Centralized Storm Information System

(CSIS) Implementation Plan

A REPORT

from the space science and engineering center
the university of wisconsin-madison
madison, wisconsin
Centralized Storm Information System
(CSIS) Implementation Plan

Space Science and Engineering Center
University of Wisconsin, Madison

May 1981
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Introduction</td>
<td>1</td>
</tr>
<tr>
<td>II. CSIS Hardware</td>
<td>4</td>
</tr>
<tr>
<td>A. GOES Antenna System</td>
<td>4</td>
</tr>
<tr>
<td>B. Computer Fail-Soft Design Philosophy</td>
<td>9</td>
</tr>
<tr>
<td>C. CSIS Computer Systems</td>
<td>12</td>
</tr>
<tr>
<td>D. Man-Interactive Terminals</td>
<td>19</td>
</tr>
<tr>
<td>E. Hardware Maintenance</td>
<td>23</td>
</tr>
<tr>
<td>F. Hardware Schedule</td>
<td>24</td>
</tr>
<tr>
<td>CSIS Capital Equipment</td>
<td>26</td>
</tr>
<tr>
<td>Boards Built by SSEC</td>
<td>29</td>
</tr>
<tr>
<td>III. CSIS Software</td>
<td>34</td>
</tr>
<tr>
<td>A. Existing McIDAS Software to be Delivered as part of CSIS</td>
<td>34</td>
</tr>
<tr>
<td>B. New System Software</td>
<td>46</td>
</tr>
<tr>
<td>C. New Applications Software</td>
<td>48</td>
</tr>
<tr>
<td>D. Evaluation and Improvement Software</td>
<td>49</td>
</tr>
<tr>
<td>E. Software Schedule</td>
<td>50</td>
</tr>
<tr>
<td>IV. Documentation and Training</td>
<td>55</td>
</tr>
<tr>
<td>V. Management Responsibilities</td>
<td>57</td>
</tr>
<tr>
<td>List of Acronyms</td>
<td>60</td>
</tr>
<tr>
<td>Appendix A - McIDAS Software which will be part of CSIS</td>
<td>62</td>
</tr>
</tbody>
</table>
I. Introduction

Meteorological data for many years has been received at weather forecast offices in a large variety of formats: charts, teletype messages, cloud photos, radar displays, and others. These varying sources of data have been difficult to handle and they require mental superpositions and intercomparisons in order for meteorologists to make subjective forecasts.

With the many kinds and formats of data available to the meteorologist, and especially with the inclusion of satellite and radar data, it has become increasingly apparent that a significant barrier to the improvement of short-term forecasts and warnings was not the lack of some new and different measurements but the inability to assimilate and understand all that is currently available in real time. This is especially true for the National Severe Storms Forecast Center (NSSFC) in Kansas City, MO. This key center in NOAA’s National Weather Service is responsible for issuing all of the severe thunderstorm and tornado watches in the country. At the NSSFC, data is still handled using paper, charts, film, grease pencils, scissors, and tape with the data arriving and being analyzed and displayed in different formats and map projections, at a number of locations within the forecast center.

There currently exists a strong need to collect and display all useful information on storms at NSSFC as well as at other NOAA operational facilities. In order to address this need, a joint NASA/NOAA effort has been initiated to provide a Centralized Storm Information System (CSIS) at Kansas City. The primary objectives of this joint project are: (1) to improve the overall severe storm forecast and warning procedure, and (2) to demonstrate the operational utility of techniques developed within applied research environments.
As part of the CSIS program, an advanced interactive computer system will be installed in Kansas City along with a GOES receiving antenna system. This new system will enable forecasters to nearly instantaneously superpose, intercompare, and display all available data including satellite derived data at the NSSFC on a color image terminal through an on-site data collection and processing system. The data will be transformable to the same map projections for different areas of interest. This is to achieve an ease of intercomparison and calculation of forecasting indices.

The capability to directly superpose satellite cloud images, IR temperature maps, radar reflectivity data, contours of surface and upper air data and to track and extrapolate the motions of severe storms is expected to produce a marked improvement in the speed and accuracy with which forecasters can interpret the data and alert the public. This qualitative expectation is based upon case studies examined in research environments.

The purpose of this implementation plan is to outline the characteristics of this CSIS computer system, itemize and describe the hardware which will make up the system, itemize and describe the software which will go into the system, and provide schedules of the implementation of the system. The parties involved in this CSIS implementation are NASA, NOAA, and the University of Wisconsin's Space Science and Engineering Center (SSEC). NASA is responsible for the overall management of the planning, procurement, and implementation of the program. NOAA is responsible for the facility accommodations, use, and evaluation of the system. A separate CSIS test and evaluation plan is being prepared by NOAA. The University of Wisconsin is responsible for the building, installation, and maintenance of the CSIS. This implementation plan will primarily center on the role of the University of Wisconsin in providing the CSIS hardware, software, and maintenance.
The implementation of CSIS actually started prior to the actual CSIS program and has been called by some "Phase 0 of CSIS". As part of the VAS program, a remote McIDAS terminal was installed in March 1980 in Kansas City at the NESS field station which provides support for the NSSFC operations. The purpose of this terminal was to allow an evaluation of the utility of remotely sensed temperature sounding for severe storm forecasting. This terminal was connected through a phone line to the University of Wisconsin. This terminal has three full resolution image frames, 12 coarse resolution frames, and three graphic overlays of three colors each. It requires several minutes to load a TV image because of the phone line limitations. The other functions of the terminal, such as interactive graphics, interactive information transfer, etc. are not degraded by the phone line. A second remote terminal was installed at NSSFC in December 1980. This terminal has 10 full resolution frames, five graphic overlays, and a dual channel enhancement system. The original terminal can only display an image and put in false color. The new terminal with the dual channel enhancement system allows the functional combination of two images, such as coloring the visible with the infrared information, false stereo presentations, etc. In addition to the VAS remote sounding evaluation, these terminals are being used for McIDAS system familiarization, training, and support of the NSSFC functions. The terminals were used an average of 20 hours/day for these functions. Kansas City is providing feedback to Wisconsin on problems, limitations, and considerations for improvements which should be incorporated into the CSIS computer system. Their feedback has been incorporated in the following implementation plan.
II. CSIS Hardware

The CSIS hardware will consist of a GOES receiving antenna system, three computers, three interactive terminals, and interface equipment. The system is designed with sufficient redundancy to allow a fail soft capability which will allow operations at a degraded level in the event of component failures. The system, however, is considered a demonstration system, and as such, will not be operational in NOAA's strict 24-hour duty, redundant capability sense of the word. The initial system is planned to be delivered and working by January 30, 1982. However, because of the funding plan delivery of all backup equipment and some of the terminals will not occur until later in 1982. Details of the delivery are contained in the section on hardware schedules.

A. GOES Antenna System

GOES imagery will be acquired by an antenna on the roof of the Federal Office Building in Kansas City. The GOES receiving system performs the data reception, demodulation and synchronization functions necessary to receive GOES data. Except for the reflector and mount, the system is designed so that redundancy can be provided in all components. The only single point long term failure is the mechanical destruction of the antenna. This is unlikely as the proposed antenna is rated for wind survival up to 125 mph (no ice). Several hundred installations have been made of this antenna model and are in service without a single structural failure. The system is patterned after the GOES receiving system recently installed at Wisconsin on the roof of the SSEC building. This antenna and mount are shown in figure 1. The reflector and mount are manufactured by Andrew Corporation. The reflector is a two piece 15-foot aluminum assembly backed and supported
Figure 1a. 15' Andrews antenna and mount on the roof of SSEC. This antenna and mount are very similar to that which will go on the roof of the Federal Building in Kansas City.

Figure 1b. Base of antenna at SSEC showing the interface pedestals which attach to the building's beams, the interface structure built from I beams, and the antenna mounting pads.
by a galvanized steel mount. The mount is steerable through use of motor controls. The antenna will be steerable so that it can receive either GOES-East or GOES-West. A Synergetics Model 10-02 down converter feeds the signal into a Synergetics Model 10-04 receiver. The IF output of the receiver is further processed by the EMR Telemetry 728 PSK Demod, 726 Bitsyncs and 822 mode A Frame Sync. The output of the frame sync is a digital data stream which will then go into the CSIS computers. In order to provide system reliability, NESS is being requested to allow use of GOES antenna electronics from FOB-4 in Washington in the event of antenna electronic failures.

In addition to the CSIS activities in Kansas City which requires a GOES antenna, The Corps of Engineers in the Federal Building in Kansas City have expressed plans for a GOES antenna to support remote platform data collection activities. The CSIS antenna will allow the Corps of Engineers a signal from which the remote platform data can be extracted. No operational support will be guaranteed by NOAA. Any additional funding required must be provided by the Corps. SSEC will provide the Corps of Engineers specifications on the antenna, down converter, and receiver to be procured for the CSIS system. If the Corps also installs an antenna, NOAA and NASA will consider an additional effort to assimilate both GOES East and West data.

The installation of the antenna on the roof of the Federal Building in Kansas City requires an RFI survey, GSA permits, structural plans for the roof modifications, construction on the antenna pads, and the actual antenna installation. The GSA permit for the installation of the CSIS antenna has been obtained. The assistant chief of the facilities engineering of the NWS central region has been appointed as the GSA contact point. GSA
will have to approve the final plans of the building modifications required for the antenna installation.

Before the final decision to put the antenna on the roof of the Federal Building is made, a radio frequency interference (RFI) study is needed to insure that radio transmitters on the Federal Building and on other nearby buildings will not interfere with the reception of the GOES data. An RFI study was performed in 1971 when plans were to put a GOES antenna on the Federal Building roof. (NESS changed its policy plans about direct reception of GOES data by field offices and the antenna never was installed.) While the 1971 survey showed a favorable RF environment for an antenna, it is sufficiently out of date because of new construction and new transmitters in the neighborhood to warrant a new RFI survey. The Institute for Telecommunication Sciences of the Department of Commerce, Boulder, Colorado (who also did the original survey) are being contracted to do a new RFI survey. They will perform this during April 1981.

A preliminary structural analysis of the Federal Building roofing plan was performed which showed that the 15 ft. Andrew antenna can be safely mounted on the roof without major building modifications. The work to be done in order to provide an antenna foundation includes mostly interface type changes, as opposed to major structural beefing up. The nature of the work needed is in principal the same as that recently done at SSEC during the installation of the Andrew antenna there. The structural analysis showed there is a configuration of structural elements on the roof which is ideal for accommodating the antenna pad geometry. This ideal configuration occurs at 15 locations on the south side of the roof. (A similar configuration also exists at 15 locations on the north side of the roof). The proposed antenna foundation approach is shown in figure 2. Three interface pedestals
Figure 2. Plan for interface structure of antenna mount for Federal building in Kansas City.
are attached directly to the structural I beams of the building. Holes are cut into the roof and the interface pedestals tie directly to the beams. These pedestals are fastened to the roof beams using long "bolts" attached to channels (which act as "washers") which are located on the underside of the beam. An interface structure ties the three pads together. This structure rests on top of and fastens to the three interface pedestals. The interface structure contains the antenna pads and the antenna mounts directly to these pads. A simple stress analysis shows a worse case loading with 125 mph winds of 37,610 psi stress on one of the beams. This is 20,000 psi below the yield stress of that beam, an adequate safety margin. However, a "certified" analysis conducted by a licensed Missouri Professional Engineer will be needed to fulfill legal requirements. This analysis will serve as a totally independent analysis of our design. The building modifications and the antenna installation will be performed by contractors with GSA approval of the plans and the work. The installation of the 15 ft. antenna dish on the roof of the Federal Building will require the use of a helicopter to lift the antenna from the parking lot beside the building up to the roof. The antenna installation is planned to be completed in the fall of 1981. The detailed schedule is contained in the section on hardware schedule.

B. Computer Fail-Soft Design Philosophy

The computer systems will consist of three computers with identical hardware configurations, but with different functions and software. The conceptual configuration is shown in figure 3. One of the computers will act as a data base manager (DBM). Its function will be to bring in, if necessary preprocess, and then store all of the data which will be used by
Figure 3. Conceptual plan for the hardware of the centralized storm information system (CSIS)
CSIS. The second computer will be used as an applications processor (AP) for the operational support of CSIS. This AP will be connected to three interactive terminals and will perform all of the analysis and display functions for the forecasters. The three terminals will be assigned to SELS, NESS SFSS, and CSIS briefing, test, and evaluation. The SELS, and NESS terminals will have occasional use, while the CSIS briefing terminal will have continual use. The third computer will be used as an applications processor for research and development activities. It will have a single interactive terminal attached to it. Communications between the computers will be with a high speed (10 Mbit/sec) link. This interprocessor link will be used for remote file reads and writes. The speed of the link is the same as the speed to the local disk storage device. The two AP's will talk to the DBM over this link. While there physically will be a line between the two APs, it will not be used except during system reconfiguration.

The system is designed for a fail-soft, degraded operations mode. All of the computers will have identical hardware configurations. All of the input data lines will go to all of the computers, but only the DBM will actively listen to these lines. The terminals will be attached to the APs through a patch panel. Any terminal can be plugged into any computer, but only the APs will listen to the terminals i.e. if one plugs a terminal into a DBM, nothing will happen. The criteria which determines if a computer is a DBM or an AP is software on the disk pack. If one of the computer systems should fail, the system would be reconfigured with the two remaining computers becoming a DBM and single AP. The reconfiguration would take place through switches on the front of the computers. For instance, if the DBM failed,
the research computer would become the new DBM. The operations on the forecast AP would continue, but the research people will have to wait until the computer is fixed before they can go back to work.

Loss of data during system failures is also designed as a fail-soft capability. The normal operation will have all of the data on the disk of the DBM. On the disks of the APs will be the data which is actually being used by the forecaster. If this AP fails, after reconfiguration where the forecasters plug their terminals into the research AP, the forecasters can reobtain their data from the DBM. If the DBM fails, the only historical data will be that which is on the AP's disks. Operational procedures will be developed to keep a sufficient amount of data on the AP disks to insure sufficient historical data if the DBM is somehow lost.

A further extension of the fail-soft philosophy is the complete redundancy of the conventional surface and upper air data inputs from the FAA 604 data line. This data is considered vital to the successful operation of the NSSFC that even a short outage would not be considered acceptable. The 604 data will be ingested by all three computers simultaneously and redundant files will be kept on each computer. Hence the only way that conventional data would be lost would be the total failure of all three computers, or a failure of the 604 line.

C. CSIS computer systems

All three CSIS computers will have identical hardware configurations. Hence only one computer will be described in detail in this section. The CSIS computer is a Harris/6. The computer will be supplied with a scientific arithmetic unit (SAU), 128 kilowords of 24 bit memory with error correcting
codes, a complete options pack of program restrict, address halt, interval timer, and programmers panel. Highspeed I/O is done using the Harris Universal Block Control (UBC) board while low speed I/O is done through the Harris Priority Input Output Channel (PIOC) board. Figure 4 shows a block diagram of the computer. Online storage is supplied with a 300 MB disk with a removable disk pack and controller. A second 300 MB could be added in the future using the same disk controller. Offline storage and program saves are done on a 800/1600 BPI tension arm tape drive. Filtered power for the system is provided by a 3KVA sola transformer/regulator. The above computer equipment will be purchased from Harris and CDC.

The data interface equipment will be constructed by SSEC. The GOES data preprocessor (or "byte mangler") interfaces the CPU with the frame sync of the antenna system. In addition to providing proper interface, it performs line averaging of the data into 1/2, 1, 1 1/2, 2, 3 or 4 mile resolution, packs the data into 24 bit words, and provides interrupts to the computer when the satellite data is ready.

