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# NASA TECHNICAL MEMORANDUM

NASA TM-82514



MSFC SCAN STAGE 1 WORKSHOP

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Space Science Laboratory

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16. ABSTRACT  This report describes the planning, implementation, and accomplishments of the first Space plasma Computer Analysis Network (SCAN) workshop held at Marshall Space Flight Center (MSFC). The purpose of the workshop was to identify specific cooperative scientific study topics within the discipline of Ionosphere Magnetosphere Coupling processes and to develop methods and procedures to accomplish this cooperative research using SCAN facilities. Cooperative scientific research was initiated in the areas of polar cusp composition, O <sup>+</sup> polar outflow, and magnetospheric boundary morphology studies and an approach using a common metafile structure was adopted to facilitate the exchange of data and plots between the various workshop participants. The advantages of in person versus remote workshops was discussed also.  *Former NRC Research Fellow, now at the Department of Physics, the University Southampton, England. **Utah State University, Center for Atmospheric and Space Science. ***University of Texas at Dallas.					
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## TECHNICAL MEMORANDIUM

### MSFC SCAN STAGE 1 WORKSHOP

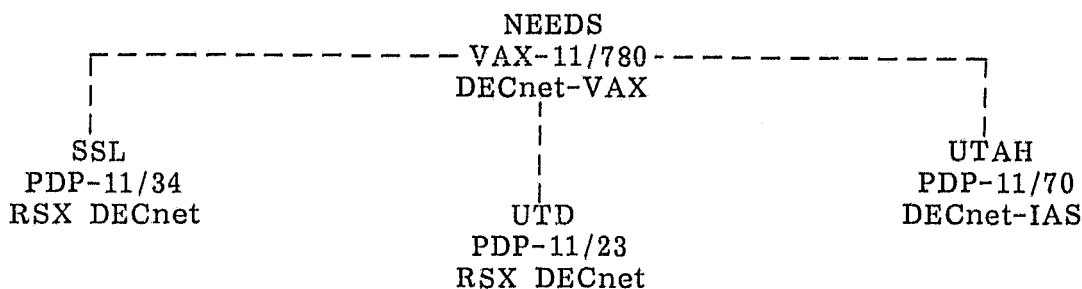
#### I. INTRODUCTION

The NASA Data System Technology Program (DSTP, formerly called the NASA's End-to-End Data System or NEEDS) is developing concepts and demonstrating technology that will significantly reduce the time required for acquired spacecraft data to reach the experimenter [1]. At Marshall Space Flight Center (MSFC), the DSTP consists of two systems: a Data Base Management System (DBMS) and a Mass Memory Assembly (MMA). The DBMS will eventually consist of several large mini-computers linked together by a high-speed, fiber optics bus with powerful data base management software to handle large quantities of data [2]. Presently, the DBMS computer system is comprised of one Digital Equipment Corporation VAX using the VMS standard operating system. Two other VAX computers and the fiber optics link between them will be installed at MSFC in May 1983. The part that the MMA plays is to store large multiple data bases at the central DBMS site in a large permanent archive [3]. The MMA is currently planned to be integrated into the DBMS computers in about May 1984.

The MSFC SCAN (Space plasma Computer Analysis Network) system is being designed around the construction of the DSTP here at MSFC. The SCAN network links several remote users to the DBMS computers. At this time, the network is configured so that there are seven "remote" (not at the central site) nodes in the network: the University of Texas at Dallas (UTD), Utah State University, Stanford University, the University of Iowa, Los Alamos National Laboratory, Goddard Space Flight Center, and the Space Science Laboratory (SSL) at MSFC. Each of the remote nodes has a direct line into the DSTP system.

There are several capabilities and features that the SCAN network is developing, making it unique within the space science community. The SCAN network provides remote nodes with access to growing space science data bases and brings scientists throughout the country together in a common working environment. Unlike all past space science networks, where the remote sites have only remote terminals (supporting one person at the remote site at a time), the SCAN network supports many users simultaneously at each remote node through computer to remote computer communication software. Users at their institutions can participate in a number of network functions involving the central DSTP computer facilities and other remote computer facilities. Data files and graphics files can be transferred to and from the DSTP DBMS and other remote facilities. Program execution can be initiated from any of the network nodes (distributive processing). The DBMS facility has a growing library of analysis software that can be transferred to remote nodes or executed at the central site. For example, the user at a remote site can initiate a library program at the central site which reads and analyzes data out of the mass memory assembly and then have the results transferred to his node. The MMA used during interim development (until May 1984) is simple disk storage. All of the nodes have the capability for message routing, enabling the remote nodes to communicate to each other as if a direct phone line existed between them, even though they may not be "adjacent" nodes.

The most important feature of this network is that remote users have easy and immediate access to geophysical measurements; this has been clearly demonstrated during workshop periods. A workshop period enables physicists to attack a science problem by interactive analysis, utilizing all available computing facilities resident at the scientist's institution as well as at the central DBMS node (also called the NEEDS node in this report). All users have access to the entire data set before, during, and after the workshops. This enables everyone to become familiar with the data and how to use the network before the workshop. The workshop activities continue long after the initial meeting, thus allowing for maturing of scientific ideas. For every workshop each participating network node is responsible for furnishing data analysis/display programs that analyze their data set and that can run on any of the computers in the network. Different data bases reside at the various network nodes and at the central site, thus utilizing both central and distributive computer processing. It is essential to realize that much activity takes place over the network during non-workshop periods since the network is available to everyone 24 hr a day, every day. A workshop should be considered only the peak of an ongoing analysis scenario over an extended period. The first SCAN Network Workshop was held at MSFC on August 19-20, 1982, with others being planned around the further enhancement of the DBMS central facility for 1983. The network configuration used during the first workshop is shown below.



The NEEDS (the central DBMS computer that all remote nodes are connected to) and SSL nodes are located at MSFC in different buildings while UTD and UTAH are very distant nodes in Texas and Utah, respectively. Note that not all nodes that were currently on the network (i.e., Iowa, Stanford, Los Alamos, and GSFC) were involved in the workshop. Preparation for the workshop began nearly 6 months earlier when these nodes were not on the network.

The purpose of this report is not only to document the first in a series of science workshops using the SCAN network but to serve as a guide to other nodes who are planning to hold workshops of their own. The workshop procedure, as discussed in this report, clearly indicates that the network can support simultaneous workshops if sufficient planning is made.

## II. WORKSHOP PHILOSOPHY

The development of a coherent and effective SCAN network philosophy is necessary for network scientists to be able to utilize the network as a scientific analysis tool. In March 1982, a series of telecons were held where voice communication was established between SSL, UTD, and UTAH nodes. The telecons were necessary first to identify the workshop objectives and second to determine how to carry out those objectives. These early telecons were viewed as practice workshops "runs," since they enabled the scientists to determine what software was needed to accomplish set goals.

The objectives of the network were generally agreed to be: (1) the development of the SCAN network as an effective tool for coordinated scientific data analysis of multifarious data bases, and (2) use of the coordinated data bases to conduct scientific analysis. A better understanding of "Ionospheric transport into the Magnetosphere" was chosen as the overall science goal. The question of how to utilize the network to accomplish the above goals will always be dependent on the available hardware/software, processing power, and the number of participants. The discussions in the telecons concerning the best use of the network during the first workshop centered around two major topics: The role of the "remote" versus "in person" workshop environment (discussed extensively in a latter section), and the use of remote site versus a centralized data base system.

With regard to the workshop environment, it was decided that both "remote" and "in person" workshops should play a role in an ongoing analysis program. During the telecon discussions, it was agreed that an "in person" workshop was important to expedite the process of familiarization of the group with the various data sets and to renew excitement about specific analysis topics. Continued remote workshops held after the formal "in person" workshop would lend themselves well to continued detailed scientific analysis of the data sets, since detailed analysis requires both careful study and extended preparation periods. It was believed important that the first workshop should be conducted from a single location. In addition to maximizing the interaction between different scientists, this would also allow the workshop activity and progress to be easily monitored. The Data Analysis Laboratory (DAL) at SSL was chosen as the site of the first workshop, since it is a room sufficiently spacious to accommodate up to a dozen people working on data analysis. The DAL is equipped with microfiche readers, slide and overhead projectors, three alphanumeric terminals, three monochrome terminals (4014 type), and one color (4027) terminal. Two of the 4014-type and the 4027 terminal have hardcopy facilities. Chalk boards, paper, and other miscellaneous materials were also provided.

In terms of the location of the data, it was decided to try a combination of central and remote data bases. The SSL node chose a centralized data base approach. In this approach, both data and analysis software are resident on the central NEEDS node. To generate the required analysis output, one simply signs on to the NEEDS computer, runs the appropriate program, accesses packetized data out of the archive, and directs the appropriate output to the desired remote node (more complete discussion of this procedure is in Section 5, 6, and 7 of the Appendix.) The UTD approach has been to maintain a remote data and software base. The UTD processing computer (a PDP 11/45), however, is not connected directly to the network. Data analysis plot files are generated on the 11/45 and transferred by floppy disc or by direct link using a local data transfer program to the 11/23 (which is connected to the central NEEDS node by phone line). This results in the



inability to carry on interactive analysis of the UTD data from other remote nodes without some local UTD support and preparation. UTD recognizes this as a restriction; thus, a more convenient method of file transfer between their computers is currently being developed. The UTAH node used a combination of the two data base approaches. Some of their data was resident in data files on the DBMS computer (not packetized, however) and some on the UTAH PDP 11/70. Limited data analysis software was developed at the NEEDS node to cope with the UTAH data interactively. Contributions to this software were accomplished by both SSL and UTAH personnel.

