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MINICOMPUTER MAINTENANCE
AND OPERATIONS CENTER
CENTER DESCRIPTION
MINICOMPUTER OPERATIONS GROUP

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1. INTRODUCTION

1.1 Purpose

The Minicomputer Operations Group (MOG), which is part of the Minicomputer Maintenance and Operations Center (MMOC), is described in this practice. See Practice BR 007-555-352 for a description of the MMOC.

1.2 REASON FOR REISSUE

This practice is being reissued to reflect changes incurred by divestiture.

2. GENERAL

2.1 MMOC Overview

The MMOC is an operations center responsible for the operation of clustered minicomputer hardware associated with centrally developed operations systems and locally-designed systems. In addition, the MMOC maintains the clustered and remote minicomputer systems within its geographic boundaries and for which self-maintenance is feasible.

The work functions of an MMOC are divided into two categories; (1) Minicomputer Operations, and (2) Maintenance. Each of these categories is normally cared for in one of two MMOC subgroups, the MOG or the Minicomputer Maintenance Group (MMG). The MOG and MMG in a model MMOC are joined under common management. The specific level at which they are joined is dependent on local practices and span of control considerations. The organization of a typical MMOC is shown in Figure 1.

2.2 MOG Responsibilities

The MOG is responsible for the day-to-day operation of minicomputers not operated by the user work center (UWC). The MOG-operated systems are clustered in one or more locations. The MOG responsibilities include starting and restarting each system, making entries in the system operation run logs, making computer switch settings specified in the operating instructions, and appropriate media handling and administration. The MOG personnel responds to system error messages and alarms and takes specified actions in response to user trouble reports. It is responsible for sectionalizing minicomputer system trouble conditions and referring them to the appropriate maintenance organizations. The MOG is responsible for analyzing computer performance, preparing management reports, and for environmental and security management.

The MOG work functions listed in this practice are collections of logically-related tasks which are assignable to an individual. In general, a job consists of one or more work functions which have been assigned to an individual.

A detailed description of each of these functions is included in this practice. Acronyms for MOG work functions are introduced for use in discussions pertaining to the interactions between personnel assigned to each of these work functions.

2.3 MOG Work Functions

The work functions incorporated into the MOG are:

- (a) **Minicomputer Operations Work Loading and Logging (MCWLL):** Personnel assigned to the MCWLL, load incoming work requests to personnel assigned to the appropriate work functions. Logging of all MOG activities and providing summaries from the MOG activity logs are also part of the MCWLL function.