The asynchronous interface (sometimes called "the 8 holer") provides interfaces to a total of eight low speed data lines. The computer console CRT and the hard copy error logger model 43 printer connect to the async interface. The console CRT and printer lines from the three computers will go to a data concentrater multiplex box so that a single CRT and printer will be used by all three computers. The cardreader/line printer lines likewise go to a central location so that a single Documation 600 cpm card reader and a Teletype model 40 high speed printer can serve all three computers. In the cabinet below the card reader is a small microprocessor station with Intel 80/24 and 534 boards. This microprocessor performs the routing and buffering functions to the computers. Other data lines into the
Figure 4. Block diagram of one of the CSIS computers
asynchronous interface include the FAA 604 line. The two WBRR radar phone lines autodialers and the D/RADEX or RRWDS dialer will share a data concentrator. An in house CRT could also share this data concentrator. The D/RADEX or RRWDS phone line will go directly into the async interface while the WBRR phone data will go through a separate radar interface box into the PIOC. This uses a total of seven out of the possible eight asynchronous ports. If there is a need for future data lines, another data concentrator could be put on.

The synchronous interface is for low to medium speed ports which obey bit serial protocol. There are six ports on the synchronous interface. Three of these ports will be dedicated to interactive terminals with connections through a short haul modem to a patch panel. The patch panel will allow rapid interchange of terminals. On the computer which is normally used for research, one of these terminal ports will be attached to a modem and connected to a remote interactive terminal at Wisconsin. The computer link to the Eclipse will also be connected to the synchronous interface. There will be two unused ports on the synchronous interface. One could be used for an ADCCP line to a remote computer such as Wisconsin's Data Base Manager.

The Eclipse-CSIS link will use the synchronous interfaces of the two computers. The Eclipse has a SLM-2 synchronous interface which currently has one empty port which will be used for the CSIS link. While there are three CSIS computers, only one will talk to the Eclipse at a time. The three CSIS computer synchronous interface parts will be fed into a patch panel so that the CSIS computer which is acting as the data base manager can be connected to the Eclipse. The low level communications between the two systems will use the Binary Synchronous Communications Protocol for
which both computer operating systems have service routines available. The higher level communications routines will have to be developed as is described in the software section.

The other interface box built by SSEC is the high speed data link (or "burn line") box. This interface allows 10 Mbit/sec communications between the three computers. The data base manager is the hub of this network. The two APs talk to the DBM but not to each other. Software makes the link between the APs inactive. Only on reconfiguration when one of these APs become a DBM will the software activate the line.

The CSIS computers, tape drives, disk drives interfaces and computer operator station will be housed in the existing computer room at the NSSFC. This will provide an environment of 70°F (Max 78°F.) with 20-80% relative humidity, non-condensing, which the CSIS equipment requires. Figure 5 shows the existing layout of the computer room. The back of the existing room will be cleared out, with the tables, bookcases and Eclipse diablo printer moved to other rooms at NSSFC. The key punch for the Eclipse will be moved to the adjacent room. Figure 6 shows the proposed layout with the CSIS equipment installed. The three computers and tape drives would be mounted in a row with the disk drives behind the computers. There is room for another three disk drives if the system should be expanded at some time in the future. The CSIS computer operator terminal CRT would be put on the table next to the existing Eclipse. The hardcopy error logger model 43 printer would be placed next to the existing Varian. The error messages to the printer will also go to the operator's CRT. All of the computer interface equipment and antenna electronics will be housed in the bottoms of the CSIS computers and tape racks. The phone modems and the terminal patch panel will be mounted on a rack against the wall. The CSIS
Figure 5. NSSFC computer room
Figure 6. NSSFC computer room with CSIS equipment
card reader and high speed printer model 40 will be installed in the room next to the computer room.

D. Interactive Terminals

The CSIS terminals form the primary man-machine interfaces. Each terminal consists of an alphanumeric CRT, a high resolution color TV monitor, a joystick pair, an alphanumeric hardcopy printer, terminal electronics and the terminal enclosure-desk. There will be a total of three CSIS terminals. Each will be functionally identical except for the number of image frames available. Figure 7 shows a terminal similar to that which will be built for CSIS. The terminal electronics and digital refresh electronics are enclosed in the two cabinets to the right of the operator's desk. Remote location for electronics may be required because of climate constraints. If this is necessary, the terminal electronics would be located in racks (one per terminal) in the computer room. Figure 8 shows a functional block diagram of the terminal. The data coming or going to the applications processor computer goes through a patch panel, a short haul modem used for isolation purposes, and is received by the bisync card. The bisync communications card provides protocol control and buffering. The timing signals necessary to drive the color monitor are generated by the TV timing card. The position of the joysticks are sensed by the joystick card, which relays this to the host AP, which in turn commands the cursor generator to position a cursor on the color monitor. The terminal is under the control of the Intel 80/24 microprocessor. The meteorologist will use the Ann Arbor CRT terminal to communicate with the host applications processor computer via the microprocessor in the terminal. Hardcopy alphanumeric output is provided by a terminal printer. The colorizer cards
Figure 7. Man-Interactive terminal similar to the CSIS terminal. The terminal electronics are in the doors to the right of the operator. The printer is not shown.
Figure 8. Block diagram of CSIS Man-Interactive Terminal
provides false color and enhancements to the TV image, and also allows selectable colors for the graphic overlays. The dual channel colorizer allows the functional combination of two images into one (such as coloring the visible image with the infrared temperature). The read/write cards control the input and retrieval of image and graphic data to and from the memory. The image and graphics are read out of the memory every 1/30 sec to refresh the television monitor. The memory is solid state CDC memory cards with CDC chassis and timing control boards. The 464 compression code board allows data compression to be used on the image data. The six bit image data (64 gray scales) will be stored as three bit compressed data in the memory. The data is unpacked on the fly allowing six bit data to go to the colorizer card. This data compression concept and also the dual channel colorizer were put into the "phase 0" terminal which was delivered to Kansas City in December 1980.

The number of images and graphics is controlled by the number of CDC memory boards in the terminal. Three of the terminals will each have a total of 26 high-resolution image frames with 13 graphic overlays. The image frames will be configured into paired opposites in keeping with the concept of visible/infrared frame pairs. A single key provides transfers between image pairs or dual channel combination of the pairs. The image data will have six bits of information (64 gray scales or false colors). The graphic overlays will have three bits of information (seven colors plus off). The colors will be selectable by the meteorologist via the colorizer tables. The terminals will have an NTSC encoder which will allow the video to be connected to a large briefing TV.

The initial CSIS hardware is scheduled to be installed in January 1982. Because of funding constraints, not all the terminals will be delivered at
this time. Two of the terminals will be delivered with the initial installation. One of the terminals installed as part of "phase 0" will be returned to Wisconsin to be used as a remote terminal to CSIS. When the CSIS equipment is working properly, the remaining phase 0 terminal will be connected to the CSIS computers. When the last terminal is delivered later in 1982, the remaining phase 0 terminal will be returned to Wisconsin. Details of the terminal construction and delivery schedule are in the schedule section of this plan.

Development activities involved in the construction of the CSIS terminals involve reworking the read/write boards to accommodate the increased frame space, redesigning the colorizer to allow graphic selectable colors, and modifications to other boards. The developments involved with the dual channel colorizer, three bit data compression, the 80/24 microprocessor board, use of the new CDC memory system, and use of the Optima table/equipment enclosures were done on prior McIDAS terminals.

E. Hardware Maintenance

Hardware maintenance for CSIS equipment through the end of FY 83 will be the responsibility of SSEC. The maintenance of the Harris computers, tape drives, disks, and card reader will be subcontracted to the Harris Corporation—Computer Systems Division. Maintenance of the Teletype printers will be subcontracted to the Teletype Corporation. The maintenance of the SSEC built equipment (the terminals and the computer interface boxes) and the antenna system will be the responsibility of SSEC with local assistance by NSSFC personnel. A government Electronics Technician (ET) is required to support this a activity on a half time basis. NOAA will provide an ET to assist in CSIS maintenance.
If there is a problem with the CSIS equipment, the NSSFC personnel will first attempt to define the problem area. SSEC will be available during normal working hours to provide telephone assistance in identifying the problem and determining if maintenance contractors, such as Harris should be called in. SSEC will provide a computer operator's manual which will outline problem identification and "get well" procedures. If the problems are isolated to SSEC equipment responsibility, telephone trouble shooting by NSSFC personnel in communications with SSEC technical experts will be attempted. If the NSSFC personnel cannot fix the problem or replace the bad boards with CSIS spare boards, SSEC will either ship functioning hardware or send SSEC repair technicians to Kansas City within 48 hours after it has been mutually agreed that NSSFC personnel cannot fix the problem. Any components replaced by spares will be shipped back to SSEC for repair. The spare equipment is listed in the section of this plan on schedule.

F. Hardware schedule

The CSIS hardware is scheduled for installation in Kansas City in January 1982. At this time the system will consist of a GOES antenna system, three computers, tape drives, interface equipment for these three computers, and two new CSIS interactive terminals. The final CSIS terminal and all the spare equipment will be delivered later in 1982. The hardware capital equipment which will be purchased as part of CSIS is listed in table 1 with brief explanation of purposes. Table 2 lists the equipment which will be built by SSEC with a brief explanation of purposes. A more detailed description of the equipment is contained in the preceding sections C and D.
The antenna is scheduled for installation in October 1981. The details of the antenna schedule are shown in figure 9. The CSIS computer schedule is shown in figure 10. The three CPU system is scheduled to be working in September, 1981 at SSEC.

The terminal delivery schedule is shown in figure 11. The first CSIS terminal will be complete in September 1981 and will be used for software development. The second terminal will be completed in December and used on the system for a month to insure that everything is working correctly. The delivery of the system to Kansas City which includes antenna electronics, three CPUs, and two terminals is scheduled for January 1982. At that time one of the phase 0 terminals will be returned to Wisconsin for use as a remote terminal to the CSIS research applications processor. The last CSIS terminal will be built with FY 82 funds, as will all the spares for the system. The spare interface boards for the CPUs will be completed in February 1982. The third CSIS terminal will be done in May 1982. When the final terminal is delivered, the remaining phase 0 terminal will be returned to Wisconsin. The spare terminal boards will be completed in October 1982.
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 3</td>
<td>Harris /6 CPU systems including 128 K 24-bit word memories with tape drives (main CSIS computers)</td>
</tr>
<tr>
<td>B. 3</td>
<td>CDC 300 M Byte disk drives with disk packs (disk storage for CPUs)</td>
</tr>
<tr>
<td>C. 10</td>
<td>CDC Chassis</td>
</tr>
<tr>
<td></td>
<td>CDC Timing Control boards</td>
</tr>
<tr>
<td></td>
<td>CDC Memory boards (128 K x 20) (for the three small terminals [24 frames, 12 graphic overlays] each gets three chassis, three timing control boards, and 15 memory boards. There is one spare chassis, one spare timing control board, and one spare memory board)</td>
</tr>
<tr>
<td>D. 5</td>
<td>Ann Arbor Ambassador CRT terminals (one CRT for each of the three interactive terminals, one for the computer operator, and one spare.)</td>
</tr>
<tr>
<td>E. 4</td>
<td>Aydin RGB TV monitors (one color monitor for each of the three interactive terminals and one spare.</td>
</tr>
<tr>
<td>F. 1</td>
<td>Teletype Model 43 printer (error logger for computer operator)</td>
</tr>
<tr>
<td>G. 1</td>
<td>Teletype Model 40 printer (main printer for CPU output)</td>
</tr>
<tr>
<td>H. 1</td>
<td>Documentation 600 cpm card reader with card case and cabinet (main card reader for CPU input)</td>
</tr>
<tr>
<td>I. 4</td>
<td>3 KVA Solar transformer/regulator, 208V input (one for each CPU system and one spare)</td>
</tr>
<tr>
<td>Quantity</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| J. 6     | 2 KVA Solar transformer/regulator  
(one for each of the three terminals, one for the card reader/line printer station, one for the antenna electronics, and one spare) |
| K. 1     | Decwriter III line printer |
| L. 6     | Intel 80/24 microprocessor boards  
(one for each terminal, one for the card reader/line printer station, and two spares) |
| M. 2     | Intel 534 board  
(one for the card reader/line printer station, and one spare) |
| N. 4     | Intel Industrial chassis  
(one for each terminal and one spare) |
| O. 3     | Optima enclosure  
(desk-enclosure of terminal, one for each terminal) |
| P. 4     | E.S.I. card cages for Intel chassis  
(one for each terminal and one spare) |
| Q. 4     | Intel 464 boards  
(contains firmware compression code. One for each terminal and one spare) |
| R. 1     | Andrew Antenna with motor drives or equivalent  
(GOES 15 ft. receiving antenna) |
| S. 1     | Sets of Antenna electronics  
(down convertor, demod, bit syncs, mode A frame sync from Synergetics, EMR or equivalent) |
| T. 1     | Large screen color monitor  
(briefing monitor) |
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. 1</td>
<td>Chrono-log clock</td>
</tr>
<tr>
<td></td>
<td>(provides current time to the computers at time of system boot.)</td>
</tr>
<tr>
<td>V. 4</td>
<td>Computer terminal work stations</td>
</tr>
</tbody>
</table>
Table 2
Boards built by SSEC

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 4</td>
<td>Asynchronous Interface</td>
</tr>
<tr>
<td></td>
<td>(one each CPU, one spare)</td>
</tr>
<tr>
<td>B. 4</td>
<td>Synchronous Interface</td>
</tr>
<tr>
<td></td>
<td>(one each CPU, one spare)</td>
</tr>
<tr>
<td>C. 5</td>
<td>High Speed Data Links pairs (Burn Boxes)</td>
</tr>
<tr>
<td></td>
<td>(one each CPU, one spare)</td>
</tr>
<tr>
<td>D. 3</td>
<td>GOES Data Preprocessors (Byte Mangler)</td>
</tr>
<tr>
<td></td>
<td>(one each CPU [only one used at any one time])</td>
</tr>
<tr>
<td>E. 2</td>
<td>Card Reader/Line Printer station</td>
</tr>
<tr>
<td></td>
<td>(one for card reader/line printer station, one spare)</td>
</tr>
<tr>
<td>F. 4</td>
<td>Joy stick pair</td>
</tr>
<tr>
<td></td>
<td>(one each terminal, one spare)</td>
</tr>
<tr>
<td>G. 4</td>
<td>Dual channel colorizer card</td>
</tr>
<tr>
<td></td>
<td>(one each terminal, one spare)</td>
</tr>
<tr>
<td>H. 4</td>
<td>Colorizer card (6 bit enhancement)</td>
</tr>
<tr>
<td></td>
<td>(one each terminal, one spare)</td>
</tr>
<tr>
<td>I. 20</td>
<td>Bisync card</td>
</tr>
<tr>
<td></td>
<td>[9] three each CPU for terminal connections</td>
</tr>
<tr>
<td></td>
<td>[4] one on each of four terminals</td>
</tr>
<tr>
<td></td>
<td>[3] one on each CPU for Eclipse link</td>
</tr>
<tr>
<td></td>
<td>[5] five spares</td>
</tr>
<tr>
<td>J. 4</td>
<td>TV Timing card</td>
</tr>
<tr>
<td></td>
<td>(one each terminal, one spare)</td>
</tr>
<tr>
<td>Quantity</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>K.</td>
<td>4 Cursor generator card (one each terminal, one spare)</td>
</tr>
<tr>
<td>L.</td>
<td>4 Harris Interface Card (one each CPU, one spare)</td>
</tr>
<tr>
<td>M.</td>
<td>11 Ram Write card (three each terminal, two spare)</td>
</tr>
<tr>
<td>N.</td>
<td>11 Ram Read card (three each terminal, two spare)</td>
</tr>
<tr>
<td>O.</td>
<td>6 WBRR radar interface (two each CPU [only two used at any one time])</td>
</tr>
<tr>
<td>P.</td>
<td>3 Radar auto dialer (one each phone line and one spare)</td>
</tr>
<tr>
<td>Q.</td>
<td>5 Data Concentrators (one for each CPU for radar dialer lines, one for operator CRI and error logger, and one spare)</td>
</tr>
<tr>
<td>R.</td>
<td>4 Six port short haul modems (one each CPU, one spare)</td>
</tr>
<tr>
<td>S.</td>
<td>4 Two port short haul modems (one each terminal, one spare)</td>
</tr>
</tbody>
</table>
Antenna System

GSA permit for antenna (March 1980)

Preliminary plan for interface

RFI survey of roof

Order antenna, electronics and mount

Final plan of interface

GSA approval of building mods

Bids for sub-contract of construction

Award subcontract

Building modification and construction of interface

Delivery of antenna and mount

Erect antenna

Install electronics

Figure 9. Schedule for CSIS Antenna System
Figure 10. Schedule for CSIS computers
CSIS terminals

Order terminal capital equipment (for first two terminals)

Delivery of capital equipment to Wisconsin

1st terminal complete

2nd terminal complete

Order capital equipment for remaining terminal

Delivery of capital equipment to Wisconsin

Delivery of 2 CSIS terminals to K. C.

