Basic Agreement NAS11-680(B), dated April 29, 1980, herein.

(2) Delete Clause A.5, Utilization of Small Business and Small Disadvantaged Business Concerns,(Sept. 1979) (1,707- 3(a)),and substitute in its stead, Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals,(June 1980) (1.707-3(a)).

(3) Amend Clause A.6-3, Acquisition of Existing Government Equipment, by changing the date thereof to March 1980.

(4) Amend Clause A.12, Disputes,by changing the date thereof to June 1980.

(5) Amend Clause C.29, Allowable Cost, Fixed Fee and Payment, by changing the date thereof to May 1980.

(6) Add Clause C.3, Limitation of Liability - Service Contract.

(7) Add Clause C.20, Limitation on Withholding of Payments .

(8) Add Clause C.28, Stop Work Order.

(9) Add Clause C. 31, Limitation of Government's Obligation.

h. The Schedule and all references thereof are amended to add the following:

"Article XV Limitation of Government's Obligation

Pursuant to the Clause of this contract, entitled, Limitation of Government's Obligation , funds in the amount of $120,000 are hereby allotted for the performance of this contract for the period January 1, 1981 through September 30, 1981."

TRW

TRW 31219.003/4
1780.5.80-6550
1 December 1980

NASA Headquarters
Contracts & Grants Division
300 - 7th Street, S.W., Room 723
Washington, DC 20546

Attention: Mr. Don Andreotta, Code HWC-2

Subject: NASA Contract NASW-3087
Proposals 31219.003 and 31219.004
Ongoing Data Reduction, Theoretical Studies
in Magnetospheric Physics

As indicated in my telephone call to you of 26 November 1980, TRW requests that the modification resulting from the subject proposals provide that the due date for the final report be changed to the end date of the added work.

TRW INC.
DEFENSE & SPACE SYSTEMS GROUP

W. G. Sanders
Contract Administrator
Applied Technology Division

WGS:bc

TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219			
JOB NUMBER: 3372-96, 97, 3467-76, 3473-58			
ISSUE DATE: 15 OCT 80	REVISION NO. 8	PAGE 1 OF 1	CONTRACT NO. NASW3087 5079-73

BASIS FOR ISSUANCE: Memorandum from AFPRO/TRW dtd 9 OCT 80

CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies, & Supporting Research in Magnetospheric Physics

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

The Administrative Contracting Officer is changed to Sandra N. Rickman/TDM/RPE,

AFPRO/TRW/TM
One Space Park
Redondo Beach CA 90278

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.	
F. L. Scarf	R1/1176	M. Wong
M. L. Calhoun	R1/1086	R1/2104
[illegible]. Friichtenicht	R1/1096	
[illegible]. Staudhammer	R1/1096	
P. R. Gentile	E1/4048	
H. D. Wilkinson	E1/5052	
D. A. Edwards	R1/1120	
A. K. Williams	R1/2104	

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

SYSTEMS 144C REV. 8-76

DEPARTMENT OF THE AIR FORCE
AF PLANT REPRESENTATIVE (DET 46) AF CONTRACT MGT DIV (AFSC)
TRW DEFENSE AND SPACE SYSTEMS GROUP
ONE SPACE PARK, REDONDO BEACH, CALIFORNIA 90278

REPLY TO ATTN OF: TM

9 Oct 80

SUBJECT: Assignment of Administrative Contracting Officer

TO: TMD/RPE/Sandra N. Rickman

1. Pursuant to the agreement between National Aeronautics and Space Administration and Department of Defense, dated 18 June 1969, and NASA Letter of Delegation, dated 25 June 1980 . from NASA Contracting Officer, you are hereby assigned as Administrative Contracting Officer for the following Contract:

Contract Number NASW-3087

Contractor: TRW Defense and Space Systems Group
One Space Park
Redondo Beach CA 90278

Office of Administration: AFPRO/TRW/TM
One Space Park
Redondo Beach CA 90278

2. This assignment is limited to the performance of those field administration support functions set forth in referenced Letter of Delegation. Functions not specified in referenced letter are reserved for the NASA Administrative Contracting Officer.

Charles Worthington

CHARLES G. WORTHINGTON, Lt Col, USAF
Principal Administrative Contracting Officer

Cy to: DCAA
Buying Office
Contractor
Contract File

TRW

CONTRACT AUTHORIZATION

SALES NUMBER: 31219			
JOB NUMBER: 3372-96, 97, 3467-76, 3473-58			
DATE: 3 OCT 80	REVISION NO. 7	PAGE 1 OF 1	CONTRACT NO. NASW-3087 5079-73
BASIS FOR ISSUANCE: Amendment No. 5			CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies, & Supporting Research in Magnetospheric Physics

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION:

(11) Period of Performance is extended to 31 December 1980.

DELIVERABLES:

Quarterly Progress Report	Repro + 7	10-15-80
Final Report	Repro + 7	12-31-80

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. L. Scarf	R1/1176
M. L. Calhoun	R1/1086
[illegible] Friichtenicht	R1/1096
[illegible]. Staudhammer	R1/1096
P. R. Gentile	E1/4048
H. D. Wilkinson	E1/5052
D. A. Edwards	R1/1120
A. K. Williams	R1/2104
M. Hoag	R1/2104

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 1

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
Five (5)	9-30-80	D-04554	

5. ISSUED BY CODE HWC-2

NASA Headquarters
Contracts & Grants Division
Washington, DC 20546
Attention: Donald J. Andreotta

6. ADMINISTERED BY (If other than block 5) CODE

AFPRO TRW
One Space Park
Redondo Beach, CA 90278

7. CONTRACTOR NAME AND ADDRESS CODE ____ FACILITY CODE ____

(Street, city, county, state, and ZIP Code)

TRW, Inc.
Defense Space Systems Group
One Space Park
Redondo Beach, CA 90278

8.
☐ AMENDMENT OF SOLICITATION NO. _____,
DATED _____ (See block 9)

☒ MODIFICATION OF CONTRACT/ORDER NO. NASW-3087
DATED 7-1-77 (See block 11)

9 THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10 ACCOUNTING AND APPROPRIATION DATA (If required)

No Cost Extension

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of the mutual agreement of the parties.

