

OPERATIONS SUPPORT SYSTEMS
T-CARRIER ADMINISTRATION SYSTEM (TCAS)
ORGANIZATION AND RESPONSIBILITIES

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1. GENERAL

1.01 This section is issued to: (1) describe the organization of a T-Carrier Administration System (TCAS), and (2) define the administrative responsibilities and relationships of various network, plant, engineering, and circuit provision groups with respect to TCAS. This issue covers Phase II TCAS and its specific application to T1 Carrier.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 Terms used in this section are defined in Part 2.

TCAS CONCEPTS

1.04 TCAS is a combination of computer-based equipment, central office equipment, procedures, and personnel for the efficient control of T-Carrier restoration and repair activities and resources. It achieves effective utilization of maintenance lines and repair forces and leads to the reduction of service outage frequency and duration. The basic premise of a T-Carrier Administration System is the existence of a centralized administrative organization capable of directing restoration activities and responsible for the administration of the T-Carrier network. A T-Carrier network is a number of T-Carrier systems, backbone lines, and maintenance lines which can be centrally administered by one group. Thus, a prerequisite for the successful implementation of TCAS is the establishment and effective operation of a T-Carrier Restoration Control Center (TRCC) which administers the utilization of backbone and maintenance lines and controls the line restoration and repair processes. Backbone lines, necessary for the rapid restoration of service by end-to-end patching around line troubles, are important for operation under a TRCC and under Phase II TCAS.

1.05 TCAS is a computer-based system which depends on *valid* information introduced into its network-description and network-status data base. The information and reports generated within TCAS are of value only if they are used to improve service and/or reduce maintenance costs.

1.06 Conceptually, the T-Carrier Administration System must extend as far into the several organizations involved in T-Carrier provisioning, operation, and maintenance as is required to achieve the objectives of effective utilization of resources and improvement of service. The successful implementation of TCAS requires a coordinated effort, transcending many traditional organizational (functional and geographic) boundaries, and involving both management and nonmanagement forces. It requires open channels for the flow of information among managers of several organizations and through the organizations' hierarchies. The performance of the T-Carrier network should be

continually evaluated by using the reports and status information available from TCAS. Directions and policies aimed at correcting deficiencies should be issued. Then the resultant performance changes, as expressed by subsequent reports, should be analyzed to determine what further refinements of procedures and additional maintenance are required.

TCAS IMPLEMENTATION AND ORGANIZATION CONSIDERATIONS

1.07 The implementation of TCAS is an evolutionary process. It should be preceded by the establishment of a TRCC, as stated above. With the implementation of Phase II TCAS equipment, programs, reports, and procedures, the functions of the TRCC personnel change to those of a TCAS Center. The administration under Phase II TCAS, described here, further builds the bases for successful implementation of the advanced phases of TCAS.

1.08 Prior to implementation of TCAS in a T-Carrier network, a TCAS coordinator should be designated. The TCAS coordinator should be delegated the responsibility and authority for accomplishing an effective implementation of TCAS. Likewise, a TCAS contact person should be designated in each of the following functional groupings: switching and transmission operations, outside plant construction and maintenance, engineering, and circuit provisioning. The coordinator should call upon the several contacts for assisting in the implementation by the functional groups. The coordinator need not be given an operational role in any of the functional groups, but should continually monitor the TCAS implementation and operation to recognize and point out areas which require greater cooperation among groups and better performance of responsibilities. Organizational accountability must be established for the T-Carrier network in each of the above functional groupings.

1.09 The T-Carrier network status information is received, processed, stored, and outputted by the computer equipment and programs of the TCAS Central. This equipment is located at the TCAS Center, the primary T-Carrier administrative center. However, the TCAS design is such that it will also support satellite administrative centers serving isolated T-Carrier networks. These centers have access to the capabilities of the TCAS Central via remote interactive terminal devices. They are entirely responsible for the administration of the

designated network, unless control is relinquished during unstaffed periods.

1.10 TCAS is also designed to support direct administration of selected portions of the metropolitan network by certain system control offices (SCO), each responsible for a large number of T-Carrier systems. The maintenance forces or supervision in selected control offices can have access to the capabilities of the TCAS Central via remote interactive terminal devices. The function of maintenance controller for these systems can be relegated to the SCO with overall control and coordination in the network still the responsibility of the TCAS Center.

1.11 It is recommended that the TCAS Center be an operations functional group. The TCAS Center's jurisdiction should not be restricted by district or division boundaries within the network for which it has administrative responsibilities. Its management hierarchy should not be peculiar to only a portion of the network. Specifically, it should be part of a centralized maintenance or network operations division rather than a part of only one of the switching districts in the served network. The common management among the several functional groups involved in the ongoing T-Carrier operations in an area should be at the lowest organizational level possible to expedite cooperation and coordination on problems. This is especially important for the TCAS centralized administration, transmission and switching operations, and outside plant maintenance functional groups.

1.12 It is recommended that the outside plant maintenance dispatch and plant coordination functions be located at the TCAS Center and be made a part of the Center organization. The TCAS Center should have responsibility for coordinating the work forces that are responsible for the installation of new line repeaters, loss measurements, line build out, replacement of repeaters, line repair, and line trouble isolation. The TCAS Center should coordinate the administration of spare plug-in line repeaters.

1.13 It is recommended that the outside plant maintenance crews be equipped and trained to trouble isolate and repair both line (cable) and repeater troubles. Also, the crew should be permitted to cross organizational boundaries in repair activities on a trouble case after the case has been assigned. These recommendations should

help to minimize the time interval required to accomplish line repairs and thus minimize the time on-patch for maintenance lines.

OVERVIEW OF T-CARRIER MAINTENANCE ADMINISTRATION

1.14 TCAS is a system which utilizes the flow of status and control information to help achieve rapid detection, trouble-patterning, restoration, trouble-location, and repair of troubles affecting the T-Carrier network and the served customers. Under TCAS, maintenance and backbone lines are controlled and administered by the TCAS Center personnel. In some installations, access to the TCAS Central is provided to satellite centers and/or selected SCOs via remote interactive terminal devices. The personnel at these locations may be authorized by the TCAS Center to administer backbone and maintenance lines, as needed, for restoration on trouble cases routed to them. Reservation of lines and verification of the patches must be made via access to the Central, thereby assuring centralized control. The operational trouble-handling steps are as follows:

- (1) A T-Carrier system or maintenance line failure or malfunction results in a carrier group alarm or maintenance line status indication at the terminal (end) offices.
- (2) The alarm condition is automatically transmitted via telemetry to the TCAS Central. The computer programs automatically obtain additional information from the data base and from the central office via telemetry to determine which system has failed.
- (3) Meanwhile, the central office forces sectionalize the trouble to the line or a terminal by terminal looping according to Section 365-200-100 and the applicable terminal BSP sections.
- (4) The TCAS Central programs analyze the patterns of the alarms to detect: (1) long outages, ie, hard failures; (2) repeated alarms on a system; and (3) multiple alarms indicating a span failure or common equipment failure (major failure).
- (5) When designated thresholds for the patterns in (4) are exceeded, a "trouble case" is established. It is placed on the work list of the terminal device for the maintenance controller

responsible for the system or span. Trouble cases may also be established by the maintenance controller in response to trouble notification by central office forces.

- (6) The maintenance controller analyzes the trouble case and informs the appropriate central office forces of the trouble, and if it is apparent from patterning, the trouble location. This is especially important in the event of a major failure. The responsible office forces should have already responded to the alarms at their locations.
- (7) Terminal troubles are cleared after further sectionalizing. The responsible office notifies the SCO of the repair. The SCO contacts the maintenance controller and provides the trouble repair information. Step (15) is then followed.
- (8) In the case of a line trouble, the SCO contacts the maintenance controller. Service is restored by backbone line patch(es) authorized by the maintenance controller according to Section 365-226-500. Backbone and maintenance line patches are verified by the maintenance controller via the TCAS Central.
- (9) The system control office directs sectionalization to the faulty span according to Section 365-225-500.
- (10) If it is determined that the alarm(s) is activity-caused, the responsible work force is notified and proper procedures are implemented.
- (11) A maintenance line is authorized by the maintenance controller for use on the faulty span and the backbone line is released, permitting reuse elsewhere. A maintenance line patch is also made on the side-system, if applicable.
- (12) The span control office directs fault-locating to the failed repeater or section according to Section 365-227-500. Troubles within an office are repaired by the office forces. If the trouble is in the outside plant, the span control office requests repair from the outside plant maintenance dispatcher, using the TCAS trouble case number for authorization.
- (13) An outside plant maintenance crew is dispatched to the trouble location to replace/repair and test with the central office.