Return of 1 "phase o" terminal

Complete and deliver 3rd terminal

Return of remaining "phase o" terminal

Complete terminal spare boards

Figure 11. Schedule for CSIS Man-Interactive Terminals
III. CSIS Software

CSIS is an outgrowth of the Man-Computer Interactive Data Access System (McIDAS) developed by SSEC. Much of the McIDAS software is directly applicable to the CSIS problem. However, the CSIS problem is sufficiently different from the McIDAS design goals that some new software is required to better tailor CSIS to the demands of the operational severe storm forecasting environment. Part of the phase "O" activities was a familiarization of McIDAS software capabilities. NSSFC has provided feedback to Wisconsin of limitations and problems with the existing software. A further evaluation of the adequacy of the McIDAS software is part of the CSIS test and evaluation activities planned for the spring of 1981.

There are three types of software activity related to CSIS. The first is new system software which is required to make the CSIS hardware perform as described in the previous section. Since the CSIS hardware is somewhat different than McIDAS, this new system software is required. The second type of software activity is developing new applications modules specifically for CSIS requirements. The third type of software activity is responding to the evaluation of deficiencies in the McIDAS/CSIS software by fixing, modifying, or rewriting the software which is causing problems or limitations.

A. Existing McIDAS Software to be Delivered as part of CSIS

McIDAS is a continually evolving system. The McIDAS software has a central core which is common to many projects and project software which is used by specific individual projects. The central core of software has over 700 programs. A listing of this software by program name and a one line description of its function is contained in Appendix A of this plan.
All of this software will be part of the CSIS software package. This list will grow throughout the CSIS project as software written for CSIS and experimental software from other projects are available for transfer to CSIS.

The software is made accessible to the McIDAS user through keyins on the CRT of the interactive terminal.

There are three distinct types of keyins. The first is program names. These are generally six letters long and are used for new experimental or project dependent software. The second type of keyin is a program alias. These are one or two letter keyins which call up a program. One letter keyins are basic functions which execute when the key is struck, such as "A" advances the TV frame to the next image, "E" gives the earth location in latitude-longitude of the cursor on the satellite image, etc. Provisions are available for user defined one letter function keys. Two letter keyins are the workhorse of the McIDAS commands as most programs are accessed through two letter commands. The command is made up of a line feed followed by the two letter command, followed by a string of parameters containing information pertinent to the desires of the user, and ended with carriage return key. The third type of keyin is a three letter macro. The macros are strings of two letter commands set up in a primitive programming logic and are used to execute preset sequences of commands. Most macros are very project or individual dependent.

The data used in CSIS will be arranged in the three basic types of data bases used on McIDAS, i.e. Images, Station Data Sets (SDS) and Grids. Images are pictures which can be displayed on a TV. When they are residing on digital disk they are referred to as areas and when they are residing
on the TV monitor they are referred to as frames. Since the frame is a subset of the area, with the area being allowed to be larger than the frame, the two terms of area and frame are necessary to avoid confusion. The Station Data Sets (SDS) are used for storing data which has a day, time, and location point. All of the weather observations are contained in this database. The third type of data are grids which serve as an interface between raw data (such as SDS data) and analysed displays on the graphics such as contours. Model data is also stored in grid files.

The McIDAS keyins which will be supplied to CSIS are listed in Table III. The frame/cursor manipulation keyins are listed in Table IIIa. These commands allow the user to loop frames and graphics together or separately, turn either on or off, switch back and forth between visible and infrared opposites, define cursor type and position, and inquire as to the status of the frames or cursor. Table IIIb lists the commands used to inquire about the data bases of the image SDS and grid files, access the data bases, and display the images and graphics. Table IIIc lists the services available for generalized graphics. Table IIIId lists the McIDAS keyins available for pseudo coloring of the image frame. These include black and white enhancement, false coloring, and dual channel combination of images. Table IIIe lists the commands used in the WINDCO package. This package allows one to track clouds to get their velocity and height. Table IIIf lists the routines available for image data massaging. Table IIIg list routines available for generating statistics on portions of areas defined interactively by the user. Table IIIh lists the keyins associated with the generalized curve fitting routines and the use of them associated with navigation prediction. Table IIIi lists the keyins associated with meteorological data services. Table IIIj lists the meteorological parameters
### TABLE IIIa FRAME/CURSOR MANIPULATION

<table>
<thead>
<tr>
<th>KEYIN</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Advance 1 Frame</td>
</tr>
<tr>
<td>B</td>
<td>Back up 1 Frame</td>
</tr>
<tr>
<td>DC</td>
<td>Define Cursor Size and Bounds</td>
</tr>
<tr>
<td>DR</td>
<td>Define Loop Dwells</td>
</tr>
<tr>
<td>DT</td>
<td>Define Cursor Type and Color</td>
</tr>
<tr>
<td>E</td>
<td>List Earth Coordinate of Cursor</td>
</tr>
<tr>
<td>F</td>
<td>List Frame Position</td>
</tr>
<tr>
<td>I</td>
<td>List Image Coordinate of Cursor</td>
</tr>
<tr>
<td>J</td>
<td>Connect Graphics Frames to Loop Control</td>
</tr>
<tr>
<td>K</td>
<td>Turn Image Frame On and Off</td>
</tr>
<tr>
<td>L</td>
<td>Start and Stop Looping</td>
</tr>
<tr>
<td>LB</td>
<td>Define Loop Bounds</td>
</tr>
<tr>
<td>N</td>
<td>Pixel Interlace Switch</td>
</tr>
<tr>
<td>O</td>
<td>Switch Signal System</td>
</tr>
<tr>
<td>P</td>
<td>Position Cursor</td>
</tr>
<tr>
<td>PC</td>
<td>Point Cursor</td>
</tr>
<tr>
<td>R</td>
<td>Frame Position Reset</td>
</tr>
<tr>
<td>SF</td>
<td>Set Frame Position</td>
</tr>
<tr>
<td>T</td>
<td>List TB Coordinate of Cursor</td>
</tr>
<tr>
<td>W</td>
<td>Turn Graphic Overlay On or Off</td>
</tr>
<tr>
<td>Y</td>
<td>Connect Image Frames to Loop Control</td>
</tr>
<tr>
<td>V</td>
<td>Loop Velocity Cursor</td>
</tr>
<tr>
<td>Z</td>
<td>Size Cursor</td>
</tr>
<tr>
<td>KEYIN</td>
<td>COMMAND</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>AA</td>
<td>Area Mover</td>
</tr>
<tr>
<td>AM</td>
<td>Area Migrate</td>
</tr>
<tr>
<td>BU</td>
<td>Define Frame Blow Up</td>
</tr>
<tr>
<td>C</td>
<td>List Frame Content</td>
</tr>
<tr>
<td>CA</td>
<td>Change Area Directory Entries</td>
</tr>
<tr>
<td>DAD</td>
<td>Multiple Area Fetches</td>
</tr>
<tr>
<td>DF</td>
<td>Define Frame</td>
</tr>
<tr>
<td>GA</td>
<td>Generate Area Size</td>
</tr>
<tr>
<td>JA</td>
<td>SDS File Move</td>
</tr>
<tr>
<td>JD</td>
<td>List PFS Element Directory</td>
</tr>
<tr>
<td>JG</td>
<td>Generate SDS File</td>
</tr>
<tr>
<td>JL</td>
<td>List SDS Directory</td>
</tr>
<tr>
<td>JO</td>
<td>Output SDS Record</td>
</tr>
<tr>
<td>JQ</td>
<td>Quit SDS File(s)</td>
</tr>
<tr>
<td>JX</td>
<td>Set SDS File Number</td>
</tr>
<tr>
<td>LA</td>
<td>List Contents of Digital Area(s)</td>
</tr>
<tr>
<td>MOM</td>
<td>Multiple Area Fetches</td>
</tr>
<tr>
<td>QA</td>
<td>Quit Digital Disk Areas</td>
</tr>
<tr>
<td>GG</td>
<td>Grid Utility</td>
</tr>
<tr>
<td>GU</td>
<td>File Utility</td>
</tr>
<tr>
<td>HM</td>
<td>Creates Lat/Lon grid from SDS file</td>
</tr>
<tr>
<td>ZC</td>
<td>Multi-WRRRM/GRID Weather Data Contouring</td>
</tr>
<tr>
<td>ZJ</td>
<td>Save SVC &quot;A&quot; or &quot;C&quot; data</td>
</tr>
<tr>
<td>KEY IN</td>
<td>COMMAND</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>CW</td>
<td>Clear WRRRM Graphics</td>
</tr>
<tr>
<td>EG</td>
<td>Erase Graphics</td>
</tr>
<tr>
<td>FG</td>
<td>Plot Figure</td>
</tr>
<tr>
<td>GD</td>
<td>Graphic Device</td>
</tr>
<tr>
<td>GF</td>
<td>Generate Figure</td>
</tr>
<tr>
<td>GI</td>
<td>Grid Image</td>
</tr>
<tr>
<td>IC</td>
<td>Plot Map Outlines</td>
</tr>
<tr>
<td>J</td>
<td>Connect Graphics Frame to Loop Control</td>
</tr>
<tr>
<td>K</td>
<td>Blank/Restore Video</td>
</tr>
<tr>
<td>L</td>
<td>Start and Stop Looping</td>
</tr>
<tr>
<td>LB</td>
<td>Define Loop Bounds</td>
</tr>
<tr>
<td>O</td>
<td>Switch Signal System</td>
</tr>
<tr>
<td>SG</td>
<td>Set Graphics Frame</td>
</tr>
<tr>
<td>SU</td>
<td>Save Utility</td>
</tr>
<tr>
<td>W</td>
<td>Graphics System Display Toggle</td>
</tr>
<tr>
<td>ZA</td>
<td>Text Annotation</td>
</tr>
<tr>
<td>ZB</td>
<td>Text Annotation - Joystick</td>
</tr>
<tr>
<td>ZL</td>
<td>Cursor Line Drawing</td>
</tr>
</tbody>
</table>
### TABLE IIIId PSEUDO COLORING

<table>
<thead>
<tr>
<th>KEYIN</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>EB</td>
<td>Black-White Contrast Pseudo Coloring</td>
</tr>
<tr>
<td>EC</td>
<td>Color Breakpoint Pseudo Coloring</td>
</tr>
<tr>
<td>EF</td>
<td>Display Pseudo Coloring Transform</td>
</tr>
<tr>
<td>EL</td>
<td>Interval Pseudo Coloring</td>
</tr>
<tr>
<td>EM</td>
<td>Pseudo Coloring Movie</td>
</tr>
<tr>
<td>ER</td>
<td>Restore Pseudo Coloring for Frame</td>
</tr>
<tr>
<td>ES</td>
<td>Save Pseudo Coloring for Frame</td>
</tr>
<tr>
<td>ET</td>
<td>Dual Channel Color Pseudo Coloring</td>
</tr>
<tr>
<td>N</td>
<td>Pictel Interlace Switch</td>
</tr>
<tr>
<td>SC</td>
<td>Select Color Pseudo Coloring</td>
</tr>
</tbody>
</table>

### TABLE IIIe WINDCO

<table>
<thead>
<tr>
<th>KEY-IN</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>ALPHA</td>
</tr>
<tr>
<td>CH</td>
<td>Cloud Height Mode</td>
</tr>
<tr>
<td>DM</td>
<td>Data Massage</td>
</tr>
<tr>
<td>DV</td>
<td>Delete Vector</td>
</tr>
<tr>
<td>H</td>
<td>Cloud Height</td>
</tr>
<tr>
<td>HM</td>
<td>Creates Lat/Lon grid from SDS file</td>
</tr>
<tr>
<td>HP</td>
<td>Height Plot</td>
</tr>
<tr>
<td>IO</td>
<td>Wind File Input/Output</td>
</tr>
<tr>
<td>IW</td>
<td>Initialize WINDCO</td>
</tr>
<tr>
<td>JA</td>
<td>SDS File Move</td>
</tr>
<tr>
<td>JD</td>
<td>List PFS Element Directory</td>
</tr>
<tr>
<td>KEYIN</td>
<td>COMMAND</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>JG</td>
<td>Generate SDS File</td>
</tr>
<tr>
<td>JL</td>
<td>List SDS Directory</td>
</tr>
<tr>
<td>JQ</td>
<td>Quit SDS File(s)</td>
</tr>
<tr>
<td>JX</td>
<td>Set Default SDS File Number</td>
</tr>
<tr>
<td>LS</td>
<td>Define Lag Size</td>
</tr>
<tr>
<td>PV</td>
<td>Plot Vectors</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>RD</td>
<td>Residual Distribution</td>
</tr>
<tr>
<td>RP</td>
<td>Reset WINDCO Vector File Pointer</td>
</tr>
<tr>
<td>SD</td>
<td>Surface Display</td>
</tr>
<tr>
<td>V</td>
<td>Loop Velocity Cursor</td>
</tr>
<tr>
<td>VC</td>
<td>Define Velocity Cursor Increments</td>
</tr>
<tr>
<td>VG</td>
<td>Vector Graphics</td>
</tr>
<tr>
<td>WC</td>
<td>Wind Vector Coordinate</td>
</tr>
<tr>
<td>WM</td>
<td>WINDCO Metric</td>
</tr>
<tr>
<td>WN</td>
<td>Lag Interpolation</td>
</tr>
<tr>
<td>WO</td>
<td>Wind Vector Output Mode</td>
</tr>
<tr>
<td>WS</td>
<td>WINDCO Status</td>
</tr>
<tr>
<td>X</td>
<td>List All Vectors within Cursor</td>
</tr>
<tr>
<td>Space Bar</td>
<td>Track Target</td>
</tr>
</tbody>
</table>
### TABLE IIIf DATA MASSAGING AND LISTING

<table>
<thead>
<tr>
<th>KEYIN</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>BN</td>
<td>Brightness Normalization</td>
</tr>
<tr>
<td>D</td>
<td>List Data Sample</td>
</tr>
<tr>
<td>LP</td>
<td>Line Plot</td>
</tr>
<tr>
<td>MA</td>
<td>Modify Area</td>
</tr>
<tr>
<td>MC</td>
<td>Multiple Area Combination</td>
</tr>
<tr>
<td>OD</td>
<td>Output Data</td>
</tr>
<tr>
<td>PA</td>
<td>Post Digital Area</td>
</tr>
<tr>
<td>PM</td>
<td>Multispectral Channel Graph</td>
</tr>
</tbody>
</table>

### TABLE IIIg STATISTICAL ANALYSIS

<table>
<thead>
<tr>
<th>KEYIN</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Compute Statistics (Area Statistics)</td>
</tr>
<tr>
<td>ASI</td>
<td>Area Statistics File Initialization</td>
</tr>
<tr>
<td>AX</td>
<td>Set Area Statistics Options</td>
</tr>
<tr>
<td>AXL</td>
<td>Set Multiple Area-Statistics Levels</td>
</tr>
<tr>
<td>GO</td>
<td>Generate Outline (Area Statistics)</td>
</tr>
<tr>
<td>OD</td>
<td>Output Data</td>
</tr>
<tr>
<td>PO</td>
<td>Position Outline</td>
</tr>
</tbody>
</table>