Another major goal was to develop the ability to have graphic displays of data from any node to be displayed by any other node (see Section VIII for a more extensive discussion). The easiest way to accomplish this was to generate a graphics file and transfer a copy of it to a remote node. Then, at the remote node, the file is sent to the device as if it was a text file. In doing this, a number of problems were immediately found:

- 1) The Tektronix 4027 plot files generated at UTD (with the IGL plotting package) were not displayed appropriately on the SSL 4027. However, the 4027 plot files generated at SSL (with the MSSL plotting package) were displayed correctly by UTD. This problem was tracked down to the way IGL generates its graphics files and the RSX-11M file transfer program. This was corrected when UTD wrote a program which corrected the graphics file type when the file was transferred over the network.
- 2) UTAH did not have any device compatible with the Tektronix 4027. A program was written by UTAH to convert both 4027 and 4010 device commands into commands understandable to their Versatec printer-plotter.

It is also desirable to have the ability to plot a graphics file without copying it to a remote node first. This would eliminate the waste of disk space by duplicate copies of files that exist elsewhere on the network. To handle this situation, UTD wrote the first version of a program which opens up the network and reads a "remote" file. SSL has added other capabilities (see Section 9 of the Appendix) to that software to allow for automatic hardcopy capability. Utah's Versatec program does the same, reading records as needed from anywhere on the network without copying whole files.

The inability of all the nodes to examine the same plots on different devices was immediately recognized. The above approach to solve this problem was implemented within a few weeks periods but only as temporary solution. A final solution appears to be the full development of a network standard for the form of device-independent plot files. Currently being studied through the network is the implementation of either the IEEE device-independent format standard or a similar one used at Los Alamos National Laboratory.

### III. DATA BASES AVAILABLE

There were three data bases that were used in this workshop: the SSL RIMS data from DE-1 (residing in the interim DBMS archive in packetized form at the NEEDS node), IDM and RPA data (residing in file form in the NEEDS computer and at UTD), and the UTAH Chatanika data (also residing in data files in the NEEDS computer). Each of these data bases has their own analysis software (discussed in the Section IV and the Appendix).

The SSL data were obtained by the DE/RIMS instrument aboard the DE-1 spacecraft which has a highly elliptical precessing polar orbit which covers the altitude range 600 to 21,600 km. The RIMS instrument uses a combination of retarding potential analysis and magnetic ion mass spectrometry techniques to measure the bulk plasma parameters of ion density ( $10^{-1}$  to  $10^6$  particles/cm<sup>3</sup>), temperature (0 to 45 eV), and bulk flow (>0.5) km/sec) in the inner plasmasphere and ionosphere and the specific ion pitch angle and energy spectral characteristics in the outer plasmasphere and plasma trough for selected mass species in a mass range of 1 to 32 amu [4]. Three identical perpendicularly-oriented heads provide three-dimensional coverage of the basic thermal plasma parameters.

The UTAH data contains thermal ion density and flow measurements obtained with the Chatanika incoherent radar facility [5]. The measurements extend from 0 to 750 km in altitude and 2400 km in the north-south direction. These measurements are centered at 65 deg invariant latitude (IL) and extend from 55 to 76 deg IL. The incoherent radar can measure ion densities from  $10^3$  to  $2 \times 10^6$  particles/cm<sup>3</sup> and the line of sight component of the ion flow velocity of up to 4 km/sec with an uncertainty of about 100 m/sec.

The UTD data is composed of ion density, temperature, and flow measurements obtained from the Retarding Potential Analyzer and Ion Drift Meter (RPA/IDM) aboard the DE-2 spacecraft [6,7]. The DE-2 spacecraft has a near circular orbit which is co-planar with the DE-1 spacecraft. The range of altitude coverage is from 300 to 950 km. The RPA/IDM measures ion densities from  $10^2$  to  $10^7$  particles/cm<sup>3</sup>, ion temperatures from about 300 to 5000 K, and three-dimensional ion flow velocities from 0 to about 4 km/sec.

During the early telecons, four days of magnetospheric and ionospheric data from the data sets described in the above were chosen to be studied during the workshop period. These days were October 24, 25, 26, and 29, 1981. The main criterion for selection was the large amount of overlapping data that already existed from these experiments during those times.

#### IV. WORKSHOP PREPARATION

This section will discuss the problems encountered with adapting, identifying, and writing utilities to accommodate data analysis for all the nodes on the system. The big advantage of using a networking system like SCAN is that written network utility programs are readily available and can be used by all the nodes, therefore eliminating duplication of programming effort. Unfortunately, in order to realistically assess what and how much science can be done, during a workshop, a somewhat detailed knowledge of each computer system is needed.

Since the SSL node was used during the formal workshop as the command node, network provisions (programs) had to be created that would allow for both submission of programs from SSL to run on the NEEDS computer and a plot replay capability (back to the originator node) for examining the results. It is important to note that the SSL node has only a PDP 11/34 (a mini-computer) for processing and connection to the network. The biggest constraint imposed by the SSL 11/34 on workshop and

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network activities is its limited memory size (256k bytes). Almost half of this is taken up with the RSX-11M operating system and resident network tasks, leaving approximately 128k bytes for user (workshop) tasks. It was obvious that local processing (apart from the file replays) could not be allowed during the workshop, so remote computers were used for running analysis programs. For network file transfers into or out of the SSL 11/34, the Network File Transfer (NFT) program supplied by Digital Equipment Corporation (DEC) as part of their DECNET software worked extremely well. However, for logging onto remote computers DEC has only the unsupported RVT (Remote Virtual Terminal) mode. One of us (Joe Douppnik) rewrote and expanded RVT to support the needed remote log on capability before the workshop. A "bug" in the RSX-11M operating system would not allow the RVT program to be properly checkpointed (roll-out to disk), meaning that RVT had to be run with the checkpointing inhibited (stay-in memory), further reducing the available memory (about 12k bytes/copy). Since RVT, NFT, and the plot replay programs are all less than approximately 20k bytes, three copies of RVT and two copies of the plot replay programs could be executed simultaneously. But even with memory and running task limitations, the SSL node was able to handle all the desires of the workshop participants. In the 2-day period of the workshop, there were nearly 85 spectrogram plots generated and more than a dozen line plots. Vendor assistance in the area of network software has been, and still remains, extremely difficult to obtain. The rewritten RVT program is being used continuously by all the PDP nodes on the network since the workshop and has provided an excellent method for logging onto remote nodes. In addition, the checkpoint problem has also been solved in the post-workshop analysis phase.

Before the workshop period, a good deal of data analysis software was also developed between the nodes. An especially good example of the cooperative software development was the Chatanika meridian scan program. In early April (1982), Utah personnel (Joe Douppnik and John Foster) placed into the central NEEDS node much of the workshop Chatanika data for use by anyone on the network. Several people from SSL (Julian Johnson and James Green) wrote a color-coded plot program for this data. Guidance from Joe on this programming task was obtained during this time by use of the VMS network mail system. Before the workshop, Joe also spent an afternoon on additional coding changes which enabled interactive changes in the color/density correspondance within the program. During the workshop much use of this program was made to examine details of the ionospheric density gradients which enabled the scientists to get a better understanding of the variability of ionospheric density profiles. Since the workshop, increased interest in the Chatanika radar measurements is evident in the three additional analysis programs developed so far. The coordinated effort in the displaying and analyzing of the Chatanika data has proven to be extremely beneficial, since the new display techniques (originally developed by SSL personnel for the RIMS data and applied to the radar data) have shown additional details in the Chatanika data not previously recognized by the scientists at UTAH.

Once the networking and analysis software was in place, data overviews for all three data sets (RIMS, Chatanika and RPA/IDM) were generated in plot file (and hardcopy) form prior to the workshop for everyone to examine (plot files were left on the network). For example, the RIMS summaries consisted of sixteen, 6-hr color spectrograms. The Chatanika data set consisted of meridian scans representing ionospheric plasma densities in the topside ionosphere (program discussed earlier) as a function of altitude and north-south distance from the radar site (not all available plots used were generated prior to the workshop). The intention in the workshop was to run a battery of data analysis programs interactively to "home in"

on whatever data intervals and plot formats were required to satisfy the scientific goals of the workshop.

## V. OPERATION OF THE WORKSHOP

The workshop control center was at the Magnetospheric Physics Branch, Space Science Laboratory (the SSL node) which is a remote node. Rod Heelis (University of Texas at Dallas) and Joe Doupnik (Utah University) were present to represent their respective remote network nodes. The Magnetospheric Physics Branch remote node was represented by Jim Green, Hunter Waite, Julian Johnson, Tsugunobu Nagai, and Rick Chappell. From the SSL node, a phase of concentrated scientific study on the collective Dynamics Explorer (DE) and Chatanika incoherent radar data bases was initiated.

The first morning of the workshop was used to clarify the general philosophy of the data network as a scientific tool and to familiarize the participants with the different aspects of the data bases. This was accomplished by distributing copies of the workshop guidelines (the Appendix) and discussing the details of that document with everyone. In addition, copies of the Appendix were put in the NET/NET account on the NEEDS central node so that remote participants would have easy access to the workshop guidelines. Next, Rod Heelis, Joe Doupnik, and Hunter Waite briefly went over the overview plots of each of the data sets.

As mentioned earlier, four days of overlapping data acquisition had been chosen several months prior to the workshop. This enabled the completion of preliminary data processing and examination before the workshop began. In the process of familiarization with the various data sets on the first day of the workshop, it became obvious that additional data selection criteria were necessary to define a working data subset. Magnetic field line conjunctions of the DE-1 and DE-2 spacecraft were chosen to further narrow the data set. These criteria along with the data variability criteria produced the data subsets listed in Table 1.

