MAP SYSTEM OVERVIEW

INTRODUCTION

The Management Analysis Programs (MAP) developed by System Studies Incorporated perform a variety of vital functions pertaining to the monitoring and management of a cable pressurization system. The MAP System consists of individual software modules that work together to provide the most sophisticated and useful pressure monitoring, dispatching, alarming, and record keeping software available anywhere. Among the programs currently available are: PressureMAP™, ReportMAP™, AlarmMAP™, CableMAP™, and Hand-Held Terminal Access™. These programs work interactively to provide multi-tasking capabilities and multiple user access. Beginning with PressureMAP Version 26, a web browser interface to PressureMAP, called PressureWEB™, was added to the family of MAP Programs. This new application makes it incredibly easy to access key PressureMAP information and reports and to identify alarms.

This section of the System Administration Manual describes each of the MAP programs, lists the key features made possible by the multi-user MAP software operating on the MAP Computer (see Section 3 of this manual), and explains what takes place during a normal twenty-four hour operating cycle. The information presented is non-technical in nature. It summarizes the important features of the MAP System in order to provide MAP System Administrators with a vivid picture of how the entire system functions. Questions not answered in this Overview can be addressed to the System Studies Technical Support Department.

MULTI-USER MAP SOFTWARE MODULE DESCRIPTIONS

The following paragraphs describe the important functions of each of the multi-user MAP software modules. A more detailed explanation of how these programs interact during a typical twenty-four hour period is provided at the end of this section.

PressureMAP

PressureMAP is a multi-functional Management Analysis Program (MAP) that is designed to enhance monitoring system capabilities by identifying air pipe and cable problems, organizing device data, and prioritizing daily dispatches. In addition, PressureMAP rates the efficiency and effectiveness of the cable pressurization system and automatically backs up and restores office monitoring systems.

PressureMAP is an easy-to-use, menu-driven program that guides the user through each phase of operation. Program options are selected from a master menu by typing the number next to the desired menu option and then pressing *<Return>*.

Master Menu Options

At the front end of the PressureMAP system is the Master Menu. This menu contains several options, each one offering access to a different portion of the PressureMAP program. A short description of each Master Menu option is provided below.

Dispatch Priorities

The Dispatch Priorities option provides a list of the top five pressure and/or flow problems found in each office selected. To accomplish this, PressureMAP compares the most recent settled readings with the device readings from the previous three days. PressureMAP then determines if a problem condition exists. If there are devices that require attention, PressureMAP creates a Dispatch Report which displays

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information about the conditions found. The five most severe dispatch conditions for each office are listed in the report. If it is determined that all of the devices within an office meet the program standards, then PressureMAP will indicate that no dispatching is required for that office.

The Dispatch Report includes an individual task number for each dispatch, the number of the device that signaled the dispatch, a short description of the dispatch condition, and a priority level for each dispatch. The priority level rates the severity of the dispatch, with four stars (****) indicating the worst condition and a single "R" representing the least critical (or "routine") condition. A star rating may be preceded by one or more hyphens to indicate an "aged" dispatch. A dispatch that is assigned one or more sharp signs (#) in place of stars identifies a location where more than one related dispatch condition has been found.

More detailed information can be produced for any of the dispatches listed by entering the task number of the dispatch in question. This procedure generates a Detailed Task Report which provides specific information regarding the device causing the dispatch, as well as information concerning other devices that have been affected by the dispatch condition. The Detailed Task Report also recommends a corrective leak locating procedure to follow.

PressureMAP's Dispatch Priorities option also provides a list of errors associated with the monitoring system itself in a System Errors Report. Error messages contained in this report are described in Appendix 3 of the MAP System Operations Manual.

Device Histories
The Device Histories option allows the user to review the current and past readings of all devices in an office. Device History Reports can be generated for an entire office, or for a variety of device groupings. The resulting report provides complete information concerning the listed device, including the device number and type, the individual device readings for the last seven days, and weekly averages for the past four weeks.

The following Device History Reports are available with this menu option:

> Histories for an entire office
> Histories for all devices on a pipe or sector
> Histories for all devices with the same location code
> Histories for all devices at a manhole or address
> Histories for all devices on a cable/sheath
> Histories for all devices of a specific type
> Histories for all devices that have been disabled through PressureMAP
> Histories of all devices showing the current reading
> Histories for all "bad" or "stuck" devices
> Histories for all devices with the same user defined "sort key"

All Device History Report selections allow access to "extended information" concerning the devices listed in the report. By entering an "x" after the report selection, the user will be provided with an additional line of information concerning each device listed. The information includes the name of the pipe with which the device is associated, the Optimum Air Usage (OAU) or the sheath number (depending on whether the device is a pressure or flow transducer), and the manhole number or physical address of the device.