It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

Whereas, the Government has a requirement for extended services of TRW, Inc., to continue Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics; and

Whereas, the Contractor has agreed to continue research and analysis during the period September 30, 1980 through December 31, 1980;

Now, therefore, in consideration thereof, Articles II and III are amended to change, "September 30, 1980", to, "December 31, 1980", therein.

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13.
☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT.
☒ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR

BY H. D. Wilkinson
(Signature of person authorized to sign)

17. UNITED STATES OF AMERICA

BY Donald J. Andreotta
(Signature of Contracting Officer)

15. NAME AND TITLE OF SIGNER (Type or print)	16. DATE SIGNED	18. NAME OF CONTRACTING OFFICER (Type or print)	19. DATE SIGNED
H. D. Wilkinson Div. Manager of Contracts (ATD)	9/24/80	DONALD J. ANDREOTTA	SEP 1[illegible]

Bill Sandusky

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
Five (5)	9-30-80	D-04554	

5. ISSUED BY	CODE	6. ADMINISTERED BY (If other than item 5)	CODE
NASA Headquarters Contracts & Grants Division Washington, DC 20546 Attention: Donald J. Andreotta	MHC-2	AFPRO TRW One Space Park Redondo Beach, CA 90278	

7. CONTRACTOR (No., street, city, county, state and ZIP code)	CODE	FACILITY CODE
TRW, Inc. Defense Space Systems Group One Space Park Redondo Beach, CA 90278		

8. AMENDMENT OF SOLICITATION NO.	DATED (See Item 9)

9. MODIFICATION OF CONTRACT/ORDER NO.	DATED (See Item 9)
NAS5-30??	7-1-77

THIS BLOCK AND ALL ITEMS APPLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning ____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA (If required)

No Cost Extension

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to: _____

The Changes set forth in Block 14 are made in the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in Block 14.

(c) ☒ This Supplemental Agreement is entered into pursuant to authority of: the mutual agreement of the parties.

(d) In addition to the above numbered contract as set forth in Block 14.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

Whereas, the Government has a requirement for extended services of TRW, Inc., t continue Ongoing Data Reduction, Theoretical Studies and Supporting Research in Magnetospheric Physics; and

Whereas, the Contractor has agreed to continue research and analysis during the period September 30, 1980 through December 31, 1980;

Now, therefore, in consideration thereof, Articles IV and XII are amended to ch "September 30, 1980", to, "December 31, 1980", therein.

ORIGINAL PAGE IS
OF POOR QUALITY

13. Except as provided herein, all terms and conditions of the document referenced in Block 9, as heretofore changed, remain unchanged and in full force and effect.

☐ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☒ CONTRACTING OFFICER IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO

15A. NAME OF CONTRACTOR/OFFEROR	15B. NAME AND TITLE OF SIGNER (Type or print)	15C. DATE SIGNED	16A. NAME OF CONTRACTING OFFICER (Type or print)	16B. DATE SIGNED
BY _____ (Signature of person authorized to sign)	H. D. Wilkinson Div. Manager of Contracts (MIS)	9/24/80	BY _____ DONALD J. ANDREOTTA (Signature of Contracting Officer)	9/25/

STANDARD FORM 30 (REV. 10-83)
GENERAL SERVICES ADMINISTRATION
FAR (48 CFR) 53.243

TRW

DEFENSE AND SPACE SYSTEMS GROUP

ONE SPACE PARK • REDONDO BEACH • CALIFORNIA 90278

INTEROFFICE CORRESPONDENCE

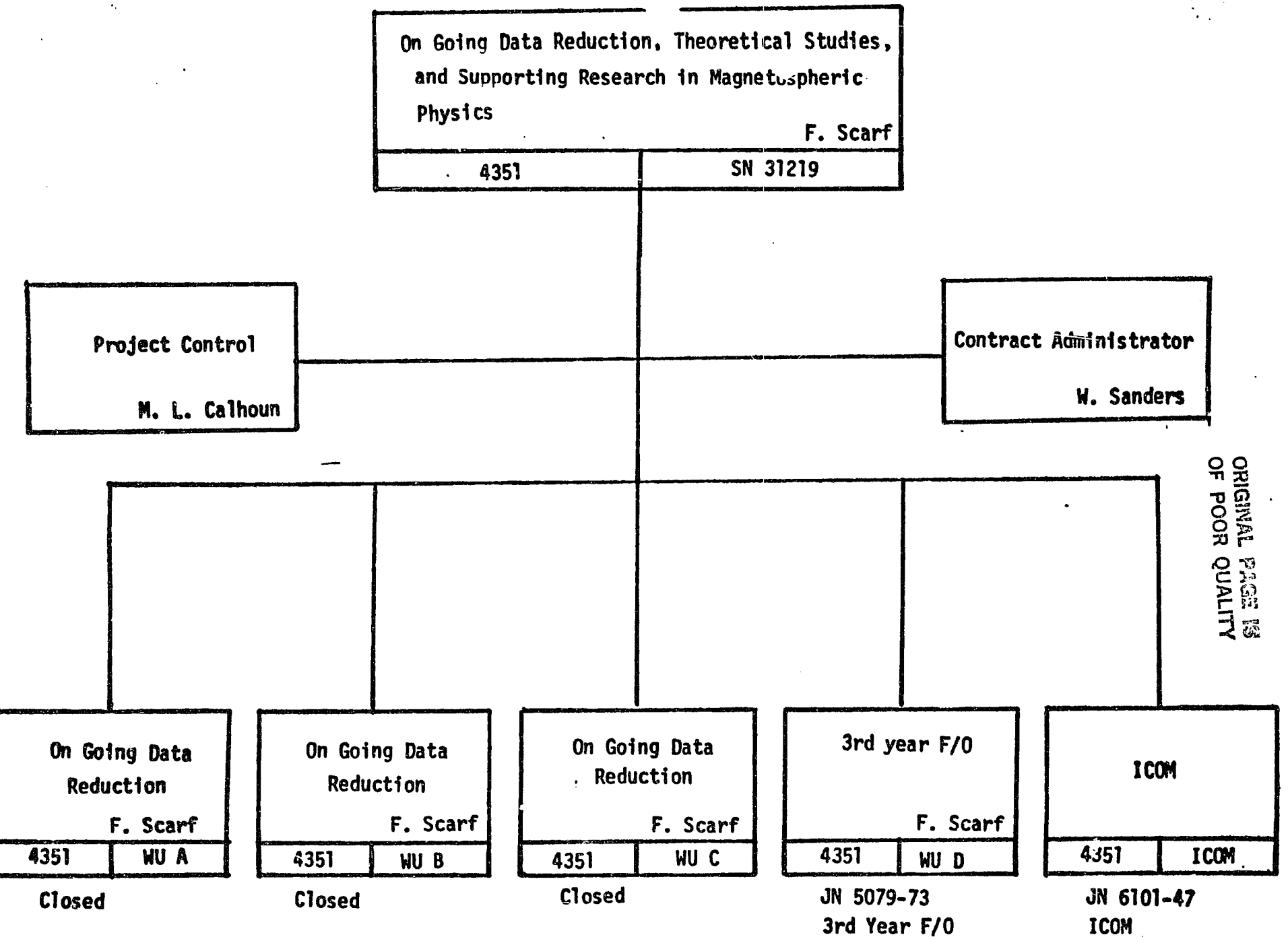
TO: F. L. Scarf CC: DATE: 11 September 1980

