Chapter 7

Control Functions

7-1. Introduction

The C-EMS control functions provide direction for the use and operation of communications facilities, and directly affect the total C-E system. The CSCE and CNCE control functions discussed here complement those of the CSPE and provide direction for the CESE.

7-2. Communications System Control Element (CSCE)

At the higher echelons of command, the communications system control element (replaces SYSCON) is the information and direction center for all subordinate C-E systems. The CSCE maintains the data base for information needed to upgrade, modify, and manage the C-E systems. This data base may be in the form of manual reports or computer stored data. The CSCE functions are oriented toward near real-time management and control and are designed to assure the best performance of the C-E system. The CSCE prepares orders to implement CSPE planning and engineering, performs short-term traffic engineering, makes adjustments in system configuration, and resolves day-to-day troubles and system problems. The functions of the CSCE include the following.

a. Implementation and installation. Prepares installation orders to subordinate elements (CNCE) which will implement CSPE planning/engineering actions for:

Installation, restoration actions, and priorities.

General site locations.

Radio antenna orientation.

Quantity and distribution of essential access and trunking circuits.

Modifications to communications links.

Interface facilities.

Switching, store and forward, and trunking equipment.

b. Monitoring. Maintains, analyzes, and displays system status information, including:

Traffic data.

System and equipment performance data.

Equipment restoral status.

Grade of service.

Outages and backlog situations.

c. Traffic control management. Assures effective customer service through control measures such as:

Routing changes.

Trunk barrings.

Line load controls (minimize).

Trunk and link directions.

Control of queues.

d. Transmission system routing control. Insures best use of resources through:

Reallocation of satellite and airborne radio relay channels.

Allocation of dedicated circuits.

Internodal routings.

Determination of number and distribution of trunking circuits.

Restoration priorities.

e. Reporting. Assembles staff guidance for the commander.

(1) This function, fundamental to efficient C-EMS operations, stems from the requirement to obtain timely and accurate information from the nodes within the network. The data should be provided by means of periodic standardized reports that can be prepared with the minimum expenditure of manpower resources. The information in the reports will be used as the basis for performing other C-EMS functions, as well as for providing inputs to data bases maintained by various elements in the C-EMS management structure.

(2) The CNCE(M) is responsible for direction and control of reporting at a communications node and should specify in an SOP the format and procedures to be used. The CNCE(M) should originate all reports from the node. Within the node, verbal reporting should be the principal means for transferring C-EMS information (written reports being used only when essential for record purposes). For reports outside the node, teletypewriter facilities are normally used, supplemented as necessary by verbal information. The CNCE(M) selects the method and channels used for the transmission of reports. Also, the CNCE(M) determines the necessity for information copies of reports to higher headquarters not in the direct channel for report transmission.

(3) The CNCE(M) collects incoming status reports on installation, equipment, personnel, traffic volume, system and circuit quality, and other related data. It also prepares outgoing status reports on system and circuit quality, fault-correction actions, equipment status, and system and circuit installation or deactivation. In addition, it prepares reports on internodal routing, rerouting, and restorals; and updates information for the CSPE and other reports as required.

f. Records keeping. Initiates, maintains, and retains the information which comprises the C-E data base.

g. Management of COMSEC resources, including keying material. This function is programed for the CY 1980 time frame.

h. Directory control. This function includes the updating and publication of directories, routing guides, etc.

7-3. Communications Nodal Control Element (CNCE)

The control element at its lowest functional level, usually company, is divided into two operational sections: the communications nodal control element (management) (CNCE(M)) and the communications nodal control element (technical) (CNCE(T)).

a. The CNCE(M) is the direct arm of the commander and replaces the facilities control function. The CNCE(M) is primarily responsible for records and reports, accounting, coordination of communications requirements, and management of the communications equipment support elements (CESE).

b. The CNCE(T) has direct control over circuitry and replaces the technical control function. It has all the required resources to perform technical supervision of communications media and equipment, to restore lost or degraded services, to accomplish continual quality assurance of installed circuitry, and to initiate new services on receipt of proper orders (TSO). It also provides technical information to the CNCE(M) for records and reports concerning the installed circuits and systems.

c. For maximum efficiency, the CNCE(M) and CNCE(T) are co-located. When these elements are not co-located, the problems encountered in coordination, transfer of information, and response materially degrade the overall C-E system.

d. The CNCE functions include:

(1) Management and technical direction. Exercises management and technical direction over subordinate activities and CNCE's.