Specific Device Information
The Specific Device Information function provides detailed data concerning the devices monitored by PressureMAP. Information includes the device number, device type, range and OAU for flow devices, the address, location code, pipe association, and the sheath numbers of all cables that are fed by a flow monitored air pipe manifold. This option also shows complete transducer cable and pair assignment data, module types, monitoring system priority levels, circuit or input numbers, stickmap and plat number references, and a variety of additional information that pertains to the office Cable Pressurization Automatic Monitoring System (CPAMS).

Furthermore, the Specific Device Information function provides details about the device's location and distance to related devices, remarks about the device and activities that may affect it, and a seven day history of readings for the device, as well as weekly averages for the past four weeks.

Using the Specific Device Information option, it is also possible to obtain a realtime reading for any working device programmed into the office's database. A realtime reading is simply a device reading which is taken at the time of the inquiry. When a realtime reading is requested, a call will be made to the appropriate office monitor and a reading of the selected device will be taken. The value returned from a realtime reading is the actual current reading of the device. (The realtime reading option is not available with all monitoring systems.)

System Indexing
This option lists a System Quality Index (SQI) number for each route in an office and an index average for the entire office. The System Quality Index is a rating formula based upon average cable pressures (PSI) and air flow (SCFH) per sheath mile of cable. The output of the SQI is a relative number with 90 considered to be the optimum index value. Indexes below 90 are considered substandard, while routes or offices with indexes above 90 are "goldplated."

The System Index Report is organized alphanumerically by route, with the central office (CO) listed first. For each office, the index listing includes the pipe designation, the sheath mileage total for the pipe, the daily indexes for an entire week, and the index averages for each of the past four weeks. A combined index for all offices installed on the system can also be obtained with the System Indexing option. This index is an average based on individual indexes and the total number of sheath miles in each office.

CPAMS Information
This PressureMAP Master Menu option provides a number of important record keeping and operational features. Among the features provided is a report which lists the configuration data for each Cable Pressurization Automatic Monitoring System (CPAMS) in an office, two types of device logs, a device status report, a device discrepancy report, automatic backup and restore utilities, and the CPAMS automatic programming utilities.

The CPAMS Configuration option displays the password and phone number (or IP address) of the monitoring system for any office in the PressureMAP database. The report produced also includes the dates of the last successful CPAMS backup and restoration.

The Device Log Reports list detailed information about each device in an office. One of the reports is a sequential listing of devices, while the other sorts devices by location. The Device Log by Location provides detailed information which can be used with a Location Code Stickmap (refer to Section 2 of the MAP System Data Entry Manual or Section 2 of the MAP System Operations Manual). The Device Status Report, which provides concise data for evaluating recent device readings in a form similar to the Sparton Status Report format, can be sent to Report Centers with the daily Dispatch Report. The Device

Discrepancy Report lists the differences between what is contained on a PressureMAP device record and the device information that has been programmed into the CPAMS monitor.

The CPAMS Information option also includes the Backup and Restore utilities. Normally, PressureMAP will make a backup of each Cable Pressurization Automatic Monitoring Systems (CPAMS) on a weekly basis. If a monitoring system should "crash" for any reason, PressureMAP will automatically restore the CPAMS data from the most recent backup file using the CPAMS Restore utility. A manual CPAMS backup may also be initiated with this option.

Note: Starting with MAP Version 20.01, the "timewarp" function backdates the monitor's real time clock on or after December 1, 1999 in the following monitors, which are not Y2K-compliant: Chatlos L2, 600, MPUZ and L3; Hercules 740; Sparton 5301A; and TMACS 1000. Effective with Version 23.00.12, the system administrator controls whether this backdating function is applied to Chatlos, Hercules and TMACS monitors (by entering the keyword "TIMEWARP" in the office **Remarks** field). The MAP System correctly displays year values after 2000 in screens and reports for offices monitored by the backdated CPAMS, since the system assumes that any incoming data is current. Only the year values in reports received directly from these monitors will appear off—by a factor of 4 for the Chatlos, Hercules and TMACS 1000 monitors, and of 28 for the Sparton—and a message regarding the year value will appear.