(14) The maintenance controller is informed of the repair, and the maintenance line is released, permitting reuse elsewhere.

(15) The maintenance controller establishes a trouble case if necessary, enters the trouble location, trouble type, and applicable comments, and closes the trouble case when the system is made normal.

OVERVIEW OF TCAS CENTRAL DATA BASE ADMINISTRATION

1.15 TCAS is dependent upon a complete and current data base describing the T-Carrier systems and maintenance lines which comprise the T-Carrier network and telemetry assignments and arrangements used for monitoring. Data base administration includes several initial and ongoing major activities:

- (1) Collection and review of input data
- (2) Entry verification and processing of data to form TCAS Central data base records (generation and update)
- (3) Coordination of T-Carrier systems turnup.

1.16 The TCAS coordinator is responsible for ensuring that procedures are established for obtaining all input data needed for generation of the initial data base and later updating. Cooperation and coordination in this area are critical, both during the initial turnup and the ongoing growth of the network served.

1.17 There are three types of data needed, as follows:

- (1) Engineering is responsible for ensuring that the supplier provides T-Carrier equipment **telemetry assignment** data to the TCAS Center, either directly or through other procedures.
- (2) The circuit provision group is responsible for providing T-Carrier **system layout** information to the TCAS Center.
- (3) The **office name, corporate structure, and telemetry network** information must be obtained by the TCAS Center from engineering and other sources prior to generation of the initial data base or updating.

1.18 The TCAS Center is responsible for generating the initial data base and updating it from information supplied by the engineering, circuit provision, supplier, and central office operations functional groups.

2. DEFINITIONS

2.01 **Action Code:** Any of several codes which can be inputted into the TCAS Central via a terminal device to indicate the last action taken in loading a trouble case. An example action is "referred to outside plant maintenance crew."

2.02 **Backbone Line:** A combination of maintenance lines "wired through" intermediate offices from one end office to another. It is set aside for rapid restoration in the case of a line failure in systems that have one or more intermediate offices between the system terminals.

2.03 **Carrier Group Alarm (CGA):** In T-Carrier, a line disturbance or equipment malfunction of 300 milliseconds or longer causes the Carrier Group Alarm circuit (Trunk Processing Unit on D3 banks) to operate, and all calls currently in progress are disconnected. The occurrence of this alarm circuit operation is termed a Carrier Group Alarm (CGA). The CGA circuit releases automatically approximately 15 seconds after the trouble condition is no longer present. Disturbances of less than 300 milliseconds cause the framing light on the D1 bank to light but do not cause a CGA or drop calls in progress.

2.04 **Central Office:** A telephone network office containing (from TCAS considerations) T-Carrier transmission equipment. The office may also include TCAS equipment and telemetry.

2.05 **Central Office Forces:** The personnel who perform the restoration, trouble-location, repair, and routine maintenance functions on T-Carrier equipment within a central office.

2.06 **Construction Forces:** The personnel who perform the installation, rearrangement, and splicing functions in the outside cable plant. In some areas they may also initially install the line repeaters and line build-out units and perform installation testing. Their activities on T-Carrier and other types of facilities potentially affect the performance of collocated T-Carrier lines.

2.07 Digital Data System (DDS): A system providing private line, point-to-point and multipoint, duplex digital data transmission.

2.08 Dispatcher: A person who dispatches outside plant (line) maintenance forces to trouble locations for replacement of manhole repeaters or repair of the cable. It is recommended that the dispatcher be located at the TCAS Center.

2.09 End Office: An office which terminates one end of a backbone line.

2.10 Hazardous Condition: Any Telco or non-Telco work activity or any environmental condition which has the potential of disrupting or interfering with the service on the T-Carrier network.

2.11 Hub Office: An office where two backbone lines may be patched together to permit rapid restoration in the case of a line failure, especially when a direct-route backbone line is not available.

2.12 Intermediate Office: An office having an office repeater for a T-Carrier system which does not terminate in that office.

2.13 Maintenance Controller: A person who administratively initiates, directs, and/or monitors the restoration, trouble-location, and repair activities in the T-Carrier network. The person interacts with central office and outside plant personnel and interacts with a TCAS terminal device for trouble case and maintenance line administration. The maintenance control function can be performed from the TCAS Center, satellite centers, or from control offices equipped with TCAS interactive terminal devices.

2.14 Maintenance Line: The combination of span terminating equipment, cable facilities, line and central office regenerators set aside to provide for the restoration of a failed T1 span line between two central offices.

2.15 Major Failure: An event in which a trouble in a common facility (cable sheath, central office power) has caused some, and has the potential of causing all, of the working T-Carrier systems using that facility to fail.

2.16 Network Control Center (NCC): An administrative center responsible for the

management of switching and transmission facilities to meet traffic needs under dynamic conditions.

2.17 Network Portion: A portion of a T-Carrier network which is assigned as a unit to a TCAS maintenance controller terminal. A network portion is specified by a label and a list of one or more systems and/or span control offices which have been grouped together and have been entered into the TCAS Central for maintenance control purposes. Maintenance control responsibility for a network portion includes all of the systems or spans which are controlled by the offices included in the network portion. Each maintenance controller terminal may be assigned one or more network portions. Changes in assignments are permitted.

2.18 Outside Plant Forces: The personnel who perform the repeater testing and replacement and cable repair on the repeatered line. They may also initially install the repeaters and line build-out units and perform installation testing. Their activities on T-Carrier facilities potentially affect the performance of collocated T-Carrier lines. In some areas the line repeater testing and replacement may be performed by central office forces.

2.19 Outside Plant Test Center (OP Test Center): A test center or toll testboard whose functions include cable test and authorization of cable sheath opening.

2.20 Patching: The use of one or more backbone or maintenance lines for restoration or the prevention of service interruption. All patches are to utilize bridging repeaters and be tagged with the authorization number.

2.21 Restoration: The process of returning a T-Carrier system to a reliable in-service state. This may involve restoring service through the utilization of backbone or maintenance lines until repair can be accomplished. The term applies to corrective maintenance activities on intermittent as well as hard-failed systems since an intermittent system is not in a *reliable* in-service state. (The total restoration process includes the trouble-locating and repair activities necessary for returning the system to its "normal" configuration.)

2.22 Satellite Center: An administrative center separated from the TCAS Central but having interactive terminal device access to the TCAS Central. A satellite center is responsible for

administering a T-Carrier *network* which is *isolated* from the primary network administered by the TCAS Center. The responsibilities are similar to those of other maintenance controllers.

2.23 *Serving Test Center (STC):* A test location established to control and maintain circuit layout records, to receive customer trouble reports, to assist in the check out of newly-installed stations, to perform trouble location, and to coordinate service restorals on special service circuits. The STC does *not* coordinate restorals of *T-Carrier systems*.

2.24 *Side System:* The system using the other side of line repeater in unidirectional repeater operation or the system using the other side of a central office 201-type repeater.

2.25 *Span:* A collection of span lines between two central offices.

2.26 *Span Control Office:* The office which is designated on the span line record as the control office for that span and thereby has responsibility for the performance and maintenance of all the span lines between the office and the other span terminating office. Alternatively, the office designated by the system control office or maintenance controller as in the best position to isolate a trouble and coordinate the trouble clearing.

2.27 *Span Line:* The combination of span terminating equipment, cable facilities, line and central office regenerators between two central offices required for a single T-Carrier system.

2.28 *System Control Office:* The terminal office which is designated on the system circuit order and system layout record as the control office and thereby has responsibility for the overall performance and maintenance of the system.

2.29 *T-Carrier Administration System (TCAS):*
A combination of central office equipment, telemetry, centralized computer processor, programs, and peripherals, administrative methods, procedures, and personnel performing the acquisition, analysis, and dissemination of T-Carrier network status information for the efficient control of restoration and repair activities and resources. For example, TCAS accomplishes broad-scale patterning on carrier group alarms to rapidly determine when a major span has failed affecting many systems. It also achieves effective utilization of backbone and

maintenance lines through monitoring thereof at major hub offices. Much of the administration is facilitated through the use of reports to management and feedback to the forces involved. Phase II TCAS includes Maintenance Line Status Indicators (MLSI) and CGA monitoring at remote offices. (Phase III TCAS includes alarm cutoff and sectionalization via Directed Line Monitors from the TCAS Central. Procedures for Phase III TCAS are not given in this issue but will be in a later issue.)

2.30 *T-Carrier Network:* A number of T-Carrier systems, backbone lines, and maintenance lines which can be centrally administered by one group. The size of the network to be handled by this centralized group should be limited only by the amount of maintenance activity and not by district or division boundaries.