W G Sanders

SUBJECT: SN 31219.003
Ongoing Data Reduction, Theoretical Studies And
Supporting Research In Magnetospheric Physics

FROM: W. G. Sanders
BLDG. R1 MAIL STA. 2004 EXT. 63837

I have been talking to Dr. Roger Williamson, whose name you gave me, to trace through the PR for the FY 81 procurement. It turns out that nothing has been done yet. Don Andreotta received our proposal a couple of months ago and sent copies to Wiskerchen, but Wiskerchen never got them, so nothing has been done. Dr. Williamson will put his hand on a copy of our proposal tomorrow and will get the process started. He holds little hope that the PR will reach Andreotta in time to conclude negotiations by 30 September 80. Andreotta is going on a business trip on 22 September and will be on vacation in the subsequent two weeks. Dr. Williamson and I agreed to touch base again on Monday, 15 September, to review status. Williamson is now thinking in terms of contracting for two years since last year's review was good for three years. Our proposal for the second and third years will reach them about 17 September since the signoff cannot be completed this week.



TRW CONTRACT AUTHORIZATION

SALES NUMBER: 31219			
JOB NUMBER: 3372-96, 97, 3467-76, 3473-58			
UE DATE: 26 June 1980	REVISION NO. 6	PAGE 1 OF 1	CONTRACT NO. NASW-3087 5079-73
BASIS FOR ISSUANCE: Amendment No. 3			CONTRACT TITLE: Ongoing Data Reduction, Theoretical Studies, & Supporting Research in

This revision is issued to modify only the following block numbers of the CONTRACT AUTHORIZATION: Magnetospheric Physics

(11) The period of performance is extended to 30 SEP 80.

(14) (15) (16) Cost, TRW Share, Total:

	Previous Totals	This Amend.	New Totals
Total Cost:	$199,980	$121,212	$321,192
Total TRW Share:	(1,980)	(1,212)	(3,192)
Total	$198,000	$120,000	$318,000

Reporting Requirements: FINAL REPORT - due 30 SEP 80

ARTICLE XIV is amended to incorporate all changes to Basic Agreement NAS11-305 (B), dated April 23, 1976 and modifications, thereto, as incorporated in this contract, contained in Basic Agreement NAS11-680 (B), and Modification No. 1, thereto, dated August 7, 1979 and February 12, 1980, respectively. Additionally, Clause A-28, Inspection and Correction of Defects (April 1975), is deleted and Clause C-34-1, Inspection (Sept. 1962) (Short Form), is substituted in its stead.

Proposal for fourth year of contract - due 30 MAY 80.

DISTRIBUTION:
STANDARD DISTRIBUTION LIST 0-1 PLUS THE FOLLOWING

NAME	BLDG./MAIL STA.
F. L. Scarf (PM)	R1/1176
M. L. Calhoun	R1/1086
[illegible] Friichtenicht	R1/1096
[illegible]. Staudhammer	R1/1096
P. R. Gentile	E1/4048
H. D. Wilkinson	E1/5052
D. A. Edwards	R1/1120
A. K. Williams	R1/2104
M. Wong	R1/2104

W. G. Sanders
CONTRACT ADMINISTRATOR

CONTRACTS MANAGER

TRW

DEFENSE AND SPACE SYSTEMS GROUP

ONE SPACE PARK • REDONDO BEACH • CALIFORNIA 90278

INTEROFFICE CORRESPONDENCE

TO: Distribution

CC:

DATE: 26 June 1980

SUBJECT: SN 31219.000
Contract NASW3087

FROM: W. G. Sanders
BLDG R1 MAIL STA. 2004 EXT. 63837

Our customer has extended the period of performance of the subject contract, so the enclosed Close-out Request is cancelled.