Finally, the CPAMS Information section of the PressureMAP Master Menu provides two options for programming certain Sparton and Chatlos monitor types with data from PressureMAP. These options were developed to eliminate the duplicate programming tasks required when changes and additions are made to the device data within an office.

User Support
Option 6 of the Master Menu also provides brief information regarding the availability of our Technical Support coverage. There are two popular Technical Support options, each of which provides toll free telephone technical support assistance between the hours of 6:00 a.m. and 4:00 p.m. Pacific Standard Time (PST) Monday through Friday. Holiday and weekend coverage is between 8:00 a.m. and 4:00 p.m. PST via a pager system.

The User support option of the Master Menu also indicates that copies of the four PressureMAP manuals, plus additional hardware and software release notes, can be obtained by logging onto the System Studies web site: www.airtalk.com. The website also provides software announcements, new version features and availability information.

ReportMAP
ReportMAP is a multi-application software library designed to be used in conjunction with the PressureMAP software. It consists of three software utilities: Dispatcher, Dispatch Report Formatting, and Pin Selector. Each of these is directed toward increasing cable pressurization system management efficiency.

Dispatcher
Dispatcher works with PressureMAP to send early morning dispatches and associated tasks to designated Report Centers via one of the system's dial out modems. The top five dispatches for individually selected offices (or for all of the offices in a PressureMAP system) may be sent to any of 72 pre-designated Report Centers. When Maintenance personnel arrive for work in the morning, a list of the dispatches for the selected offices will be awaiting them.

In addition to sending dispatches, Dispatcher may be instructed to send more detailed Task Dispatch Information. This includes specific information for the device causing the dispatch, as well as a list of probable causes for the dispatch condition, procedures for correcting the situation, and complete information for any devices on either side of the reporting device that have changed as a result of the dispatch condition.

The user has the option of designating the Dispatch Priorities and/or the Device Status Report, and the priority level cutoff for each report. For Dispatch Priorities, for example, Dispatcher may be programmed to send Task Information for only the most severe dispatches, all of the top five dispatches, or any grade in between.

Dispatcher does not require hardware modifications to function. The program waits until PressureMAP has completed its nightly updating sequence and has finished developing dispatches, task information and indexes before it calls the various Report Centers. It may be programmed to distribute dispatches at baud rates up to 19200 baud, depending upon installed equipment.

Dispatch Report Formatting

Dispatch Report Formatting is a MAP software utility that allows the customization of the PressureMAP Dispatch Reports distributed to field maintenance offices or other specified locations called Report Centers. The Dispatch Reports are initially set up to contain information in the standard PressureMAP format for Dispatch Priorities and Task Dispatching Information. Dispatch Report Formatting allows the standard report to be customized by only including the report information that is useful to the user of each PressureMAP system. When a report format is customized, ALL Report Centers in the MAP System will receive their reports with the modified format. The following report information may be included or excluded for each Dispatch Report:

Dispatch Header	Dispatch Description
Any Associated Cable Activities	Dispatch Procedure
Device Information	CPAMS Information
Office and Field Associations	Device Remarks Field
Device Reading Lines	Associated Devices
Leak Locating Chart	

Pin Selector

Pin Selector is a utility used with offices monitored by either the System Studies 289H LSS or the WECO E2A Remote Terminals. Both of these monitoring systems are different in design and function from most other monitoring systems. Most other systems are equipped with memory and computing power. They generate reports and track device information including which device access numbers are in use and which are available. The System Studies 289H LSS and WECO E2A Remote Terminal are entirely dependent upon the MAP System to collect reading measurements and interpret them into reports, as well as track used and available device access numbers.

Pin Selector is the component of the MAP System that tracks device access numbers for both the 289H LSS and E2A Remote Terminals. It automates the process of tracking, assigning, and reserving access numbers. Pin Selector does not have its own database, but keeps track of access numbers by using and manipulating the PressureMAP history file database. This database contains information about access numbers in use, devices with "NONE" as an access number, those dedicated (reserved) for future use, and those available for assignment. This database is also updated by PressureMAP Data Entry which marks access numbers "used" or "available" as devices are added or removed from an office. An access number is considered "used" when it is assigned to an existing device. A dedicated (or reserved) access number is

one allocated for future device placements or test devices unmonitored by the MAP System. A dedicated access number is not assigned to any existing device. All other access numbers are considered "available."

Pin Selector provides functions to print logs about the current status of access numbers in the database. Log functions can list all access numbers, those in use, those dedicated for future use, or those still available. Functions are also provided to dedicate numbers, and to release dedicated numbers. Because device types differ between the 289H LSS and E2A monitor types, each monitor type has its own unique Pin Selector menu and instructions.