### TABLE IIIh CURVE FITTING

<table>
<thead>
<tr>
<th>KEYIN</th>
<th>COMMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>UD</td>
<td>Move Data from Navigation File to CRVFIL</td>
</tr>
<tr>
<td>UE</td>
<td>Edit CRVFIL</td>
</tr>
<tr>
<td>UF</td>
<td>Find Least Squares Best Fit Function</td>
</tr>
<tr>
<td>UP</td>
<td>Measure Point on Curve</td>
</tr>
<tr>
<td>UW</td>
<td>Transfer Wind Component to Curve File</td>
</tr>
<tr>
<td>KEY IN</td>
<td>COMMAND</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>GG</td>
<td>Grid Utility</td>
</tr>
<tr>
<td>GU</td>
<td>File Utility</td>
</tr>
<tr>
<td>HM</td>
<td>Creates Lat/Lon Grid from SDS File</td>
</tr>
<tr>
<td>IA</td>
<td>Plot Data on Graphics</td>
</tr>
<tr>
<td>PYK</td>
<td>Four Panel YK</td>
</tr>
<tr>
<td>PZK</td>
<td>Four Panel ZK</td>
</tr>
<tr>
<td>XS</td>
<td>Cross Sections</td>
</tr>
<tr>
<td>YA</td>
<td>Weather Text Listing</td>
</tr>
<tr>
<td>YC</td>
<td>Analyze Upper Air Data</td>
</tr>
<tr>
<td>YI</td>
<td>RAOB Information Retrieval</td>
</tr>
<tr>
<td>YP</td>
<td>Plot Upper Air Data on Printer/CRT</td>
</tr>
<tr>
<td>YS</td>
<td>Stuve Plotter</td>
</tr>
<tr>
<td>ZC</td>
<td>Multi-WRM/Grid Weather Data Contouring</td>
</tr>
<tr>
<td>ZI</td>
<td>SVC-A Information Retrieval</td>
</tr>
<tr>
<td>ZJ</td>
<td>Save/Restore SVC-A/RAOBS</td>
</tr>
<tr>
<td>ZK</td>
<td>Contouring SVC-A Data</td>
</tr>
<tr>
<td>ZM</td>
<td>Plot Base Maps</td>
</tr>
<tr>
<td>ZP</td>
<td>Plot SFC Weather Data on Printer/CRT</td>
</tr>
<tr>
<td>ZQ</td>
<td>SVC-A 24 Hour Data Listing</td>
</tr>
</tbody>
</table>
**TABLE III: AVAILABLE METEOROLOGICAL PARAMETERS**

<table>
<thead>
<tr>
<th>KEY</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Temperature</td>
</tr>
<tr>
<td>TD</td>
<td>Dew Point</td>
</tr>
<tr>
<td>PRE</td>
<td>Pressure</td>
</tr>
<tr>
<td>WIND</td>
<td>Wind Data</td>
</tr>
<tr>
<td>LO,MID,HI</td>
<td>Cloud Data</td>
</tr>
<tr>
<td>CLD</td>
<td>Composite Cloud Data</td>
</tr>
<tr>
<td>THA</td>
<td>Potential Temperature</td>
</tr>
<tr>
<td>THE</td>
<td>Equivalent Potential Temperature</td>
</tr>
<tr>
<td>Q</td>
<td>Mixing Ratio</td>
</tr>
<tr>
<td>PCP</td>
<td>Precipitation (6-hour)</td>
</tr>
<tr>
<td>VIS</td>
<td>Visibility</td>
</tr>
<tr>
<td>GUS</td>
<td>Wind Gusts</td>
</tr>
<tr>
<td>Z</td>
<td>Height of a Constant Pressure Surface</td>
</tr>
<tr>
<td>STR</td>
<td>Streamlines</td>
</tr>
<tr>
<td>WX</td>
<td>Current Weather</td>
</tr>
<tr>
<td>DIV</td>
<td>Divergence</td>
</tr>
<tr>
<td>VOR</td>
<td>Vorticity</td>
</tr>
<tr>
<td>DSH</td>
<td>Deformation - Shear</td>
</tr>
<tr>
<td>DST</td>
<td>Deformation - Stretching</td>
</tr>
<tr>
<td>TAD</td>
<td>Temperature Advection</td>
</tr>
<tr>
<td>DAD</td>
<td>Dew Point Advection</td>
</tr>
<tr>
<td>QAD</td>
<td>Mixing Ratio Advection</td>
</tr>
<tr>
<td>AAD</td>
<td>Potential Temperature Advection</td>
</tr>
<tr>
<td>EAD</td>
<td>Equiv. Potential Temperature Advection</td>
</tr>
<tr>
<td>PAD</td>
<td>Pressure Advection</td>
</tr>
<tr>
<td>SNO</td>
<td>Snow Cover</td>
</tr>
<tr>
<td>TDI</td>
<td>Temperature Divergence</td>
</tr>
<tr>
<td>DDI</td>
<td>Dew Point Divergence</td>
</tr>
<tr>
<td>QDI</td>
<td>Mixing Ratio Divergence</td>
</tr>
<tr>
<td>ADI</td>
<td>Potential Temperature Divergence</td>
</tr>
<tr>
<td>EDI</td>
<td>Equiv. Potential Temperature Divergence</td>
</tr>
<tr>
<td>PDI</td>
<td>Pressure Divergence</td>
</tr>
<tr>
<td>KEYIN</td>
<td>COMMAND</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>FS</td>
<td>Free Lockwords</td>
</tr>
<tr>
<td>SH</td>
<td>Find</td>
</tr>
<tr>
<td>SS, (?)</td>
<td>System Status</td>
</tr>
<tr>
<td>SX</td>
<td>String Definition</td>
</tr>
<tr>
<td>U</td>
<td>List Project User</td>
</tr>
<tr>
<td>ZS</td>
<td>Utility</td>
</tr>
<tr>
<td>OM</td>
<td>Terminal Communications</td>
</tr>
<tr>
<td>!</td>
<td>Whoder Location finder</td>
</tr>
</tbody>
</table>
available for use in the meteorological data services at Table IIIi. Table IIIk lists miscellaneous other commands.

The list of keyins in Table III will grow prior to the delivery of the CSIS in January 1982. As software is written for CSIS and as experimental software from other projects are ready for use by CSIS, they will be included as part of the CSIS package.

B. New System Software

The system software effort consist of three types of tasks. The first is modification of the system software to reflect the CSIS hardware configuration. The second is communications software to allow input of various data sources. The third system software effort is to improve the system's performance and reliability.

The system configuration effort is relatively straightforward. The McIDAS operating system needs to be modified to reflect the CSIS hardware. The CSIS hardware which is different from the McIDAS hardware (such as the 300 Mb disks on the APs) requires new system drivers. Likewise, the operating systems which ignore some data lines when the systems are APs and pay attention to them when they are DEBs and vice versa needs to be developed. We plan to load all of the CSIS software from source code and will have an executable linked version. While this is considerably more time consuming than copying the McIDAS relocatable code, it does insure that all of the CSIS code is consistent with the software documentation and listings. The system integration at U.W. and bring-up is estimated at requiring two man months of effort spread out over four to six calendar months and is reflected in the delivery schedule.

The communications software allows the CSIS to gather data from
outside sources. The FAA 604 ingestor and the GOES satellite ingestor which will be used for CSIS are already working on McIDAS. The WBRR ingest software was started as part of VAS and phase 0 of CSIS. During phase 0 it was determined that the hardware design for the radar interface was deficient and a new design was started. When this is completed, it will take about one man-month to complete the WBRR ingest software, and integrate it into the radar system software already written. The D/RADEX or RRWDS software will be done in 1982. The main communications task is the Eclipse/NMC link. Its primary purpose is to obtain NMC observations and forecast fields. Initially the link will be established by implementing Remote Job Entry (RJE) between NMC's IBM 360/195 System and CSIS. This capability will be manually controllable (switchable) by NSSFC personnel so that either the Eclipse System or CSIS can be used selectively for the RJE function. Scheduling of the use of RJE on the Eclipse or CSIS systems will be NOAA's responsibility.

The second phase for the establishment of the CSIS/NMC link involves the development of software and hardware to support more efficient communications between the Eclipse and CSIS systems, so that, at the minimum, NMC observations and forecasts can be transferred without burdening the CSIS computer system.

Work on the link will begin during the fall of 1981 with the final debugging of the link during the early part of the spring of 1982 after the CSIS hardware has been installed.

The third type of CSIS system software development has to do with improving the system's performance and reliability. Records are being kept on the McIDAS performance. These have shown that an improvement in system performance and reliability can be accomplished by improving the McIDAS
and Harris operating system. A total of five man-months of effort is planned for this task in 1981 prior to delivery of the system in January 1982.

C. New Applications Software

The CSIS will have sources of data which are different from that currently on McIDAS. The CSIS users also have demands on the system which are different that those on McIDAS. This requires an effort on new applications software and data base management. There currently is software for data base management of surface hourlies reports, radiosonde reports, manually digitized radar, locally generated grids, and satellite images. Before the system is delivered in January 82, the WBRR will be added to this list.

Work on new applications software will begin during 1981. For some areas, data base design and communication software will be necessary; otherwise, new applications programs will be needed for radar, grids, satellite winds, graphics, conventional data, text handling, and geography.

Radar data from MDR, WBRR, and later the D/RADEX or RRWDS will be ingested and stored for later processing which includes navigation, remapping and compositing. Accuracy of remapping will not exceed that of the input data.

Work on locally-generated grids will concentrate on adding speed and flexibility to the present procedures. Additionally, unification of the interpolation procedure from a variety of data sources will be realized. The handling of NMC gridded data will also be added. These data will then be available for manipulation and display utilizing the same software that operates on locally-generated grids.

To aid interpretation, we will work on graphics displays in an effort to improve animation capabilities, provide for rapid recall of previously display graphics, and decluter data plots.
Conventional data (including routine and special surface and radiosonde capabilities) will be expanded to include cloud height reports, recall of reports with significant remarks, display of stability parameters from raob data, analysis and display of isentropic data, and plotting of pilot reports. In addition, work will be done to enhance data editing capabilities.

Improvements in message text handling of FAA604 data will be made so that text is recalled in a "LIFO" (last in-first out) manner.

A map base containing county outlines will be added to the present capabilities, and the ability to plot city names on the graphics will be added. Improvements will also be made in the procedures for updating the weather station location dictionary. The detailed schedule for these software tasks is shown in the section on software schedule.

D. Evaluation and Improvement Software

In keeping with the concept of CSIS as an experiment in interactive technology, a certain amount of flexibility is required. SSEC will augment and modify existing McIDAS software modules to address the NSSFC-specific application needs. This will be done on an iterative fashion with the Techniques Development Unit of NSSFC. Through normal use of the McIDAS and CSIS systems, and from the results of the test and evaluation activities, there will be identified deficiencies, limitations, and inconveniences of the system. SSEC will then attempt to correct these problems. The details of this effort are difficult to plan to advance. However, SSEC is planning to provide at least 12 staff months per year of programmer support to this effort.
Some of this effort has already begun in response to Kansas City's comments of McIDAS limitations. The program which prints out data has been modified to allow temperature printout of infrared data rather than satellite counts. The TV display program has been modified to allow a non-linear gray scale presentation of the infrared images which shows up the details of the convective cloud tops. A program has been written (Whoder) which allows the meteorologist to locate the towns nearest a point on the satellite image, or shows the location of any given town name. The keyin handler has been modified in support of the test and evaluation program to allow the collection of statistics on program utilization by the meteorologist. A program has been written to collect statistics on the timeliness of the FAA604 data collection. The program which loads the TV image on the terminal is being modified to speed it up and to reduce the memory requirements for TV loads of remote users so that other operations can go on in parallel. In response to the comment that McIDAS is not using all possible surface data, the master location table of currently available weather stations has been updated. An effort is planned at allowing dynamic plotting density to allow various resolution plots without overwriting previously plotted data. These efforts at responding to Kansas City's requests will continue throughout the CSIS program.

E. Software Schedule

The schedule shown in Figure 12 shows the plan for software development activities. While many of the tasks can be performed asynchronously and in parallel, the tasks which require new data bases which are not on McIDAS are to be performed in the order of forming the data base, writing file
management software and then writing applications software. In addition to the tasks shown on the software schedule, there will be the unscheduled software effort associated with the evaluation and improvement effort described in section IIId. This effort will add at least 12 staff months per year to the effort shown on the schedule.
A. System Software
1. System integration and bring up
2. System check out

B. Communications Software
1. 604 data line
2. WBRR dial-up data
3. Satellite images
4. D/RADEX or RRWDS
5. CSIS-Eclipse link

C. Data Base Software
1. Surface hourlies/RAOBS
2. MDR
3. Satellite images
4. WBRR
5. D/RADEX or RRWDS
6. Hourly Remarks

CSIS Software Implementation Schedule

figure 12
7. Local grids
8. NMC grids
9. Pilot Reports
10. Geography
11. Graphic paging/directory

D. Applications
1. WBRR Radar remap and display
2. Grid Interpolation
3. Unification of all data bases
4. Satellite winds
5. MDR display
6. Surface hourly specials
7. Pilot reports
8. D/RADEX or RRWDS remap and display
9. RAOB isentropic coordinates
10. Stability parameters
11. Checking and correcting
12. Geography
13. FAA604 text save/recall
14. Graphic directory
15. NMC link
16. NMC link through eclipse
17. NMC gridded display
18. Plotting unification
IV. Documentation and Training

SSEC will have the responsibility for both hardware and software maintenance of the CSIS at least through 1983. NSSFC will have the responsibility of using the system. Consequently, the primary documentation provided to NSSFC will focus on the knowledge required for the user and the operator of the CSIS. The manuals will include a general system overview, an explanation of each user keyboard command, its function, the user specified data that is required for successful execution, related software modules, and anticipated output. The McIDAS user manual was updated in April 1981, and a computer operator's manual will be completed by the summer of 1981. These manuals will be updated and expanded prior to the delivery of CSIS equipment in January 1982. In addition to the computer operator's manual of keyins to ingest data, etc., there will be an operator's troubleshooting manual which allow the operator to recognize problems and decide what to do about them.

In addition to the user manuals, SSEC will provide to NSSFC available hardware documentation, program source listings, documentation on file structures, and other program documentation. This documentation should be considered for information purposes only as no major effort is planned at insuring the completeness of this documentation.

The training of the CSIS users and computer operators will be done at NSSFC after delivery of the system. SSEC instructors will teach several on-site training sessions of approximately 3 days each with up to six training sessions per year. The sessions will provide individualized instruction related to practical applications of CSIS to the particular meteorological problems of the individual in addition to generalized CSIS capabilities. The training of the NOAA Electronics Technician who will provide CSIS
hardware maintenance support will be done at Wisconsin in two one week training sessions prior to the delivery of the CSIS equipment in January 1982.
V. MANAGEMENT RESPONSIBILITIES

The Centralized Storm Information System (CSIS) is a cooperative project of NASA and NOAA established by a Memorandum of Understanding between the two groups. This Memorandum outlines the basic responsibilities of the two groups. NASA is responsible for the overall management of the planning, procurement, and implementation of the program. NOAA is responsible for the facility accommodations, use, and evaluation of the system. The University of Wisconsin - SSEC, under contract to NASA, is responsible for building, installation, and maintenance of the CSIS. Major project changes involving schedules and costs will be coordinated with NOAA by NASA. The Memorandum specifies that NASA and NOAA identify single points of contact to represent each agency in the resolution of any substantive issues which may arise in the course of accomplishing the CSIS project. These individuals are Dr. L. R. Greenwood for NASA and Dr. R. E. Hallgren for NOAA.