TABLE 1. DATA SUBSETS

DE-1, -2 Conjunction	Magnetic Local Time (MLT)
(1) 1981 Day 298 0555 to 0615 UT	10 hours
(2) 1981 Day 298 1215 to 1235 UT	9 hours *
(3) 1981 Day 299 0600 to 0700 UT	20 hours
(4) 1981 Day 302 0700 to 0720 UT	9 hours
(5) 1981 Day 302 2300 to 2355 UT	7 hours

The starred entry in Table 1 is also a Chatanika conjunction time. It is important to note that although, from the events studied, there was only one DE-1, -2 and Chatanika conjunction, the Chatanika radar measurements were still used in all the other events. In fact, for purposes of examining convection cell patterns over the northern pole, it was desirable not to have conjunctions (measurements at the same magnetic local time) between DE-2 and Chatanika but that they be simultaneous in time and separated by at least 3 hr in MLT position.

Concentrated data analysis of these subsets continued throughout the remaining day of the workshop. First, increased resolution (1 hr) RIMS spin, energy-time spectrograms of all measured ion species ( $H^+$ ,  $He^+$ ,  $O^+$ ,  $He^{++}$ , and  $O^{++}$ ,) were produced for the times listed in the "RIMS data time" column of Table 1. These spectrograms were produced interactively on the NEEDS central computer, and the plot files were transferred to the SSL remote node where MATRIX camera hard copies were produced for all remote node representatives. In addition, Joe Doupnik of UTAH processed additional ion density meridian scans from the Chatanika data during the chosen data concentration periods at the UTAH remote site, transmitted them to the NEEDS node, and created plot files which were hard-copied on the SSL MATRIX camera. Rod Heelis produced ion velocity vector plots of his data during the selected times and copied additional DE-2 measurements from the DE-2 summary plots. This interactive processing produced additional DE-1 RIMS spectrograms, Chatanika color meridian scans, and DE-2 RPA/IDM vector plots which were examined by the workshop participants. From this examination, three very interesting science topics were chosen which are listed in Table 2.

TABLE 2. SCIENCE TOPICS

Science Topic	Conjunction
(1) DE-1, -2 cusp study	1
(2) DE-1, -2 Chatanika ionosphere plasmasphere boundary study	3
(3) DE-1, -2 $O^+$ flow study	5

## VI. WORKSHOP SCIENCE TOPICS

In this section each of the selected workshop science topics listed in Table 2 will be briefly discussed and areas of continuing research will be identified.

### A. DE-1, -2 Cusp Conjunction Study: 1981 Day 298 0600 to 0700 UT.

The DE-1 and DE-2 were in magnetic field line conjunction between 60 and 72 deg IL near 9 to 10 hr magnetic local time on Day 298. This conjunction occurred in the region of the auroral cleft as identified by the DE-2 Low Altitude Particle Instrument or LAPI (this data is from the DE microfiche generated by GSFC and sent to all the principal investigators in the DE project) and DE-1 RIMS (generated in the NEEDS computer). DE-2 LAPI saw a characteristic flux of 1 keV transversely accelerated  $O^+$  ions at 5:57 UT and 71.5 deg IL at the same time that the DE-2 RPA/IDM saw a large upward flux of  $O^+$  ions as shown in Figure 1. High altitude DE-1 RIMS measurements indicated a narrow band of down going  $He^{++}$  ions with a conical distribution at 06:31 UT and 71 deg IL, followed by a downgoing conical) distribution of  $H^+$  ions with accompanying upgoing  $H^+$  field-aligned ions between 71.3 and 72.9 deg IL. The  $He^{++}$  and  $H^+$  RIMS measurements can be seen in the spectrogram of Figures 2 and 3, respectively, where the upper panel for each ion species is an energy-time spectrogram of ion flux and the lower panel a spin phase angle-time spectrogram. The spacecraft is traveling perpendicular to the magnetic field direction at this time so that -90 deg spin phase angle is downwards along the field line in the northern hemisphere in this spectrogram (this is marked by the dashed horizontal line in the bottom panel of each RIMS spectrogram). The spatial and/or temporal separation of

DE-B CONVECTION PARAMETERS  
DAY=81293 ORBIT= 1223 NORTHERN HEMISPHERE

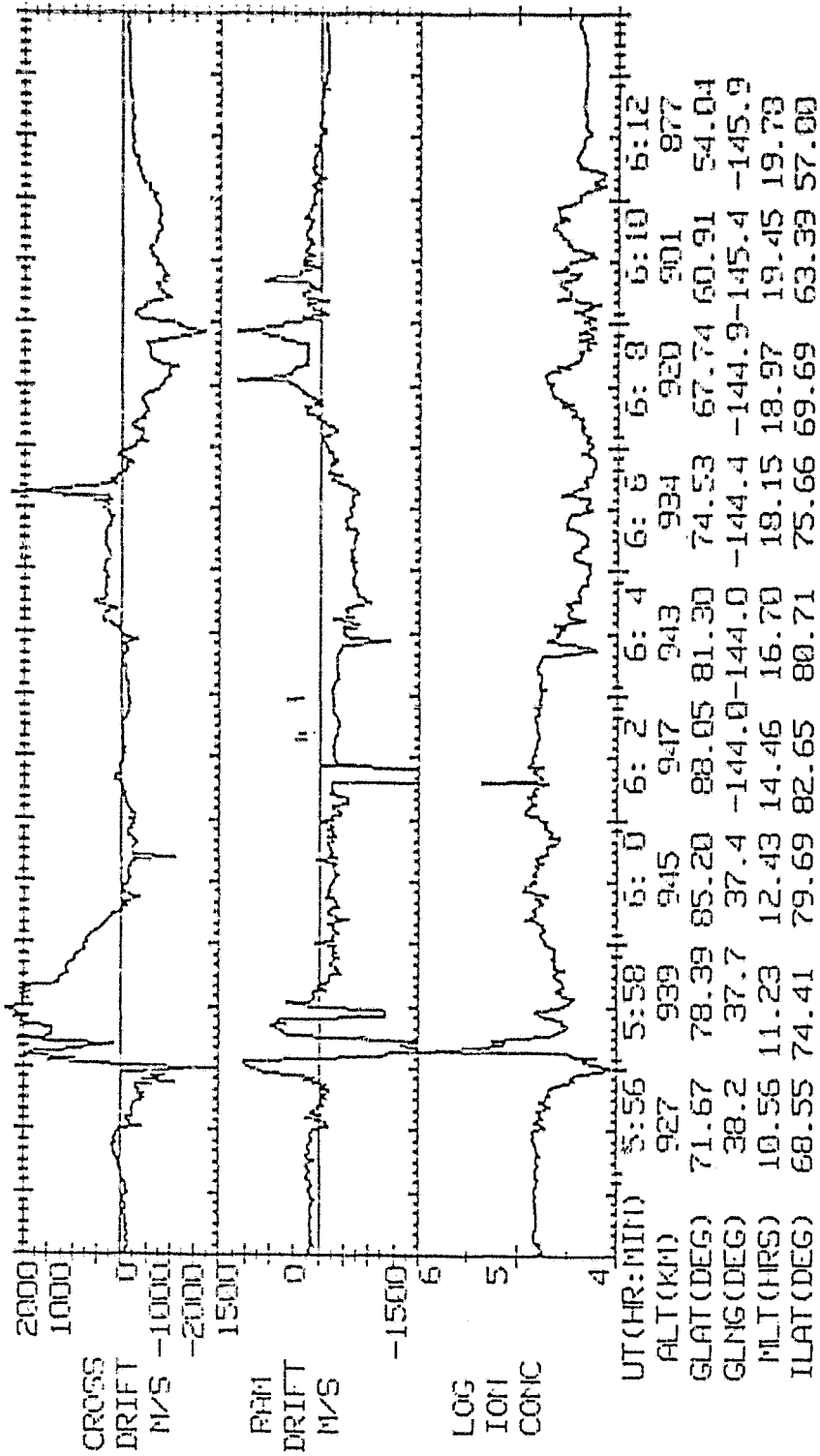


Figure 1. This data is from the RPA/IDM experiments onboard DE-2. The top two panels indicate the plasma cross and ram drift velocities, respectively, while the bottom panel shows the log of the ion concentration. Note the large upward flux of 0+ ions seen in the bottom panel at about 05:57 UT.