AlarmMAP

AlarmMAP works in conjunction with PressureMAP to provide continual surveillance of the cable pressurization system. Unlike PressureMAP, which establishes settled readings once daily in the early morning hours, AlarmMAP places calls continually throughout the day to obtain more current device information. AlarmMAP filters out nuisance alarms (small pressure drops or flow increases that cross threshold limits) and identifies conditions that threaten the integrity of the pressure system. When one situation causes alarm conditions in multiple devices, the software will send an alarm only for the device nearest the problem ("Alarm Masking") to direct the technician toward the source of the problem.

In addition to making routine scheduled calls, AlarmMAP receives incoming CPAMS alarms and alerts that occur during and after normal call times. Once an alarm is received, it is evaluated to determine if it represents a system-threatening condition. If it does, the alarm is distributed to one or more Alarm Centers. AlarmMAP will send alarms to any remote terminal/printer, pager or email address that has been set up in the MAP System to receive alarm notification.

AlarmMAP allows users to establish multiple Alarm Centers and designate specific time periods during which alarms will be sent to the centers. Different calling schedules can be established for weekdays, weekends, and holidays. In addition, the user can select among several types of alarm reports to receive, including: the default Summary Report, a Full Report (which includes detailed task information, plus a schematic drawing of the approximate location of the condition causing the alarm), One Report (delivered when there are multiple alarms at the same location), and a Brief Report (designed for email delivery).

AlarmMAP attempts to call each of the Alarm Centers specified to receive reports during the defined calling period and deliver the alarm information. Alarm Centers that could not be contacted during the first call attempt will be tried again until communications can be established or a user-defined maximum number of calling attempts has been made. Once all of the Alarm Centers have been contacted and alarm reports sent, AlarmMAP proceeds with its scheduled office calling routine.

CableMAP

CableMAP automates Cable Opening Logs and helps track cable splicing activity. By keeping a complete log of current cable openings and recent closures, CableMAP is able to produce reports that list all cable splicing operations. Since it is fully integrated into the MAP System, it enables AlarmMAP to reference Cable Opening Logs and identify any splicing activity that may be associated with an alarm condition. In this capacity, it eliminates double dispatching and provides greater control over the maintenance of the cable pressurization system.

When a dispatch or alarm is the result of a cable opening, the word "OPEN" appears either in the Dispatch Priorities report or the Alarm Summary. The detailed task information associated with either report contains details about opens and recently closed openings at the location of the problem.

Effective with Version 20.01, CableMAP was redesigned to allow for "advance closings" of cable activities to streamline the database maintenance process. An advance closing date and time may be manually entered when an activity is opened, or the Standard Closing Time option may be set. (For more information on this CableMAP function, please refer to Section 13 of the MAP Data Entry Manual.) After the advance closing date and time have passed, the system will automatically close the activity, log the closing date and time, and issue a Closing Number with the identifying prefix AUT. This daily function is coordinated with the MAP System's schedule to ensure that open activities are automatically closed in a timely manner and do not interfere with detection and delivery of alarms.

Operating in conjunction with the PressureMAP database, CableMAP allows managers and craft personnel immediate access to a common database. As entries are made both at the main computer terminal and from remote locations, the most recent cable opening information is recorded. Management is not only able to track cable splicing activity, but also monitor how splicing has affected the condition of the cable pressurization system.

CableMAP provides the following information via the CableMAP Activity Log Menu:

- All Cable Activity in the Cable Activity Log
- Activity by an Opening Number
- All Activity for a given Day, Week or Month
- All Activity by a Specified Technician
- All Activity by Job/Task Number
- All Activity by an Address or Manhole
- All Activity by PressureMAP Location Code
- All Activity on a Pipe
- All Activity for a Cable/Count
- All Activity Not Yet Closed
- Recent Activities for all Technicians (TechFinder)

Hand-Held Terminal Access

An adaptation of the MAP System enables users with hand-held terminals to obtain specific PressureMAP and CableMAP information. The software reformats the output of these MAP programs for display on small, hand-held terminal screens (anywhere from 8-15 lines by 20-40 characters). The software currently works with terminals manufactured by Itron and Melard Technologies, Inc.

PressureMAP Specific Device Information can be obtained in two formats: 1) a short form, which includes device identification, address information and device readings, and 2) a long form, which lists all of PressureMAP's Specific Device Information. Realtime readings for designated devices are also available.