The CSIS project involves three organizations which closely coordinate and cooperate with each other. Fig. 13 shows the organization structure involved with the CSIS implementation. The solid lines in the figure show direct paths of direction and responsibility within organizations. The dashed lines show paths of coordination between organizations. There are two basic levels of coordination. The top level of coordination is between the administrators involved with planning, financing, and monitoring the project. The second level of coordination is at the technical level between individuals involved with the actual implementation of the CSIS project. Table IV lists the key personnel currently involved with CSIS projects and their role in the project.
Figure 13. CSIS organizational structure
<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
<th>ROLE</th>
<th>PHONE #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawrence Greenwood</td>
<td>NASA Hq.</td>
<td>CSIS single point of contact for NASA</td>
<td>202-755-8620</td>
</tr>
<tr>
<td>Debbie Macellaro</td>
<td>NASA Hq.</td>
<td>NASA Contract Officer</td>
<td>202-755-3494</td>
</tr>
<tr>
<td>Richard Hallgren</td>
<td>NOAA Hq.</td>
<td>CSIS single point of contact for NOAA</td>
<td>301-427-7711</td>
</tr>
<tr>
<td>Doug Sargeant</td>
<td>NOAA SDO</td>
<td>NOAA Coordination</td>
<td>301-427-7745</td>
</tr>
<tr>
<td>Fred Zbar</td>
<td>NWS/OM&amp;O</td>
<td>NWS Headquarters focal point</td>
<td>301-427-7714</td>
</tr>
<tr>
<td>Jim Giraytys</td>
<td>NOAA/OA2</td>
<td>NOAA Headquarters focal point</td>
<td>301-443-8811</td>
</tr>
<tr>
<td>Larry Hyatt</td>
<td>NOAA/NESS</td>
<td>NESS focal point for CSIS</td>
<td>301-763-8282</td>
</tr>
<tr>
<td>Fred Ostby</td>
<td>NWS/NSSFC</td>
<td>NSSFC Director</td>
<td>816-374-5922</td>
</tr>
<tr>
<td>Ed Ferguson</td>
<td>NWS/NSSFC</td>
<td>NSSFC Assistant Director</td>
<td>816-374-3427</td>
</tr>
<tr>
<td>Joe Schaefer</td>
<td>NWS/NSSFC/TDU</td>
<td>CSIS focal point at K.C.</td>
<td>816-344-3367</td>
</tr>
<tr>
<td>Brian Heckman</td>
<td>NOAA/NESS</td>
<td>Acting Manager K.C. NESS SFSS</td>
<td>816-374-2102</td>
</tr>
<tr>
<td>Roger Remboldt</td>
<td>NWS/Central Region</td>
<td>GSA contact point</td>
<td>816-374-5364</td>
</tr>
<tr>
<td>Sandy MacDonald</td>
<td>ERL/PROFS</td>
<td>PROFS-CSIS coordination</td>
<td>303-497-6852</td>
</tr>
<tr>
<td>Verner Suomi</td>
<td>Univ. of WI/SSEC</td>
<td>SSEC Director</td>
<td>608-262-6172</td>
</tr>
<tr>
<td>Bob Fox</td>
<td>Univ. of WI/SSEC</td>
<td>SSEC Executive Director</td>
<td>608-262-0544</td>
</tr>
<tr>
<td>Fred Mosher</td>
<td>Univ. of WI/SSEC</td>
<td>SSEC CSIS Program Manager</td>
<td>608-262-3755</td>
</tr>
<tr>
<td>Rob Uram</td>
<td>Univ. of WI/SSEC</td>
<td>SSEC CSIS Hardware Manager</td>
<td>608-262-6757</td>
</tr>
<tr>
<td>Tom Whittaker</td>
<td>Univ. of WI/SSEC</td>
<td>SSEC CSIS Software Manager</td>
<td>608-262-9538</td>
</tr>
<tr>
<td>John Roberts</td>
<td>Univ. of WI/SSEC</td>
<td>SSEC contracts and finance</td>
<td>608-262-0985</td>
</tr>
</tbody>
</table>
## List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADCCP</td>
<td>Advanced Data Communications Control Protocol</td>
</tr>
<tr>
<td>AFOS</td>
<td>Automation of Field Operations and Services</td>
</tr>
<tr>
<td>AP</td>
<td>Applications Processor</td>
</tr>
<tr>
<td>CDC</td>
<td>Control Data Corporation</td>
</tr>
<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
</tr>
<tr>
<td>CRT</td>
<td>Cathode Ray Tube</td>
</tr>
<tr>
<td>CSIS</td>
<td>Centralized Storm Information System</td>
</tr>
<tr>
<td>DBM</td>
<td>Data Base Manager</td>
</tr>
<tr>
<td>D/RADEX</td>
<td>Digital Radar Experiment</td>
</tr>
<tr>
<td>ET</td>
<td>Electronics Technician</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>GOES</td>
<td>Geostationary Operational Environmental Satellite</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>MB</td>
<td>Megabyte</td>
</tr>
<tr>
<td>Mbit</td>
<td>Megabit</td>
</tr>
<tr>
<td>McIDAS</td>
<td>Man-Computer Interactive Data Access System</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NESS</td>
<td>National Earth Satellite Service</td>
</tr>
<tr>
<td>NMC</td>
<td>National Meteorological Center</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NSSFC</td>
<td>National Severe Storms Forecast Center</td>
</tr>
<tr>
<td>PIOC</td>
<td>Priority Input Output Channel</td>
</tr>
<tr>
<td>RAWARC</td>
<td>Radar and Warning Coordination Circuit</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
<tr>
<td>RRWDS</td>
<td>Radar Remote Weather Display System</td>
</tr>
<tr>
<td>SELS</td>
<td>Severe Local Storms</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>SFSS</td>
<td>Satellite Field Services Station (of NESS)</td>
</tr>
<tr>
<td>SSEC</td>
<td>Space Science and Engineering Center</td>
</tr>
<tr>
<td>TDU</td>
<td>Technique Development Unit</td>
</tr>
<tr>
<td>UBC</td>
<td>Universal Block Control</td>
</tr>
<tr>
<td>VAS</td>
<td>VISSR Atmospheric Sounder</td>
</tr>
<tr>
<td>VISSR</td>
<td>Visible Infrared Spin Scan Radiometer</td>
</tr>
</tbody>
</table>
## Appendix A  McIDAS Software Which Will Be Part of CSIS

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Programmer</th>
<th>library</th>
<th>function</th>
</tr>
</thead>
<tbody>
<tr>
<td>C CHGARA PENSON Ø173</td>
<td>GENL</td>
<td>CHANGE ENTRIES IN AREA DIRECTORY</td>
<td></td>
</tr>
<tr>
<td>C DIPUPD RUEDEN 1178</td>
<td>SDSB</td>
<td>PAKGRND SDSDIR FILE ALLOCATOR (BY PROJ#)</td>
<td></td>
</tr>
<tr>
<td>C GLUN RUEDEN 1178</td>
<td>DBMR</td>
<td>GET LUN &amp;/OR BUFFER</td>
<td></td>
</tr>
<tr>
<td>C MTDLPB PENSON Ø176</td>
<td>GENL</td>
<td>DEFINE TYPE AND REEL NUMBER OF TAPE ON DRIVE</td>
<td></td>
</tr>
<tr>
<td>C ODISRD RUEDEN Ø179</td>
<td>DBM</td>
<td>READS/REFORMATS ODIS TAPES INTO AN AREA</td>
<td></td>
</tr>
<tr>
<td>C RLVHRR DALY Ø678</td>
<td>GENL</td>
<td>SIMPLE READ PROG FOR VERR TAPES</td>
<td></td>
</tr>
<tr>
<td>C FENAMA DALY Ø780</td>
<td>DBM</td>
<td>MOVES AREA BY RENAME</td>
<td></td>
</tr>
<tr>
<td>C RESGRD RUEDEN Ø600</td>
<td>DEML</td>
<td>READ GRD SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>C RESSDS RUEDEN 1276</td>
<td>DEML</td>
<td>READ SDS SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>C RSTSDK RUEDEN Ø375</td>
<td>DBM</td>
<td>RESTORES AREAS FROM SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>C RSTSDK2 RUEDEN Ø375</td>
<td>DBM</td>
<td>RESTORES APPS FROM SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>C RZDOC. DALY Ø576</td>
<td>GENL</td>
<td>EIMANGLER EXCERSIZER FOR HARDWARE DEBUGGING</td>
<td></td>
</tr>
<tr>
<td>C SACMF. DALY Ø173</td>
<td>DBM</td>
<td>INITIALIZES FILE SACMF</td>
<td></td>
</tr>
<tr>
<td>C SAVEDK DALY Ø579</td>
<td>DEML</td>
<td>WRITE DIGITAL AREA SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>C SAVGRD RUEDEN Ø960</td>
<td>DBML</td>
<td>WRITE GRD SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>C SAVSDS RUEDEN 1278</td>
<td>DEML</td>
<td>WRITE SDS SAVE TAPE</td>
<td></td>
</tr>
<tr>
<td>* STATD3 HIBBAF Ø177</td>
<td>DBM</td>
<td>LISTS SYSTEM STATUS ON CRT</td>
<td></td>
</tr>
<tr>
<td>C TAPDIR DALY Ø278</td>
<td>DEML</td>
<td>SC'ED BY LISDIR TO LIST SAVE TAPE DIRECTORY</td>
<td></td>
</tr>
</tbody>
</table>
C TLDUMP DALY 0179 DEM TAPE DUMP KEVIN FOR GRID TAPE
C TREAD DALY 1079 DEML SIMPLE TAPE TO AREA IMAGE LOADER
C
C ARTOAR DALY 0773 GENL NEW AREA TO AREA TRANSFER
C ARENCV PENCN 0173 GENL DELETE SPECIFIED DIGITAL AREAS
C ARSZIE BENSEN 1279 GENL GENERATES DIGITAL DISK AREA
C BLOUP DALY 0174 GENL DISPLAY BLOWUP OF AREA ON A FRAME
C CHGARA BENSEN 0173 GENL CHANGE ENTRIES IN AREA DIRECTORY
C CPMELH BAREFET 0380 GENL CREATE BLOCKED OR UNBLOCKED FILE
C CURDEF DALY 0179 GENL DEFINE/LIST CURSOR SIZE
C CURLOC WHITTA 0478 GENL SENDS SVCA OR RAOS STATION LOCATION TO PC
C DATOUT SMITH 0174 GENL APPLIES SELECTED MESSAGE TO DATA IN CURSOR
C DFOUND RUEDEN 0173 GENL DEFINE LOOP FRAME BOUNDS
C DDPROC BENSEN 0277 GENL SET UP AREA FOR SMS S/T OR REAL TIME INGEST
C DEFCUR BENSEN 0279 GENL DEFINE CURSOR SHAPE AND COLOR
C DEFVEL RUEDEN 0279 GENL DEFINE/LIST VELOCITY CURSOR FRACTIONAL DISPLACEMENTS
C DRAE RUEDEN 0279 GENL DEFINE/LIST LOOP DWELL VALUES
C ERMESS RUEDEN 0173 GENL OUTPUTS ERROR MESSAGE FROM ERMESS FILE
C LDCNTV DALY 0173 GENL DISPLAYS DIGITAL AREA ON SPECIFIED TV FRAME
C LISDIR DALY 0180 GENL LIST AREA DIRECTORY (BURN-BOX VERSION)
C LOGIN BENSEN 0279 SYSL INITIALIZE TERMINAL AT USER LOGIN
C LOGLOG RUEDEN 0173 GENL FILES LOGIN/LOGOUT RECORD IN LOGFIL
C LOGOUT BENSEN 0180 GENL CLEANS UP AT TERMINAL LOG OUT TIME
C MDAREA BENSEN 0174 GENL MODIFY DATA IN DIGITAL AREA
C MDCOMB DALY 0177 GENL MULTIPLE AREA COMBINATION
C MEMEXO ERICKS 1260 GENL: CHECK MEMORY ABOVE $4K
C NCRMAG SGHER 0676 GENL PERFORM BRIGHTNESS NORMALIZATION ON DIG DATA
C ODIBAR DALY 0680 ODIL COMPUTE INGEST BOX CENTER FROM UL CORNER
C OMES BENSEN 0174 GENL SENDS MESSAGE TO USER TERMINAL
C POSCUR BENSEN 0173 GENL POSITION CURSOR AT SPECIFIED COORDINATE
C POSTAR DALY 1277 GENL
C PUBLISH BAREFET 0980 GENL PUBLISH INDEXED NOTES, DOCUMENTS, ETC.
C SETFPM BENSEN 0173 GENL SET VIDEO DISPLAY TO SPECIFIED FRAME
C SQIT RUEDEN 1079 GENL SQ PROGRAM WITH PARAMETERS VIA KEYIN
C
C ANNDLN WHITTA 0176 GRAL DRAW LINE ON GRAPHICS DEVICE WITH CURSOR
C ANNOT WHITTA 0176 GRAL TEXT ANNOTATION ON GRAPHICS DISPLAY
C CONPNTR SANTEK 0279 GRAL OUTPUT GRID ON LINE-PRINTER.
C CONTRR SANTEK 0179 GRAL PLOT CONTOUR/STREAMLINES FROM GRIDFILE (MULTI-WRM)
C CWMAIN DALY 0175 GRAL SET ALL WRRRM BITS IN CURSOR TO SPECIFIED LEVEL
C ERASGPE RICKS 0180 GRAL: ERASE GRAPHICS DEVICE
C FILPIC DALY 0579 GRAL PLOT A FILLED GRAPHIC OBJECT ON WRRRM
C GENFIC DALY 0079 GRAL LETS USER DRAW A GRAPIC FIGURE AND SAVE
C GFAFLC WHITTA 0075 GRAL LIST GRAPH SCALE VALUES UNDER CURSOR
C ICGEND DALY 1279 GRAL PROJECTS AND PLOTS MAP OUTLINE ON SAT IMAGE
C IGRID DALY 0377 GRAL PLOT LAT-LON GRID ON WRRRM OVER SAT IMAGE
C IGRID DALY 0177 GRAL: PLOTS LAT-LON GRID ON SAT IMAGE
C KONPNTR WHITTA 1076 GRAL PUTS GRIDS ON PRINTER...SIMILAR TO KONTUR/PLTMAP.
C KONTUR WHITTA 1076 GRAL PLOT CONTOUR OR STREAMLINES FROM GRIDFILE DATA
C LINCON SANTEK 0279 GRAL GREY SHADES
C LINPLT DALY 0175 GRAL PLOTS IMAGE LINE BRIGHTNESS VS SAMP POSITION
C PLSEL DALY 0079 GRAL SET SYSCOM TO SELECTED GRAPHICS OUTPUT DEVICE
C PITSIG DALY 0479 GRAL PLOTS A GRAPHIC FIGURE INSIDE CURSOR
C PLTMAP WHITTA 0576 GRAL PLOT MERC MAP ON WRRRM, AND OTHER FUNCTIONS
C PLTMCH DALY 0175 GRAL MULTISPECTRAL CHANNEL GRAPH
C PLTRES WHITTA 0075 GRAL RESTORES SAVED PLOTS TO PLOT FILE OR WRRM
C PLTSAV WHITTA 0075 GRAL SAVES PLOT FILE BY TRANSFERRING IT TO DIGITAL
C SCEUTI DALY 0779 GRAL SCENE FILE UTILITY
C SETGPA DALY 0179 GENL SET SYSCOM TO CHANGE WRRM CURRENTLY DISPLAYED
C SVCALS WHITTA 0176 GRAL PLOT MAP ON CRT WITH REQUESTED SVCA STATION
C TXTFIC DALY 0579 GRAL S2-ED BY PLTFIC TO DRW A TEXT ON WRRM
C WIDFIC DALY 0579 GRAL SC-ED BY PLTFIC TO DRW A WIDELINE FIGURE
C ZPMAIN DALY 0677 GRAL JOYSTICK CONTROLLED TEXT ANNOTATION
C BARB RUEDEN 0279 GRAR PLOT WIND BARB ON ACTIVE GRAPHICS PLANE
C DYTMSA DALY 0577 GRAR CONVERTS IMAGE DAY-TIME TO SVC-A OR PAGE DTG
C GRAPH WHITTA 0173 GRAR GENERATE A LABELED GRAPH FROM AN INTEGER ARRAY
C LALOTV DALY 1278 GRAR LAT-LON TO TV COORD XFORM, FOR SAT IMAGE OR MAP
C MRCMAP DALY 0577 GRAR DRAWS MERCATOR MAP, XFORMS LAT-LON TO TV COORD
C PLT3D DALY 0779 GRAR PLOTS 3-D SURFACES ON WRRM
C PLTDIG WHITTA 0575 GRAR PLOTS INTEGER VALUES ON GRAPHICS DISPLAY (R)
C PLTSTA DALY 0577 GRAR PLOTS 6 PIXEL CROSS ON WRRM AT TV LIN.TVELE
C PLTWNV DALY 2377 GRAR PLOT WIND VECTORS ON WRRM
C PLTXTN WHITTA 0175 GRAR TEXT STRING WRITER (BLOC CHAR) GRAPHICS DISPLAY (R)
C QCON DALY 0575 GRAR LINE PRINTER SHADE-CONTOUR ROUTINE (R)
C SETUP DALY 0679 GRAR USED BY MCIVAM SOFTWARE TO RESCALE FIGURES
C STREAM WHITTA 0676 GRAR STREAMLINE CONSTRUCTION PROGRAM (R)
C SVCMAP WHITTA 0575 GRAR CONSTRUCT PSEUDO-MERC MAP ON LINE PRINTER (R)
C SVTMAP WHITTA 0175 GRAR CONSTRUCT PSEUDO-MERC MAP ON GRAPHICS DISPLAY (R)
C SVTMAP WHITTA 0176 GRAR: PLOT MAP ON WRRM, THEN XFORM LAT-LON TV-L-E
C SVTMAP WHITTA 1279 GRAR: MODIFIED THIS DATE FOR 91 DEG INPUT PARAMETERS...
C SVTMAP ERICKS 1179 GRAR: CHANGED TO ELIMINATE USELESS CALLS TO PLOT
C WRTXT WHITTA 0575 GRAR ASCII TEXT WRITER FOR GRAPHICS DISPLAY (R)
C BITCH BENSON 0173 GEN: OUTPUTS TAPE MOUNT MESSAGE TO OPERATOR
C CTHGAR BENSON 0173 GENL CHANGE ENTRIES IN AREA DIRECTORY
C DIRUPD RUEDEN 1179 SDSL FAXGRND SDSDIR FILE ALLOCATOR (BY PROJ#)
C GLUN RUEDEN 1178 DEMP GET LUN &/OR BUFFER
C MTDEFP BENSON 0176 GEN DEFINE TYPE AND REEL NUMBER OF TAPE ON DRIVE
C ODISRDU RUEDEN 0179 DEM READS/REFORMATS QDIS TAPES INTO AN AREA
C RDVHR DALY 0678 GENL SIMPLE READ PROG FOR VHRR TAPES
C RENA MA DALY 0720 DEM MOVES AREA BY RENAME
C RESSDS RUEDEN 1278 DEML READ SDS SAVE TAPE
C RESTLK RUEDEN 0275 DEML RESTORES AREAS FROM SAVE TAPE
C RZDOC DALY 0575 GENL RIMANGLER EXCERSIZER FOR HARDWARE DEBUGGING
C SACMSL DALY 0173 DEML INITIALIZES FILE SACMFL
C SAVDCLR DALY 0579 DEML WRITE DIGITAL AREA SAVE TAPE
C SAVSDS RUEDEN 1272 DEML WRITE SDS SAVE TAPE
C STAT DB HIBBAR 0177 DEM LISTS SYSTEM STATUS ON CRT
C TDATDIR DALY 0279 DEML SC-ED BY LISDIR TO LIST SAVE TAPE DIRECTORY
C TDUMP DALY 0179 DEM TAPE DUMP KEYIN FOR GRID TAPE
C TREAD DALY 1272 DEML SIMPLE TAPE TO AREA IMAGE LOADER
C CURSCR BARRET 0230 HMLP LOCATE CURSOR AND ADJUST FOR TV EDGE
C DESSIL BARRET 2680 HMLR DESTROY FILE
C DEVGD BARRET 0580 HMLR RETURN PRINT DEVICE CODE FROM LETTERS
C FINDFS BARRET 0920 HMLR FIND FILE SECTION (IN FLOCKED FILE)
C GETLIN BARRET 0680 HMLR READ 1 LINE FROM BLOCKED FILE, CHECK FOR EOF
C GETWD BARRET 0680 HMLR ISOLATE NEXT WORD ON LINE
C ICEIL BARRET 0263 HMLR SMALLEST INTEGER .GE. M/N, OR 0 IF N=0
C IFLOOR BARRET 0260 HMLR LARGEST INTEGER L.E. M/N, OR 0 IF N=0
C INSECT BARRET 0180 HMLR READ FILE AT SECTOR BY FILENAME OR LUN
C KCHAR BARRET 0980 HMLR FETCH CHARACTER FROM (A3) LINE
C LHF BARRET 1279 NASR FETCH LEFT HALF OF WORD
C MACKR BARRET 0680 HMLR CREATE SCRATCH FILE AND RETURN ITS NAME
C MATCHR BARRET 0460 HMLR CHECK WHETHER LETTER (A1) OCCURS IN TEST (A3)
C CPNSFI BARRET 0660 HMLR CHECK BLOCKED FILE. DYNAMISE IT, OPEN IT.
C CUSECT BARRET 0180 HMLR WRITE FILE AT SECTOR BY FILENAME OR LUN
C PCHAR BARRET 0380 HMLR PUT A1 CHARACTER INTO A3 LINE
C PEGTEXR BARRET 0180 HMLR RUN MSG TO USER & CR OR CR OR CR OR CR OR CR OR CR
C SPLICR BARRET 1279 HMLR MAKE WORD WITH L AS LEFT HALF, R AS RIGHT HAF
C TPMES BARRET 0260 HMLR OUTPUT TEXT + INTEGER/A3 ON DEVICE(S)
C TCMES BARRET 0360 HMLR OUTPUT TEXT + INTEGER/A3 ON CRT
C UREAD BARRET 1680 HMLR UNIVERSAL DISK READ--REMOTE OR LOCAL
C WERES BARRET 0183 HMLR CALCULATE WHERE'S RECORD N IN BLOCKED FILE
C WHOAMI BARRET 0180 HMLR RETURN NAME OF CURRENT LOAD MODULE