DISTIRBUTION

Classified Material Control
Contract Accounting
Contract Close-Administrator
General Counsel
Patents Counsel
Project Manager
Procurement Close-out Coordinator
Property Management OFfice
Resident DCASR Office
Contracts Communication Center

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
4 Four (04)	6/25/80	D-04500	

5. ISSUED BY — CODE

NASA Headquarters
Contracts & Grants Division
Washington, DC 20546
Attention: Ms. Theresa Curtis

6. ADMINISTERED BY (If other than block 5) — CODE

AFPRO TRW
One Space Park
Redondo Beach, CA 90278

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) — CODE — FACILITY CODE

TRW, Inc.
Defense Space Systems Group
One Space Park
Redondo Beach, CA 90278

8.
- ☐ AMENDMENT OF SOLICITATION NO. _____
  DATED _____ (See block 9)
- ☒ MODIFICATION OF CONTRACT/ORDER NO. NAS5-3087
  DATED 7/1/77 (See block 11)

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods: (a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA (If required)

N/A

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☒ The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) ☐ This Supplemental Agreement is entered into pursuant to authority of _____
It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

This supplemental agreement is issued to change the procurement request number from 10-23665 (mod 3) to 10-23655.

ALL OTHER TERMS AND CONDITIONS OF THIS CONTRACT REMAIN THE SAME.

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

☒ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☐ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN _____ COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR	17. UNITED STATES OF AMERICA
BY _____ (Signature of person authorized to sign)	BY _____ (Signature of Contracting Officer)
15. NAME AND TITLE OF SIGNER (Type or print)	16. DATE SIGNED
18. NAME OF CONTRACTING OFFICER (Type or print)	19. DATE SIGNED

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO	4. PROJECT NO (If applicable)
Three (3)	25 JUN 1980	10-23665	

5. ISSUED BY — CODE HWC-2

NASA Headquarters
Contracts & Grants Division
Washington, D. C. 20546
Attention: Mr. Donald J. Andreotta

6. ADMINISTERED BY (If other than block 5) — CODE

AFPRO TRW
One Space Park
Redondo Beach, CA 90278

JN 5079-73

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) — CODE — FACILITY CODE

TRW, Inc.
Defense Space Systems Group
One Space Park
Redondo Beach, CA 90278

8.
- [ ] AMENDMENT OF SOLICITATION NO. _____
  DATED _____ (See block 9)
- [X] MODIFICATION OF CONTRACT/ORDER NO. NASW-3087
  DATED 7-1-77 (See block 11)

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

[ ] The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers [ ] is extended, [ ] is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment, (b) By acknowledging receipt of this amendment on each copy of the offer submitted, or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

10. ACCOUNTING AND APPROPRIATION DATA (If required)

RED(79) 809/00108 170-36-55-18-10($50,000.00) Cost-$120,000.00
385-36-01-19-10($70,000.00) No Fee/Cost Share-$1,212.00

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) [ ] This Change Order is issued pursuant to _____

The Changes set forth in block 12 are made to the above numbered contract/order

(b) [ ] The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12

(c) [X] This Supplemental Agreement is entered into pursuant to authority of 10 U. S. C. 2304(a)(11)

It modifies the above numbered contract as set forth in block 12

12. DESCRIPTION OF AMENDMENT/MODIFICATION

The purpose of this Modification is to continue research under contract NASW-3087; to amend the Statement of Work; to increase the estimated cost; to extend the period of performance; to revise the reporting requirements for the final report; and to restate the contract in accordance with current NASA Procurement Regulations.

a. Article I is amended to add the following:

"During the period of performance specified for Modification No. 3 to this contract, the contractor shall continue on going data reduction, theoretical studies and supporting research in magnetospheric physics, as more particularly described in the contractors proposal no. 36115.000, and revision no 1, thereto, dated August 1979 and April 11, 1980, respectfully, both of which are incorporated herein by reference.

Tasks shall include, but not be limited to: (SEE FOLLOWING PAGES)

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13.
- [ ] CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT
- [X] CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 3 COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR		17. UNITED STATES OF AMERICA	
BY H. D. Wilkinson (Signature of person authorized to sign)		BY Donald J. Andreotta (Signature of Contracting Officer)	
15. NAME AND TITLE OF SIGNER (Type or print) H. D. Wilkinson, Manager ATD Contracts	16. DATE SIGNED 6/23/80	18. NAME OF CONTRACTING OFFICER (Type or print) Donald J. Andreotta	19. DATE SIGNED 25 JUN 19[illegible]

NSN 7540-01-152-8070 — PREVIOUS EDITION NOT USABLE — STANDARD FORM 30 (REV. 10-83) — Prescribed by GSA FAR (48 CFR) 53.243

U.S. GOVERNMENT PRINTING OFFICE 1984 0-421-934

Block 12 continued

a. FORESHOCK - Define and study the large scale structure of the foreshock and its dynamic behavior, using field, particle and plasma wave data from IMP 7, 8 and ISLE A, B. Data from Pioneer Venus and Voyager 1, 2 will be used to study the regions upstream from Venus and Jupiter in order to analyze different kinds of foreshock phenomena.

b. INTERPLANETARY TRANSIENTS - Conduct long baseline studies of traveling interplanetary phenomena using field, particle and plasma wave data from Pioneer Venus, ISEE A, B, C, IMP 7, 8 and Voyager 1, 2.

c. WAVE - PARTICLE AND WAVE - WAVE INTERACTIONS - Search current observational data base for examples of wave-wave interaction phenomena. Conduct theoretical studies to determine if these represent true mode coupling phenomena.

d. PLANETARY MAGNETOSPHERES - Conduct detailed comparative studies of lightning production and propagation paths through the ionosphere and magnetospheres of the planets.

e. RESEARCH ON SENSOR AND SPACECRAFT - Investigate the in-flight behavior of wave sensors on spacecraft; and problems related to spin modulated solar array noise detected at low frequencies with electric antennas."

ARTICLE II is amended to add the following:

The work to be performed under this modification shall be completed no later than September 30, 1980.

ARTICLE III is amended to add the following:

"The final report for the work to be performed under this modification shall be delivered no later than September 30, 1980.

ARTICLE V is amended by changing the total cost of performing the work under this contract and the total estimated cost to the Government from $199,990 and $198,000 to $321,192 and $318,000, respectively.

The work to be performed under this modification shall not be subject to the provisions and operations of ARTICLE XII, notwithstanding language in the article to the contrary. References in the article to a contract expiration date and completion of contract performance shall be construed to mean August 31, 1979, the end of performance date for Modification No. 2 to this contract.