(2) Implementation and execution. Responds to directives from the controlling CSCE.

(3) Line circuit conditioning and interfacing with C-E systems.

Provides equipment necessary to condition analog and digital circuits for best performance.

Provides interface for direct current (dc) circuits, voice frequency (vf) circuits, dc-to-vf conversion, and analog-to-digital conversion, etc.

(4) Activation and deactivation of circuitry.

Complies with CSCE orders.

Directs subordinate activities and subscribers to execute orders.

Coordinates with other CNCE's.

Monitors circuit activation and deactivation.

(5) Technical coordination to accomplish quality assurance programs.

Modifies or corrects circuit configuration and coordinates changes with CSCE.

Tests installations of subordinate CESE's for adherence to established standards.

(6) Maintenance of systems standards.

Conducts in-service and out-of-service quality control through performance monitoring and testing.

Conducts fault isolation on intranodal, internodal, and extension facilities (DCS, allied, commercial transmission systems).

Refers fault isolation findings and corrective actions to appropriate subordinate activities.

(7) Rerouting and restoration of circuits, groups, and systems; updates nodal records to reflect all changes.

(8) Reports and reporting.

Receives reports and takes the necessary action in the areas of activation and deactivation (TSO), resource commitments, trouble conditions, performance data, test results, and facility status.

Sends reports to controlling CSCE and to appropriate subordinate

CESE's concerning activations and deactivations, trouble status, coordination with other CNCE's(T), equipment status, performance data, testing data, and system status.

(9) Records keeping. Records are maintained for the current deployment as opposed to the comprehensive data base maintained by the CSCE. The records include:

Circuit records with orders and technical directives regarding circuit connectivity (TSO), electrical and physical connections at the CNCE nodal facilities for which it is technically responsible, and the availability of circuits and equipment at the node are necessary for real-time operation.

System and circuit status records of all systems and circuits terminating at the node.

Nodal data base update (directories, etc.).

e. The CNCE(M) implements restrictive measures when traffic overloads the system. This involves the restriction of communications service to subscribers on a selective or priority basis to reduce originating traffic for certain areas. The C-E staff of each major command prepares, for the commander's approval, the broad policies for accomplishing the following:

(1) Trunk barring. This measure denies subscriber access to specified trunk groups. The operator at the affected node will no longer service outgoing calls on the designated trunks (manual system).

(2) Minimize. This administrative measure is employed to restrict selected users from the telecommunications system. A directive from the senior commander states the restrictive conditions and subscribers authorized to initiate trunk calls during periods of MINIMIZE.

(3) Line load control. This is a feature of automatic switches which, when activated, permits subscribers to make local calls only. Outgoing trunk calls are prohibited; incoming trunk calls are allowed.

f. At some staff and unit levels, implementing restrictive measures requires a planning and engineering effort. At most operating unit levels, the function is primarily a control measure that is applied at the switching central or at the telecommunications center where message traffic is originated. Each controlling CSCE should be delegated the responsibility of trunk barring and line load control within its area of responsibility consistent with established policies and procedures.

g. With tactical automatic telephone switches, certain features permit data base changes that provide a means of selectively limiting communications capabilities. Some of the restrictive measures available with the automatic telephone switches are line load control, changing class of service marks, and cancellation of alternate routing. Also, the switches contain a rerouting matrix that will permit rerouting of traffic in the event a distant node sustains degradation or traffic overload problems. In some switches, this is accomplished by automatic alternate routing; in others, it must be done by manually changing the routing in the data base.

h. The CNCE(M) establishes authentication procedures to protect information. These procedures will be necessary until total communications security is achieved. Until then, a need exists to enforce authentication procedures used for transmissions on unsecured channels. These procedures are designed to minimize enemy deception. The procedures establish who authenticates; when to authenticate; and how to authenticate. Authentication policy is developed by the Department of the Army. Army publications, AR 380-52 and DA Pam 380-150, interpret the

instructions and provide procedures for use throughout the Army. Authentication tables are generated only by the National Security Agency (NSA) and are available through COMSEC logistics channels. AR 710-2 addresses COMSEC logistics and describes procedures for request and delivery of authentication tables to major commands.

i. Both the CNCE(M) and CNCE(T) participate in restoring circuitry that has become substandard. This function assures the return of communications service to acceptable standards after communications failure or degradation. Participants in restoration actions are at all levels of authority and responsibility, depending on the extent of the damage and the decision level required to accomplish the recovery. Although one unit may be specifically charged with establishing and maintaining signal communications with another, both units are responsible for taking immediate action to restore disrupted communications. Restoration of service is the responsibility of the lowest level CSCE in the C-EMS organization that has control of all nodes affected by the trouble.