C ADSCHD HIBEAR 0679 INGL ADD AN AREA TO AN IMAGE'S SCHEDULE
C CLOCHE2 HIBEAR 0679 INGR ROUTINES USED BY INGEST CLOCK TASK
C CLOCH2 HIBEAR 0679 INGR (S) TO DEFTA
C CLOCHE2 HIBEAR 0679 INGL INGESTOR FOR EAST SATELLITE
C CLOCH2 HIBEAR 0679 INGL INGESTOR FOR WEST SATELLITE
C CPU HIBEAR 0679 INGP HOME STATE FOR INGESTOR CPU TASK
C DB BENSEN 0679 INGR SQ TO DEFTA
C DESCHD HIBEAR 0679 INGL DELETE AN AREA FROM AN IMAGE'S SCHEDULE
C DISC HIBEAR 0679 INGP HOME STATE OF INGESTOR DISK TASK
C FWAIT BILL 0679 INGP WAIT FOR NOMINAL START TIME
C INTERT HIBEAR 0679 INGP BIMANGLER INTERRUPT HANDLER
C IFTASK HIBEAR 0679 INGP HOME STATE OF INGESTOR IR TASK
C LISSCHD HIBEAR 0679 INGL LIST AN IMAGE'S SCHEDULE
C LOGIC HIBEAR 0679 INGP HOME STATE OF INGESTOR LOGIC TASK
C LOGIC2 HIBEAR 0679 INGR ROUTINES USED BY INGESTOR LOGIC TAS2
C LATQ BILL 0679 INGP PUT LATENCY MOVE ON CPU QUEUE
C MOVQ BILL 0679 INGP PUT BLOW DOWN MOVE ON CPU QUEUE
C NASCHD HIBEAR 0679 INGL LIST THE TIMES SCHEDULED FOR A SATELLITE
C PERSCHD HIBEAR 0679 INGL PREPARE AN IMAGE'S SCHEDULE FOR INGEST
C PERSCHD HIBEAR 0679 INGL PRESCHEDULAN IMAGE