2.31 *T-Carrier Restoration Control Center (TRCC):* An administrative center which works with central offices and outside plant forces in a metropolitan area to coordinate rapid restoration and timely repair of T-Carrier systems that have failed in the repeated line. It has complete authority over the use of all backbone and maintenance lines. The TRCC also keeps track of outage time due to bank (terminal) failures and assists in the restoration when necessary.

2.32 *T-Carrier System:* A digital transmission system employing pulse code modulation to provide 24 (or a multiple thereof) 2-way voiceband channels (or combinations thereof) over 2 pairs of conductors or other carrier medium. Digital channel banks (D-bank), ie, *terminals*, are used at each end of the system for conversion between the voiceband channels and the digital signal. The signal is regeneratively repeated at various points in the transmission *line* (T1 line).

2.33 *TCAS Center:* The primary administrative center of TCAS, which includes personnel procedures, and the TCAS Central. T-Carrier network status information is provided by telemetry. Records of trouble case and maintenance line administration are kept via the computer and its peripherals. The TCAS Center or satellite center has complete authority over the use of all backbone and maintenance lines in the network served. A TCAS Center is an evolution of a TRCC.

2.34 TCAS Central: The hardware, software, and data base of the TCAS Center.

2.35 TCAS Central Controller: A person who interacts with the TCAS Central for purposes such as initialization, operating parameter changes, reports definition, and diagnostics.

2.36 TCAS Coordinator: A person who has been delegated the responsibility and authority for coordinating the implementation of TCAS by the several organizations or functional groups involved with the network provision and operation.

2.37 TCAS Data Base: A disc resident collection of structured files which contain detailed descriptive information on T-Carrier system layout and telemetry assignments. In addition, the files contain variable information of a statistical and historical nature. The data base is organized to support such TCAS features as pattern analysis and report generation.

2.38 Terminal Office: An office at one end of a T-Carrier system which contains a terminal (channel bank) of the system.

2.39 T1 Line: The combination of span lines cross-connected at intermediate offices to make up the facilities between a pair of channel banks.

3. TCAS CENTER ORGANIZATION

FUNCTIONS

3.01 The primary functions of the TCAS Center are derived directly from the T-Carrier Administration System objectives of transmission service improvement and effective resource utilization. The flow of information and control *from* the Center is as important as the flow information *into* it. The functions depend heavily on the personnel of the Center for effective accomplishment of TCAS objectives through interaction with outside plant and central office personnel.

Service Improvement

3.02 Reduce Length of Outages. Long outages of T-Carrier facilities affect message network customers attempting calls by reducing the number of trunks available. Outages also affect special service customers whose circuits are assigned to

T-Carrier channels. Through the TCAS Center information flow and administrative control, the outage lengths are reduced by faster detection, patterning, and restoration and by better controlled repair activities. Thus, the functions of the Center include coordination of restoration and repair based upon centralized information and control. The Center is especially vital during major cable or office failure restorations.

3.03 Reduce Frequency of Outages. Frequent outages of T-Carrier facilities greatly deteriorate the service provided to message and special service customers. The cutoff of all calls in progress by a Carrier Group Alarm activation is the most objectionable effect of degraded transmission performance. Often systems are intermittent, producing many CGAs in a short interval. The information and patterning available at the TCAS Center must be utilized to promptly detect and sectionalize the trouble so that restoration and repair activity can be directed to remove the trouble. The problem may be work activity on (or affecting) the T-Carrier facilities or office equipment. An important function of the TCAS Center is to recognize activity-caused alarm patterns, correlate with known hazardous conditions, and promptly notify the alarm-causing personnel. Likewise, T-Carrier systems with marginal performance must be identified by the Center and the system "patched off" until the trouble is remedied.

Resource Utilization

3.04 Improve Maintenance Line Utilization.

- (1) Control the use of maintenance and backbone lines centrally so that they can be utilized on a priority basis consistent with the needs of the network.
- (2) Identify backbone and maintenance lines and systems requiring repair activity so that they are made ready for service.
- (3) Closely control the time-on-patch of lines so that the failed system is repaired and made normal, thus freeing the maintenance line for use on another trouble. This results in better facility utilization and reduced outage time since the probability of having a line available for immediate restoration is increased.

3.05 Improve Work Force Utilization.

- (1) Use the current network status to coordinate and direct maintenance forces for the most effective action according to network priorities, especially during major failures.
- (2) Reduce the amount of activity required in offices to detect and sectionalize troubles by providing centralized information during major failures.
- (3) Identify needs for additional craft training.
- (4) Provide reports and other information needed for more effective management of work forces and needed to evaluate effects of policies, methods, and techniques. Reduce the amount of work force time expended in preparing reports on the network.
- (5) Reduce work force alarm response activity by reducing the frequency of alarms through improved trouble identification techniques.
- (6) Reduce work force activity required for daily maintenance line testing.
- (7) Reduce work force time required for new system turnup verification.
- (8) Improve work force effectiveness by providing consultation on trouble isolation and restoration.

PERSONNEL

Staffing

3.06 The TCAS Center operating force should be staffed with personnel drawn from the groups which have responsibility for the central office T-Carrier maintenance and for the outside plant cable maintenance. This is to provide technical expertise in carrier maintenance at the TCAS Center for administrative functions and for consultation to other forces. This also helps to establish rapport with the other forces.

3.07 The TCAS Center personnel should all be trained in T-Carrier systems operation and maintenance. An understanding of the principles and some familiarity with the equipment of T-Carrier are essential for proper administration of maintenance. Leadership, aggressiveness, and capability of thinking in abstract terms are important traits for the Center personnel.

3.08 The number of personnel required at the TCAS Center is highly dependent upon the number of T-Carrier systems to be served and the failure rate. The specific functions to be accomplished are maintenance control (trouble case and backbone and maintenance line administration), maintenance crew dispatch, TCAS Central Control, data base control, T-Carrier turnup, and supervision (administration of the Center). The maintenance control activity is also dependent upon the parameters selected for definition of trouble cases.

Organization

3.09 The TCAS Center should be a part of a centralized maintenance or network operations division common to the entire T-Carrier network.

3.10 It is recommended that the data base control and T-Carrier turnup functions be performed by a minimum number of individuals, rather than being shared by all personnel on a part-time basis. This is to help control the data base update process. Likewise, the Central control function performance should be assigned to only one individual per shift.

3.11 The dispatch function should be performed by a person who has experience in outside plant operations. It is preferable that the individual be a member of the TCAS Center staff. However, through the use of an interactive terminal device, the individual may be located at a plant control center or other dispatch point.

3.12 The personnel performing the maintenance control function need not all be located in the TCAS Center. Personnel may be located at a satellite center serving an isolated network. The designated personnel of large T-Carrier system control offices may utilize a remote interactive terminal device for maintenance administration. The various personnel should be assigned specific network portion responsibilities by the supervision.

Training

3.13 The designated TCAS Center supervision is responsible for arranging for TCAS training of Center personnel prior to implementation and generic changes in operation and for personnel replacement and growth training. Areas of training include administrative procedures, interactive capabilities, central control, and diagnostics. The supervision is also responsible for assisting in

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introduction of TCAS operating procedures to central office forces.

4. TCAS CENTER RESPONSIBILITIES

NORMAL OPERATION

Maintenance Control Responsibilities

4.01 The maintenance control responsibilities with respect to trouble case and backbone and maintenance line administration are essentially the same whether performed from the TCAS Center, satellite centers, or system control offices equipped for interactive access to the TCAS Central. Detailed maintenance control procedures are given in Section 190-200-030. The maintenance controller's responsibilities are given in 4.02 through 4.09.

4.02 *Trouble Case Administration.* Ensure rapid restoration of T-Carrier service in the case of failures and intermittent performance. Coordinate, monitor, and follow up during sectionalization, fault-location, and repairs to implement restoration. Determine the order of priorities and provide a centralized source of information, especially during multiple failures. The responsibilities are to:

- (1) Accept trouble cases presented by telemetry, telephone, or other means.
- (2) Obtain relevant past history data on the failed system(s) and analyze time patterns. If a failure has cleared after a trouble case has been established, contact the SCO to obtain trouble-location and type information before closing the case.
- (3) Obtain relevant data on other systems and spans currently experiencing failures and analyze cross-section patterns. Look for indications of fuse, span cable, case, bay, or side-system failures. Coordinate with other controllers to achieve maximum use of available information.
- (4) Implement restoration considering service priorities when multiple failures exist. This is especially important in span failures where many lines must be restored by patching. Determine how many systems have failed and the number of restoration facilities available. Coordinate with the Network Control Center or

equivalent to determine the restoration priority per local practices.