The Schedule and all references thereto is amended to add the following:

"ARTICLE XV OPTIONS
Government Option to Extend the Term of the Contract for the Four and Fifth Years of Performance.

Block 12 continued

The period of performance of this contract may be extended at the option of the Government for two one year option periods, provided that the Contracting Officer shall have given preliminary notice of the Government's intention to extend at least sixty (60) calendar days prior to the expiration of this contract. (Such preliminary notice shall not be deemed to commit the Government to the exercise of any option).

Not later than 120 calendar days prior to the expiration of the performance period, the contractor shall submit a cost proposal for the option period under consideration.

In the event the parties cannot agree to an estimated cost the Government may direct the contractor to continue performance under the contract and the failure to agree shall be considered a dispute as defined under the Clause entitled "Disputes" of the General Provisions."

g. ARTICLE XIV is amended to incorporate all changes to Basic Agreement NAS11-305 (B), dated April 23, 1976 and modifications, thereto, as incorporated into this contract, contained in Basic Agreement NAS11-680 (B), and Modification No. 1, thereto, dated August 7, 1979 and February 12, 1980, respectively. Addionally, Clause A-28, Inspection and Correction of Defects(April 1975), is deleted and Clause C-34-1, Inspection(Sept. 1962)(Short Form), is substituted in its stead.

TRW
DEFENSE AND SPACE SYSTEMS GROUP
ONE SPACE PARK • REDONDO BEACH • CALIFORNIA 90278

INTEROFFICE CORRESPONDENCE

TO: File

CC: C. Bolin
F. Scarf
J. Friichtenicht
P. Staudhammer
L. Calhoun
H. Wilkinson

DATE: 25 April 1980

SUBJECT: SN 36115.000R1
Memorandum of Negotiations
Ongoing Data Reduction, Theoretical Studies, and Supporting Research in Magnetospheric Physics

FROM: W. G. Sanders
BLDG R1 MAIL STA. 2004 EXT. 63837

This negotiation was conducted by telephone with Don Andreotta of NASA/HQ on 23 April 1980.
This proposal was submitted on a cost sharing basis as an add-on to contract NASW-3087 (SN 31219). The negotiation is summarized as follows:

Total Estimated Cost	$121,212
Cost Share	(1,212)
NASA Cost Share	$120,000

So that we could receive all of NASA's $120,000 of funding and leave room for reductions due to DCAA recommended rates, the proposal was submitted for a slightly larger amount:

	Base Cost	ICOM	Total Cost	TRW Cost Share	Percent
Proposed/ Adjusted	$120,120	$2,297	$122,417	($1,224)	(1.0%)
Negotiated	118,908	2,304	121,212	(1,212)	(1.0%)
Yield	99.0%			99.0%	

ICOM included in total cost = $2,304
ICOM as a percent of base cost = 1.9%

The resulting contract modification (#3) will state that the level-of-effort clause will not be applicable to the negotiated work.

The basic agreement will be updated from NAS11-305(B) to NAS11-680(B). The same "A" and "C" clauses will be applicable except that A.28 (Inspection and Correction of Defects) will be deleted and C.34-1 (Inspection - Short Form) will be added. The Statement of Work will be paraphrased into five tasks.

The start date will be the date of the PCO's signature, unless Don can get permission for an earlier start date. The end date will be 30 September 1980.

TRW

TRW 36115.000R1
1780.5.80-6190
11 April 1980

NASA Headquarters
Contracts & Grants Division, Code HWC-2
300 - 7th Street, S. W.
Room 723
Washington, D. C. 20546

Attention: Mr. D. Andreotta

Subject: Proposal No. 36115.000R1
A Proposal for Ongoing Data Reduction, Theoretical Studies, and Supporting Research in Magnetospheric Physics

Enclosed is updated pricing for the subject proposal as discussed by telephone between you and Mr. Sanders of TRW on 8 April 1980. It is proposed that this work be added to Contract NASW-3087. We propose that this work not be subject to a level-of-effort provision. We understand that Dr. Wiskerchen agrees to this. Except for revised pricing and level-of-effort, our proposal is the same as previously submitted.

This proposal is submitted on a cost sharing basis and is open to acceptance for a period of sixty days from the date of this letter. No changes to the terms and conditions are proposed except those noted above.

Please address all official correspondence pertaining to this requirement to the attention of our Contracts Administrator, Mr. W. G. Sanders, who has been authorized to represent the Company for this program. Mr. Sanders may be reached by telephone 213/536-3837, or through Mail Station R1/2004.

TRW INC.
DEFENSE & SPACE SYSTEMS GROUP

H. D. Wilkinson
Division Manager of Contracts
Applied Technology Division

HDW:bc

NOTE:

"This document contains commercial or financial information, or trade secrets, of TRW Inc., which are confidential and exempt from disclosure to the public under the Freedom of Information Act, 5 U.S.C. 552 (b) (4), and unlawful disclosure thereof is a violation of the Trade Secrets Act., 18 U.S.C. 1905. Public disclosure of any such information or trade secrets shall not be made without the prior written permission of TRW Inc."

DEPARTMENT OF DEFENSE

CONTRACT PRICING PROPOSAL (RESEARCH AND DEVELOPMENT)

Form Approved
Budget Bureau No. 60-R199

This form is for use when (i) [illegible] of cost or pricing data (see NASA PR 3.807-3) is required and (ii) subcontractor [illegible] Form 633 is authorized by the contracting officer.

PAGE NO. | NO. OF PAGES

NAME OF OFFEROR	SUPPLIES AND/OR SERVICES TO BE FURNISHED
TRW INC., DEFENSE AND [illegible] EMS GROUP	ONGOING DATA REDUCTION & ANALYSIS
HOME OFFICE ADDRESS (Include ZIP Code) ONE SPACE PARK REDONDO BEACH, CA 90278	
DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED APPLIED TECHNOLOGY DIVISION - SAME	TOTAL AMOUNT OF PROPOSAL $121,193
GOVT SOLICITATION NO.	