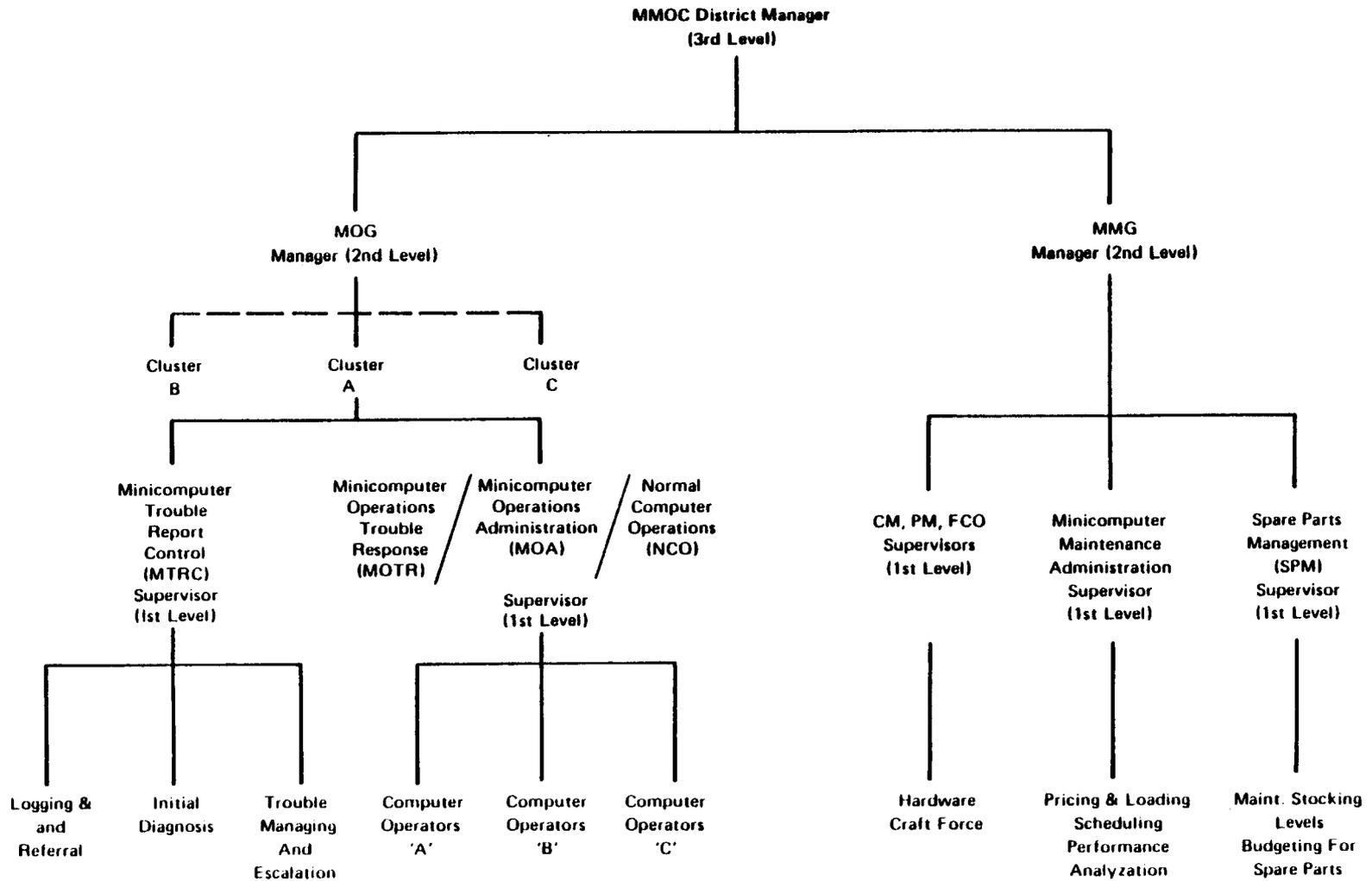


Figure 1. Typical MMOC Organization

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- (b) **Normal Computer Operations (NCO):** This includes the daily tasks associated with the operation of minicomputer systems. Backups, system monitoring, selective report generation, media management, system starts and restarts, and other tasks included in service agreements are all part of the NCO work function.
- (c) **Minicomputer Trouble Report Control (MTRC):** This fulfills the need for a single user call-in point for minicomputer systems trouble reporting. The MTRC personnel sectionalize troubles for referral to the proper repair group. Minicomputer troubles are referred to personnel assigned to the minicomputer operations trouble response (MOTR) work function in the MOG. The MTRC includes coordinating activities which occur in resolving complex system troubles.
- (d) **The MOTR:** This work includes minicomputer operations tasks which are oriented toward resolving trouble conditions discovered through alarms or user trouble reports referred through MTRC.
- (e) **Minicomputer Operations Administration (MOA):** The MOA group is involved in several administrative tasks, including preventive maintenance, change order scheduling, and new release coordination.

3. OPERATIONS PROCESSES

Clustering of minicomputer hardware is recommended to achieve the benefits associated with centralized operation and maintenance. While User Work Centers (UWCs) operate some unclustered minicomputer system hardware, most minicomputer clusters are operated by the Minicomputer Operations Group (MOG). In this practice, the terms "user operated" and "MOG operated" are used to distinguish these two classes of systems.

3.1 Minicomputer Systems Usage and Operation

Minicomputer-based operations systems are designed to support the work functions of one or more work centers. There are two types of human interactions with minicomputer-based systems; (1) those intended to carry out the functions of the users of the system, and (2) those which support the operation of the computer hardware. The first type is referred to as system usage; the second type is referred to as system operation. Some minicomputer systems are designed with an intentional partitioning of human interactions into usage and operation functions. However, other systems are not designed with a clear separation of these functions.

For a system to be MOG operated, the distinction between MOG functions and UWC functions must be clarified. This clarification can be done while negotiating service agreements between the UWC and the MMOC.

A service agreement provides a clear understanding of which minicomputer system interactions are the responsibility of the MOG. The MOG responsibilities denoted in a service agreement, not including trouble response tasks, define the NCO work function for each system.

The NCO work function is incorporated into the UWC for user-operated systems.

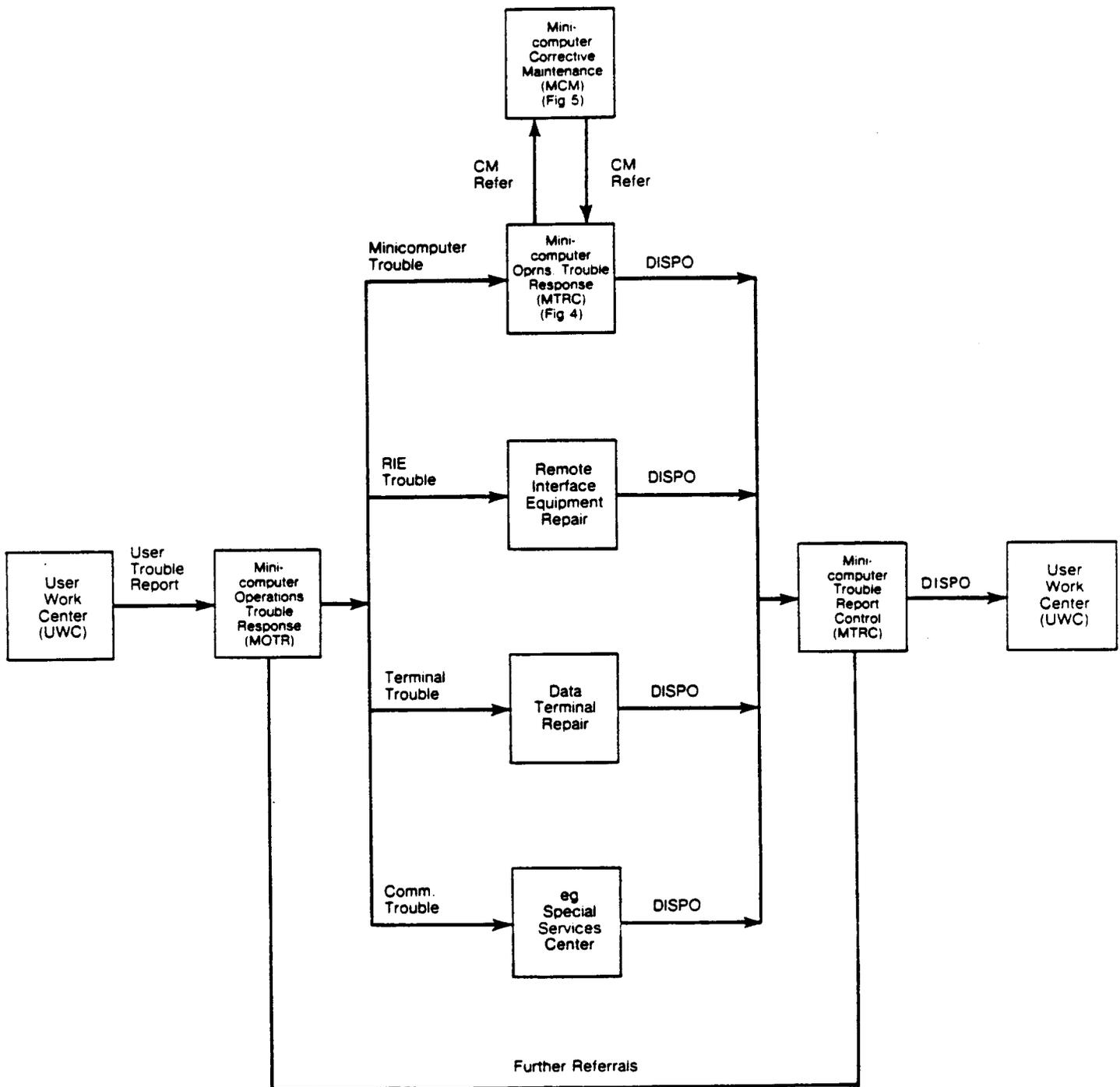


Figure 2. Minicomputer Trouble Response Process

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3.2 Minicomputer Trouble Response