- (5) Establish additional trouble cases/tickets as needed for record keeping and backbone and maintenance line implementation.
- (6) Determine if previous action on the trouble case is pending. If so, contact responsible maintenance groups, determine cause for delay, and refer to progressively higher levels of management as successive intervals elapse.
- (7) Correlate failure with any known hazardous conditions to possibly identify trouble location. Give prompt and detailed attention to intermittently failing systems, which significantly deteriorate the network performance. Have corrective action taken on such systems to remove the source of trouble or take the system out of service as quickly as possible.
- (8) If a failure(s) is likely work-activity-caused, based on known work locations and patterns, contact the responsible work force and instruct in proper procedures. Determine if the failure condition is remedied by the cessation of activity, if intermittent.
- (9) If failure location is not apparent, contact the system control office (SCO), if not already in communication and have the trouble sectionalized to line versus terminal.
- (10) In terminal troubles, have the SCO direct the repair activity and report when complete. Proceed to (27).
- (11) In line troubles determine if a backbone line, or combination of lines, is available for restoration if the faulty span has not been identified. In the case of intermittent failures, utilize a backbone or maintenance line to patch out the defective line to reduce the network deteriorating affect of frequent outages. Direct action to locate and repair or remove the source of trouble prior to reusing the defective line.
- (12) Designate the line(s) for restoration and authorize the use thereof (including trouble case number) to the SCO. Give attention to other trouble cases, as necessary.

- (13) Throughout the duration of the trouble case, update the trouble case record of trouble location and type codes and action codes whenever appropriate.
- (14) Ensure that the system is restored via a patch within time limits. Determine the necessity of office force call-outs or deferral until normal working hours. Analyze alternate routing capabilities.
- (15) Upon notification that a backbone or maintenance line patch is complete, verify the line and system status via the central, if available.
- (16) Ensure that the SCO sectionalizes the line trouble to a span in a timely manner, consistent with the maximum interval for a backbone patch.
- (17) Determine if a maintenance line is available for reduction of the backbone patch after the faulty span has been identified. Designate the line for restoration and authorize use thereof (including trouble case number) to the SCO.
- (18) Ensure that the backbone patch is reduced to a maintenance line patch.
- (19) Upon notification that the patch is complete, verify the maintenance line and system status via the central, if available. Verify that the backbone line has been released for reuse and resupplied with a quasi-random signal (QRSS).
- (20) Upon notification that a side system patch is required, proceed as in (17), ensuring that the side system SCO is informed of the patch.
- (21) Ensure that the span control office fault locates the line trouble in a timely manner.
- (22) Upon notification of the fault location, assurance that it was performed properly and accurately, and determination that the trouble lies outside the offices, refer the trouble case to the dispatcher who is responsible for dispatching the outside plant maintenance force for repair.
- (23) Ensure that the outside plant maintenance and office forces trouble locate and repair in a timely manner, consistent with the maximum interval for a maintenance line patch.
- (24) Utilize demand and scheduled reports to identify trouble cases with excessive failure or time-on-patch, indicating delays in action. Proceed per (6).
- (25) Upon notification that the repair is complete and the system is made normal, verify the maintenance line and system status via the central, if available.
- (26) Enter the trouble location and type information. Ensure that the outage time is recorded manually if not automatically by the TCAS central.
- (27) Verify and update the trouble case record. When complete, close the trouble case.

Specifically, with DDS:

- (28) If at any time during a failure it is determined or estimated that an excessive outage length (as stated by Section 314-903-300) will be encountered on a system carrying DDS, notify the DDS-STC of the trouble and the estimated time-to-restore service, according to the above practice.

4.03 Backbone and Maintenance Line Administration. Centralize control of backbone and maintenance lines. Maintain utilization and status records. Coordinate preventive and corrective maintenance on these lines. Responsibilities are to:

Restoration:

- (1) Establish TCAS Central trouble cases as needed for record keeping.
- (2) Determine if a backbone line, or combination of lines, is available for restoration when required on a trouble. Utilize the display and reporting capabilities of the TCAS Central. Consider the availability of work forces and the repeater locations at the offices.
- (3) Designate (to the TCAS Central) the line(s) to be used for restoration, thus reserving the line for use.

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- (4) Authorize the use of the backbone line by issuing the trouble case number and the line number to the appropriate SCO.
- (5) Verify the line use status via the central when notified that the patch is complete.
- (6) Throughout the duration of line utilization, update the trouble case record of action codes whenever appropriate.
- (7) Ensure that the backbone line patch is reduced in a timely manner, consistent with the maximum interval for a backbone line patch.
- (8) Determine if a maintenance line is available for reduction of the backbone patch after the faulty span has been identified. Determine if a maintenance line is available for use on the side system, if necessary.
- (9) Designate (to the TCAS Central) the line(s) for patch reduction or restoration, thus reserving the line for use.
- (10) Authorize the use of the maintenance line(s) by issuing the trouble case number and the line number to the appropriate SCO.
- (11) Verify the line use status via the central when notified that the patch is complete. Verify that the backbone line has been released via the central.
- (12) Ensure that the maintenance line patch is removed in a timely manner, consistent with the maximum interval for a maintenance line patch.
- (13) Upon notification that the system is made normal, verify that the maintenance line has been released via the central.
- (14) Upon receipt of a trouble case indicating that a maintenance line has been seized and used in a patch without prior reservation via the central, contact the office forces involved and their supervision and instruct in the proper procedures.

Preventive Maintenance:

- (1) Utilize trouble cases and reports to identify backbone and maintenance lines which show

defective performance as detected by MLSI measurements, either via the central or by visual observation by central office forces.

- (2) Contact central office forces and direct them to perform testing necessary to fault locate defective lines.
- (3) Request dispatch of outside plant forces or central office forces to repair and test defective lines.
- (4) Report to the responsible group those backbone and maintenance lines in need of rebuilding or rearrangement.

Utilization Analysis:

- (1) Analyze maintenance line utilization reports to identify spans which are frequently in need of additional maintenance lines and to identify routes which are frequently in need of additional backbone lines.
- (2) Analyze maintenance line utilization reports and trouble case histories to determine whether the insufficiencies of maintenance line quantities are due to excessive time on patch or represent real needs due to condition of the span repeatered lines.
- (3) Determine means of overcoming the insufficiencies of maintenance line quantities by closer adherence to maximum time-on-patch intervals and upgrading of the span repeatered lines.
- (4) Report to the responsible group those spans in need of additional maintenance lines to serve the systems utilizing the spans where an insufficient number of lines is available, based upon maintenance line utilization reports and the above analysis.
- (5) Report to the responsible group those routes in need of additional backbone lines to serve the systems utilizing the routes where an insufficient number of lines is provided, based upon maintenance line utilization reports.
- (6) Analyze maintenance line utilization reports to identify spans which have *more* maintenance lines than are needed to serve the systems using those spans. Report to the responsible group

those spans which have surplus maintenance lines.

- (7) Analyze maintenance line utilization reports to identify routes which have *more* backbone lines than are needed to serve the systems using those routes. Report to the responsible group those routes which have surplus backbone lines.

4.04 *Pattern Analysis.*

- (1) Periodically analyze the trouble cases to detect span, terminal, apparatus case, and manhole failure patterns to supplement patterning performed by the TCAS Central processor. Correlate time patterns with known or potential hazardous conditions to identify probable sources of failures and alarm-causing activities. Identify improper procedure practices which lead to alarms.
- (2) Utilize displays and summary reports to obtain additional data helpful in patterning.
- (3) Utilize the results of pattern analysis to determine trouble causes and to effect rapid removal of the trouble source or to effect rapid restoration.
- (4) Utilize summary reports to determine systems or spans with excessive outages, to identify offices with excessive outages, and to identify methods or practices which are resulting in poor network performance. Make recommendations to management for areas of improvement and need for corrective maintenance. Make recommendations regarding whether cable splices should be rebuilt or systems realigned.

4.05 *Hazardous Condition Information.*

- (1) Keep records of splicing operations and hazardous conditions as supplied by the outside plant construction, test center, and cable maintenance forces.
- (2) Enter corresponding hazardous condition notices against appropriate cables or systems in the TCAS Central data base.
- (3) Utilize the hazardous condition notices when attempting to determine the cause of system or span line failures or intermittents.