DETAIL DESCRIPTION OF COST ELEMENTS

1. DIRECT MATERIAL (Itemize on Exhibit A)				EST COST ($)	TOTAL EST COST	REFER TO PAGE
a. PURCHASED PARTS						SEE PAGE
b. SUBCONTRACTED ITEMS						
c. OTHER - (1) RAW MATERIAL						
(2) YOUR STANDARD COMMERCIAL ITEMS						
(3) INTERDIVISIONAL TRANSFERS (At other than cost)						
TOTAL DIRECT MATERIAL						
2. MATERIAL OVERHEAD (Specify)						
3. DIRECT LABOR (Specify)		ESTIMATED HOURS	RATE/HOUR	EST COST ($)		
ENGINEERING LABOR		3410		39,770		
TOTAL DIRECT LABOR					39,770	3,6
4. LABOR OVERHEAD (Specify department or cost center)		O.H. RATE	$ BASE	EST COST ($)		
ENGINEERING OVERHEAD				59,655		
TOTAL LABOR OVERHEAD					59,655	3,8
5. SPECIAL TESTING (Including field work at Government installations)				EST COST ($)		
TOTAL SPECIAL TESTING						
6. SPECIAL EQUIPMENT (If direct charge) (Itemize on Exhibit A)						
7. TRAVEL (If direct charge) (Give details on attached Schedule)				EST COST ($)		
a. TRANSPORTATION						
b. PER DIEM OR SUBSISTENCE						
TOTAL TRAVEL					4,332	3,11
8. CONSULTANTS (Identity - purpose - rate)				EST COST ($)		
TOTAL CONSULTANTS						
9. OTHER DIRECT COSTS (Itemize on Exhibit A)					5,402	
10. TOTAL DIRECT COST AND OVERHEAD					109,165	
11. GENERAL AND ADMINISTRATIVE EXPENSE (Rate	% of cost element Nos:		) 9		13,252	
12. ROYALTIES 4						
13. TOTAL ESTIMATED COST					122,417	
14. FEE OR PROFIT					(1,224)	
15. TOTAL ESTIMATED COST AND FEE OR PROFIT					121,193	

This proposal is submitted for use in connection with and in response to (Describe RFP, etc.)

and reflects our best estimates as of this date, in accordance with the instructions to offerors and the footnotes which follow.

TYPED NAME AND TITLE	SIGNATURE	
JAMES ADLER, MANAGER OF PRICING, ATD		
NAME OF FIRM		DATE OF SUBMISSION
TRW INC., DEFENSE AND SPACE SYSTEMS GROUP		4/11/80

DD FORM 633-4 (NASA EDITION)

EXHIBIT A - SUPPORTING SCHEDULE (Specify. If more space is needed, use blank sheets)

COST EL NO.	ITEM DESCRIPTION (See footnote 1)	EST COST ($)
9	Technical Services	316
	Computing Services	2,789
	Cost of Money	2,297
	TOTAL OTHER COSTS	5,402
11	G & A is not applied to Cost of Money	

I. HAVE THE DEPARTMENT OF DEFENSE, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, OR THE ATOMIC ENERGY COMMISSION PERFORMED ANY REVIEW OF YOUR ACCOUNTS OR RECORDS IN CONNECTION WITH ANY OTHER GOVERNMENT PRIME CONTRACT OR SUBCONTRACT WITHIN THE PAST TWELVE MONTHS?

☒ YES ☐ NO *If yes, identify below.*

NAME AND ADDRESS OF REVIEWING OFFICE *(Include ZIP Code)* — TELEPHONE NUMBER/EXTENSION

Cognizant CAO AFPRO-TRW, One Space Park, Redondo Beach, Cal. 90278 (213) 536-3113

DCAA Resident Auditor, One Space Park, Redondo Beach, Cal. 90278 (213) 536-1580

II. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS PROPOSED CONTRACT?

☐ YES ☒ NO *If yes, identify on a separate page.*

III. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT?

☐ YES ☒ NO *If yes, identify:* ☐ ADVANCE PAYMENTS ☐ PROGRESS PAYMENTS OR ☐ GUARANTEED LOANS

IV. DO YOU NOW HOLD ANY CONTRACT (or, do you have any independently financed (IR & D) projects) FOR THE SAME OR SIMILAR WORK CALLED FOR BY THIS PROPOSED CONTRACT?

☐ YES ☒ NO *If yes, identify*

V. DOES THIS COST SUMMARY CONFORM WITH THE COST PRINCIPLES SET FORTH IN NASA PR, PART 15 *(see 3.807-2)*?

☒ YES ☐ NO *If no, explain on a separate page.*

INSTRUCTIONS TO OFFERORS

1. The purpose of this form is to provide a standard format by which the offeror submits to the Government a summary of incurred and estimated cost (*and attached supporting information*) suitable for detailed review and analysis. Prior to the award of a contract resulting from this proposal the offeror shall, under the conditions stated in NASA PR 3.807-3, be required to submit a Certificate of Current Cost or Pricing Data (see NASA PR 3.807-3 and 3.807-4).

2. As part of the specific information required by this form, the offeror must submit with this form, and clearly identify as such, cost or pricing data (that is, data which is verifiable and factual and otherwise as defined in NASA PR 3.807-3). In addition, he must submit with this form any information reasonably required to explain the offeror's estimating process, including:

a. the judgmental factors applied and the mathematical or other methods used in the estimate including those used in projecting from known data, and

b. the contingencies used by offeror in his proposed price.

3. When attachment of supporting cost or pricing data to this form is impracticable, the data will be specifically identified and described (*with schedules as appropriate*), and made available to the contracting officer or his representative upon request.

4. The format for the "Cost Elements" is not intended as rigid requirements. These may be prepared in different format with the prior approval of the contracting officer if required for more effective and efficient presentation. In all other respects this form will be completed and submitted without change.