(1) Restoration starts when a trouble report is received from a node facility, remote CNCE(T), or CSCE. The CNCE(M) initiates the required actions and coordinates with, adjacent or remote nodes. Each CNCE(M) has the responsibility for restoration actions affecting its nodes, consistent with system priorities and requirements. For rapid restoration of service, the CSCE provides traffic engineering support as required to the CNCE's(M).

(2) The TAS system is preengineered to restore or reroute service through the use of information stored in a data base. For example, in the AN/TTC-38 automatic telephone central office, prepunched routing tapes may be used to change the routing around a damaged node. Future devices will use memory storage to accomplish the same action.

(3) Facility damage requires the submission of a trouble report to the CSCE by the CNCE(M). Damage may be total, such as the complete destruction of a multichannel relay or multiplex terminal; or damage may be partial, such as the loss of a major component of a terminal (power unit, spare transmitter, distribution cable), or antenna damage that produces a link degradation.

(4) When a facility is partially damaged, available spare components are placed in use, pending repair or replacement of the damaged items. This is accomplished at the direction of the CNCE(M). However, if damage is total, a reserve facility must be activated (as approved by the CSCE). Simultaneously, backup service will be initiated. Additional messenger service will be provided and, if needed, RATT which is normally used for control purposes will pass traffic to adjacent nodes. If jamming or interference is involved, total loss of the link might well necessitate a frequency change, as directed by the CSCE or as authorized in the CEOI.

j. Jamming or interference could produce complete loss of link transmission or degradation. The remedies for those problems are essentially the same as those for reported damage and could be included in contingency plans. For example, telephone, teletypewriter, or data traffic would be promptly rerouted. This could involve circuit patching by the CNCE(T) to bypass the affected node or to provide alternate routes and the transmission of teletypewriter traffic by way of alternate tape relays to and from the affected node. In the case of enemy jamming, antijamming techniques are attempted first. If available, a reserve facility might be placed into operation on a new frequency while continuing operation on the jammed frequency.

k. The CNCE(T) physically performs all patching in the control facility at the node. Patching is the installation of permanent or semipermanent connections in order to route circuits between node facilities and access points in a communications system or to redistribute them within a node. Patching may be performed to activate or deactivate service, to implement a restoration plan, or to modify the configuration of a communications system in accordance with changes in traffic loading. Patching can also route a multichannel group directly through a node as part of a traffic engineering plan to bypass a damaged portion of the system. Patching is performed by a CNCE(T). There must be close coordination throughout the implementation process. When a system is engineered, it should be designed so that most circuits are "normal-through" where possible. Patching is performed by a CNCE(T).

(1) When patches are made on a system involving two or more nodes, the requirements are determined by the CSCE performing traffic engineering of the system. The controlling CSCE must initiate the necessary plan and coordinate its implementation through CNCE's(M) at the nodes. Coordination of system patching will be done as necessary between CNCE's(T) at terminal and relay points. Senior signal unit CSCE's are responsible for maintaining a record of all internodal circuit and group patching that they have ordered at nodes within their area of responsibility using the communications control journal (DD Form 1753) and TSO's.

(2) The CSCE's should delegate to nodal commanders the authority to change circuit patches on extension systems installed and operated by the nodal commanders. In addition, CNCE(T) may make circuit changes within a node when they do not affect system capabilities. The CNCE(T) will maintain, on a current basis, a system and circuit record of all patching accomplished at the node.

l. The CNCE(T) tests all circuits and systems according to a schedule dictated by the CNCE(M). Testing is performed on circuits to insure that they meet performance standards prior to implementation of service. Testing is also performed to identify the source of a disruption of service (fault location), to ascertain the extent of damage or degradation, and to verify that required standards of service are being provided after restoration.

(1) The testing process can be initiated as the result of monitoring, the receipt of a trouble report, or by direction of the CNCE(M), based upon a request that originated from outside the node. Facility operating personnel (CESE) will perform testing by using either the auxiliary test equipment or the testing capabilities designed into the system. In some cases, test equipment located in facilities other than the CNCE(T) may be used. Authorization for the use of those facilities is arranged through the CNCE(M).