CableMAP Data Entry can be accessed with a Hand-Held Terminal. With this option it is possible to designate a cable opening, close a cable opening number, and view and edit existing cable openings.

CPAMS Diagnostics

CPAMS Diagnostics is a menu driven program designed for diagnosing possible problems with Western Electric E2A Remote Terminals and System Studies 289 LSS Monitoring Systems. Unlike Chatlos and Sparton monitors, the E2A Remote Terminal and the 289 LSS monitor do not transmit data in a "human readable" form. Rather, they transmits information in a binary format to facilitate rapid data transfer. This utility provides test modes to exercise all data transfer functions and diagnose problems with these

monitors. As such, the CPAMS Diagnostics completely replace the CPMS Acceptance Tests formerly required for E2A Remote Terminals with a much simpler set of menu driven tests.

The CPAMS Diagnostics program also provides access via the PressureMAP modem to other types of CPAMS. It acts as an automatic dialer to the monitor, allowing you call the CPAMS unit without leaving the PressureMAP program. Once a connection is made, interaction with the CPAMS unit returns to you, allowing manual scans and maintenance operations, or CPAMS data entry to be done.

User Initiated Operations

The five options of the User Initiated Operations Menu were developed to help increase the efficiency of your cable pressurization management. Three of the options enable you to update your MAP System after data entry or office changes have been made by placing a call to the PressureMAP office to acquire new readings, and to regenerate the PressureMAP Dispatch Priorities and System Indexes. The fourth function allows you to browse the files created by AlarmMAP whenever an alarm is not properly received. These files include office associated alarm error files, the "unrecognizable" office alarm error files, and any "mailed" alarms that could not be sent. The fifth menu option allows you to run "custom" reports for analyzing your system's office data.

System Administration

Included with the Management Analysis Program software is a detailed System Administration Menu that offers control over the maintenance of the MAP System. This menu can only be accessed by individuals with system manager privileges. Among the functions that can be performed from the System Administration Menu are the following:

- Setting the default backup mode (standard tape cartridge or one of the other backup resources available with the purchase of BackupEDGE™ software)
- Manually backing up and restoring the MAP System—including the creation of Linux Migration media (to convert from an SCO UNIX PressureMAP System to a Linux PressureMAP system)
- Updating the system
- Shutting down the computer
- Setting the time and date
- Listing all users currently logged into the system
- Resetting file permissions
- Initializing the asynchronous modems
- Resetting the multi-port serial card
- Printer administration
- Starting/stopping of selected processes
- Managing user login accounts
- Setting idle logout times
- Network administration
- Configuring backup resources for use with BackupEDGE
- Displaying system uptime

Many of these functions will need to be performed as part of the normal system maintenance. For example, the person designated as the System Administrator will be responsible for backing up the MAP system on a regular basis. This procedure guarantees that a relatively recent, working version of the MAP

system, complete with office and device data, will be available if an equipment or software error were to occur.

Several of the other System Administration functions will need to be performed only periodically, either at the request of a user or as a particular need arises. By controlling these functions, through the System Administration Menu, system "down time" is greatly minimized and maintenance operations become routine.

One of the most important System Administration options is User Management. This utility enables the System Administrator to create new user accounts, manage the list of existing accounts, modify accounts, and delete old user accounts. With User Management, the System Administrator has the ability to control access to the entire MAP System. This account management capability results in smooth program operation and improved system security.

Network Administration is another increasingly important System Administration responsibility. With more and more systems relying on LAN communications for data acquisition, user access to reports and information, printer sharing, and dispatch and alarm distribution, setting up and maintaining the network is an important communications requirement. All of the required functions can be performed via option 19 of the System Administration Menu.

MAP System Multi-Tasking Characteristics

The multi-user MAP software modules described in the previous pages have been developed and tested to work optimally on a MAP Computer with designated peripheral equipment. Due to the exceptional processing speed and Random Access Memory (RAM) capacity of the MAP Computer hardware, the multi-user operating system is able to process and perform a number of critical tasks simultaneously. The result is improved reaction time and quicker access to information.

What follows is a brief description of some of the performance benefits made possible by the multi-user operating system and the MAP Computer:

- *Multi-tasking/Multi-user Operation.* The multi-user operating system and hardware configuration enable multiple functions to be performed simultaneously. While users are accessing program menus or performing data entry, the MAP software runs efficiently in the background. Scheduled data acquisition is unimpeded, and dispatch and alarm distribution proceeds without interruption.