4.06 *Coordination and Referral.*

- (1) Coordinate by directing, monitoring, or follow up during restoration, sectionalization, fault-locating, and repair. Serve as the liaison between central office and outside plant forces.
- (2) Coordinate during major cable operations affecting T-Carrier.
- (3) If a backbone or maintenance line is not released for reuse within the time limits specified in Section 190-200-001, refer the problem to progressively higher levels of management in the responsible organizations at stipulated intervals until the trouble is cleared.
- (4) Make referrals to higher management of the TCAS Center and the responsible groups' organization on troubles, priorities, or practices needing resolution.
- (5) Coordinate during new digital system turnup.
- (6) Refer line problems requiring cable maintenance to the outside plant cable maintenance crew dispatcher.
- (7) Evaluate impact of abnormal condition outages and coordinate with the Network Control Center per local practices. This is especially important in determining restoration priorities in major failures of many systems.
- (8) Contact responsible group when it is decided that cable splices need rebuilding or systems need realignment based upon pattern and trouble case analysis.
- (9) Ensure that T-Carrier order wire and fault-locating lines are installed and are maintained in operative condition.

4.07 *Consultation.*

- (1) Provide consultation service on T-Carrier maintenance to outside plant and central office forces.
- (2) Provide technical consultation to own management and other organizations on T-Carrier maintenance and operations. Recommend improvements in maintenance operations.

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- (3) Make recommendations for additional training needed by work forces as determined in consultation role.
- (4) Maintain files of current BSPs and engineering information references on the T-carrier network and its maintenance for use in consultation role.

4.08 Interaction With Other T-Carrier Centers.

Coordinate with other TCAS Centers, satellite centers, and TRCCs with respect to T-Carrier maintenance, especially on systems crossing administrative area boundaries.

4.09 Interaction With DDS-STC. Interact with the Digital Data System Serving Test Center per Section 314-903-300. If at any time during a T-Carrier failure it is determined or estimated that an excessive outage length (as stated by the above practice) will be encountered on a system carrying DDS, notify the DDS-STC of the trouble and the estimated time-to-restore service.

Dispatch Responsibilities

4.10 The outside plant maintenance crew dispatch function should be located at the TCAS Center. The dispatcher should be a part of the TCAS Center organization, if possible. The dispatcher should have complete authority over the work (trouble case) assignments of the outside plant cable maintenance crew(s) in the area covered by the TCAS Center. The dispatcher's responsibilities are given in 4.11, 4.12, and 4.13.

4.11 Crew Dispatch. The dispatcher shall direct the outside plant maintenance crews to work on trouble cases brought to its attention by the TCAS Maintenance Controllers and central offices. The dispatcher shall review the trouble case information before making an assignment. The priority of repair of the case with respect to other cases shall be determined and considered. Also, trouble cases shall be correlated so that several may be repaired by one dispatch to a locality if possible.

4.12 Authorizations. The dispatcher shall utilize the trouble case number for repair activities. Outside plant maintenance crews are not to proceed on a case without receipt of the trouble case authorization number. The dispatcher should obtain a communication contact number from the maintenance

crew before work is begun on a cable, splice, or apparatus case. The Outside Plant Test Center should notify the dispatcher when a sheath opening is issued on a cable containing T-Carrier pairs. The dispatcher should keep track of these splicing operations (and any resulting troubles) and ensure that hazardous condition notices are entered.

4.13 Trouble Case Administration.

(1) The repair activity shall be closely monitored by checks with the outside plant maintenance crews to ensure that the repair is accomplished in a timely manner. The dispatcher should assist in resolving technical or work priority difficulties arising between the maintenance crews and the central office forces. The maintenance controller should be advised of progress of repair and abnormal delays. The dispatcher should also assist by contacting outside plant forces when it is suspected that their activity is causing alarms.

(2) When provided with a TCAS Central terminal device, the dispatcher shall utilize the capabilities to obtain information on referred trouble cases and to update the action codes and trouble location and trouble type codes. The trouble cases should be referred back to the responsible maintenance controller for case closing.

(3) The dispatcher should also keep track of items such as whether the trouble was accurately fault located by the central office, whether the apparatus case "0" ring had been replaced, and the value of the air pressure reading in the case. These items could indicate problems or a need for more training.

TCAS Central Control Responsibilities

4.14 The person responsible for the control of the TCAS Central should initialize the Central and set control parameters, evaluate the utilization of TCAS equipment, distribute periodic reports, and run maintenance diagnostics on the Central. Specific responsibilities are given in 4.15 through 4.18.

4.15 Control and Parameter Specification.

- (1) Initialize the TCAS Central per procedures in Sections 190-200-030 and 190-200-200.

Specify parameters required for the TCAS Central operating system, such as time and date. Interactively input directives required to place the Central in the desired state. Control the overall operational modes of the Central and telemetry. Input schedules for major software activities as required by procedures.

- (2) After authorization by supervision, interactively specify the values of the several operational parameters and thresholds of the TCAS Central at time of initialization. Change values as required by load and condition variations per guidance from supervision.
- (3) Monitor the TCAS Central control device output for diagnostic messages.

4.16 *Peripheral Utilization.*

- (1) Specify the utilization of the several TCAS Central peripheral devices where flexibility is provided. In particular, specify the application, availability, and restrictions of the several interactive terminal devices located at the Central or elsewhere. When unmanning the Central, transfer control to a specified remote terminal device if so equipped.
- (2) Specify the system control offices for each network portion and specify the network portions for interactive terminal devices as directed by supervision. Modify the assignments as dictated by availability of personnel and devices.
- (3) Enter directives and perform media/device manipulations as required to keep devices available and to access files required for initialization and operation. Retain files in appropriate storage for intervals specified by supervision.

4.17 *Reports.*

- (1) Define and schedule special reports specified by supervision within the capabilities of the TCAS Central. Schedule standard available reports according to specifications by supervision.
- (2) Remove and separate reports as they are produced by the TCAS Central. Maintain a recent set of reports for use in case of fallback to manual operation. Obtain additional copies needed through local duplication services.

- (3) Check the content of the reports for consistency with specifications and completeness. Take corrective action on erroneous reports. Submit all reports for review by TCAS supervision. Mark or flag report items requiring special attention by users as designated by TCAS supervision.

- (4) Distribute or route copies of the reports to the recipients by district, division, TCAS management, etc.

4.18 *Diagnostics and Maintenance.*

- (1) Monitor the output of the control terminal device for diagnostic or warning messages. Perform diagnostics indicated by procedures in Sections 190-200-300 and 190-200-500 to sectionalize the trouble location to central processor, peripherals, or telemetry section.
- (2) Take action to continue operation with other equipment available.
- (3) Perform corrective maintenance or contact maintenance contract organization to further isolate and repair the trouble.
- (4) Restore Central to full capability on repaired equipment.
- (5) Schedule preventive maintenance of the TCAS Central equipment in accordance with guidelines in Section 190-200-300. Arrange to have preventive maintenance performed outside of normal business hours, if possible, to minimize the impact on TCAS operations.
- (6) Perform preventive maintenance of the TCAS Central equipment as required per local maintenance plan implementation.

Data Base Control Responsibilities

- 4.19 Generate the initial TCAS Central data base and update it as in 4.20 and 4.21.

4.20 *TCAS Central Turnup.* The following activities are required:

- (1) Receive information from engineering, central offices, or supplier on telemetry status and control assignments for T-Carrier equipment.

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- (2) Review information for completeness and accuracy.
- (3) Input above information via terminal device into Central data base.
- (4) Correct and reenter information identified as erroneous by data base generator.
- (5) Receive information from circuit provision group or central offices on T-Carrier equipment, spans, and cable pairs assigned to T-Carrier systems in the form of system layout records.
- (6) Input, correct, and reenter information obtained in (5) according to (2) through (4).
- (7) Initiate any additional data base generator processors according to detailed TCAS Center procedures provided in Bell System Practices.
- (8) Through TCAS Center supervision, obtain assistance of the TCAS coordinator to ensure the flow of information required in (1) and (5) as required.
- (9) Conduct accuracy checks with the central offices according to applicable Bell System Practices to verify the assignments of T-Carrier equipment to systems by comparing the displayed data base contents with the actual equipment utilization in the central offices.
- (10) Errors must be returned to the circuit provision group for correction of layout cards.
- (11) Correct and reenter information identified as erroneous by the verification in (9).
- (12) Prepare an exception report on the above information and route it to the circuit provision group for records correction.

4.21 Data Base Update. Data base update is the ongoing growth and change of the data. It includes additions, changes, and deletions to the data base established during TCAS Central turnup. The following activities are required:

- (1) Conduct the operations specified in 4.20 [(1) through (9)] for new T-Carrier equipment and systems.