Figure 2 shows a diagram of the minicomputer trouble response process. User trouble reports are received by personnel assigned to the MTRC work function. The MTRC work group performs the preliminary diagnosis required to sectionalize the source of the trouble (e.g., check status of data set). A log is opened for each trouble. Trouble tickets are referred to the work groups responsible for maintaining the subsystem in which the trouble seems to be located. The work group is also informed by computer operators when they discover potentially user-affecting problems.

Shown in Figure 2, a trouble can be caused by faults in communication hardware (data sets and lines), user data terminals, system remote interface equipment, e.g., Centralized Automatic Reporting on Trunks (CAROT), Remote Office Test Line (ROTL), Engineering and Administrative Data Acquisition System (EADAS), EADAS Traffic Data Converter (ETDC), or in the minicomputer itself. An important part of the MTRC work function is to determine the most probable location of a fault and to refer the trouble to a designated work group for more detailed investigation.

For faults sectionalized to the minicomputer, the trouble is referred to a person assigned to the MOTR work function. The trouble response operator can try a procedural fix (e.g., system reboot) or can refer suspected hardware faults to the MMG or responsible vendor for corrective maintenance.

The maintenance person turns the system back to the trouble response operator who restores service if the system is operable. The disposition of the referral is given to the MTRC person, who notifies the user if the trouble is fixed or continues the referral process if the problem remains.

The MTRC gives the user one place to refer all troubles and coordinate activities associated with sectionalizing problems in systems having multiple repair agencies. An indication of trouble is reported when it is discovered so that MTRC personnel will have up-to-the-minute knowledge of all system status. For example, the trouble response operator notifies the MTRC personnel of power failure so that they can respond to trouble calls.

3.3 Minicomputer System Administration

Minicomputer system administration includes management functions in the UWC, MOG, MMG, and MMOC Support Group (MSG). This cooperative administrative process is required to ensure efficient use, operation, and maintenance of minicomputer systems (Figure 3).

This includes the MOA function of the MOG, the minicomputer maintenance administration function of the MMG, and the system management work function in the UWC (Figure 3). The MSG serves as a single point of contact for all interaction with Bell Communications Research and vendor support organizations.

The minicomputer system administration supports distribution of software release materials, assists the minicomputer operations work loading and logging personnel in MOG work force pricing and loading, service agreement arbitration, preventive maintenance policy and scheduling, and hardware change implementation decisions.

4. CENTER FUNCTIONS

Work functions that are part of the MOG are described in this section. These functions are incorporated into the UWC for any minicomputer system not operated by the MOG.

MINICOMPUTER SYSTEM ADMINISTRATION

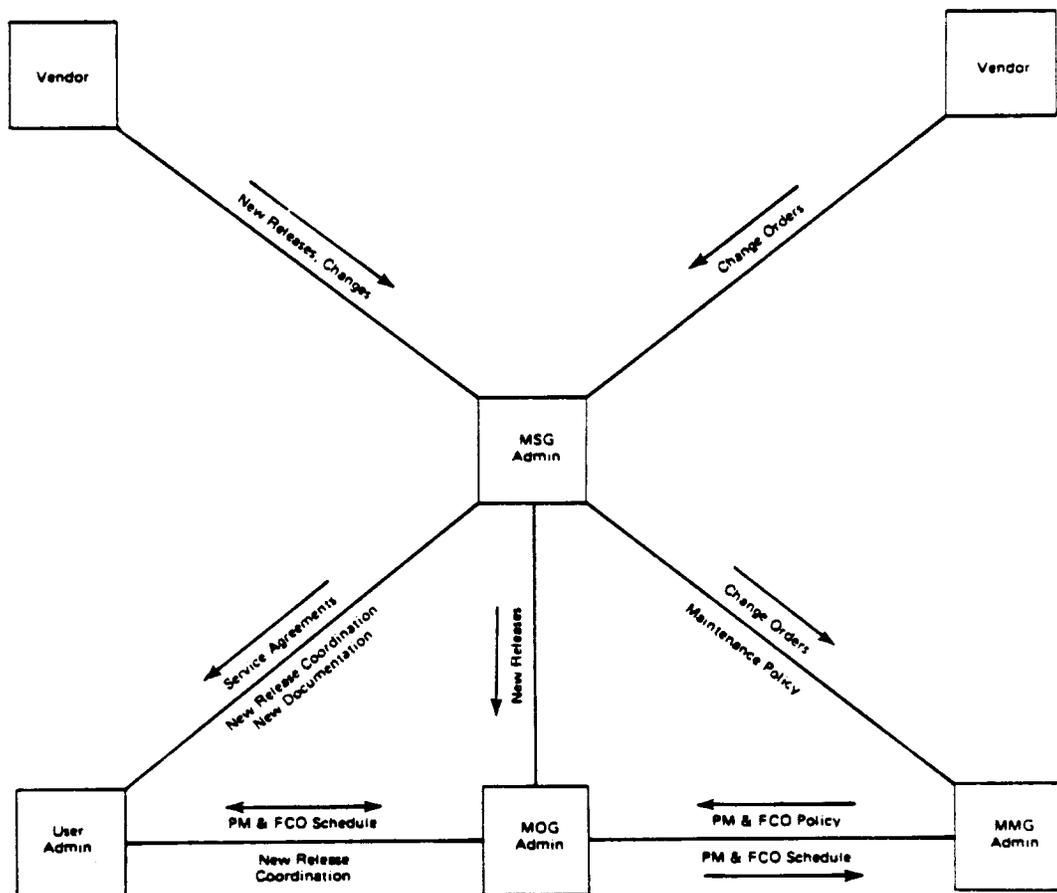


Figure 3. Minicomputer System Administration

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4.1 Minicomputer Operations Work Loading and Logging

The personnel assigned to this function keep the MOG-scheduled activities loaded to personnel assigned to the NCO work function. In addition, work requests are received and loaded to appropriate MOG personnel.