C ACOS DAILY 0175 LIBR
C ADF BENSEN 0175 LIBR ADVANCE LUN PAST ONE EOF MARK
C ARLOC DEDEIC 0274 LIBR FIND ARFA OF INPUT FRAME OR TIME
C AS1 BENSEN 0677 LIBR BINARY TO VIDEO CHARACTER
C ASIN SMITH 0173 LIBR
C BSN BENSEN 0274 LIBR BACKSPACE LUN ONE RECORD
C CHR SMITH 0274 LIBR CONVERT INTEGER TO CHAR., 1 CHAR PER WORD
C COAREA SMITH 0173 LIBR CLOSES LUN, DE-ASSIGNS FILE NAME
C CCDE BENSEN 0174 LIBR DECODE 'KEY' PARAMETER INTO (I,E,T), AND (U,C,D)
C CEE BENSEN 0173 LIBR WAITS UNTIL SPECIFIED AMOUNT OF CORE AVAILABLE
C CSF BENSEN 0173 LIBR RELEASE SPECIFIED ARFA'S SECTORS TO SYSTEM
C CURM BENSEN 0173 LIBR ENTRY POINTS SQ,TC,CC,GUI,TSCUSH,M$NAM
C CUSRCR SMITH 0174 LIBR COMPUTE SIZE OF CURSOR
C CURSIZE BENSEN 0173 LIBR RETURNS CURSOR SIZE IN RASTERS AND PICTURES
C DEL BENSEN 0173 LIBR DELETE DISK FILE SPECIFIED
C DFLONT DAILY 0175 LIBR
C DIRECT SMITH 0173 LIBR COMPUTE A WIND DIRECTION IN DEGREES FROM U,V
C DIRLIS BENSON 0173 LIBR LIST TERM OR SAVE TAPE DIRECTORY ON LUN
C DISKIO BENSIO 0173 LIBR I OR C'S RECTANGLE OF DATA FROM AREA
* DYNOMP DALY 1076 LIBR ADDS I/N AMENDMENTS, OPENS FILENAME/LUN,RETURNS STATUS OF OPEN
* EMESS BENSON 0173 LIBR SENDS ERROR MESS TO TERM VIA SQ TO ERMESS
C ENAREA BENSIO 0173 LIBR MAKE AN ENTRY IN AREA DIRECTARY
C ENCOD DEDKE 0276 LIBR ENCODE ROUTINE, BINARY TO ASCI1
C ENCODR DALY 0173 LIBR
C ENF12B DALY 0879 LIBR
C ENHIO DALY 6677 LIBR ENHANCEMENT TABLE IO HANDLER
C FIALO SMITH 0173 LIBR DDMMSS TO FLOATING POINT DEGREES
C FLOW DALY 0173 LIBR
C FRESSET BENSON 0173 LIBR RESET VIDEO DISPLAY TO FRAME ONE
C FRMBAK DALY 0279 LIBR MOVE FRM AND/OR WRM BACK ONE
C FRMFOR DALY 0279 LIBR MOVE FRM AND/OR WRM FORWARD ONE
* FSYNK BENSON 0173 LIBR SUSPEND EXECUTION TILL NXT TV VERT RETRACE
C FTIME SMITH 0173 LIBR EHMMSS TO FLOATING POINT HOURS
C FUVCOM SMITH 0173 LIBR SCALED INTEGER (*100) TO FLOATING POINT
* FVALID SAWYER 0175 LIBR VERIFY EXISTENCE OF A MACRO FILE
C GEF BENSON 0173 LIBR GET ENTRY FOR 056 OR 45664 GAME DIRECTORY
C GEN BENSON 0173 LIBR GENERATE AREA
C GEOLEAT PHILLI 0174 LIBR GEOGRAPHIC TO GEODETIC LATITUDE CONVERSION
* GEDAY SAWYER 1075 LIBR RETURN CURRENT YYYY
* GETIOB DALY 1075 LIBR RETURNS 72 CHARACTERS FROM TCB I/O BUFFER
* GETMD DALY 0678 LIBR GET MASTER DISC DIRECTORY ENTRY FOR FILE
C GETTIM BENSON 0173 LIBR RETURNS CURRENT EHMMSS
* GK BENSON 0173 LIBR RETURNS TERM CONTROL BLOCK_POINTER WORD
C GRAHOR SMITH 0173 LIBR
C GRAVOR SMITH 0173 LIBR
C GTAP BENSON 0177 LIBR CALL OPERATOR TO MOUNT TAPE, WAIT TILL DONE
C HOWBIG BENSON 0173 LIBR RETURNS SIZE OF SPECIFIED AREA
* IADDR RUDEEN 0279 LIBR GET ADDRESS OF FORTRAN VARIABLE OR ARRAY
C IASCII RUDEEN 0778 LIBR EBCDIC TO ASCII CONVERSION ROUTINE
* IDDT BENSON 0173 LIBR RETURNS WORD FROM DISK DEF TABLE, USED BY GEN
C IEBCDC RUDEEN 0778 LIBR ASCII TO EBCDIC CONVERSION
C IEOF RUDEEN 1276 LIBR END-OF-FILE CHECKING FUNCTION
C IEOT RUDEEN 1276 LIBR END-OF-TAPE CHECKING FUNCTION
C IFFILE SAWYER 0173 LIBR
* IFLD DEDKE 0276 LIBR BIT REPACKER
C ILALO SMITH 0173 LIBR FLOATING POINT DEGREES TO DDMMSS
C INDATA SMITH 0173 LIBR INPUT SOME DIGITAL DATA FFCM AREA
* IO BENSON 0173 LIBR FORTRAN LINKAGE TO $IO
* IOPP DALY 0279 LIBR COMPUTE OPPOSITE FRM OR WRM GIVEN MAX & CURREN
C OISTAT DALY 0279 LIBR
C IROUND SMITH 0173 LIBR ROUND A FLOATING POINT NUMBER
* ISQRT BENSON 0173 LIBR INTEGER SQUARE ROOT
* ISYS BENSON 0173 LIBR SEND MESSAGE TO OPERATION SYSTEM
* ITD BENSON 0173 LIBR VALUE=WALLCLOCK TIME IN MSE/16, DATE IN ARG
C ITIME SMITH 0173 LIBR FLOATING POINT HOURS TO INTEGER EHMMSS
C ITOG BENSON 0173 LIBR TOGGLE INPUT WORD
C IUVCOM SMITH 0173 LIBR FLOATING U OR V TO SCALED INTEGER (*100)
* IVALID WHITE 0877 LIBR CHECKS INPUT TO SEE IF VALID PROGRAM FILE NAME
C IVSYS BENSON 0173 LIBR RETURNS VIDEO SYSTEM OF CALLING TERMINAL
C IWAIT RUDEEN 0279 LIBR MORE GRACEFUL JWAIT
* JFDL  DEDECK 0276 LIBR ANOTHER BIT REPACKER
C JOYCUR  BENSON 0173 LIBR RETURNS POSITION OF SPECIFIED JOYSTICK
C JAIT  BENSON 0173 LIBR WAITS FOR LOCK WORD TO FREE, THEN RELOCKS
* KEY  BENSON 0173 LIBR RETURNS BIT KEY FOR SPECIFIED PROJ NUMBER
C LISADE  BENSON 0276 LIBR
C LISDAT  SMITH 0173 LIBR
C LSTMD  DALY 0276 LIBR
C MAKE  BENSON 0173 LIBR CREATE A NEW FILE WITH SPECIFIED NAME
C MARKDN  BENSON 0173 LIBR MARK AREA DIRECTORY ENTRY—AREA AVAILABLE
C MARKOK  BENSON 0173 LIBR MARK AREA DIRECTORY ENTRY—DATA PRESENT IN AREA
C MARKUP  BENSON 0173 LIBR MARK AREA DIRECTORY ENTRY—AREA IN USE
C MASADD  SMITH 0173 LIBR
C MATCH  DALY 0277 LIBR FINDS PATTERN IN STRING, RETURNS 1ST CHAR POS
* MCDLIB  HIBBAR 0278 LIBR PUN LINE RELOCATABLES—RSQ, RREADW, RLCCPU, CPUID, NAMCPU
C MISC  DEDECK 0175 LIBR MISCELLANEOUS UNDOCUMENTED RUTINES
C MOVE  BARRET 1179 LIBR MOVE BUFIN(1...NWDS) TO BUFOUT(1...NWDS)
* MPC  BENSON 2678 LIBR
* MVBYTE  DALY 0277 LIBR MOVES NBYTES FROM BUFIN TO BUFOUT
C MVCHAR  DALY 0370 LIBR MOVE CHAR STRING, CONVERT INTGER TO BUFFER
C MVCHR  RUEDEN 0380 LIBR MOVE CHAR, CONVERT INTEGER (DECIC), BLANK BUFFER
C NDAT  BENSON 0173 LIBR RETURNS VALUE OF SPECIFIED SYSCOM WORD
C NOCKED  HIBBAR 1675 LIBR: DEM AREA NAMER
C NCT  BENSON 0173 LIBR RETURNS XNN IN ASCII FOR INPUT INTEGER NN
C NSECL  BENSON 0173 LIBR COMPUTE NUM SECTORS FOR SPECIFIED NUM BYTES
C O6  BENSON 0173 LIBR HANDLER FOR SPOOL FILE TO PRINTER
C OM  BENSON 0173 LIBR OUTPUT MESSAGE TO OPERATOR
C OPN  BENSON 0173 LIBR OPEN LUN
C OPNA  BENSON 0173 LIBR OPEN AREA
C OPNDIR  BENSON 0173 LIBR USED BY PDIP, RDIRL TO OPEN AREA DIRECTORY FILE
* OPTION  SAUWER 0175 LIBR OPTION = .TRUE. IFF CHAR EMBEDDED IN WORD
C OUTINT  SMITH 0173 LIBR LISTS AN ARRAY OF INTEGERS ON CRT USING TQP
C OVRFL  SAUWER 0175 LIBR EVAL TO TRUE IFF X IS MAXIMUM FULL SCALE OR
C OVRLAY  SMITH 0173 LIBR
C PROVAL  BENSON 0173 LIBR EXITS IF PROJECT ILLEGAL FOR PROGRAM
C PUTINT  CHAFFE 0477 LIBR PUTS OUTPUTS UP TO 16 INTEGERS VIA CALLS TO TQP
C PUTMD  DALY 0676 LIBR
C QUIET  BENSON 0173 LIBR WAITS UNTIL LAST TERMINAL I/O COMPLETED
* RANDBILL 0679 LIBR RETURNS A VERY RANDOM ARGUMENT
* RANDOM  BILL 0679 LIBR RETURNS AN EXTREMELY RANDOM ARGUMENT
C RADDIR  DALY 0879 LIBR
C RAN  BENSON 0173 LIBR ALPHA READ FROM LUN, RETURNS AFTER INITIATION
C RANW  BENSON 0173 LIBR ALPHA READ FROM LUN, RETURNS WHEN I/O COMPLETED
C RDIR  BENSON 0173 LIBR INPUT AREA DIRECTORY, LOCK WORD SET
C RDIPL  BENSON 0173 LIBR INPUT AREA DIRECTORY, LOCK WORD SET (SYSCOM 96)
C RREAD  BENSON 0173 LIBR BINARY READ FROM LUN, RETURNS AFTER INITIATION
C RREADA  BENSON 0273 LIBR READ NWDS AT SEC IS AREA IA INTO BUF A
C RREADW  BENSON 0173 LIBR BINARY READ FROM LUN, RETURNS AFTER COMPLETION
C REMARA  BENSON 0173 LIBR DELETE SPECIFIED AREA AND RELEASE SECTORS
C REMENH  RUEDEN 0475 LIBR FORMATS AND SENDS ENHANCEMENT PACKET FOR NEW TERMINAL
C RENAME  BENSON 0173 LIBR RENAME DISK FILE
C RENW  BENSON 0173 LIBR INITIATE REWIND ON LUN
C RHOME  BENSON 0173 LIBR OUTPUT DMR ERROR MESSAGE AND CALL EXIT
C RIVER  BENSON 0173 LIBR COMPARES TWO READS OF A SECTOR, MESSAGE IF DIF
C SATADR  BENSON 0173 LIBR AREA ADDRESS OF DATA SPECIFIED IN IMAGE COORD
C SATTV  BENSON 0177 LIBR TRANSFORM FROM SATELLITE TO TV COORD
C DEFSK W D A L Y 0174 NAVL DEFINE SKEW
C DEFSPN D A L Y 0174 NAVL DEFINE SPIN PERIOD
C DELNAV D A L Y 0174 NAVL DELETE NAVIGATION FILE ENTRIES
C FFMCAM D A L Y 0174 NAVL DEFINE FRAME AND CAMER A GEOMETRY
C IPDNAV D A L Y 0973 NAVL FRONT END FOR IR DCC SYSTEM...SCED BY INGESTER
C IRDOA 0979 NAVL DECODE IR LINE DCC AND SAVE OA BLOCK
C LISNAV D A L Y 0180 NAVL LIST LNDFIL ENTRIES (BURN-BOX VERSION)
C LOCES S H I Z E R 0375 NAVL LOCATE AND FILE 2 EARTH EDGES
C MANTAN D A L Y 0180 NAVL INITIALIZER FOR LNDFIL (BURN-BOX VERSION)
C NAVCORD D A L Y 0979 NAVL COPY NAV DATA ON CARDS TO NAV SAVE TAPE
C NAVL D A L Y 0180 NAVL HANDLE FOR LNDFIL
C NAVSF A L Y 0979 NAVL SAVE/RESTORE NAVIGATION FILE DATA ON TAPE
C SATCAM S M I T H 0174 NAVL
C SYSS NAV D A L Y 0375 NAVL COMPUTE S/C ATTITUDE,IAJUST,GAMMAS,RESIDUALS
C UPGC P B PHILL I 0679 NAVL COMPUTE ORBIT FROM LANDMARKS,BETAS. AND ATTITUDE 2074
C XFORMS S M I T H 0174 NAVL SYSTEMS IMPLEMENTATION OF SATSAR
C ATITUD PHILL I 0177 NAVL COMPUTE SATELLITE ATTITUDE
C BETGAM D A L Y 0074 NAVL
C BUMPT D A L Y 0277 NAVL ADDS INCMIN TO TIME IN YR,DAY,HOUR,MIN
C CHEBBY D A L Y 0477 NAVL
C CORSET PHILL I 0275 NAVL
C DOTDOI PHILL I 0275 NAVL
C EARCOR PHILL I 0174 NAVL CONVERTS IMAGE LINE-ELEMENT TO LAT-LON
C EA RSAT D A L Y 0076 NAVL
C EATOST PHILL I 0175 NAVL FAST EARTH TO SAT CCORD TRANSFORM
C GA JUST PHILL I 0074 NAVL
C GEBDOR PHILL I 0477 NAVL IE FM-POTE BETC,BETF-TEFPR PID-TAPE HEAD R9REC
C GETET D A L Y 0420 NAVL FETCH ALL VALID ETA PAIR RECORDS FROM LNDFIL
C GETGAM D A L Y 0977 NAVL GETS GAMMA,GAMDOT FOR DAY,TIME FROM NAV FILE
C GETLND D A L Y 1077 NAVL FETCH VALID LNDMRK DATA FOR IDAY FROM LNDFIL
C GETNAV D A L Y 1079 NAVL FILLS GAMCOM,BETCOM WITH VALUES FROM NAV FILE
C GETREC D A L Y 0977 NAVL READ-ONLY RECORD HANDLER FOR NAVIGATION FILE
C GDPHGA 0076 NAVL
C GSHIFT PHILL I 0174 NAVL COMPUTE GAMMA SHIFTS
C GT D A L Y 0074 NAVL
C HEXPIN PHILL I 0025 NAVL
C IEMIO D A L Y 0074 NAVL
C INVERT SAWTER 0175 NAVL N-DIMENSIONAL MATRIX INVERSION ROUTINE
C IRPDNAV D A L Y 0979 NAVL FRONT END FOR IR DCC SYSTEM...SCED BY INGESTER
C IRDOA 0079 NAVL DECODE IR LINE DCC AND SAVE OA BLOCK
C IYDPSM D A L Y 0079 NAVL
C LISTS OA D A L Y 0477 NAVL LIST 120 O/A BLOCK ITEMS ON LINE PRINTER
C LLXYZ D A L Y 0025 NAVL CONVERT LAT-LON TO EARTH CENTERED X,Y,Z COORD
C NAVO D A L Y 0979 NAVL MAKES HI-VOLUME ENTRIES IN LNDFIL
C CPNLND D A L Y 0979 NAVL OPENS NAV FILE AND SETS UP COMMON /PAPAM/
* PACK16 D A L Y 0273 NAVL INPLACE BUFFER PACK OF 3 BYTE TO 2 BYTE WORDS
C POOL D A L Y 0273 NAVL MANAGES POOL OF AVAILABLE BLOCKS IN FILE
C PUTSYD D A L Y 0579 NAVL MAKES A DAY-BLOCK ENTRY IN NAVIGATION FILE
C PUTHR D A L Y 0579 NAVL MAKES HI-VOLUME BLOC ENTRIES IN LNDFIL
C RAEPROC PHILL I 0174 NAVL CONVERTS EARTH LON TO CELESTIAL LON
C RSEC D A L Y 0077 NAVL RECORD HANDLER FOR LNDFIL
C RESIDU D A L Y 0079 NAVL
C RETRAN D A L Y 0079 NAVL
C SATTEAR PHILL I 0079 NAVL MOST GENERAL SAT-EARTH COORD TRANSFORMATION
C SATPC S PHILLI 0174 NAVR SAT POSITION VECTORS FOR EARTH CENTER
C SATPS P PHILLI 0173 NAVR SIZZL & SIZELE IN KM AT INPUT LAT-LON
C SATSUB DALY 0277 NAVR Computes LIN,ELE,LAT, LON OF SAT SUBPOINT
C SETUP D DALY 0277 NAVR SETS UP NAVCOM AND NAVINI COMMONS FOR FARSAT
C SHADOW PHILLI 0478 NAVR
C SHIFT DALY 0277 NAVR SHIFTS ALL RECS IN ELK CHAIN 1 REC POSITION
C STAGAT D DALY 1077 NAVR RETURNS SAMPLE TIME OF LANDMARK MEASUREMENT
C STSPOT PHILLI 0177 NAVR AREA OF SMS SCANNER SPOT IN KMSC AT LAT-LON
C STTTEA PHILLI 0372 NAVR TRANSFORMS SAT COOR TO EARTH COOR.
C TIMUTL DALY 0478 NAVR PACKS AND UNPACKS ISYD, IHMS TIME VARIABLES.
C CALCMT ENSON 0175 SYSL ONE LETTER KEYIN HANDLER
C DATLIS ENSON 0277 SYSL LIST DIGITAL VALUE OF PIXEL AT CURSOR CENTER
C ENHTOG DALY 0677 SYSL Toggles ENHANCEMENT, BLANK/RESTORE WITH $ KEYIN
C FMEMAR SMITH 0174 SYSL EARTH POINT - CURSOR TRANSFORMATIONS
C FERMIM ENSON 0173 SYSL LIST IMAGE COORDINATES OF CURSOR
C FERMPO D DALY 0173 SYSL LIST IMAGE AND WRRRM FRAMES CURRENTLY DISPLAYED
C FMTRVG ENSON 0173 SYSL LIST TV COORDINATES OF CURSOR
C LFRAME ENSON 0177 SYSL LISTS FRAME DIRECTORY INFO FOR CURRENT FRAME
C LNDMCR SMITH 0174 SYSL GENERATE LANDMARK FROM CURSOR POSITION
C WAUSE ENSON 0173 SYSL LIST PROJECT CURRENTLY LOGGED ON TERMINAL
C FILL RUEDEN 1176 SDSR FILL BUFFER AND UPDATE INFO IN OSTAT(JL)
C FILL2 RUEDEN 0376 SDSR FILL BUFFER AND UPDATE INFO IN OSTAT FOR JD
C PFSASG RUEDEN 0678 PFSR ASSIGN FILENAME TO LUN, INIT COMMON IF NECESSARY
C PFSCEL RUEDEN 0676 PFSR CREATE ELEMENT (IN DIRECTORY)
C PFSCLS RUEDEN 0673 PFSR CLOSE ELEMENT