- *Remote Editing.* As part of the multi-user function, data entry can be performed at remote locations while multiple users are accessing the common data base. Prior to development of the multi-user MAP software, users would be locked out of the program while editing functions were being performed. Editor and user privileges are assigned and controlled by the System Administrator.

- *Password Security.* Another benefit of the multi-user operating system is that it guarantees protection of the system from unauthorized users. In order to access data, all users will be required to enter a personalized password. In addition, editor and non-editor privileges can be specified. Within the company or area, users can designate login accounts which invoke editor or user-only privileges. This prevents non-authorized personnel from intentionally or accidently editing office and device information.

- *System Dispatching.* A severe alarm is created whenever a Cable Pressurization Automatic Monitoring System (CPAMS) goes down. If the monitoring hardware fails, the MAP software will detect the failure and develop and distribute an alarm.

- *Alternate Consoles.* The multi-user operating system provides the capability of switching consoles at the computer during normal user operation. A user session begins on one of the eight user-designated consoles. If a user is logged into the program at the MAP Computer, s/he may view the MAP Program's Status Report by pressing the *<Alt>* and *<F12>* keys. A list of incoming alarm activity can be viewed by pressing the *<Alt>* and *<F10>* keys. Consoles may be switched back and forth without disrupting normal user or program operations.

  Beginning with Version 25, the same type of information that is available from the Alternate Consoles can also be viewed remotely via a QuickLogin to the View Logs Menu. This menu provides options for viewing the Alarm Receiver, the Scheduler and the System Status Logs. Information about accessing this information remotely is provided at the end of Section 4 of this manual. More detailed information regarding the MAP Program's Status Display is supplied in Appendix 2 of this manual.

- *Multiple Printers.* The MAP software allows multiple printers, local and remote, to be set up to receive printed reports from the system. A system default printer is designated through System Administration. However, when logging in, a user may designate a printer for screen capture or Browser printing for that login session, while having the ability to direct individual print jobs to any specified printer. In addition, printers may be configured to receive reports from other MAP systems.

- *Automatic System Backup.* By utilizing conventional backup hardware (electronic tapes, DVD-ROM, CD-ROM, etc., the multi-user MAP software automatically backs up the entire MAP database on a daily basis or on demand via menu options. This function eliminates the need to perform time consuming manual backups of data.

- *Improved Customer Support.* The multi-user operating system also provides improved software diagnostic tools to help with customer support functions. The multi-user operating system enables customer support personnel to dial into a system and activate helpful data logging facilities. With these controls, the effectiveness of customer support efforts have been improved significantly.

- *Future Use.* Hardware can be upgraded or expanded as program developments arise. Additional user access lines (modems and serial ports) and expanded memory provide better performance.

Modem Communications Standards

To allow maximum access to the MAP software, a Digi PortServer II serial port concentrator or Corollary communications card provides the serial port connections for one or more modems. The MAP system uses several modems connected to these ports to perform the following functions: 1) dial out to the Cable Pressurization Automatic Monitoring System (CPAMS) to collect readings, 2) send alarms to remote sites, 3) provide dial-in access for remote users, and 4) receive alarms sent by the Cable Pressurization Automatic Monitoring Systems (CPAMS). Additional PortServer* communications boxes can be added to the hardware configuration to expand the system.

* Although Corollary equipment is still supported for use with PressureMAP on systems running the SCO UNIX operating system, it is a discontinued product and no longer available for purchase.

Used in conjunction with the serial port concentrator or communications card, System Studies-certified modems allow high speed communications with remote users. It is the recommendation of System Studies Incorporated that a minimum of eight certified modems be used with the system. The functions of these modems are as follows:

- *Four Dial-Out Modems.* Dial out modems enable the MAP software to: 1) call the CPAMS and obtain readings, and 2) send alarms and dispatches to remote terminals. The AlarmMAP program uses one dial-out modem to constantly poll the CPAMS and send out alarms. A second dial-out modem (DTMF) can be dedicated to accessing data from Dial-a-Ducers. The third and fourth dial-out modems are reserved for users to access realtime device readings.

- *Two User Access Modems.* Two additional modems are used to provide user access to the MAP System. With this function, multiple users can simultaneously dial into the program and access reports, edit the database, and perform other MAP software and CPAMS diagnostic functions.

- *Two Incoming Alarm Modems.* The remaining two modems are dedicated to receiving alarms from CPAMS units in the field.