DE RIMS SE-T SUMMARY (V2.1) 81/298 25-OCT 6:25: 0- 6:55: 0  
H=R/L M: 1690: 1870 HE++ R: 0:1000 A: -180: 180

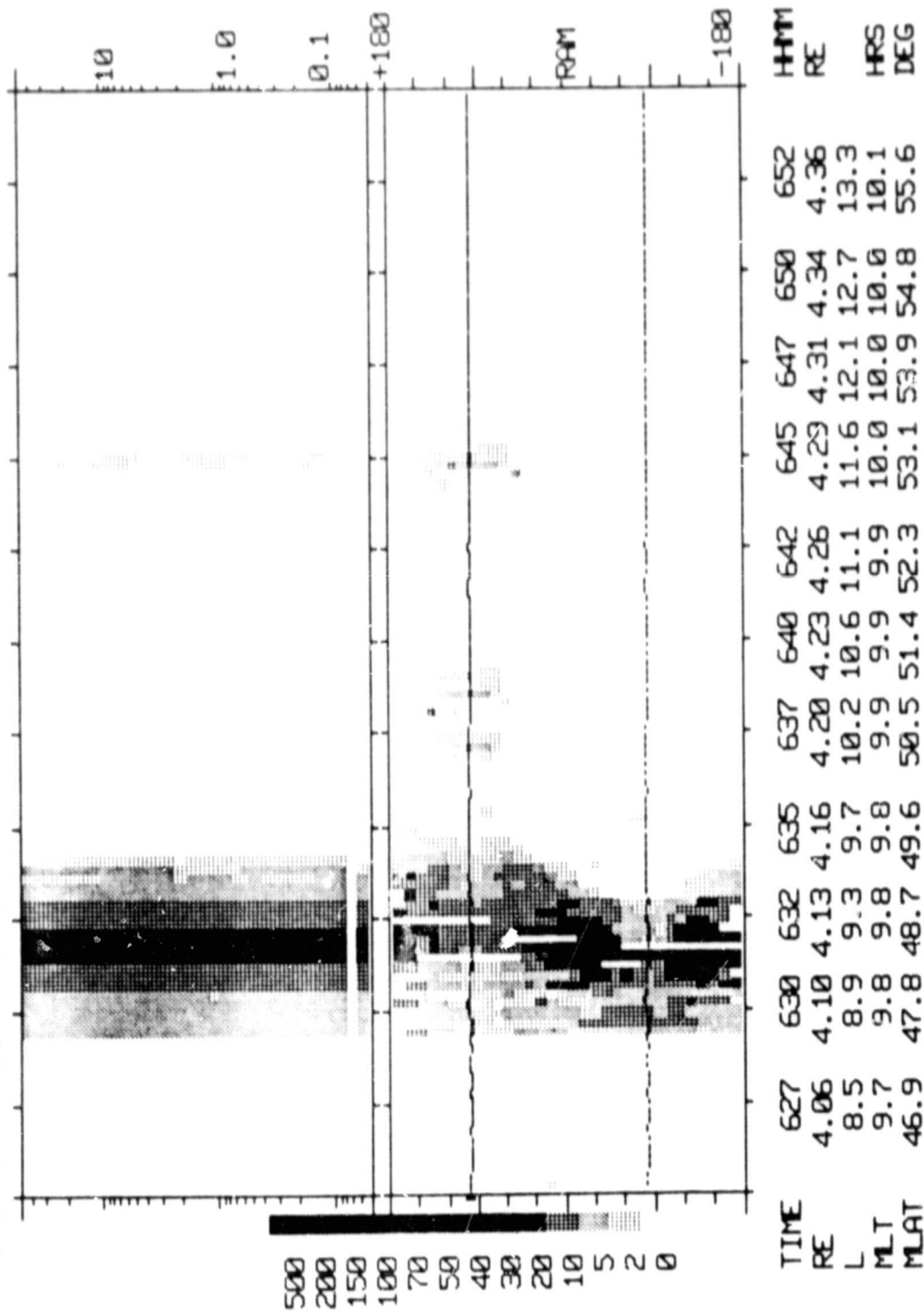
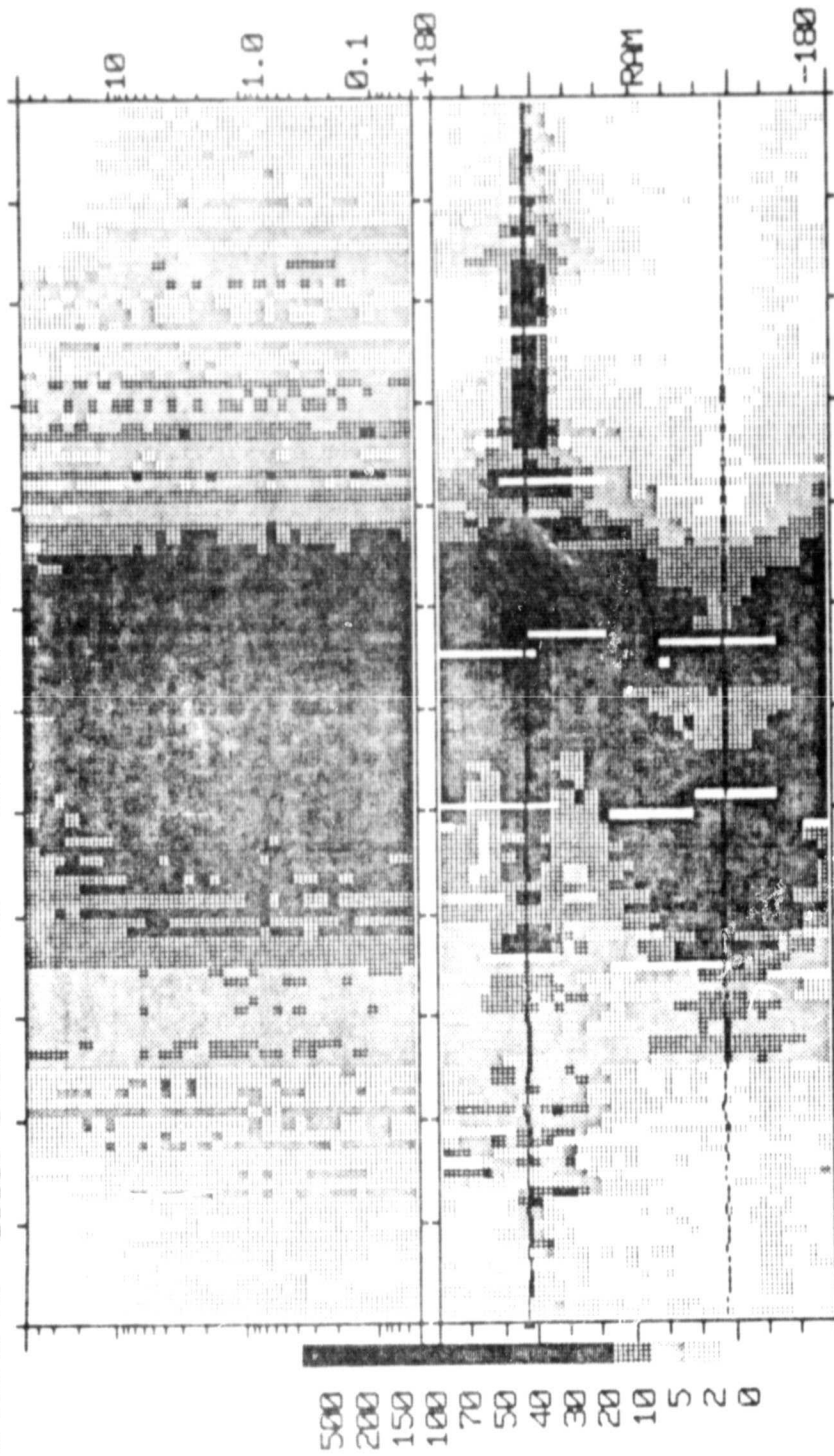


Figure 2. This He++ data is from the RIMS experiment onboard DE-1 and displayed in an energy-time spectrogram (top panel) and a spin-time spectrogram (bottom panel). Note that these high-energy (greater than 50 eV) ions are seen predominately flowing down the field line marked by the dashed horizontal line in the bottom panel. The DE-2 RPA/IDM data of Figure 1 is coincident with this RIMS pass.

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DE RIMS SE-T SUMMARY (V2.1) 81/298 25-OCT 6:25: 0- 6:55: 0  
H=RL/L M: 3500: 3730 H+ R: 0:1000 A: -180: 180



TIME	627	630	632	635	637	640	642	645	647	650	652
RE	4.06	4.10	4.13	4.15	4.20	4.23	4.26	4.29	4.31	4.34	4.36
L	8.5	8.9	9.3	9.7	10.2	10.6	11.1	11.6	12.1	12.7	13.3
MLT	9.7	9.8	9.8	9.8	9.9	9.9	9.9	10.0	10.0	10.0	10.1
MLAT	46.9	47.8	48.7	49.6	50.5	51.4	52.3	53.1	53.9	54.8	55.6
HMM											
RE											
HRS											
DEG											

Figure 3. The low-energy H+ plasma data from the RIMS experiment is displayed in this figure using the same format as discussed in Figure 1 and covers the same time period. Note the drastic difference in the angular distribution of these two ions when comparing the bottom two panels of this and the previous figures.



the He<sup>++</sup> and H<sup>+</sup> ion flows is interesting and may be a result of ExB drift coupled with energy dispersion of the observed ions.

Several important questions remain to be answered by more comprehensive analysis:

- 1) Does the upward flux of O<sup>+</sup> ions seen by DE-2 RPA/IDM equal the low-energy H<sup>+</sup> ion flux seen at higher altitudes near the poleward edge of the cleft by DE-1 RIMS?
- 2) Does the "gap" in the 1 keV ion fluxes of the DE-2 LAPI instrument at 05:57:15 map to the H<sup>+</sup> field-aligned flow region of DE-1 RIMS?
- 3) Where is the cusp boundary at high altitudes as defined by the DE-1 High Altitude Particle Instrument (HAPI)?
- 4) What is the source of the downgoing low-energy H<sup>+</sup> and He<sup>++</sup> conics seen by DE-1 RIMS and what causes their spatial and/or temporal displacement?

Further investigations using the SCAN network will hopefully provide some answers to these questions.