A log is kept up to date for each system. It lists all major system activities including system backups, system changes, maintenance activities, and any system failure or restart.

By inspecting these logs, the MOG should be able to reconstruct all system activities which may affect the users.

The logs should be placed near a system preventive maintenance schedule so the work loader can anticipate upcoming activities.

The system logs are summarized periodically in support of the MOA function.

4.2 Normal Computer Operations

For any given MOG-operated system, the detailed tasks in the NCO work function are laid out in a service agreement between the UWC and the MOG. The computer operations tasks that can be included in service agreements are described in this practice. However, some tasks can be allocated to either the user or the MOG work function (e.g., report generation and distribution). They are included here for completeness. The functions are described in BR 007-550-301.

4.2.1 System Status Monitoring

Monitoring the status of a system is an important part of the NCO work function. This activity includes the following:

- (a) Checking the system's availability to the user. This check could entail entering an appropriate command at the system console terminal to see if the system responds.
- (b) Running and interpreting the outputs of system-provided data base integrity check commands. If a data base irregularity is discovered, the work group responsible for maintaining the system data base is notified (usually the UWC).
- (c) Analyzing system error log outputs to detect problems in system peripherals before these problems cause system outage.

4.2.2 Monitoring Computer Room Environment

To operate properly, minicomputer equipment must have a controlled environment. Temperature, humidity, and power must be monitored to ensure proper operation. Physical security of the minicomputer site must be maintained and access limited to authorized personnel. (See Practices BR 007-590-300, BR 007-590-301, BR 007-590-302, BR 007-590-303, BR 007-590-304.)

4.2.3 Protection of System Software and Data Files

Normal operations tasks involve protecting system software, including both programs and on-line data bases. The primary method for software protection is to establish a regular system backup procedure. Recommended backup procedures are usually provided as part of the system documentation.

Backups are accomplished by loading the appropriate media and executing system commands which copy the contents of the system program or data files from one disk to another or from disk to tape. A proper system backup procedure ensures that updated copies of the system software and data base files are available to restore system service in the event of a failure.

The MOG supervisor and the system manager determine a schedule for system backup activities. Backups are normally scheduled for times when the UWC operations will not be adversely affected. Since disk to disk backups are much faster than disk to tape, they can be scheduled more frequently (e.g., once a day).

Data base backups can be requested by system managers after major data base update activities. System backups should be done before system preventive maintenance or hardware changes. Backups should also be done both before and after any system software changes.

Procedures must be set up to specify the number of copies to be prepared, where they should be kept, and the length of time. Off-premise tape storage is beneficial for disaster recovery (see Practices BR 007-590-300, BR 007-590-301, BR 007-590-302, BR 007-590-303, and BR 007-590-304). A copy of the system software must always be kept on-site for immediate system recovery.

System recovery is accomplished by loading the system from the proper backup copy and applying appropriate transactions which have ensued since the backup. Many systems have transaction logs that can assist in the recovery process. These logs must be dumped periodically to tape and stored in an appropriated location for recovery purposes.

An additional factor in software protection is to maintain a proper level of system security. This can be accomplished by controlling access to system data base update ports carefully. The system user should not be permitted to make unauthorized changes to the software.

4.2.4 System Change Activities

Installing new system release software is part of the computer operations work function. System installation activities are scheduled and coordinated by the MOA work function in cooperation with the system managers and the corporate MSG. The MSG is the primary contact point in the operating telephone company for receiving centrally-developed system changes. With some systems, the computer operator may be asked to enter system data base change transactions.

The MMOC management and the UWC must have a clear understanding as to where the responsibility for data base management lies. This can be accomplished through a service agreement. Since the UWC is closest to the system application, it is the logical home for data base management. However, with some systems, the computer operator may be asked to execute data base update procedures for the system user.

4.2.5 Operator Performed Preventive Maintenance Procedures

The minicomputer system hardware preventive maintenance routines are included in the MMG preventive maintenance work function. Detailed knowledge of minicomputer hardware, associated diagnostics, and adjustment procedures is required.

The following preventive maintenance tasks can be done by computer operators as part of their normal work functions:

- (a) General computer area housekeeping (includes keeping the environment free of dirt which can contaminate computer hardware)
- (b) Cleaning tape machine heads.
- (c) Verifying operation of data communication facilities through routine tests.

These procedures are scheduled on a periodic basis. Most of the procedures do not require bringing down the entire system and can be accomplished during normal system operation.

The computer operator prepares the system for MMG preventive maintenance and hardware change activities. This involves protecting the software in the same manner as in preparing for corrective maintenance. After completion of the preventive maintenance function, the operator restores service to the users.

4.2.6 File Media Management

Minicomputer systems have data files which physically reside on various types of disks and magnetic tapes. Some system disk drives have permanent media (e.g., fixed head disk), but many data files exist on fixed or removable disk packs or tape reels. Part of the NCO work function involves management of these physical media, including mounting, dismounting, and cleaning disks and tapes, as well as loading card readers, punches, and printers.

Some of a system functions require mounting and dismounting physical storage media (i.e., disk packs and tape reels). Usually a message on the system console alerts the operator to the need for media movement.