- (2) Before a T-Carrier system is put into service, contact the SCO, have the system failed, and verify that the system status is "failed" and that each telemetered terminal status is "failed." Have the system cleared and verify that the respective conditions are "cleared."
- (3) Conduct the operations specified in 4.20 [(10) through (12)].
- (4) Prepare a report of systems verified by (1) through (3) above and route it to circuit provision and to the responsible SCO(s).

Administration of the Center

4.22 Responsibilities for administration of the Center are included in 4.23 through 4.28.

4.23 General.

- (1) Ensure that all inputs needed for generation and updating of the TCAS data base are received in a timely manner. Take steps to obtain inputs from other functional groups, where required, with the assistance of the TCAS coordinator.
- (2) Arrange for sources and flow of data base telemetry network definition and administration structures definition.
- (3) Establish threshold levels for the definition of trouble cases. Have the parameter values entered via the central control device.
- (4) Establish control office to network portion assignments and have these entered.
- (5) Establish and enter the assignment of network portions to specific maintenance controller interactive terminals.
- (6) Arrange for transfer of the TCAS Central control to a remote location when the TCAS Center is unmanned.
- (7) Provide and/or obtain assistance for personnel in accomplishing assigned duties, as required.
- (8) Specify intervals for media retention and disposition procedures.

(9) Establish procedures and responsibilities for implementation of TCAS Central equipment corrective and preventive maintenance.

(10) Additional general responsibilities are listed in 9.01 and 9.02.

4.24 Observation Monitoring.

(1) Ensure that the TCAS Center functions are accomplished properly in a timely manner.

(2) Monitor and supervise the restoration, repair, dispatching, reporting, backbone and maintenance line utilization, Central control, and data base updating processes.

(3) Monitor the status of the network as presented by the TCAS Central and detect and correct abnormal maintenance situations requiring attention.

(4) Monitor the status of maintenance controller work lists. Provide training, assistance, relief or relocation as required to alleviate delays in handling.

4.25 Coordination and Referral.

(1) Coordinate activity among the several work forces, maintenance and control centers, and with administrative peers as required to accomplish T-Carrier restoration and corrective maintenance and new system turnup verification. Refer currently unresolvable problems or priorities to higher levels of management until resolved.

(2) Assist in the turnup of additional remote offices (TCAS implementation) by coordinating checkout and testing where possible from the TCAS Center.

4.26 Analysis and Requirements Definition.

(1) Study needs of central office and outside plant management for reports. Arrange for the production of such reports where practical. Review all generated reports for gross errors and trends in network and personnel performance. Point out problem areas to responsible management.

(2) Study the trouble case activity level under the current set of TCAS operational parameters and thresholds. Determine whether revised

values are needed for efficient Center operations consistent with network objectives of outage frequency and duration reduction and resource utilization.

(3) Analyze the operation of the TCAS Center and determine where improvements can be made by improved utilization of personnel and capabilities.

4.27 Network Improvement Recommendations.

(1) Ensure that backbone and maintenance lines are maintained in a serviceable condition and are properly administered. Ensure that defective lines are repaired and tested promptly.

(2) Notify engineering or other departments of those backbone and maintenance lines in need of rebuilding or rearrangement according to local practices.

(3) Notify engineering of those spans in need of additional or fewer maintenance lines based upon utilization reports and analysis. Make requests for establishment of additional or fewer wired-through backbone lines where indicated.

(4) Notify control office management of systems requiring repair or realignment to reduce frequency of service interruptions.

(5) Notify central office and outside plant management of apparent violations of established practices and procedures leading to frequent or long service interruptions.

(6) Establish improved objectives for network performance with consent of managers responsible for performance.

(7) Analyze ongoing T-Carrier operations under TCAS and recommend to management improved techniques, tools, and procedures where indicated.

4.28 Work-Load Assignment.

(1) Designate the personnel to be responsible on each shift for maintenance control, Central control, data base control, reports generation, and dispatch.

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- (2) Provide additional personnel and/or reallocate network portion assignments to adapt to changing levels of activity in the network covered.
- (3) Adjust threshold levels with discretion to keep the work load at a level compatible with capabilities and network objectives.

FALLBACK AND MANUAL OPERATION

4.29 If the TCAS Central computer or certain major peripherals (such as the disc) are disabled due to a failure or maintenance, it is necessary to continue operation of the TCAS Center in a manual mode. Responsibilities of the personnel are listed below.

Maintenance Control Responsibilities

4.30 *Trouble Case Administration.*

- (1) Utilize past hard-copy listings of system status and trouble case openings to determine present status of the T-Carrier network. Fill out manual trouble tickets (see Section 190-200-001) for failed or on-patch systems.
- (2) Contact system control offices to resolve questionable conditions.
- (3) If the TCAS Central downtime is expected to exceed one-half hour in length, notify the system control offices of the fact. Request that all major failures be reported to the Center immediately after detection.
- (4) Conduct trouble case administration according to Section 190-200-001 (TRCC), utilizing verbal reports of T-Carrier failures as a source of information. Utilize the manual trouble ticket for record keeping.
- (5) Upon resumption of automated TCAS Center operation, open TCAS Central trouble cases for systems still failed or on-patch.

4.31 *Backbone and Maintenance Line Administration.*

- (1) Utilize past hard-copy listings of backbone and maintenance line status to determine present status and utilization of backbone and maintenance lines. Fill out a manual log (see

Section 190-200-001) for each maintenance line currently in use.

- (2) Contact central offices to resolve questionable conditions.
- (3) Conduct backbone and maintenance line administration according to Section 190-200-001, referring to manually updated hard-copy lists of available lines. Maintain such lists so that utilization is coordinated among the several maintenance controllers.
- (4) Upon resumption of automated TCAS Center operation, update TCAS Central trouble cases for systems on-patch with the backbone and maintenance line utilization information.

TCAS Central Control Responsibilities

4.32 *Fallback.*

- (1) When diagnostics or other symptoms indicate that a critical portion of the TCAS Central has failed or requires maintenance, shut down the equipment in an orderly manner per operating procedures. Determine the type of failure, if possible.
- (2) Notify all TCAS Center personnel that manual operation is necessitated.
- (3) Contact TCAS Central equipment diagnostic or maintenance forces to have the Central repaired.
- (4) Keep all TCAS Center personnel informed on the expected time of repair and the failure's effect on the data base and resumption of automated TCAS operations.
- (5) Where possible, resume operations on a limited basis (for example, without telemetry but with automated TCAS Central record-keeping capabilities).
- (6) Schedule periodic preventive maintenance of TCAS equipment during out-of-normal business hours, if possible, to minimize impact on TCAS operations.

4.33 *Recovery.*

- (1) Attempt to resume full capability operation with the minimum impact on the data base. Re-create the data base from magnetic tape backup, if necessary.
- (2) Restore operational parameters per procedures, if necessary.
- (3) Notify all personnel of the availability of the TCAS Central. Assist in resumption of operations.
- (4) Take steps to ensure that the TCAS Central outage interval is compensated for in results summaries.
- (5) Document the failure and repair in the equipment log. Note any time patterns requiring additional corrective actions.

Administration of the Center

4.34 Administration of the Center is as follows:

- (1) Closely supervise the activities of the Center during manual operation. Assist maintenance controllers in determining the status of systems and maintenance lines. Establish priorities in fallback to manual operations.
- (2) Supervise the diagnostics and repair of the Central. Assist in obtaining maintenance forces where required.
- (3) Take action as required to minimize the impact on the T-Carrier network of the TCAS Central failure.

5. CENTRAL OFFICE RESPONSIBILITIES

5.01 The responsibilities of the various central offices under Phase II TCAS are not significantly dependent upon the "availability" (operating versus failed) of the TCAS Central (processor and telemetry). One major exception is listed below under "Backbone and Maintenance Line Surveillance." Detailed procedures for central offices with respect to T1 maintenance are given in Section 365-020-302.

SYSTEM CONTROL OFFICE (SCO)

5.02 The System Control Office has *overall* responsibility for the maintenance, trouble location, restoration, and repair of failed systems.

The SCO may be provided with an interactive terminal device for access to the TCAS Central. When authorized by the TCAS Center, the SCO also performs the functions of a TCAS maintenance controller, listed in 4.01, on trouble cases routed to the SCO.