The modem configuration described above maximizes the potential of the Management Analysis Programs by providing uninterrupted data communications and user access to important features. Depending upon the number of offices in a particular system and the configuration of hardware, additional serial ports and additional modems can be used to further enhance MAP System performance.

Communications Via Local Area Network

In addition to standard modem communications, PressureMAP can also be set up to provide user access to reports and data via a company's LAN or WAN. Not only can multiple PressureMAP users access PressureMAP information directly, they can also receive alarms and associated tasks over the network via email. This capability requires a properly configured MAP Engine computer and the completion of a number of network administrative functions such as setting up the configuration of an Ethernet LAN connection, SMTP mail server, and serial port resources.

PressureMAP can also poll LAN-enabled office monitors, such as the 289H LSS and uM260 Micro Monitor, and even receive alerts via the company's network. This capability eliminates long distance data communications fees associated with calling office monitors via modems. Section 6 of this manual provides both general and detailed information about these network administrative tasks.

MULTI-USER MAP SOFTWARE PERFORMANCE SUMMARY

This section explains how the MAP software functions during a typical 24-hour period. During this time period device histories are updated, dispatch reports are created and prioritized, system quality is evaluated, alarm conditions are analyzed, and reports are distributed. To comprehend how the system works, it is necessary to understand the following interrelated activities: PressureMAP data collection and report generation, Dispatcher report distribution, and AlarmMAP data collection and analysis. Most of these operations are orchestrated by the MAP System Scheduler.

In the cycle of daily MAP System activities, PressureMAP and Dispatcher are active only in the early morning hours, while AlarmMAP functions throughout the day. PressureMAP obtains settled device readings once each 24-hour period and generates Dispatches and System Indexes from these values. Dispatcher distributes Dispatch Reports after PressureMAP has completed generating the reports. AlarmMAP automatically receives and actively requests new device readings throughout the day. It then sends new Alarm Reports as problems are noted.

The following sections provide a brief explanation of specific MAP routines. Together, they constitute a summary of MAP System functions and interactions.

Scheduled PressureMAP Functions

As mentioned above most MAP operations are controlled by the System Scheduler. The Scheduler directs acquisition of data, updating of device histories, development of daily dispatches and system quality indexes, and distribution of reports. As the name implies, it is comprised of a schedule or list of operations performed during each 24-hour period. At the start of each day, the Scheduler initiates the PressureMAP routines.

Shifting Device Reading History

At midnight the device readings history is adjusted to reflect the change of date. The daily device readings are shifted by a day—the device reading for today becomes the reading for yesterday, and so forth. The better of the "current reading" or "last reading" is promoted to the new reading for today. Note that the current and last readings are the result of ongoing data acquisition associated with AlarmMAP. The readings in these two columns are cleared at midnight.

Establishing New Settled Readings

Early in the morning hours, the current reading of each device is used to establish a "settled reading". Settled readings are taken at an early hour when cable pressures and manifold flows have recovered from the previous day's construction activity and no new activities are likely to be underway. This occurs at approximately 2:00 AM, when the better of the "current reading" and "last reading" is once again promoted to the "today reading", establishing a settled value. Again, please note that the current and last readings are the result of ongoing AlarmMAP data acquisition.

Developing Dispatch Priorities

After today's reading is settled, the Scheduler initiates PressureMAP Dispatch Priority generation. Dispatch Priority compares each new "today" reading with the last few days of readings. It looks to see 1) if a change has occurred, 2) what degree of change took place, and 3) over what period of time the change occurred. For example, if a flow monitoring device increased 5 Standard Cubic Feet per Hour (SCFH) since the last settled reading, it would receive a high priority alarm rating. If a similar device increased by 5 SCFH over a 72-hour time period, it would receive a less severe rating. Since the flow increase in this second example happened over a comparatively longer period time and did not have an immediate impact on the system, it is given a lower rating.

Dispatch Priorities are not just developed for devices that show a change. They are also created for static conditions such as: pressure devices that are below standard, flow devices that are flowing more than their assigned Optimum Air Usage, and devices indicating an error.

Developing Indexes

The next PressureMAP function is the development of indexes for each of the offices in the office list. This Scheduler function implements the code that develops a System Quality Index for each route in an office. The index formula is a complex equation which uses both air pressure and air flow readings per sheath mile of cable to compute an air pressure quality rating. Like Device Histories, the Scheduler shifts the most current value in the index file for an office into yesterday's column. This causes the other values to shift also. At the end of the week, a new weekly index average is computed for each route in an office.