System storage media must be properly identified with external labels, including the system identification, creation date, and expiration date.

System media (especially backups) contain critical records that must be protected from loss, damage, and contamination. A major NCO responsibility is maintaining a media storage library for the protection of the system data files.

4.2.7 Report Generation and Distribution

For some systems without remote printers, the MOG is required to generate and distribute system reports, either on schedule or on demand. The operator enters a transaction to generate the report and monitors the operation of the printer (i.e., keeps hopper filled and checks for jamming of paper). In general, this task should be scheduled in advance to limit demand requests which could negatively impact MOG work force scheduling.

4.3 Minicomputer Operations Trouble Responses

In Figure 4, a flow chart of the MOTR work function is shown. This function will either be in the MOG or the UWC.

4.3.1 Preliminary Investigation

The first stage of the MOTR work function entails the preliminary interpretation and diagnosis of trouble reports, system alarms, and error indicators. The upper box shown in Figure 4 contains a brief list of the tasks involved.

The investigation may occur as a result of user trouble reports, received from a trouble report controller (MTRC work group) or system error indicators and alarms. All user trouble reports referred by the trouble report controller are logged and tracked. The problem described in a trouble report must be understood clearly before investigation commences. Any ambiguities should be clarified with the originator of the trouble report. In some cases, the interpretation of the trouble report will lead to the decision that no real trouble exists (e.g., user misinterpretation of system documentation) and the trouble log can be promptly closed by informing the trouble report controller. If a problem does seem to exist, preliminary diagnosis must be started by the trouble response operator in the MOG.

MINICOMPUTER OPERATIONS TROUBLE RESPONSE (MOTR)

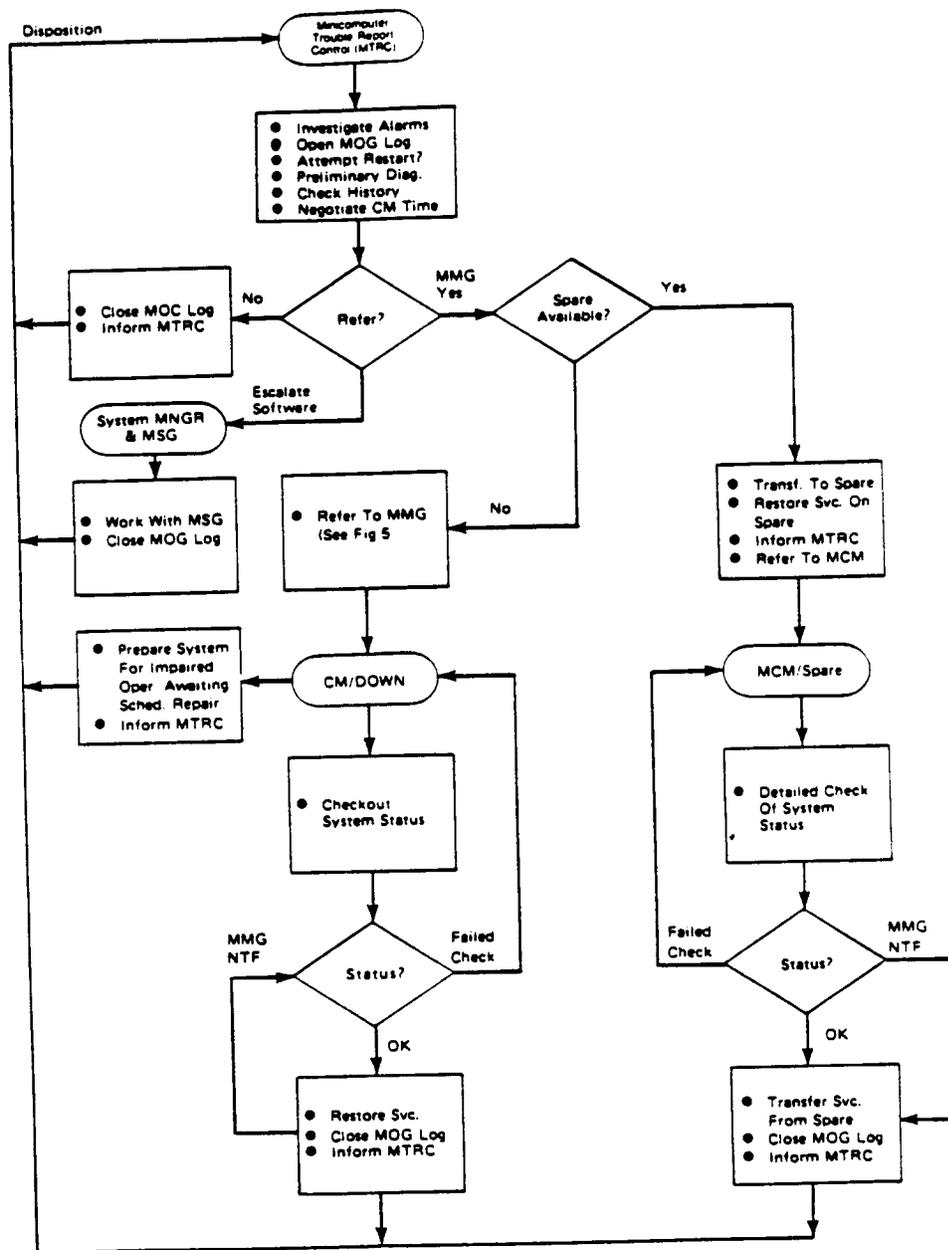


Figure 4. Minicomputer Operations Trouble Response

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When, while investigating system alarms and trouble indicators, the computer operator discovers a potential user-affecting trouble, the MTRC work group must be informed of the system status, a computer operations trouble log entry should be opened, and an operator should be assigned to start a preliminary diagnosis. Once a trouble log is opened, an alarm-indicated trouble is treated the same as a user trouble report.