Failed System Trouble Clearing

5.03 Failed system trouble clearing is as follows:

- (1) Respond to T-Carrier system alarms by determining which system has failed and conducting the terminal looping test and alarm cutoff (ACO).
- (2) Contact the other terminal office and direct terminal looping. Sectionalize the trouble to a terminal or a direction of transmission on the line using the looping results.
- (3) If it is a terminal trouble, direct the responsible office to prepare a trouble ticket, further isolate the trouble, and repair the terminal. Meanwhile, inform the responsible TCAS maintenance controller of the trouble location and type and the expected time to repair. When the system is returned to normal, notify the TCAS maintenance controller of the repair completion. Provide information on the outage time, if requested.
- (4) If it is a line trouble, inform the responsible TCAS maintenance controller of the trouble.
- (5) Provide information to the maintenance controller as required to open a trouble case on the failure.
- (6) Utilize the patterning information provided by the maintenance controller to determine the likely location of the trouble.
- (7) Respond to alarms identified by the maintenance controller as requiring attention, according to (1) through (6) above.
- (8) Confer with the maintenance controller to assist in choosing a backbone line(s) for line restoration patching if the failed span is not apparent or forces are not available for a span patch.

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Note: Do not use a backbone line or portion thereof without authorization from a TCAS maintenance controller.

(9) Direct the restoration patching using the maintenance facility authorized by the maintenance controller and tag with the authorization number. Notify the maintenance controller when the patching is complete.

(10) Direct the sectionalization to the faulty span by arranging line performance checks at each office in the system route.

(11) Contact and confer with the maintenance controller to assist in choosing a maintenance line for span patching.

Note: Do not use a maintenance line without authorization from a TCAS maintenance controller.

(12) Direct the span patching using the maintenance facility authorized by the maintenance controller and have it tagged with the authorization number. Take down (direct) the backbone patches existing on the system. Notify the maintenance controller when the patching is complete.

(13) Initiate and check the progress of the fault-locating by the span control office.

(14) Assist the maintenance controller in closing out the trouble case by providing the required information.

Intermittent System Trouble Clearing

5.04 Perform maintenance tests and corrective action to reduce the frequency of service interruption due to intermittent system failures. Intermittent systems are identified by the TCAS Central and trouble cases are established for the attention of the maintenance controller and corrective action by the central offices.

Utilization of TCAS Generated Reports

5.05 Utilize reports as follows:

- (1) Utilize reports to identify systems requiring additional corrective maintenance or patterns of excessive outages requiring faster restoration.

- (2) Review all reports for accuracy. Notify TCAS Center of known detected errors so that the data collection and processing can be evaluated.

- (3) Prepare facility trouble reports and forward to locally established network control centers.

SPAN CONTROL OFFICE

Failed System Trouble Clearing

5.06 Failed system trouble clearing is as follows:

- (1) Coordinate the span patching using the maintenance facility authorized by the maintenance controller and SCO. Use bridging repeaters. Tag the patch with the authorization number.

- (2) With the assistance of the maintenance controller, determine if a side system patch is required. If so, obtain authorization for and make the span patch on the side system using bridging repeaters after notifying the side system control office.

- (3) Direct the fault-locating to the central office, failed repeater, or cable section. Notify the maintenance controller of the fault-locating results.

- (4) Request a dispatch of an outside plant maintenance crew to the failed repeater or cable section, but only when it is determined that the failure is outside the central office.

- (5) Coordinate with the outside plant maintenance crew via communications facilities to help isolate the trouble and to verify the trouble repair. Inform the SCO when the repair is complete. Remove the span patch when certain of repair. Remove the side system patch if one has been made.

- (6) Inform the maintenance controller and SCO when the system is made normal. Provide information on the trouble location and type.

Utilization of TCAS Generated Reports

5.07 Utilize reports to identify spans or span lines requiring additional testing and subsequent corrective maintenance.

OFFICES (GENERAL)**Trouble Clearing**

5.08 Trouble clearing is as follows:

- (1) Perform trouble detection, reporting, sectionalizing, isolation, and repair per equipment BSPs in conjunction with the system control office.
- (2) Perform patching using bridging repeaters as directed by the maintenance controller, SCO, or control office after receiving an authorization number for use of a maintenance facility. Tag the patches with the number provided. Make all patches with bridging repeaters. Provide pulses and terminations for all unused lines.
- (3) Perform sectionalizing and fault-locating tests as directed by system or span control office.
- (4) Prepare equipment trouble tickets and route to appropriate destination according to the Controlled Maintenance Plan or equivalent.
- (5) Perform corrective maintenance and assist in testing of TCAS equipment per Section 365-330-500 in coordination with and per direction of the TCAS Center.

Backbone and Maintenance Line Surveillance

5.09 When informed by the TCAS Center that manual surveillance of maintenance lines or backbone lines appearing in the remote office is necessary, periodically observe the Maintenance Line Status Indicator (MLSI) to detect the lines in a failed state. Verbally report the status to the TCAS Center as requested. This also applies prior to the installation and operation of TCAS telemetry in the offices equipped with MLSIs.

Preventive Maintenance

5.10 Perform preventive T-Carrier equipment maintenance according to the Controlled Maintenance Plan or equivalent. Test and repair maintenance aids, such as, order wires, fault-locating lines, and patching facilities to keep them in good working condition. Patch off working systems using bridging repeaters during splice rebuilding and cable rearrangements.

T-Carrier System Turnup

5.11 T-Carrier system turnup is as follows:

- (1) Assist the TCAS Center in testing the telemetry wiring and data base assignments for new T-Carrier systems being turned up, according to Section 365-330-200 and related practices.
- (2) Upon successful turnup, route completion notices to other organizations per locally established procedures.
- (3) Update office records upon installation of T-Carrier equipment and system orders and turnup.
- (4) Make cross-connections to TCAS equipment per Section 365-330-200 upon receipt of appropriate circuit order records.

6. OUTSIDE PLANT RESPONSIBILITIES

6.01 Detailed procedures for outside plant forces with respect to T-Carrier operations under TCAS are given in 644 series BSP sections for outside plant. Responsibilities are summarized in 6.02 and 6.03.

CONSTRUCTION FORCES

6.02 Construction forces responsibilities are as follows:

- (1) Obtain a cable sheath opening authorization from the outside plant test center (OP test center) before proceeding with a task on a cable or in a manhole which contains T-Carrier. Inform the OP test center of the communication contact and work location. The OP test center should inform the TCAS Center of all sheath openings.
- (2) Arrange to have central office forces patch off working systems using bridging repeaters prior to splice rebuilding and cable rearrangements if possible.
- (3) Inform the OP test center of all hazardous conditions (current or potential) known on cable routes containing T-Carrier. The OP test center should inform the TCAS Center of all known hazardous conditions.

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- (4) Cooperate with the TCAS Center by ceasing activity when notified that the activity is suspected of causing T-Carrier alarms or disturbances.

MAINTENANCE FORCES

6.03 Maintenance forces responsibilities are as follows:

- (1) Obtain a trouble case number authorization prior to proceeding on a line trouble assignment. Obtain a cable sheath opening authorization from the outside plant test center prior to opening any cable sheath. Repeater cases are to be opened for maintenance purposes only after receipt of a trouble case authorization.
- (2) Accept work assignments on trouble cases from the TCAS Center dispatcher. Report any cases or trouble found to be in the central office to the dispatcher. Report all cases when complete.
- (3) Inform the TCAS Center of the work location and communication contact prior to proceeding on an assignment at each location. Inform the TCAS Center of any known hazardous conditions.
- (4) Cooperate with the TCAS Center by ceasing activity when notified that the activity is suspected of causing T-Carrier alarms or disturbances.
- (5) Establish and maintain communication with the responsible central office(s) during trouble isolating, replacement, and repair. Work with the central office(s) to determine the source of trouble. Report all defective maintenance lines, order wires, and fault-locating wires to the responsible central office. Refer to own management any unresolved maintenance problems.
- (6) Accomplish cable repairs, testing, repeater replacement, and check out according to practices in a timely manner to minimize the number and length of patches in effect. Follow through on trouble isolation and repair to its completion, regardless of location or type. Test T1 repeaters in their own environment with the J98710P Error Detector or equivalent before returning them for repair.

- (7) Utilize reports of outages and maintenance line utilization to identify spans requiring rework and to identify practices and techniques causing network performance deterioration. Take corrective action. Refer unresolvable problems to management.

7. ENGINEERING RESPONSIBILITIES

TCAS IMPLEMENTATION AND GROWTH

Overall Engineering

7.01 Monitor and coordinate the TCAS equipment installation processes. Procedures are given in Sections 865-201-100 and 865-201-190. Given the decision to implement TCAS in a metropolitan area, select the appropriate offices for monitoring by telemetry after consultation with the Network Operations department. Determine the equipment required to implement the system. Considerations such as the following should be included:

- (1) Overall features to be provided.
- (2) Data network engineering.
- (3) Interfaces to other TCAS Centers and other automated maintenance centers.
- (4) Expansion and growth of the T-Carrier network.
- (5) Several smaller T-Carrier networks may be homed on one TCAS Center.
- (6) TCAS equipment maintenance planning.