#### B. DE-1, Chatanika Plasmapause Conjunction Study: 1981 Day 299 0600 to 0700 UT.

The DE-1 spacecraft was in magnetic field line conjunction with the Chatanika incoherent radar facility between 06:30 and 07:12 on Day 299. This conjunction occurred less than 10 min after the Chatanika facility obtained the ion density measurements shown in Figure 4. In the Chatanika meridian scan plot, the F region can be seen between 250 and 450 km altitude and in latitude from Chatanika to 1200 km south of Chatanika. Note that near the center of this plot there is a sharp density depletion which occurs at the high-latitude convective boundary which separates the lower latitude F region from the polar cap ionosphere (400 to 1200 km north). The polar cap ionosphere has higher densities and extends to higher altitudes as the result of auroral precipitation, evidenced by vertical stripping of the polar cap ionosphere spectrogram. Such observations as characterized by the low-altitude ionosphere observers would like the convective depletion boundary (density depletion at 400 km north) with the plasmapause boundary at high altitudes. Such is not the case as shown by looking at the DE-1 RIMS H<sup>+</sup> spin, energy-time spectrogram in Figure 5.

The RIMS data is plotted as a linear function of invariant latitude which is directly comparable to the features in the Chatanika plot in Figure 4. From the RIMS data, the plasmapause boundary is located at 7:06 UT or at 59.4 deg IL. Outside the plasmasphere is a region of warm plasma characterized by conical and isotropic distributions from 06:49 to 07:06 UT which maps directly to the quiet F region plasma between 69:3 and 59:4 deg IL. Poleward of this, DE-1 RIMS observes intermittent field-aligned flows of H<sup>+</sup> which maps to the Chatanika polar cap ionosphere.

This new low- and high-altitude comparison of corresponding ionosphere and magnetosphere boundary features is very exciting and raises many new questions:

- 1) Where does the DE-1 HAPI locate the plasmashet boundary (this data would come from the Southwest Research Institute who is scheduled to be on the network in 1983)?

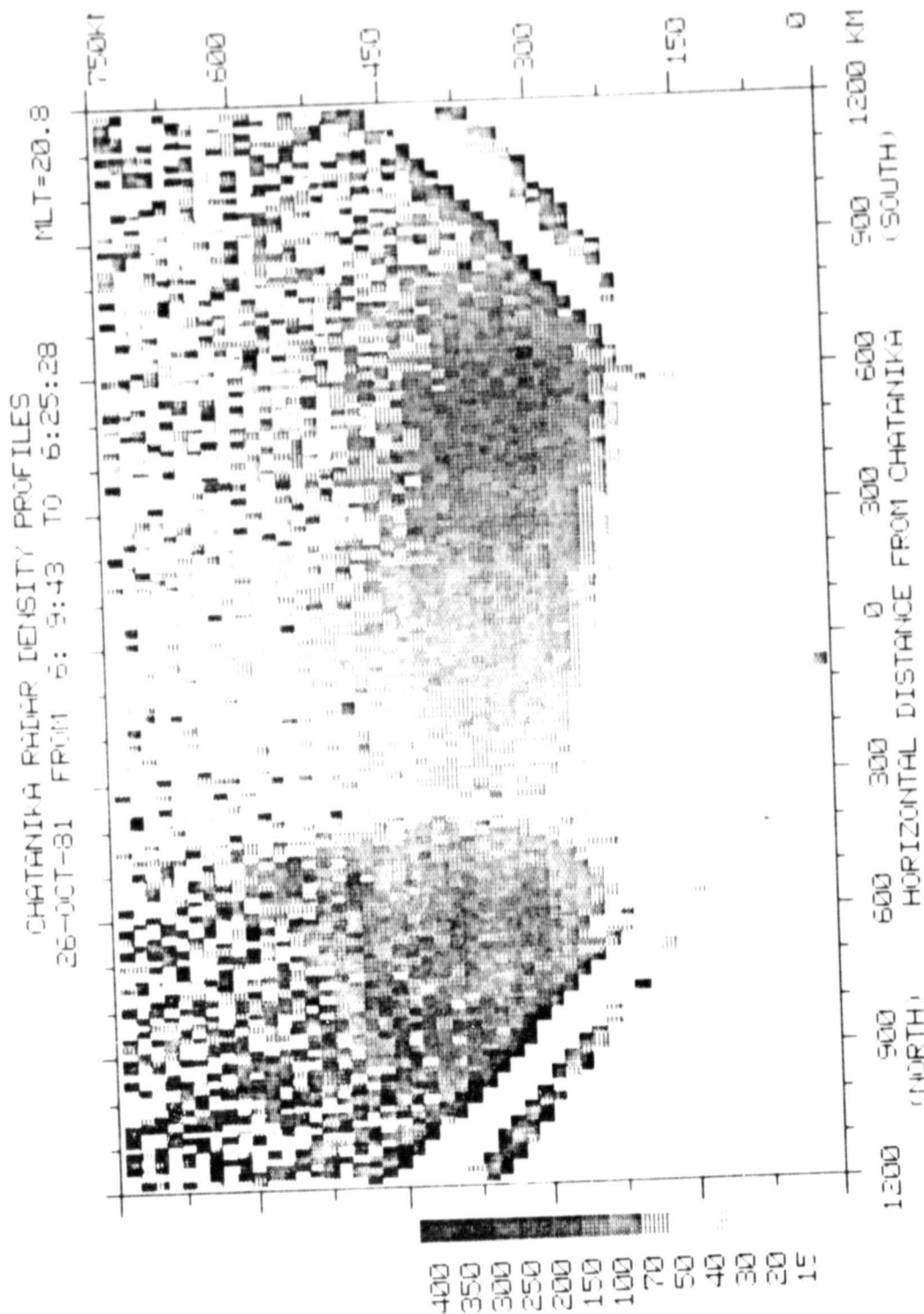


Figure 4. This magnetic meridian density scan was done by the incoherent scatter radar facility at Chatanika, Alaska. Density is coded in units of  $10^3$  particles/cm<sup>3</sup>. The Chatanika radar can measure ion density from +1200 to -1200 km north and south of the facility and to a height of at least 750 km. Note the large densities around 350 km altitude in the F region decrease dramatically from 400 km north to 300 km south of Chatanika. The F region trough at invariant latitudes near 70 degrees maps along magnetic field lines to DE-1 altitudes at 12,400 km where the RIMS detector measures H<sup>+</sup> ions that have a conical pitch angle distribution.

DE RIMS SE-T SUMMARY (V2.1) 81/299 26-OCT 6:30:19- 7:12:43  
H=RL/L M: 3500: 3730 H+ R: 0:1000 A: -180: 180

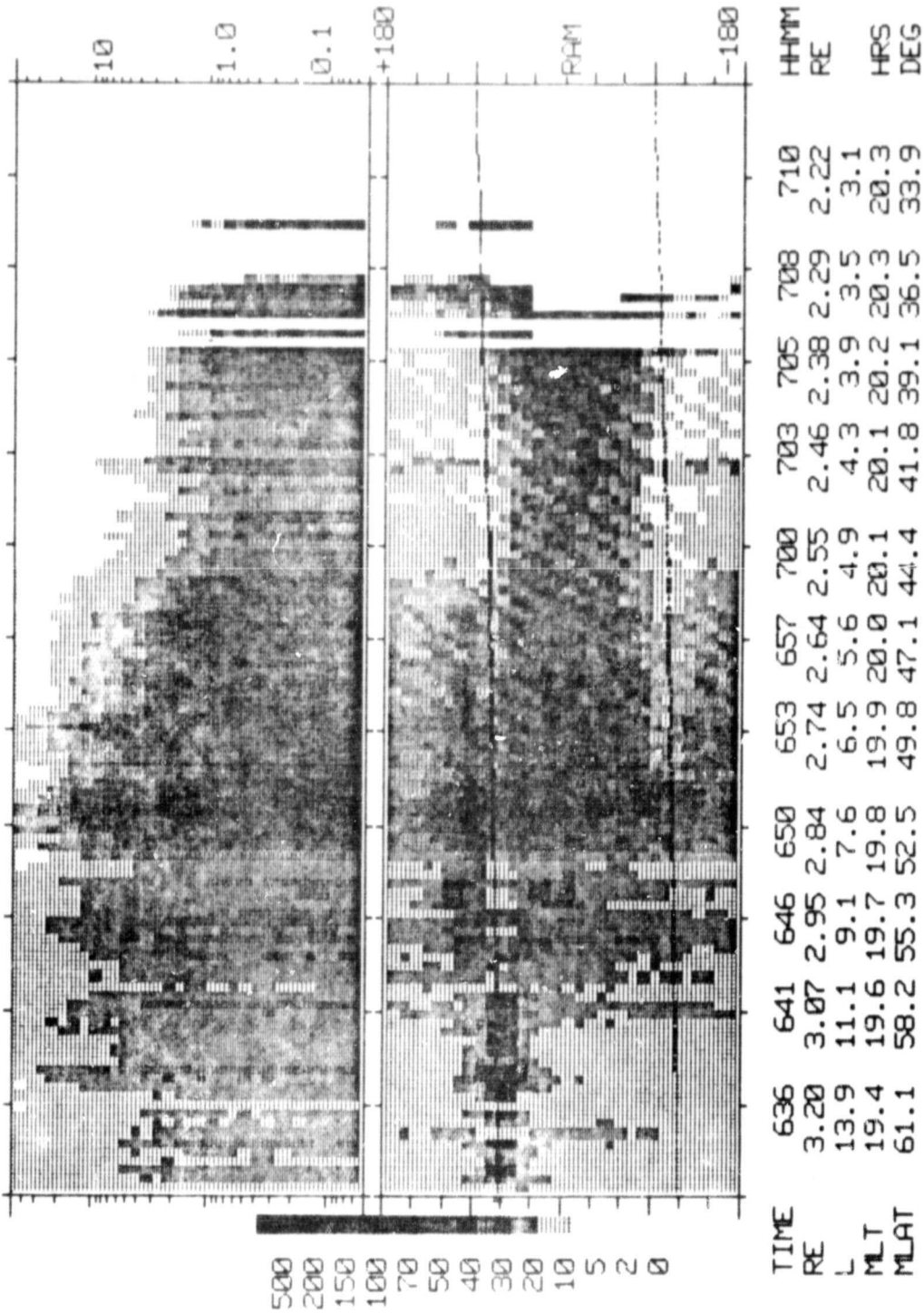


Figure 5. The corresponding RIMS DE-1 spectrogram for the Chatanika data shown in Figure 4. The data is plotted such that the invariant latitude of the DE-1 spacecraft matches that measured by the Chatanika radar in the previous figure. For correlative purposes these figures (4 and 5) can be placed over one another. Note that the field-aligned flows measured by RIMS map to regions of relatively high densities in the F (350 km altitude) layer of the ionosphere (300 to 1200 km north).