The operator should use whatever tools are available to obtain a preliminary diagnosis of the location of the fault. Some tools that could be helpful are:

- (a) System trouble history
- (b) System error logs (useful to uncover memory and peripheral faults)
- (c) System internal register readings
- (d) Minicomputer system-provided diagnostics.

By interpreting the available information, the trouble response operator should try to categorize the nature of the trouble. Troubles can be categorized into four basic types:

- (a) **Solid Troubles:** A solid trouble permanently affects the operation for the minicomputer.
- (b) **Transient Troubles:** Some troubles occur once, temporarily affect the system operation (i.e., power hit), and can be cleared through procedural means (e.g., reboot).
- (c) **Intermittent Troubles:** Intermittent troubles continue to appear and disappear until they are cleared. Program bugs and deteriorating components can cause sporadic trouble indications.
- (d) **Marginal Troubles:** Marginal troubles occur during extremes of operating conditions such as environmental limits and periods of low or high usage.

Intermittent troubles can often be resolved temporarily through procedural means (e.g., system reboot or system reconfiguration). The recoverable nature of some intermittent faults makes them very hard to isolate. The pressure to restore service and the existence of transient faults which never return make procedural fixes an appropriate response in many cases. When an intermittent fault persists, the system manager in the UWC should be consulted regarding turning the system over for detailed investigation of the nature of the fault. The MSG can assist in the coordination between the MOG and the UWC. Once the decision is made to take the system from the user, a detailed investigation can be scheduled (immediate or deferred) with the UWC.

Whenever a system crashes (all user functions of the system are lost) due to any type of problem, the trouble response operator should record appropriate status indicators (e.g., predetermined key hardware register readings) for later pattern analysis if the trouble recurs. If a suitable diagnostic "crash program" is supplied with the system, it should be run before the system is referred for corrective maintenance. Intermittent hardware faults are often difficult to find and correct; information which is available only at the crash point is helpful for finding the cause.

After the preliminary investigation, there are three alternatives:

- (a) Return a fully- or partially-operable system to the user.
- (b) Refer the system for hardware corrective maintenance.
- (c) Refer the system for investigation of a suspected software trouble.

The trouble response operator informs the MTRC person of the disposition of the preliminary investigation.

4.3.2 Suspected Software Trouble Referral

If the trouble response operator suspects that a system program software error is present, the system manager should be informed and the log entry closed out. The trouble response operator will assist the system manager or MSG in solving the problem. The system manager has the necessary knowledge to work with the MSG to determine if a software trouble report should be escalated. Generally, the computer operator will not have the required knowledge of the system to investigate software program faults.

4.3.3 Hardware Corrective Maintenance Referral

Referral of hardware problems for corrective maintenance is shown in Figure 4, with two options. The boxes on the right pertain to a hot-spare system to give emergency service restoration to the user. The boxes to the left are the analogous flow for systems without an available spare.

If several systems are in need of corrective maintenance, the operator should use an established emergency recovery procedure to decide which system should go on the spare. Assuming a spare system is available, the operator should follow established procedures to restore emergency service to the user on the spare system. If the system data base has been damaged, it should be restored on the spare system using backup tapes or disks and running the appropriate transaction log tapes. Once emergency service is restored, the MTRC person should be informed. At this point, the system is ready to be turned over to the MMG for corrective maintenance.

Before turning a system over to the MMG, the computer operator should protect the system software (i.e., remove system disk packs) and gather the applicable information to assist the MMG in its diagnosis and repair. In some intermittent fault cases, it is advisable to contact the MMG to see if access to the system is required before the software is removed. Once the MMG has started its work, the operator should inform the MTRC person, who keeps track of time spent and, if necessary, triggers the appropriate escalation measures after predetermined escalation time intervals have lapsed.

4.3.4 System Reconfiguration for Impaired Operation

If the user does not have emergency service (flow of boxes to the left shown in Figure 4) and the MMG cannot fully repair the system (e.g., due to lack of parts), then the trouble response operator will work with the MMG to reconfigure the system for impaired operation (e.g., run with fewer peripherals or put in spare disk drive). After the system is restored to an impaired state, the trouble response operator informs the trouble report controller as to the nature of the service restored. The log is updated to reflect the impaired state but is not closed until full service is restored to the user. When the MMG is ready for final repair, it will inform the operators of the system, and final repair is scheduled as a new activity linked to the original trouble entry on the log.

4.3.5 System Checkout After Corrective Maintenance

Once the MMG has finished repair activities, the operator will check out the system status. If the problem remains, it is immediately referred back to the MMG. With an available trouble response operator, the MMG person who took the referral will wait at the site until the system is returned to an operational mode. This should take no longer than a half-hour if appropriate system check procedures are established for each system. For example, see if the system responds to operator transactions (Figure 5).

If the user has emergency service on a spare system, the trouble response operator can continue a more detailed check of the system status after the maintenance craft personnel leave and before returning the system to the user.