TCAS Center

7.02 Procedures are given in Sections 865-201-101 and 865-201-102. Engineering consideration of the following is required for the TCAS Central:

- (1) Providing physical accommodations
- (2) Estimating the equipment required including size of network, administrative structure, staffing of the center
- (3) Equipment and telemetry configuration
- (4) Growth in network and TCAS Center

- (5) Sources for the data base input information described in Section 865-201-102
- (6) Adequate telephone and conferencing arrangements for communication with multiple central office and outside plant forces
- (7) Maintenance plan, test equipment, service contract, and training requirements for the maintenance of the TCAS Central equipment.

Central Offices

7.03 Procedures are given in Sections 865-201-110 and 865-201-111. The following engineering activities are required:

- (1) Selection of offices to be equipped with telemetry
- (2) Selection and ordering of the necessary TCAS equipment and telemetry network
- (3) Engineering the retrofit of existing office arrangements
- (4) Consideration of growth beyond initial implementation
- (5) Determination of the number of backbone lines and maintenance lines to be monitored
- (6) Determination of the test equipment and training requirements for the maintenance of TCAS equipment in the central offices.

BACKBONE AND MAINTENANCE LINE REQUIREMENTS

7.04 The backbone and maintenance line requirements are as follows:

- (1) Determine the maintenance lines to be wired through intermediate offices to form backbone lines that can be used for immediate terminal-to-terminal restoration.
- (2) Arrange for centralized monitoring of backbone and maintenance lines via telemetry using MLSIs to eliminate the need for daily and pre-use testing of these lines.
- (3) Determine the need for additional backbone and maintenance lines in certain routes to meet the restoration demands due to higher

failure rates, based upon TCAS line utilization reports. Determine the need for maintenance line rebuilding or rework to improve performance of these lines, as indicated by TCAS maintenance line performance reports and TCAS Center recommendations.

- (4) Initiate and follow up the action required to fill the above needs.

T-CARRIER SYSTEM GROWTH

7.05 The T-Carrier system growth responsibilities are as follows:

- (1) Given the trunking needs (determined by the network department or equivalent), determine the need for additional facilities. Obtain availability information from the Circuit Provision data base.
- (2) After determining need for additional facilities, place orders on the supplier for central office T-Carrier equipment. Specify factory-wired compatibility with TCAS monitoring. Specify TCAS compatible wiring information format and delivery of such information to the TCAS Center by the supplier. Place orders on Outside Plant Construction for new cable emplacement and repeated line installation.
- (3) Notify Circuit Provision of requirements.
- (4) Follow up on facility order issuance and installation activities.
- (5) During T-Carrier growth in smaller offices, evaluate the addition of TCAS telemetry monitoring. Place corresponding TCAS orders when justified.

8. CIRCUIT PROVISION RESPONSIBILITIES

TCAS IMPLEMENTATION

8.01 To be supplied in a later issue.

T-CARRIER SYSTEM GROWTH

8.02 To be supplied in a later issue.

9. ADMINISTRATIVE RESPONSIBILITIES

GENERAL

9.01 The general administrative responsibilities are as follows:

- (1) Provide the resources, direction, personnel, tools, and equipment required to accomplish the functions for which supervision is responsible.
- (2) Ensure that the functions are accomplished properly in a timely manner.
- (3) Establish local practices and policies to ensure coordination.
- (4) Resolve problems and work priorities between organizations.
- (5) Utilize data and reports to determine the effects of operating methods and strive to determine the best operating methods for the network.
- (6) Arrange for training as required or indicated by deficiencies in performance.
- (7) Provide network status information to higher management.
- (8) Set goals for the reduction of service interruptions and implement plans for accomplishment.

TCAS CENTER

9.02 The TCAS Center administrative responsibilities are as follows:

- (1) Establish time goals for the restoration of service and return of backbone and maintenance lines to "available" status, consistent with network objectives, per guidelines in Section 190-200-001. Ensure that central office and outside plant managers are made aware of these goals.
- (2) Establish threshold levels for definition of trouble cases, consistent with network objective and force availability.
- (3) Arrange for 24-hour per day coverage of the TCAS Center capability, either by manning

of the Center or by remoting of control responsibility to a manned location.

- (4) Ensure that adequate telephone service, space, supplies, furnishings, records, and personnel are provided for operation of the TCAS Center.
- (5) Introduce TCAS operations concepts and methods to central office and outside plant supervision and forces. Obtain and utilize feedback on operational successes and difficulties.
- (6) Monitor and supervise the restoration, repair, dispatching, reporting, maintenance line utilization, and data base updating processes.
- (7) Coordinate activity among the several work forces and with administrative peers as required to accomplish T-Carrier restoration and corrective maintenance and new system turnup verification. Refer currently unresolvable problems/priorities to higher levels of management until resolved.
- (8) Assist in the interpretation and utilization of TCAS reports, information, and methods by all users as required.
- (9) Participate in the preparation and administration of the maintenance plan for the TCAS Central and office equipment.

CENTRAL OFFICE

9.03 The central office administrative responsibilities are as follows:

- (1) Ensure timely restoration, repair, corrective maintenance, and return to normal service of T-Carrier problems, especially those brought to attention by TCAS Center personnel or reports.
- (2) Identify troublesome spans, equipment, maintenance groups, procedures, and practices requiring improvement to reduce outage lengths and frequency by utilizing the TCAS reports and other information.
- (3) Ensure that line troubles are verified as not within the central office before referring to outside plant maintenance.

- (4) Ensure that central office forces cooperate with the TCAS Center and TCAS maintenance controllers.

OUTSIDE PLANT CONSTRUCTION

9.04 The outside plant construction administrative responsibilities are as follows:

- (1) Establish and implement procedures for forces in obtaining cable sheath opening authorizations from a central location before proceeding with the job.
- (2) Ensure that hazardous condition notices are supplied to the TCAS Center as soon as the condition becomes known.
- (3) Ensure that the TCAS Center is informed of the communication contact and location of all work forces potentially affecting T-Carrier facilities.
- (4) Ensure that work forces cooperate with the TCAS Center in ceasing activity when notified that the activity is suspected of causing T-Carrier alarms or disturbances. Ensure that proper procedures and techniques are utilized.
- (5) Ensure that working systems are patched off prior to splice rebuilding and cable rearrangements.

OUTSIDE PLANT MAINTENANCE

9.05 The outside plant maintenance administrative responsibilities are as follows:

- (1) Establish and implement procedures for forces in obtaining the trouble case number authorization before proceeding with a work request.
- (2) Ensure that trouble location and repair are accomplished properly and in a timely manner, consistent with the maximum interval for maintenance line span patches. Strive to minimize the number of systems on patch awaiting line repair.
- (3) Identify troublesome spans and maintenance groups and procedures requiring improvement by means of available reports and other observation

techniques. Advise engineering, through appropriate channels, of spans needing rework.

(4) Items (2) through (5) of 9.04.

(5) Establish and implement procedures for the centralized dispatching of work forces on T-Carrier troubles by a dispatcher located at the TCAS Center.

(6) Ensure that central office forces and management are informed of maintenance aids such as order wire, fault-locating lines, and maintenance lines that are not in working order. Ensure that forces cooperate with the central office to clear the troubles in a timely manner.

(7) Establish dedicated (full-time) outside plant maintenance crews authorized, equipped, and trained to isolate, repair, and test both cable and repeater type troubles.

(8) Establish and implement procedures permitting outside plant maintenance crews to work on all locations of a system line trouble assigned without regard to organizational geographic boundaries.

(9) Ensure that all outside plant maintenance crews are equipped with the J98710P Error Detector or equivalent. Ensure that T1 repeaters are tested in their own environment with the error detector before returning them for repair.

TCAS COORDINATOR

9.06 The TCAS coordinator's administrative responsibilities are as follows:

- (1) Take actions required to accomplish an effectual implementation of TCAS by all operational and support functional organizations involved.
- (2) Call upon the several TCAS contacts in the several functional organizations for assistance in implementation.
- (3) Monitor the TCAS operation to recognize and point out areas which require greater cooperation among groups and better performance of responsibilities.

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(4) Coordinate the TCAS Central, telemetry, and remote office equipment ordering, installation, and check out processes.

(5) Provide staff assistance to management for TCAS implementation and operation.

(6) Determine special information and reports contents and distribution needs in the area and find methods of meeting these needs.

(7) Initiate and aid in preparation of the maintenance plan for the TCAS Central and office equipment according to guidelines in Section 190-200-300.