2) What is the relation between the warm-trapped plasma trough population and the quiet nightside ionosphere?

3) Do the ion beam bursts seen by DE-1 RIMS map to the enhanced density regions in the polar cap topside ionosphere?

These questions are now being investigated.

#### C. DE-1, -2 O<sup>+</sup> Outflow Study: 1981 Day 302 at 23:50 UT.

DE-1 and DE-2 were in magnetic field line conjunction near 23:20 over the northern polar cap. Soon after conjunction at 23:43 UT, DE-1 RIMS saw an intense burst of field-aligned O<sup>+</sup> outflow as shown in the DE-1 RIMS spin, energy-time spectrogram of Figure 6. The mean energy of the O<sup>+</sup> ions is only 1-5 eV. These low-energy ion outflow events have been seen about 5 percent of the time in the DE-1 RIMS polar cap data, and indications are that they may be associated with auroral activity.

The DE-2 RPA/IDM has also observed occasional large vertical fluxes of O<sup>+</sup> ions out of the ionosphere (not shown). It is hoped that by using this conjunction data, it will be possible to correlate the DE-1 and DE-2 O<sup>+</sup> outflow observations.

As one can see from this brief science summary, the stage 1 workshop began a phase of correlative space science which is extremely interesting and exciting. It is also quite clear from this discussion that the work has only begun, and much coordinated scientific analysis remains to be done. It is anticipated that the network will be a valuable tool in achieving these objectives.

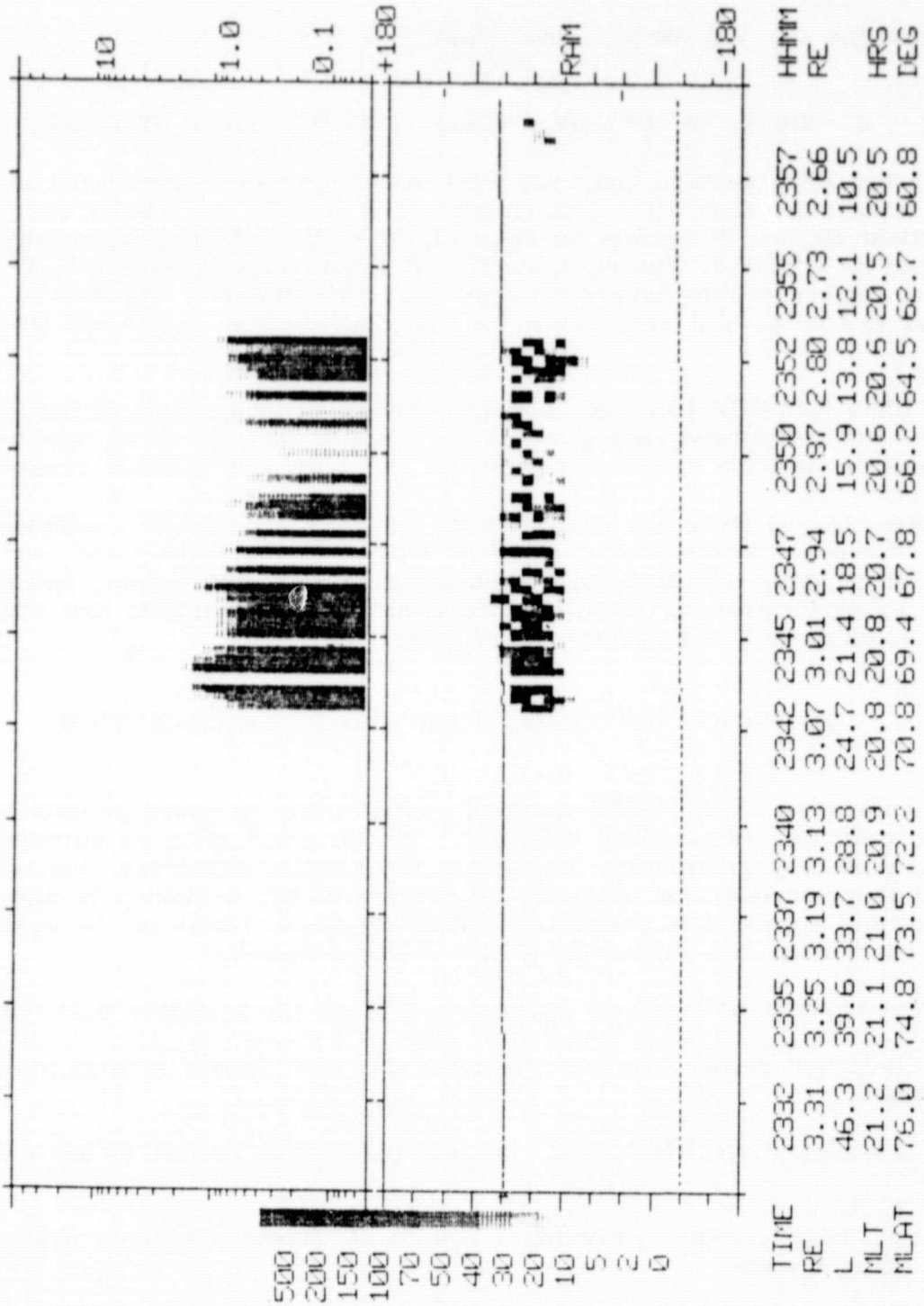
### VII. WORKSHOP EVALUATION AND RECOMMENDATIONS

The evaluation of the SCAN network system must be based primarily on the success in obtaining the desired scientific objectives and goals as outlined in the section on workshop philosophy. Regarding the science objectives, the workshop was an outstanding success, but much of the success of the workshop is due to the recognition and appropriate preparation within the constraints of the system. The following summarizes the successful points of the workshop:

- 1) Participants obtained an appreciation of all the available data bases.
- 2) Continued research is being carried on, with future science publications being planned.
- 3) The centralized RIMS data base was by far the easiest to use and most accessible.
- 4) The SCAN network provided a system of shared resources which includes hardware and software.

It is important to point out that a number of problems have been encountered and identified with a workshop of this type that must be examined carefully in order to improve future workshops. The following summarizes several of the problems:

DE RIMS SE-T SUMMARY (V2.1) 81/302 29-OCT 23:30: 0- 0: 0: 0  
 H=RL/H M: 810: 935 0+ R: 0:1000 A: -180: 180



ORIGINAL PAGE IS  
 OF POOR QUALITY

Figure 6. Another RIMS spectrogram but for low-energy 0+ ions. Note the upgoing 0+ ions (along the solid horizontal line in the bottom panel). These flows are seen only during times when no H+ and He+ flows are measured.

1) Before the workshop, the node representatives worked mainly on their own data set and were not prepared to examine other data bases at the start of the workshop.

2) Some of the software and hardware devices were little utilized, limiting the output of the workshop.

3) ORACLE, the data-based management language on the NEEDS node, was not significantly used.

4) There was a need for additional data bases to resolve questions.

5) Some software analysis programs were not "user friendly."

6) There is a need for better systems-level software to enable the PDP machines to be readily accessible by network users.

7) Device-dependent plot files generated by different graphics software were generally difficult to display.

The following is a list of recommendations which will help solve many of the above stated problems:

1) More diverse data bases are needed in the archive.

2) The size of the archive must be increased considerably.

3) A standard, device-independent plot file structure needs to be adopted by the everyone on the network.

The SCAN network provides scientists with several capabilities that were not available in the past. Although the NEEDS central archiving and data ingest system is helping to develop the mass memory technology, the SCAN network uses currently available commercial networking technology. Space plasma physics scientists throughout the country are using computing systems which range in age (capabilities decreases dramatically with age) from several to nearly 20 years old. Even today, just the trading of data is a monumentous task which is accomplished through the use of computer cards or magnetic tape media and is always labor intensive. Invariably, software necessary to read the cards or tape into a familiar format must be written. This procedure has produced, in general, a high impedance to doing correlative work. In a network environment once the data is communicated over the "line", one can put it into a familiar medium. Data communication over the SCAN network is done with relative ease and is not labor intensive.

The trading of software has not been extensive in the space science community, in the past, particularly because of the diversity of computer systems used and once again its labor intensive nature. In a network environment, such as SCAN, software trading is extremely easy and, as this document demonstrates, has proved to be extremely beneficial. Along the same lines as the trading of software, the network supports the transmission and reception of manuscripts. This significantly decreases the time it takes to perform correlative work when authors are located across the country.

Another feature of the network which has been extremely useful is the mail facility. The mail facility allows for rapid exchange of information between scientists on the network. A user is notified of the mail when he logs onto the system. The mail is accumulated in a file in each user's account and can be printed or deleted at any time, thus providing an easy means of documenting any message. The ability to accumulate mail allows one to find time to handle many messages at a more convenient time and not be bothered by a stream of phone calls.