MINICOMPUTER CORRECTIVE MAINTENANCE

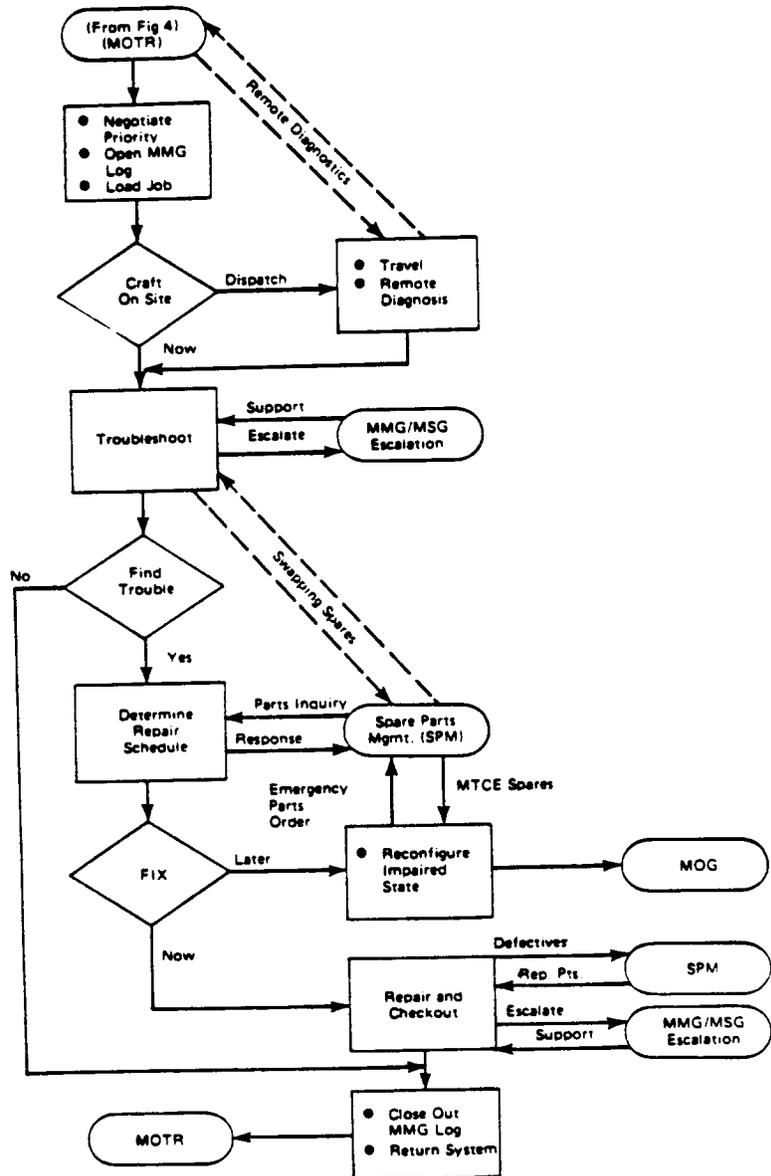


Figure 5. Minicomputer Corrective Maintenance

4.3.6 Service Restoration

Once the system is in a fully-operational mode, service is restored to the user. If the user is on a spare system, a time should be negotiated with the system manager for transferring back to the original system. If the data base needs it, reconstruction should be accomplished by the MOG before the system is returned to the user. Once service is fully restored, the MTRC person should be informed and the trouble log closed. Proper trouble logging, especially in the case of intermittent troubles, will ensure that the appropriate history information is available for subsequent trouble investigations.

4.3.7 Remote Interface Equipment Troubleshooting Procedures

In some systems, remote interface equipment trouble resolution (e.g., CAROT, ROTL) can require the involvement of a trouble response operator in the troubleshooting process. Operations procedures should be established to define the actual tasks included in the MOTR work function for resolving remote interface equipment troubles as these troubles may be dependent upon individual system architect and features.

4.4 Minicomputer Operation Administration

The MOA work function represents the MOG in negotiations between the MSG, the MMA work function, and the system manager in the UWC. The MOA is also responsible for the management functions of the MOG. The major responsibilities of the MOA area include:

- (a) Working with the system manager to negotiate a schedule for system and data base backups.
- (b) Participating in negotiations for service agreements between the UWC and the MMOC.
- (c) Negotiating with the system manager in the UWC for system time to install hardware changes. Requests for hardware changes are received from the MMA.
- (d) Coordinating, with the system manager and MMG personnel, the production of a preventive maintenance schedule for each minicomputer system.
- (e) Assisting in the analysis of system error logs and status check outputs.
- (f) Interfacing with the system manager and MMG personnel in scheduling corrective maintenance for intermittent system troubles.
- (g) Analyzing system activity logs and gathering information for minicomputer activity reports.
- (h) Coordinating system installations.
- (i) Coordinating system software changes and new releases with the MSG, MMA, and the system manager.
- (j) Instituting computer room security procedures.

4.5 Minicomputer Trouble Report Control

The MTRC personnel act as a single point of contact for minicomputer system users and receive and begin investigation of all trouble reports relating to minicomputer systems. For MOG-operated minicomputer systems, the MTRC function is an integral part of the MMOC. For non-MOG systems, the UWC takes on the MTRC work function.

The MTRC personnel receive user trouble reports (preferably from a system manager who can filter out user misunderstandings) and determine the most probable work group to refer the problem. Trouble report control involves establishing methods and procedures to:

- (a) Maintain surveillance over the entire system to detect impaired operation before it becomes service affecting.
- (b) Receive trouble reports from the UWC, computer operators, and maintenance personnel. These include power or environmental problems affecting computer operations, minicomputer hardware or software trouble, system-generated alarms which indicate potential outage, data link or facility failures, and terminal or remote interface equipment troubles.
- (c) Isolate the trouble condition to a particular part of the system.
- (d) Manage and coordinate trouble-clearing activities, including referral to designated work groups, following up on trouble status, and initiating escalation procedures when necessary.
- (e) Keep the system manager informed of trouble status.
- (f) Keep records of system troubles and referrals.

5. MOG EXTERNAL INTERFACES

The MOG has external interfaces with various UWCs, repair centers (e.g., Special Services Center), maintenance vendors, and the MSG. These interfaces can be classified as:

- (a) The MOG center inputs
- (b) The MOG center outputs
- (c) The MOG negotiations involving other work centers.

A list of MOG center inputs is provided in Table A. For each input, this list shows the media, relative frequency, the external organization which the input is received from, and the MOG work function receiving the input. The acronym "UWC" is used to denote any user work center which uses the operations or maintenance services of the MOG. (See section 3.)

A list of the MOG center outputs is provided in Table B. The external organization receiving each output and the associated MOG work function are listed in this table.

A list of the negotiations in which the MOG participates is provided in Table C. The external organizations with which the negotiations take place are shown, along with the corresponding MOG function.