This concludes the program functions that are directly associated with the PressureMAP portion of the MAP software. Depending upon the number of offices in the system, these activities generally take only a few minutes to complete.

Dispatcher Report Distribution

Once the Scheduler has run the Dispatch Priorities and Index programs, Dispatcher is activated. Using one of the dial-out modem ports on the MAP Computer, Dispatcher assembles the Dispatch Reports for each of the offices in the system and distributes them to the Report Centers designated in the ReportMAP editor. Dispatcher will provide a list of the top five dispatches in an office and the associated task information for the dispatch priority levels indicated during the data entry process. Starting with Version 22, the Device Status Report may be sent along with, or instead of, the Dispatch Report. The scheduled amount of time for this Dispatcher function is two hours.

After Dispatcher has distributed its reports in the early morning hours, the portion of the MAP program that analyzes, updates and indexes the day's settled readings has completed its activity. From this point on, all scheduled activity pertains to AlarmMAP.

Scheduled AlarmMAP Functions

AlarmMAP continually calls offices to obtain current data and check for incoming alarms. The two most active Scheduler functions associated with AlarmMAP are the calling procedures and the shifting of readings in the history files from the "current" to the "last" column. These activities take place almost continually throughout the day and night.

The Scheduler uses a two hour calling cycle for AlarmMAP. This calling cycle was developed to allow sufficient time for the program to obtain device readings from all of the offices in a system. If an office cannot be reached during the normal calling sequence (due to a busy or defective modem), AlarmMAP attempts to recall the office during the cycle after the remaining offices on the list have been contacted. After calling each office, AlarmMAP analyzes the data to determine if there are any alarm conditions. After the two hour call cycle has been completed, a new cycle begins.

Resetting Device Histories

After the Scheduler has cleared the "current" and "last" columns during its morning routine, AlarmMAP begins its first calling cycle. The first readings collected are placed in the "current" column of the device history file. The Dispatch Alarm program compares these readings with the settled readings to see if any Dispatch Alarms apply.

Immediately before the next calling cycle begins, the readings in the "current" column are shifted, making room for new readings. The Scheduler then begins the calling process, and the new readings are placed in the "current" column. This shifting of device readings continues with each calling cycle.

Dispatch Alarms

After each of the offices has been called during a scheduled time period, the Dispatch Alarm program examines all of the offices in the office file. It looks for new readings and compares them with settled readings. If any high priority Dispatch Alarm conditions have been discovered, AlarmMAP searches for an available call-out modem in order to distribute the alarms.

Dispatch Alarms parallel the top priority, dynamic Dispatch Priorities developed by PressureMAP. Both types identify changes that occur within a specific time period. In the case of Dispatch Alarms, however, the change in device readings must take place in less than 24 hours. An example of a typical Dispatch Alarm is an underground pressure device that has dropped 4 or more PSI **in under** 24 hours. This can be seen as a drop in the settled pressure reading (in the "today" column) from 7.0 PSI to 3.0 PSI in the "current" column.

If a device goes into alarm, AlarmMAP searches all of the CableMAP opening logs to see if the alarmed device's location number appears in any of the opening logs. If it does, the program inserts the word "OPEN" into the "Level" column of the Dispatch Alarm Report and provides associated cable opening information with the Detailed Task Report. This capability ties CableMAP into the alarm surveillance function of the MAP system.

The Alarm Receiver Function

Acting independently of the scheduled PressureMAP, Dispatcher, and AlarmMAP processes is the Alarm Receiver function. This part of the MAP program uses a dedicated modem to receive alarms or alerts sent directly to the MAP System by any of the office monitoring units (CPAMS). The Alarm Receiver's function is to process incoming CPAMS alert information and store it in the MAP System database. When AlarmMAP scans each office for four star conditions, the readings will be evaluated to determine if they warrant a Dispatch Alarm.

As soon as AlarmMAP has finished updating an office during its scheduled two hour cycle, it processes alarms—not only for the office just updated, but for the other offices in the system. In this way, it is able to detect if any major alarms have come in through the Alarm Receiver. And after a scheduled calling cycle has been completed, AlarmMAP continues to check each office for any new readings made available through the Alarm Receiver.

This concludes the ongoing cycle of MAP System activities. While these activities are taking place, users may access the system to examine reports, request realtime readings, place locator tone on selected monitoring pairs, perform data entry, and initiate other specified functions. When midnight arrives, the internal calendar changes and the entire sequence begins again.