Based on the sharing of software, the coordinated effort of data analysis, program development, and the workshop period, the DBMS system and network configuration is, in our opinion, an extremely beneficial step toward determining an effective and desirable method of future data analysis.

### VIII. IN-PERSON VERSUS REMOTE WORKSHOPS: A COMPARISON

One of the main objectives of the SCAN network project is to accommodate coordinated data analysis without leaving one's institution. This objective is already met by the network, but there are several constraints. These constraints are thoroughly discussed in this section, and a procedure has been defined that will eliminate them within the next few years. Although the computers in the network can easily handle the exchange of data (with some constraints, see below), the direct scientist-to-remote scientist interface is a more difficult problem. During the first SCAN workshop, time was set aside for a discussion of the advantages and disadvantages in doing a totally "remote" workshop or doing an "in-person" workshop. Although the first workshop was initiated as an "in-person" workshop, there were five telecons previous to the workshop for which the remote participants sat behind terminals on the network. Unfortunately, during the telecons, science was not done, since testing the system and finding problem areas were the primary purposes of the telecons. The following thoughts were expressed at the first workshop on this subject.

Advantages of an "in-person" workshop are:

- 1) A face-to-face meeting was believed to be better, to avoid getting lost in trying to understand the fine points about a particular data set when emphasis should be placed on trying to understand the physics behind the observations. In addition, correlative work would become secondary to looking at particular aspects of your own data on a new system.
- 2) The scientist is able to get away from distractions with the presence of visiting scientists providing substantial obligations on the hosts.
- 3) The participants quickly decided how and what to do (previous telecons did not solidify this problem).
- 4) The participants generally felt that we wouldn't have been as productive. Scientists could point to features in the data plots asking for interpretations or explaining the data.
- 5) Earlier phone conferencing was poor in terms of hearing all parties. This was generally a bad experience on every occasion and left the impression that a telephone voice link during a remote workshop would be disastrous. Computer text



communication (mail) is available, but it is too slow to be productive scientifically, on the time scale of a workshop (seconds).

6) Face-to-face discussions certainly provide a quick means of generating excitement among scientists that would be difficult to do remotely.

7) The "in-person" workshop cuts down on the amount of software effort needed for full graphics support of remote nodes (note this is a current and not a long-term problem).

8) "In-person" workshops allow for easy monitoring of the scientific progress and network usage.

Disadvantages are:

1) If plotting or programming problems arise there is not time to pursue the problem. Remote workshops would suffer from this also except that to some extent they could be rescheduled for the next day or a future date.

2) In general, the cost both in terms of time and, money is considerably greater for the same workshop time (assuming a network already exists) for a central workshop, compared to that for a remote workshop (cost and time of travel, subsistence, etc.).

Certain elements were identified that are essential in order for a "remote workshop" to have any degree of success. Two major elements are: remote scientists must be able to look at data plots, and reliable communication with all participants is essential. As the use of the network continues and remote workshops are carried out, more elements will be identified. The following takes a closer look at these two points in relation to existing software and hardware constraints.

#### Problem:

Remote scientists must be able to look at data plots.

#### Possible Solutions:

1) Obtain all the data and the software used for that data set from the node responsible and network it to your site or mail tapes of this information. The mailing of tapes of this type only makes sense (if you have determined that everything is needed inhouse) when nearly identical systems are involved. There is no such thing as institutions with identical systems in the space sciences. Networking the data and software using current network and communications technology can only be done successfully with very small amounts of data and software (it would take 1 hr to transmit 1 hr of RIMS data over the network to any node). However, stored packets of data (raw or processed) will be useful to examine locally for science details. Currently, very little data is packetized, since this is a new concept of the DSTP program which is not used significantly outside the network. As high data rates of communication are used, the method of transferring data and software quickly becomes much less of a problem. However, there are still the problems of software running on one system that will not necessarily run on another system and that programs may be using a plotting device that is not available at your institution (see next section).



Additional points which must be considered in this scenario are: documentation must also be distributed to all nodes, including instructions as to how to build and maintain the software libraries; there is then an obligation on the people who originally wrote this software/documentation to provide updates and new programs to the remote nodes as they become available. This is not a negligible workload.

2) Generate the plots remotely and network them to your node. This produces a graphics display problem explained in the next section.

### Problem:

Few institutions have the same graphics devices for displaying the generated graphics plots.

### Possible Solutions:

1) Buy everyone on the network the same graphic devices. The same plotting device does not ensure that plots generated at one node can be read by another node with the same device. Example, UTD plots (generated by IGL) could not be replayed successively by the SSL node even though we had the same devices. All SSL plots could be replayed at UTD but they were generated by the MSSL plotting package. We believe a diversity of plotting devices has distinct advantages; the same plot devices on a network is only a short-term solution. Inhomogeneous devices force one to use device-independent plot files and meta-file-based graphics.

2) Buy everyone not only the same graphics device but the same plot language. This produces another problem; not everyone has the same machine (DEC, UNIVAC, IBM, etc.) or more importantly the same size machine; and, therefore, the graphics language chosen must fit on all machines. This means that the graphics language must fit on the smallest machine used. For example, although the SSL 11/34 has IGL (a modest size graphics library) on the system, the programs which use this library have a very small amount of space in the machine to manipulate data. The capabilities of a graphics language generally increases in proportion to the size of the machine it is designed to operate on. It is unreasonable to assume that institutions whose computers have the capacity for extensive graphics software will use a small and limited language such as the MSSL graphics language. Also, graphics packages can come and go. PLOT10 (IGL is based on a PLOT10-like library) is no longer used extensively since the advent of plotting libraries such as DI3000 or DISPLA. In addition, PLOT10 and IGL are not supported by Tektronix but merely provided by the company.

3) Use a standard device-independent file structure. This will get around the device and graphics language problems, however, it produces additional problems. First, IEEE is just beginning to define a "standard" device-independent file structure. This standard is called the "core system." IEEE's work in this area will probably be complete in a few years. In addition to the core system, there are device-independent file structures (or meta files) already in use by plot libraries such as DI3000 and DISPLA and one used at LANL. These meta file formats are different and are not completely compatible with the core system as presently defined. Most plotting libraries do not have any facilities for generating meta files. It is unlikely that a core system for the MSSL library will be available in the near future unless it is written in-house.

### Problem:

Good scientist-scientist communication.

### Possible Solutions:

1) It is essential that the communication between scientists not be significantly degraded for a remote workshop, over what is available for a central workshop, otherwise the scientific interchange and ultimate scientific output will be seriously impaired. When one considers the subtlety with which people communicate, this is clearly not a trivial problem. A solution requires good (i.e., at least acceptable) voice communications between participants. Since this does not appear possible with existing telecon equipment, then we must go to headsets. Apart from the obvious disadvantage of such equipment (freedom of movement, etc.), this is likely to be more acceptable than poor telecon quality.

2) A superior solution would be video links between participating nodes, though it is arguable what good this would be unless several members at each node could be viewed simultaneously by the other node members. Also, costs would need to be considered, the cost savings brought about by having remote workshops being eroded by expensive video links. However, savings in scientists time would still be significant.

The implementation of remote workshops is an ongoing project of the SCAN network. Two major areas of work necessary to overcome the problems discussed in this section that we are putting considerable effort into are: adapting a meta file structure as a standard for the network and the development of a scientific graphics and communication work station that accommodates the networking.

## IX. GROWTH AND FUTURE OF THE NETWORK

The SCAN network provides very easy access to large, multifarious data sets with powerful, easy-to-run software for large periods of uninterrupted time. We are confident that this network will continue to provide a means for accomplishing scientific research in the easiest and most cost effective manner provided that we do not lose track of the exploding technology around us and utilize this technology in such a way that will keep the system upward compatible.

Several new nodes have just been added to the network, such as the Code 960 VAX computer at GSFC and computers (a large local area network) at the Los Alamos National Laboratory. The addition of LANL will enable other network nodes to have access to a large and fast "number-crunching" computer for modeling purposes (a Cray machine), making it possible to compare sophisticated theory with actual observations. Within the next few months, two new nodes will be added to the network: Southwest Research Institute (SWRI) and the University of Michigan, with many more research centers being considered for the future. With the addition of new nodes comes more and diverse data bases, more distributive computing power, and more scientific expertise. This situation naturally provides the opportunity to hold many diverse future workshops. This kind of growth is necessary to fully develop the capabilities of the SCAN network system.

The network hardware structure is also expected to grow considerably over the next few years. The nodes that will be added to the present star configuration will form small networks of their own. For example, SWRI will be connected to UTD. This enables continued correlative work with the small networks during the times when the central DBMS facilities are temporarily down and reduces substantially the communications cost without reducing functionality. It is also expected that progress will be made in using satellite communications instead of land lines. The development of an economical "micro-based" graphics work station based on the network is currently on the drawing board and will be implemented. The network work stations are being designed around the scientists' needs for computer-aided analysis tools. These are just a few directions that are being pursued within the scope of the SCAN network.

The Space plasma Computer Analysis Network (SCAN) is in its infancy but is having a major effect on NASA's data systems of the future. The network, with advice from the Data System Users Group (DSUWG), brings into NASA and the user community needed technological expertise, increasing the capabilities and productivity of today's scientists.

## APPENDIX

This appendix, in the following form, was available on the network before and for a short time after the workshop. It is important to note that several changes in the network that have occurred since the workshop are not reflected in this appendix. For instance, at the time of the workshop the network was called the MSFC/NEEDS network which has now been changed to SCAN. In addition, Section 8 is completely obsolete, since right after the workshop individual packets were accessed automatically from the desired input time period.