TABLE A. MOG CENTER INPUTS

INPUT	MEDIA	FREQUENCY	FROM	FUNCTION
User Work Requests	Written or Telephone	Daily (as required)	UWC	NCO
Vendor Maintenance Disposition	Verbal	As Required	Vendor	MOTR
Work Group Referral Disposition	Telephone	As Required	SSC (example)	MTRC
New Release Material	Documentation and Tapes	Yearly (as required)	MSG	MOA
User Trouble Reports	Telephone	As Required	UWC	MTRC

TABLE B. MOG CENTER OUTPUTS

INPUT	MEDIA	FREQUENCY	TO	FUNCTION
Data Base Trouble Notice	Telephone	As Discovered	UWC	NCO
Work Request Results	Requested Material	Daily (as required)	UWC	NCO
Scheduled Reports	Computer Printouts	Daily (as required)	UWC	NCO
User Trouble Report Disposition	Telephone	As Required	UWC	MTRC
Software Trouble Referral	Telephone and Written	Rare	UWC	MOTR
Vendor Maintenance Referral	Telephone	As Required	Vendor	MOTR
Work Group Trouble Referral	Trouble Ticket	As Required	SSC (example)	MOTR
System Availability Data	Written	Monthly	MSG	MOA

TABLE C. MOG NEGOTIATION ACTIVITIES

NEGOTIATION	MEDIA	FREQUENCY	WITH	FUNCTION
Data Base Backup Scheduling	Verbal and Written	Monthly (as required)	UWC	MOA
Service Agreement Negotiation	Written	Yearly (as required)	UWC	MOA
Intermittent Trouble Investigation Scheduling	Telephone	As Required	UWC	MOA

6. CENTER ORGANIZATION

The center organization is based on the typical Model B company environment. It assumes recognized standards for span of control, supervision, and averages for Model B minicomputer systems, processors, and clusters. Management functions and responsibilities more specific to the MMOC are also included in these assumptions. (Figure 1).

The MOG organization consists of 48 computer operators supporting 6 clusters and approximately 107 systems. Approximately eight to ten additional personnel are needed to perform the functions of the MTRC group and the MOA group. The management organization includes five first-level supervisors managing the clusters, one first-level supervisor for the MTRC, and one first-level supervisor for the MOA. These seven first-level supervisors report to one second-level manager.

7. RESOURCES

The MOG resources include minicomputer system-provided features, logs and history files, environmental monitors, operation documentation, and maintenance tools.

7.1 Minicomputer-Provided Features

Minicomputer systems have features intended for use by the computer operations personnel. These include an operator command language, system console messages, system alarms, system error log listings, and system-provided diagnostics.

7.2 Logs

The following logs are needed:

- (a) **System Operation Activity Log:** All computer operation activities which could affect the system user or which should be added to the system history file are recorded on this log. The activities which are logged include:
 - System backups
 - System failures and restarts (including key register readings following a system crash)
 - System alarm and console message investigations
 - System maintenance referrals.
- (b) **User Trouble Referral Log:** Every user trouble referred to the MOG, including the symptom, the agency referred to for investigation or repair, and the disposition of each referral is recorded on this log.
- (c) **Purchase Order Log:** All purchase orders, incoming vendor shipments, bills, and payments are recorded and tracked on this log.

7.3 Information Files

Several information files are required for the MOG function. These include:

- (a) **System Media Local File** The minicomputer operators can locate any retained system media (e.g., backup tapes) by using this file.
- (b) **System Error Log History File:** Minicomputer system-generated error log listings should be retained for analysis purposes.

- (c) **Inventory Files:** Inventory files are needed to keep track of spare parts and to have a detailed breakdown of all minicomputer hardware components deployed in systems for which the MMG is responsible.
- (d) **Minicomputer System Operation Documentation File:** Self-explanatory.

7.4 Environmental Monitors

Equipment is needed for monitoring and recording temperature, humidity, and electric power levels in the minicomputer equipment rooms.

Reissues of this section will provide a more definitive list and explanation of equipment necessary for proper environmental monitoring.

8. PHYSICAL DESCRIPTION

Some of the MOG work functions require specially-designed work locations. These work locations are:

- (a) **Minicomputer Equipment Room:** Where the clustered minicomputer equipment is located. Most of the MOG work functions occur in the minicomputer equipment room.
- (b) **The MOG Office Space:** This location is isolated from the noise of the equipment room and is needed to house the desks and files for MOG personnel.
- (c) **Minicomputer System Media Library:** This room has special cabinets for the system media storage.

Reissues of this section will address more detailed recommendations for the physical description and layout.

9. COMMUNICATIONS DESCRIPTION

The MOG is responsible for checking the operational status of the minicomputer communications equipment (e.g., data sets) associated with the clustered minicomputers.

The MOG uses voice telephone communications to receive trouble referrals from users, to refer problems, and to report on the status of trouble referrals.

Work requests from the UWC and other less timely information interchanges are distributed by company mail.

10. GLOSSARY

Abbreviations/acronyms used in this practice are defined as follows:

BELLCORE

Bell Communications Research.

CAROT

Centralized Automatic Reporting On Trunks. This is a minicomputer operations system which periodically tests the operational status of trunks through the use of the ROTL.

EADAS

Engineering and Administrative Data Acquisition System. This is a minicomputer operations system which gathers traffic data from central offices.

ETDC

EADAS Traffic Data Converter.

MCWLL

Minicomputer Operations Work Loading and Logging.

MMA

Minicomputer Maintenance Administration.

MMG

Minicomputer Maintenance Group.

MMOC

Minicomputer Maintenance and Operations Center.

MOA

Minicomputer Operations Administration. This is an MOG work function.

MOG

Minicomputer Operations Group.

MOTR

Minicomputer Operations Trouble Response. This is an MOG work function.

MSG

MMOC Support Group. This is the telephone company staff organization responsible for providing the MMOC with technical support, administrative support, and planning.

MTRC

Minicomputer Trouble Report Control. This is an MOG work function.

NCO

Normal Computer Operations. This is an MOG work function.

ROTL

Remote Office Test Line.

UWC

User Work Center.