C PFSCPF RUEDEN 0675 PFSR CREATE PARTITIONED FILE
C PFSSCPY RUEDEN 0675 PFSR COPY SUP
C PFSSCS RUEDEN 0678 PFSR SPECIAL CLOSE (UPDATES ELEMENT LENGTH)
C PFSSEL RUEDEN 0676 PFSR DELETE ELEMENT DIRECTORY ENTRY
C PFSDFP RUEDEN 0678 PFSR DELETE FILE
C PFSDEG RUEDEN 0676 PFSR DE-ASSIGN FILENAME FROM LUN
C* PFSERP RUEDEN 0150 PFSR PRINTS PFS ERROR MESSAGE VIA SC OR RSG TO PFSMES
C PFSGBA RUEDEN 0675 PFSR GET BLOCK OF DIRECTORY IN ABSOLUTE ORDER
C PFSGBN RUEDEN 0678 PFSR GET BLOCK OF DIRECTORY BY NAME
C PFSGFS RUEDEN 0676 PFSR GET BLOCK OF DIRECTORY BY SECTOR
C PFSGETI RUEDEN 0678 PFSR GET ELEMENT INFO BY REPNO
C PFSGETI RUEDEN 0678 PFSR GET HEADER INFO FROM LUN
C PFSGNA RUEDEN 0675 PFSR GET NEXT ABSOLUTE DIRECTORY ENTRY
C PFSJCPN RUEDEN 0678 PFSR OPEN ELEMENT
C PFSJPK RUEDEN 0679 PFSR PACK PFS FILE
C PFSPOS RUEDEN 0676 PFSR POSITION TO REQUESTED LRN
C PFSPSA RUEDEN 1176 PFSR POSITION TO ABSOLUTE SECTOR, WORD (UNBLOCKED ELES ONLY
C PFSRD RUEDEN 0678 PFSR READ FROM ELEMENT
C PFSREW RUEDEN 0179 PFSR REWIND AND CLEAR ELEMENT
C PFSRNF RUEDEN 0676 PFSR RENAME FILE
C PFSRLN RUEDEN 0678 PFSR RENAME ELEMENT
C PFSFPL RUEDEN 0678 PFSR REPLACE (INC CURRENT CYCLE COUNT) DIRECTORY ELEMENT
C PFSUPD RUEDEN 0479 PFSR UPDATE RECORD COUNTER 902E6DT33 ZNG ELEMENT
C PFSVSG RUEDEN 0678 PFSR CREATE VARASG TYPE NAME
C PFSWEP RUEDEN 0679 PFSR WRITE EOF ON BLOCKED ELEMENT
C PFSWRT RUEDEN 0679 PFSR WRITE TO AN ELEMENT
C PFSZAE RUEDEN 0678 PFSR ADD ELEMENT TO RAM LISTS
C PFSZGZ RUEDEN 0678 PFSR ADD LUN TO RAM TABLES
C PFSZC1 RUDEN 0678 PFSR COPY ELEMENT TO ELEMENT
C PFSZC2 RUDEN 0678 PFSR COPY ELEMENT TO FILE
C PFSZC3 RUDEN 0678 PFSR COPY FILE TO ELEMENT
C PFSZC4 RUDEN 0678 PFSR COPY FILE TO FILE
C PFSZC5 RUDEN 0678 PFSR COPY PFS FILE TO PFS FILE
C PFSZDE RUDEN 0678 PFSR DELETE ELEMENT FROM LAM LISTS
C PFSZDL RUDEN 0678 PFSR DELETE (DECREMENT) LUN
C PFSZDS RUDEN 0678 PFSR DIRECTORY SEARCH
C PFSZDT RUDEN 0678 PFSR DETERMINE FILE TYPE
C PFSZEO RUDEN 0180 PFSR READ EITHER/OR (REMOTE OR LOCAL)
C PFSZGD RUDEN 0678 PFSR GET DIRECTORY ENTRY AT LRN ON LUN
C PFSZGF RUDEN 0678 PFSR GET FILE NAME FROM LUN
C PFSZGH RUDEN 0678 PFSR GET HEADER SUBROUTINE
C PFSZGL RUDEN 0679 PFSR GET LINK FOR BLOCKED ELEMENT
C PFSZHF RUDEN 0678 PFSR DIRECTORY HASH FUNCTION
C PFSZLS RUDEN 0678 PFSR LRN TO SECTOR .WORD CONVERT (DIRECTORY)
C PFSZPD RUDEN 0678 PFSR PUT DIRECTORY ENTRY AT LRN ON LUN
C PFSZPK RUDEN 0679 PFSR PUT HEADER SUBROUTINE
C PFSZRD RUDEN 0679 PFSR READ A BLOCK
C PFSZUD RUDEN 0779 PFSR UNPACK DIRECTORY ENTRY
C RSDIRL RUDEN 1178 SDSR READ SDS DIRECTORY SECTOR AND LOCK
C RSDIRL RUDEN 1178 SDSR READ SDS DIRECTORY SECTOR AND LOCK
C RSDIR RUDEN 1179 SDSR READ SDS DIRECTORY SECTOR
C RSDRT RUDEN 2479 SDSR READ SDS DIRECTORY SECTOR (EXTERNALLY SUPPLIED TERM #)
* SCRACK RUDEN 0679 PFSR SDS CRACK AND READ SUBROUTINE
C SDSASG RUDEN 1179 SDSR ASSIGN SDS FILE AND SET-UP FOR I/O
C SDSASN RUDEN 0679 SDSR ASSIGN SDS FILE AND SET-UP FOR I/O (NO DIR LINKAGE)
C SDSEGN RUDEN 1178 SDSR GENERATES SDS DIRECTORY ENTRY AND ASSOCIATED FILE
C SDSGEN2 RUDEN 0180 SDSR GENERATES SDS DIRECTORY AND FILE FOR ANY TERMINAL
C SDSGRN RUDEN 0250 PFSR GET NUMBER RECORDS IN SDS ELEMENT
C SDSGR SDSR SDS GENERAL I/O SUB
C SDSNAM RUDEN 1179 SDSR CREATE SDS NAME FROM SDS NUMBER
C SDSPTR RUDEN 0380 PFSR GENERAL KEY INDEX FINDER SUB
C SDSRD RUDEN 1179 SDSR READ AND UNPACK SDS RECORD
C SDSSTP RUDEN 2580 PFSR SDS GENERAL PURPOSE SET-UP ROUTINE
C SDSVAL RUDEN 0180 PFSR CHECK FOR VALID TERMINAL/CPU/SDS# COMBINATION
C SDSSRT RUDEN 1179 SDSR WRITE AND PACK SDS RECORD
C SETUP RUDEN 1273 DEMP SETUP AND PRINT A LINE FOR LSTSDS
C SETUP2 RUDEN 0879 PFSR SEET-UP PRINT BUFFER FOR JD
* SPACK RUDEN 0679 PFSR SDS PACK AND WRITE SUBROUTINE
C WSDIR RUDEN 1178 SDSR WRITE A SDS DIRECTORY SECTOR
C WSDIRU RUDEN 1178 SDSR WRITE A SDS DIRECTORY SECTOR AND UNLOCK
C WSDIRT RUDEN 0150 SDSL WRITE A SDS DIRECTORY SECTOR FOR A SPECIFIED TERMINAL
C DIRPSDS RUDEN 0379 SDSL SDS: SDS ELEMENT DIRECTORY LISTER (JD)
C DIRUPD RUDEN 1178 SDSL BAKGRND SDSDIR FILE ALLOCATOR (BY PROJ#)
C GENSDS RUDEN 1178 SDSL GENERATE SDS AREA (JG)
C LSTSDS RUDEN 1178 SDSL SDS DIRECTORY LISTER (JL)
C PFSMS RUDEN 0180 SDSL PRINT PFS AND SDS ERROR MESSAGES
C PETSDS RUDEN 0279 SDSL PRINT OR LIST SDS RECORDS (SEMI-ANNOTATED)
C QITSDS RUDEN 1178 SDSL JUIT SDS AREA (JG)
C SDSDSM RUDEN 0130 SDSL MOVF SDS AREAS
C SETS3 RUDEN 1178 SDSL SET SDS DEFAULTS (JX)
C UPDSDS RUDEN 0272 SDSL UPDATE OLD FORMAT SDS FILES TO NEW
LFGRID WHITTA 0279  SVCR GRID FILE SUPPORT ROUTINE FOR FINE MESH L/L GRID...
LLGRID WHITTA 0179  SVCR GRID FILE SUPPORT ROUTINE FOR FILE A LAT-LONG GRID...
LLPS BARRET 1182  SVCR CONVERT LAT/LON TO POLAR-STEREO COORDS.
PLTWRF DALY 0577  SVCR PLOT WIND FLD ON WRFPM MAP OR SAT IMAGE
PSL BARR ET 0480  SVCR CONVERT FROM POLAR-STEREO TO LAT/LON COORDS
RDGRID WHITTA 0179  SVCR GRID FILE SUPPORT ROUTINE TO READ A GRID
RDGRID RUEDEN 0980  SVCR READ GRD DIRECTORY SECTOR AND LOCK
FGRID RUEDEN 0980  SVCR READ GRD DIRECTORY SECTOR
FGRID RUEDEN 0980  SVCR READ GRD DIRECTORY SECTOR (EXTERNALLY SUPPLIED TERMINAL)
SAYGRID RUEDEN 0880  DSMI WRITE GRD SAVE TAPE
SDANL WHITTA 0277  SVCR COMPUTE STABILITY PARAMETERS FROM SOUNDING (R)
SCARY WHITTA 1176  SVCR
SCVRAB WHITTA 1176  SVCR RADIOSONDE (RAOB) DECODER (R)
SCVRCTA WHITTA 1176  SVCR
VDRUMR WHITTA 0179  SVCR DISC READ ROUTINE FOR GRID-FILE SUPPORT
WGRID RUEDEN 0580  SVCR WRITE A GRD DIRECTORY SECTOR
WGRID RUEDEN 0580  SVCR WRITE A GRD DIRECTORY SECTOR AND UNLOCK
WGRID RUEDEN 0960  SVCR WRITE A GRD DIRECTORY SECTOR FOR A SPECIFIED TERMINAL
WGGRID WHITTA 0279  SVCR PROGRAM TO WRITE A GRD IN THE GRID FILE
EMAGIC RUEDEN 0750  SYSL READS DECK INTO FILE WITH FOF AFTER SECJ - BLACK MAGIC
BRATES RUEDEN 0450  SYSL RATE SETTING PROGRAM FOR BILLING ROUTINE
DEKDEL RUEDEN 0750  SYSL DELETE DECK FROM SOURCE DECK FILE
DEKLI RUEDEN 0780  SYSL PRINT SOURCE FILES FOR DOCUMENTATION BINDER
DEKMRG RUEDEN 0760  SYSL MERGE TWO SOURCE DECK FILES
DLSPO RUEDEN 0660  SYSL FOREGROUND SPOOL FILE DELETER
DELX BARRET 0477  SYSL DELETES ABORTED MACRO EXPANSION FILES
DIAGPR RUEDEN 0270  SYSL PRINTS DIAGNOSTIC DEFINITION FILE
DMAP DALY 0573  SYSL FOREGROUND DMAP UTILITY
DOCMT DALY 2177  SYSL PRODUCES SORTED LISTINGS OF DOCUMENTATION FILE
FILPUT HIBBAR 0780  SYSL PUTS FILE TO REMOTE SYSTEM FILE
FILEC HIBBAR 0750  SYSL RECEIVES FILE FROM REMOTE SYSTEM FILE
FFRAMES BENSON 0780  SYSL BACKGROUND DUMP OF FRAMED
FREEUP DALY 1075  SYSL FREES SYSCOM LOCK WORDS LEFT BY ABORTED
FKEYNS DALY 1277  UTIP LOADS OR UPDATES NAMLIST KEYIN DIRECTORY
MAGIC RUEDEN 0780  SYSL MAGICALLY READS CARD DECK INTO FILE ($EOJ'S & ALL+)
MCBILL RUEDEN 0480  SYSL MCIDAS BILLING ROUTINE
MOVE DALY 0770  SYSL MOVE A PROGRAM FILE FROM ONE PACK TO ANOTHER
PRINT WHITTA 0177  SYSL CARD LISTING UTILITY
PUTJOB HIBBAR 0750  SYSL PUTJOB TO REMOTE SYSTEM REMJOB
PURPGR DALY 0280  SYSL MOVE A LOAD MODULE FILE FROM FROM/TO ANY CPU
RECJOB HIBBAR 0780  SYSL RECEIVES JOB FROM REMOTE SYSTEM REMJOB
REMJOB HIBBAR 0780  SYSL COORDINATES SENDING JOE TO REMOTE SYSTEM PTJOB, RCJOB
REMOSQ RUEDEN 0280  SYSL REMOTE SQ'R
RENAMA DALY 0780  SYSL MOVES AREA BY RENAME
RESRRC RUEDEN 0780  SYSL RESTORE SOURCE DECK FILE FROM TAPE
RMSTAT HIBBAR 0780  SYSL GETS REMOTE SYSTEM STATUS STAT
* S.FGSP DALY 0780  SYSL SAVE SOURCE DECK FILE ON TAPE
* STAT HIBBAR 1275  SYSL LISTS SYSTEM STATUS ON CRT RMSTAT
SVCASP BARRET 0580  SYSL WHITTAKERS HANDY SYSTEM UTILITY
SVCASP WHITTA 0177  SYSL WHITTAKERS HANDY SYSTEM UTILITY
TDUMP DALY 0279  SYSL GENERAL TAPE DUMP ROUTINE
TFMEDF RUEDEN 0560  SYSL SET TERMINAL TIMEOUTS
VIDSYS BENSON 0177  SYSL CHANGE VIDEO SYSTEM ASSIGNED TO TERMINAL
C AUTHGT RUEDEN 0579 WINL SETS SYSCOM AND WINCOM CONTROLLING CLD HGT MODE OF WIND
C CHGOUT SMTH 0174 WINL SETS SYSCOM WORD CONTROLLING OUTPUT MODE
C CTDHGT RUEDEN 2579 WINL ONE KEYIN DRIVER TO DETERMINE CLOUD HEIGHT
C CCWPWIN SMTH 0174 WINL SETS WINCOM WORD DEFINING WIND VECTOR COORD
C DEFAALP MOSHER 0174 WINL DEFINE CLOUD HEIGHT ALPHA
C DELWIN DALY 0174 WINL PHYSICALLY DELETE VECTOR(S) FROM WINW FILE
C DISSUR SMTH 0174 WINL SET SURFACE DISPLAY SYSCOM WORDS
C HTGPTL RUEDEN 0579 WINL
C INWIND SMTH 0174 WINL INITIALIZE WINCO CONTROL WORDS
C LAGSIZ SMTH 0174 WINL SETS SYSCOM WORDS DEFINING LAG SIZE
C MASAGE SMTH 0174 WINL SETS WINCOM WORDS CONTROLLING DATA MASSAGE
C METRIC SMTH 0174 WINL SETS WINCOM WORDS CONTROLLING MATCH METRIC
C PLTVEC DEDECK 0578 WINL PLOTS WIND VECTORS FROM FILE ON WRRRM
C PL投降 DALY 0776 WINL SCATTER PLOT WINW FILE DATA ON GRAPHICS DEVICE
C QCPARM SMTH 0174 WINL SET WINCOM QUALITY CONTROL WORDS
C PRPOIN DALY 0174 WINL RESETS WINCO/HGT FILE POINTERS TO ZERO
C SURDIS SMTH 0174 WINL GENERATE SURFACE DISPLAY ON GRAPHICS DEVICE
C TETRAM SMTH 0174 WINL IAG POSITION INTERPOLATION TYPE CONTL WORD
C UVDIST SMTH 0174 WINL
C VECOFI SMTH 0578 WINL SETS SYSCOM WORDS CONTROLLING VECTOR GRAPHICS
C WINDBL RUEDEN 2479 WINL LIST ALL VECTORS WITHIN CURSOR
C WINDIO DALY 1175 WINL WINCO FILE TO PRINTER OR CRT
C WINLIS RUEDEN 0579 WINL DISPLAY THE DOCUMENTATIONS FOR WINCO KEYINS
C WINSR RUEDEN 1279 WINL RESTORE OLD FORMAT WIND TAPE TO NEW FORMAT WIND FILE
C WINT21 RUEDEN 0579 WINL
C WINT22 RUEDEN 0579 WINL WINCO SPACE BAR HANDLER
C WINT23 RUEDEN 0579 WINL WINCO SPACE BAR HANDLER
C WINT24 RUEDEN 0579 WINL WINCO SPACE BAR HANDLER
C WINT25 RUEDEN 0579 WINL
C ANGLES MOSHER 1074 WINR ZENITH ANGLES TO SAT, SUN, AND REL AZIMUTH ANGLE
C CDPIT DALY 0476 WINR 3D PLOT OF CLOUD TOP SURFACE
C WISTAT SMTH 0174 WINL LIST WINCO CONTROL WORD STATUS ON SCREEN
C CLESUB HSIEH 0579 WINR FETCHES DATA WITHIN THE CURSOR
C CROFMIN PHILLI 0174 WINR FINDS LOCATION OF MINIMUM VALUE OF LAGCOF
C COMIN RUEDEN 1173 WINR READ WINCO DISC COMMON BLOCK
C COMLAG PHILLI 0174 WINR GENERATES LAG COEFFICIENT ARRAY
C COMOUT RUEDEN 1175 WINR WRITE WINCO COMMON BLOCK TO DISC
C CONDAT SMTH 0174 WINR CONTOUR PLOTS MATCH COEFF ARRAY ON CRT OR PRNT
C CROCUR PHILLI 0174 WINR CHANGES EUCLIDEAN NORM TO CROSS CORELATION
C DIF MOSHER 1074 WINR LOCATES A VALUE IN AN INTERVAL
C DANCE SMTH 0173 WINR APPLY CURRENT COLOR ENH 10 INPUT ARRAY
C EMISS MOSHER 1074 WINR CONVERT VISIBLE OPTICAL THICKNESS TO IR EMISS
C FRACT MOSHER 1074 WINR FRACTIONAL CLD COVER OF FRIGHT PART OF CURSOR
C GRAHOR RUEDEN 0579 WINR GRAPH LINE
C HSSUBL MOSHER 1175 WINR MAIN CONTROL MODULE FOR CLOUD HGT COMPUTATION
C INDATE RUEDEN 1279 WINR INPUT DATA FROM AREA WITH SMALLER BUFFER THAN INDATC
C INTCEN MOSHER 1674 WINR GET INTENSITIES FROM DISK FILE MUSCA
C INTPR RUEDEN 1074 WINR STANDARD ATMOSPHERE INTERPOLATION
C INTPR MOSHER 1074 WINR ZTOL LINEAR INTERPOLATION ROUTINE
C I PLANK MOSHER 0177 WINR CALCULATES TEMPERATURE AS A FUNCTION OF RADIANCE
C IIRPL MOSHER 1074 WINR INPUTS DATA FROM MUSCA FILE
C IRVSM MOSHER 0579 WINR RETRIEVE IR PIXEL CORRESPONDING TO A VISIBLE
C IUVQSC SMTH 0476 WINR U,V COMPONENT QUALITY CONTROL CHECK
LAGDIS PHILLI 0174 WINR INTERPOLATES LAG MEASUREMENT
LININT MOSHER 1074 WINR INTERPOLATES BETWEEN PEAK POINTS IN STANDARD STMS.
MRKERR HSIEH 1179 WINR FIND PREVIOUS VECTOR AND MARK IN ERROR
NULVEC DEDECK 0175 WINR PLOTS CROSS FOR WIND VECTOR TOO SHORT TO BE SEEN
PARTS MOSHER 1074 WINR FIND BRIGHTEST AND DIMMEST 4X6 BOX IN CURSOR
PINT MOSHER 0476 WINR INTERPOLATE CLOUD PRESSURE
PLANK MOSHER 0177 WINR CALCULATES RADIANCE AS A FUNCTION OF TEMP
POSSAT PHILLI 0174 WINR IDENTICAL TO SATPOS
RADCOR PHILLI 0174 WINR ADJUSTS EUCLIDEAN NORM FOR MEAN BRIGHTNESS
TAU MOSHER 1074 WINR SATELITE BRIGHTNESS TO OPTICAL THICKNESS
TTOZ MOSHER 1074 WINR TEMPERATURE TO HEIGHT USING STND ATMOS
WINSUB SMITH 1175 WINR MAIN CONTROL MODULE FOR WIND COMPUTATION