### WORKSHOP OPERATIONS MANUAL

#### 1.0 Introduction

This document is intended to act as a reference for the MSFC/NEEDS workshop, to be held on August 19-20, 1982. It includes documentation on how to run the available RIMS, Chatanika, UTD and network programs, where the data are located, suggestions for the sharing of the facilities, making hardcopies of plots, etc.

If you are not familiar with the NEEDS node (DBMS central VAX system), analysis, and networking software, and there are therefore omissions in this document from your perspective, please let us know so this document may be updated accordingly.

#### 2.0 Intended mode of operation

The ES53 Data Analysis Lab will be the "center of operations" (unless the SSL 11/34 goes out with hardware problems, in which case there will be a mass move to the NEEDS VAX). However, it is expected that most plot generation will be performed on the VAX; then actual plotting will be done on one of the three available plot devices in the data room.

#### NOTE:

USE OF THE SSL 11/34 FOR PROGRAM  
DEVELOPMENT THROUGH THE DURATION  
OF THE WORKSHOP IS PROHIBITED!

In addition, the submitting of batch jobs on the NEEDS VAX is discouraged - not only has no "software" or documentation been generated to support this mode of operation, it is suspected that many more requests for plot generation would be submitted than the VAX could cope with. Thus, the workshop would very rapidly cease to be "interactive." By limiting programs to the two or three that will be run interactively with the available terminals, total interactive throughput will be maintained. Please follow these guidelines.

#### 3.0 Plotting devices

The devices which are available at SSL, and for which we have programs to drive, are:

## Plot device

## Hardcopy Unit

Tektronix 4027 color monitor  
Tektronix 4014 graphics terminal  
Princeton 8500 graphics terminal

Matrix camera  
Tektronix H/C unit  
Tektronix H/C unit

Whenever possible, please use the monochrome plot program EXCEPT where you really do need color. The matrix camera will support Polaroid 10x8 hardcopy film (very limited quantities), and also a 35 mm camera (for which film is more readily available, though cannot be developed in the timeframe of the workshop).

See the section "Hardcopying" for multiple-frame files.

## 4.0 Accounts

On the SSL 11/34 please use the following accounts for scratch files, plot files, etc.:

[UIC]	Account Name
[303,001]	NET
[311,001]	NETSSL
[307,001]	NETUTAH
[306,001]	NETUTD
[305,001]	NETNEEDS

Of course, if you are a permanent resident of SSL, use your own account if you so wish. The above accounts are also available on the NEEDS VAX, so use those when you log in. When logging on the NEEDS VAX from the SSL 11/34 (this is remote log-in) please use the same account.

Type HELP UICLIST on the SSL 11/34 to see a list of the account names/UIC's.

### NOTE:

KEEP OUT OF THE SSL[200,\*] DE ACCOUNTS,  
AND THE NEEDS::[NETLIB] ACCOUNT  
THROUGH THE WORKSHOP!

## 5.0 Remote log-on's

Joe Douplik has spent a large amount of time removing the bugs from the program RVT (remote virtual terminal). A complete description of this program is in the DECNET-RSX manual. To run this program all one does is to type RVT and answer the questions (see DEDASH, volume II) [8].

Logging onto the NEEDS VAX in one of the network accounts will allow you to use the DEP facility for running DE RIMS programs (see later). Normally you will generate a plot file (you will not drive a plot device directly), and you can then send the plot file to the SSL 11/34 with an NFT command:

```
NFT SSL"NET NET"::=plot name.plt
```

Alternatively, if you log into one of the terminals used as a plot device, you may use NFT to plot the file directly, viz: NFT

TI:=NEEDS/NET/NET::plot file.plt

This has the advantage, of course, that you do not generate a load of old plot files on the SSL 11/34. See the DECNET documentation for more details.

## 6.0 Programs available

This section discusses the data analysis programs available on the central NEEDS VAX.

### 6.1 RIMS data

There are three data bases that will be used in this workshop: RIMS data from DE-1 (residing on the NEEDS VAX), IDM and RPA data (residing on the NEEDS VAX and at UTD), and Chatanika data (residing on the NEEDS VAX). Each of these data bases has their own software.

The principal RIMS programs [8] available are:

- 1) LSTD'T1 - List data times for a data set
- 2) LSTMF1 - List MF1 data to a file
- 3) SENTGS - Spin/energy versus time spectrogram
- 4) RPASGS - RPA versus spin plot (greyscale/color)
5. CESPEC - Count versus energy spectrum (line plot)
6. CSSPEC - Count versus spin spectrum (line plot)
7. CTSTIM - Count versus time (line plot)
8. PORBC - Plots DE-1 orbit segments (color only)

There are two versions except for PORBC of the graphics programs, one to drive the 4027, the other to drive the Princeton/TX4014. The task names (.EXE files) for the above programs are, therefore, followed by M for monochrome (4014), or C for color (4027). The listing programs (LSTD'T1, LSTMF1) have .EXE names the same as the program names. Use the .EXE name when you want to run a program. Since you generate plot files, we have adopted a default file type for the plot files.

.PLT for the monochrome plot files (Princeton/4014)  
.COL for the color plot files (4027)

Please stick to this convention; it may help to minimize chaos.

Example output, detailed documentation, and a detailed description of the input required for the monochrome versions of the programs are found in the DEDASH [8].

### 6.2 Chatanika plots

There is currently one program in the NEEDS VAX that produces Chatanika radar plots; it is called SCANPLC. This program asks for a color bar file (used as a lookup table), an ELS file of input data, and the start time you need.

### 6.3 UTD plots -

There are several programs that will plot UTD data that is at UTD. They are: NETREP, TEXMETC, and TEXMETM. All these programs are in the NET NET account.

NETREP is a network replay program that will display plot files (you must know ahead of time if it is a 4027 or a Princeton 8500 plot file).

TEXMETC is a network plotting program that reads a UTD device-independent META file and plots it onto a 4027.

TEXMETM is a network plotting program that reads a UTD device-independent META plot file and plots it onto the Princeton.

### 7.0 DEP procedure

DEP stands for DE processing (of RIMS data only) and is a command procedure used in all network accounts on the NEEDS VAX. The DEP facility is intended to simplify running of the RIMS programs listed in Section 6.1. To do this simply type: DEP<ret>

DEP is menu driven so little explanation is necessary. The procedure asks what the data source is and then asks which program you want to run. All the RIMS workshop data has been packetized, so respond with a P for Packet data. You may answer H for help to either of these questions to get more information. The assignments to put the plot output into file are performed automatically. If you reply with <return> in response to the "plot file name" question, the output plot file will be "program.PLT" or "program.COL," depending on whether you are running mono-chrome or color programs. The output for the LSTMF1 program goes to a file called FOR002.DAT (sorry about that). If you simply type

```
DEP program-name<ret>
```

DEP assumes you want to run program "program-name," and that you will be working from the PACKET data; it does not prompt for which data type.

For programs (SENTGS, RPATGS) that require a file name with contour values, hitting return will give you file [NETLIB.DE]CONTRS.TXT. This contains the approximately logarithmic count sequence to be seen on all the summary DE RIMS plots. A second file is [NETLIB.DE]CONTLIN.TXT which contains a linear sequence of count values. Alternatively you may create your own with the editor (values are read in under \* format, and there must be no more than 14).

### 8.0 File name input for packet data

All the DE RIMS programs ask for "data file name" at the beginning of the run (it does not loop back to request as alternative input file). If you are running from packet data, this data file is a file of the type in DR1:[DEARCH]; i.e., packetized data. Each packet contains approximately 3 min of data; if you are doing intensive analysis on only 3 min, you can supply the packet name directly (do

```
DIR drl:[DEARCH]*.ORC
```

to see a list of packets). Normally, however, you will be processing on a larger quantity of data than this, and the way this is done at present is to put the list of packet file names in a .CMD file. Then respond to the "input file name" prompt with

@file name

where file name contains the list of packets. If the file type is .COM you do not need to specify it. Ensure that you have [DEARCH] preceding each of the file names in the list.

The files D297.COM, D298.COM, D299.COM, and D302.COM contain lists of packets for each of the four workshop days, but if you are working at the end of the day things will be very slow, because at the moment the programs skip through each file (rather than skipping files). Therefore, please copy what archive files you need from the above com files. When the central data base management becomes fully operational, this procedure will not be necessary.

#### 9.0 Hardcopying at the SSL node

Use of the Matrix will not be discussed here; there are plenty of people who know how to use it.

It is possible (and frequently desirable) to generate multiple-frame plot files. Simply using PIP or NFT to replay these files will cause a problem if you want to hardcopy all or some of the frames. Two programs exist (on SSL 11/34 type DEP prog-name) to replay these files, frame by frame. You will need to reassign TX: to the actual device you are using if you are not using the default TX:.

Program	Output to:
RP4027	TK:
RP4010	TX:

Example:       >DEP ONLINE  
                  >ASN TT6:=TK:  
                  >RUN RP4027

You will need to type DEP ONLINE, before you run either of these, since they use DEP offline/online convention. The RP4010 program has the capability to automatically hardcopy all frames. This will only work when it is driving a device to which the hardcopy unit is attached by a multiple pin connector (e.g., the 4014), but not when it is only connected by a BNC (e.g., the Princeton).

The programs should be self-explanatory when you run them, reply with the plot file name. These programs currently work only when the plot files are on the SSL 11/34.

(Julian Johnson and James L. Green, August 17, 1982)



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APPROVAL

MSFC SCAN STAGE 1 WORKSHOP

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The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.



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