5. By submission of this proposal, offeror, if selected for negotiation, grants to the contracting officer, or his authorized representative, the right to examine, for the purpose of verifying the cost or pricing data submitted, those books, records, documents and other supporting data which will permit adequate evaluation of such cost or pricing data, along with the computations and projections used therein. This right may be exercised in connection with any negotiations prior to contract award.

FOOTNOTES

1 Enter in this column those necessary and reasonable costs which in the judgment of the offeror will properly be incurred in the efficient performance of the contract. When any of the costs in this column have already been incurred (e.g., on a letter contract or change order), describe them on an attached supporting schedule. Identify all sales and transfers between your plants, divisions, or organizations under a common control, which are included at other than the lower of cost to the original transferor or current market price.

2 When space in addition to that available in Exhibit A is required, attach separate pages as necessary and identify in this "Reference" column the attachment in which information supporting the specific cost element may be found. No standard format is prescribed; however, the cost or pricing data must be accurate, complete and current, and the judgment factors used in projecting from the data to the estimates must be stated in sufficient detail to enable the contracting officer to evaluate the proposal. For example, provide the basis used for pricing materials such as by vendor quotations, shop estimates, or invoice prices; the reason for use of overhead rates which depart significantly from experienced rates (reduced volume, a planned major rearrangement, etc.); or justification for an increase in labor rates (anticipated wage and salary increases, etc.). Identify and explain any contingencies which are included in the proposed price, such as anticipated costs of rejects and defective work, or anticipated technical difficulties.

3 Indicate the rates used and provide an appropriate explanation. Where agreement has been reached with Government representatives on the use of forward pricing rates, describe the nature of the agreement. Provide the method of computation and application of your overhead expense, including cost breakdown and showing trends and budgetary data as necessary to provide a basis for evaluation of the reasonableness of proposed rates.

4 If the total royalty cost entered here is in excess of $250 provide on a separate page (or on DD Form 783, Royalty Report) the following information on each separate item of royalty or license fee: name and address of licensor; date of license agreement; patent numbers, patent application serial numbers, or other basis on which the royalty is payable; brief description, including any part or model numbers of each contract item or component on which the royalty is payable; percentage or dollar rate of royalty per unit; unit price of contract item; number of units; and total dollar amount of royalties. In addition, if specifically requested by the contracting officer, a copy of the current license agreement and identification of applicable claims of specific patents shall be provided.

5 Provide a list of principal items within each category describing known or anticipated source, quantity, unit price, competition obtained, and basis of establishing source and reasonableness of cost.

GPO 916-814

ONGOING DATA REDUCTION & ANALYSIS

COST ESTIMATE

ENGINEERING LABOR	RATE	HOURS	AMOUNT	TOTAL
Engineering B	21.05	452	$ 9,515	
Engineering C	17.40	452	7,865	
Technicians	9.20	2240	20,608	
Clerical & Support	6.70	266	1,782	
TOTAL ENGINEERING LABOR				$39,770
TOTAL ENGINEERING OVERHEAD				59,655
OTHER DIRECT COSTS	**RATE**	**QTY**	**AMOUNT**	
Technical Services:				
Vu-Graphs	5.02	20	$ 100	
Xerox, pages	.055	3,927	216	
				316
Computing Services:				
Processor Units	235	7	1,645	
Peripheral Units	85	1.1	94	
Remote Terminal, hrs.	10.50	100	1,050	
				2,789
Travel:				
L.A./Wash., D.C.				
Air Fare, trips	612	5	3,060	
Subsistence, days	79	10	790	
Travel Requests, each	12.50	5	63	
L.A./San Francisco, CA.				
Air Fare, trips	96	1	96	
Subsistence	79	4	316	
Travel Requests, each	12.50	1	13	
				4,338
TOTAL OTHER DIRECT COSTS				7,773
COST BEFORE G & A				$106,868
G & A EXPENSE				13,252
SUBTOTAL				$120,120
COST OF MONEY				2,297
TOTAL ESTIMATED COST				$122,417
TRW COST SHARE				(1,224)
TOTAL COST LESS TRW COST SHARE				$121,193

EXPLANATORY NOTES FOR BIDDING CATEGORIES

These notes are included to provide a definition of each bidding category. The following list includes the major bidding categories, however, all may not be applicable to this proposal.

ADMINISTRATIVE CONTRACTING OFFICER (ACO)

AFPRO-TRW
Chief, Contract Administration Div.
TRW Inc., Defense and Space Systems Group
One Space Park
Redondo Beach, California 90278

RESIDENT AUDITOR

DCAA Resident Office
TRW Inc., Defense and Space Systems Group
One Space Park
Redondo Beach, California 90278

TRW Inc., Defense and Space Systems Group believes that its current cost accounting practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in its submitted Cost Accounting Standards Board Disclosure Statements and revisions thereto. Additional Disclosure Statements or revisions may be in preparation and notification and submittal will be accomplished pursuant to ASPR 3-1205(b).

The data contained in this cost proposal has been prepared by C. W. Bolin, ATD Pricing Operations, TRW Inc., Defense and Space Systems Group, One Space Park, Redondo Beach, California 90278.

BIDDING CATEGORIES

TRW Inc., Defense and Space Systems Group operates under a policy of ACO bidding rate approval, subject to periodic review. The above Resident ACO normally reviews for approval those Company established bidding rates for use in pricing contract proposals to the Government that are identified with an asterisk. The code numbers listed within the parentheses identify the account number used to accumulate the respective costs in the Company accounting system.

BIDDING CATEGORIES	ESTIMATING BASIS
Direct	
Direct Labor*	Direct Labor Hours
Travel/Subsistence*	Trip/Days
Consultants	Days
Material	Material Item Cost
Major Procurements	Labor or Material Procurement
Customer Plant Equipment	Equipment Item Cost
Technical Services (Graphics Prod.)	Service Request
Configuration Adm. & Data Mgmt.*	Service Request
Computing Services*	Service Hours/Units
Overtime Premium	Direct Labor Hours
Indirect	
Overhead*	Direct Labor Dollars
Procurement*	Direct Procurement Dollars
General & Administrative	Total Cost Prior to G & A
Cost of Money Factors	Applied to the same bases as are used to allocate Indirect Expenses

STATUS OF BIDDING RATES

Revision #109
27 March 1980

The following table displays the bidding category, Pricing Manual reference, and status of Company established or cognizant Resident ACO approved bidding rates.

Bidding Rates	Pricing Manual References: Bidding Rates Section/Date/Rev.#	Pricing Manual References: ACO Approval Letter Section/Date/Rev.#	Status of Bidding Rates
Direct Labor 1980-1985	3.1.1,2,3,4,5/8 February 1980/Var	3.2.1/8 February 1980/#7	Formally approved by the cognizant Resident ACO.
Technical Services (Reprographic Services)	4.2.1/2 May 1977/#2	4.2.3/11 December 1974/New	Formally approved by the cognizant Resident ACO.
Computing Services	4.4.1/8 January 1980/#23		Company established bidding rates.
Subsistence	4.1.10/24 March 1980/#2		Company established bidding rates.
Configuration Admin. & Data Management	4.3.1/3 March 1980/#12		Company established bidding rates.
Overhead, Procurement & G&A 1980-1982	5.1.1/10 January 1980/#25		Company established bidding rates.
1983-1985	5.1.2/10 January 1980/#20		Company established bidding rates.*
Cost of Money Factors 1980-1982	5.1.3/27 March 1980/#10		Company established bidding rates.
1983-1985	5.1.4/27 March 1980/#9		Company established bidding rates.*

* It is the practice of the cognizant Resident ACO not to establish ACO approved Cost of Money Factors, Procurement or Overhead and G&A bidding rates beyond a three year period.

DIRECT LABOR

Direct labor costs are identifiable directly to a specific contract or project. The direct labor rates are developed by labor category, as identified and shown in this proposal, from historical data and the evaluation of industry wage and salary patterns, labor market conditions, and other relevant factors.

Direct labor bidding rates are subject to review and formal approval by the cognizant Resident Administrative Contracting Officer (Chief, Contract Administration Division). The actual direct labor rates are continually under review by TRW and the ACO. When a significant variance between the actual rates and the bidding rates or a change in the conditions upon which the bidding rates were based is identified, TRW or the ACO may request a revision of the direct labor bidding rates.

The proposed work will be accomplished during calender year 1980.

The direct labor hours proposed are from detailed subtask estimates provided by the functional organizations responsible for the performance of specific tasks; These estimates have been reviewed and analyzed and are the basis for the proposed labor.

The direct labor rates applied in this proposal are for the calendar year(s) 1980.

On the following page are the Labor Category descriptions for the proposed project.

LABOR CATEGORY DESCRIPTION

Engineering B (100B) Top engineering and scientific personnel who are responsible for planning, organizing, and directing engineering programs and activities of outstanding importance.

Engineering C (100C) Senior engineering and scientific personnel whose duties and responsibilities require creativity, engineering judgment in solving unusual and complex engineering problems, determining program objectives and requrements, and developing standards and guides for diverse engineering and scientific activities.

Technicians (106) Non-exempt technical job classifications involving technical support of laboratory design, development, and test activities. Typical classifications are Electronic and Mechanical Technician, Laboratory Analyst and Research Assistant.

Clerical & Administrative Support (103) Non-exempt job classifications involving the performance of clerical and administrative duties.

INDIRECT EXPENSE RATES

Indirect expenses are incurred for the common benefits of all contracts and are not identifiable to a specific contract. A multiple burden pool system is employed for the collection and distribution of indirect expenses. The use of multiple burden pools recognizes that certain functional and organizational activities contribute to the performance of a contract in different ways and degrees depending upon the type of work or services they perform, and the pools are designed to accomplish the most equitable distribution of expenses.

Overhead consists of costs incurred by organizations involved in the day-to-day support of operating tasks necessary for fulfillment of all contracts and includes management support, payroll expenses, communications costs, etc. Expenditures for overhead tasks are charged to one of the burden pools of the multiple burden pool system. Distribution of the pools to contracts is based on direct labor dollars.

Procurement consists of all those indirect expenses generated by cost centers involved in purchasing, subcontracting, receiving, etc., of procurements. A rate is developed by dividing the total procurement pool costs by the total dollar value of procurements. The base for the application of the procurement rate is the dollar value of the procurements that are charged direct to the project.

General and Administrative (G & A) consists of expenditures for those functions which are identified with the overall management and sustenance of TRW Systems Group. The G & A rate is developed by dividing the G & A pool expenses by the cost of sales. The base for the application of the G & A rate to the project is the total cost of the project including all applicable direct and indirect costs.

Cost of Money consists of imputed interest costs determined by applying a cost of money rate to facilities capital employed in support of Company contracts. The base for the application of each cost of money factor used in this proposal is the same base as is used in applying the respective Overhead, Procurement or G&A burden rates.

Proposal No. 36115.000R1

CONTRACT FACILITIES CAPITAL AND COST OF MONEY

CONTRACTOR: TRW Inc., Defense and Space Systems Group
BUSINESS UNIT: DSSG - Applied Technology Division
ADDRESS: One Space Park, Redondo Beach, California 90278

RFP/CONTRACT PIIN NO.

PERFORMANCE PERIOD

1. OVERHEAD POOLS	2. COST ACCOUNTING PERIOD	3. CONTRACT OVERHEAD ALLOCATION BASE	FACILITIES CAPITAL COST OF MONEY	
			4. FACTORS	5. AMOUNT
ENGINEERING LABOR	1980	39,770	.051199	2,036
G & A	1980	106,868	.002439	261
6. CONTRACT FACILITIES CAPITAL COST OF MONEY				2,297
7. FACILITIES CAPITAL COST OF MONEY RATE			÷ 7.7875%	10.25%
8. CONTRACT FACILITIES CAPITAL EMPLOYED				22,410

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