(2) The testing of circuits is performed according to established procedures. Some circuits may be tested while they are in use. All users of these circuits **MUST BE NOTIFIED PRIOR TO TESTING.** Others must be tested when not in use to prevent the false triggering of alarm circuits within the equipment. In all testing of circuits involving the TAS, the circuit controller in the CNCE(T) must coordinate with the TAS personnel prior to testing. Failed circuits are retested as soon as possible. Restoration is based upon the priority rating of that circuit. of that circuit.

(3) All test operations related to internodal circuits are monitored and coordinated by the circuit controller at the CNCE(T). The installation and maintenance personnel assigned to a node should be directly

responsible for the testing and maintenance of the intranodal communications system.

(4) The CNCE(T) should record the results of testing received from operating facilities (CESE) or other CNCE's(T) on a system and circuit status record.

(5) The CNCE(T) will report the test results to the CNCE(M), which in turn may report to the CSCE. For significant outages, reports may be rendered up through the entire communications chain. For lesser troubles, such as a single (nondedicated) channel or a local telephone problem, reports are generally limited within the node. However, the CNCE(T) of the node should be informed promptly of any testing within the node that is related to actual outages or trends toward interruption of service.

m. The CNCE(T) monitors circuits on a continual basis. This function is for the purpose of observing the performance of communications facilities in order to detect indicators of inadequate performance or to detect trends leading to degradation in performance. Monitoring, an inherent element of facility operation, can be accomplished as prescribed by SOP, as directed, or during performance of preventive maintenance. The function involves observation by operating personnel or by automatic metering, alarms, or monitoring devices built into facility equipment and auxiliary devices.

(1) All operating facilities of a node are monitored, including multichannel transmission terminals and relays, multichannel radio and cable extension links, multiplex equipment, automatic telephone switches, and the teletypewriter/data facilities of the terminal and the tape relay sections. When monitoring of TAS circuits could result in triggering of alarm circuits, TAS personnel must be notified.

(2) The CNCE(M) has overall responsibility for the proper accomplishment of monitoring at a node and should provide appropriate SOP guidance for the operating facilities.

(3) The CNCE(T) is responsible to the CNCE(M) for monitoring the performance of all internodal circuits. The CNCE(T) maintains a system and circuit status record. This record shows the status of systems and circuits terminating at the node. The CNCE(T) will rely mainly on operating facility personnel (CESE) to report any noted link or equipment outages or degradation. Monitoring results are reported by operating personnel to the CNCE(T) as required by local procedures or as directed by the CNCE(M). The CNCE(T) reports to the CNCE(M) which, in turn, may relay the information in the appropriate format to a CSCE. However, all monitoring results should not necessarily be reported outside the node. The CNCE(M) makes the decision as to when monitoring results will be reported to the controlling CSCE.

7-4. C-E System Deactivation

a. The following establishes guidelines for commanders when closing down a system. The primary objective is to insure that everyone involved is properly notified of closure time, procedures, actions, and directions to follow before, during, and after the closure. There are two methods of notification: normal chain of command channels and technical control channels.

b. Overall responsibility for closure rests upon the commander of the system. He delegates this responsibility downward, through both the chain of command and the technical control channels (C-EMS), to rest finally with the CSCE and CNCE's directly involved in the deactivation of the system.

c. The closing of a C-E system, or any portion of it, is a control procedure and requires close coordination between all elements of that system. Past experience shows that the process of closing a C-E system can vary from a smooth operation to a gigantic "snafu." The experience level of the personnel controlling and operating the systems is a critical element; and because experience varies from person to person, a precise method of control is required.

d. Closure orders which include the activities involved, closure times, and actions to be followed after the closure are sent to the CSCE and CNCE's. Both command and technical control channels are used to insure that everyone involved "gets the message."

SECURITY NOTE: All orders or instructions relative to closing down the C-E system must be authenticated according to instructions provided by the CEOI. This requirement applies regardless of how the instructions or orders are issued.

e. The CSCE, acting through the controlling CNCE, directs and supervises the closing of the system. The CNCE, in turn, notifies all subscribers of the closure time. Normal chains of command, engineering orderwire, and other engineering channels are used to notify all systems, relays, and subscribers, including users of "strap-through" and "dedicated" (sole-user) circuits.

f. When closure time occurs, the CSCE/CNCE's direct subordinate units to terminate subscriber service. The CNCE verifies termination of all subscriber service and notifies the CSCE. The activation/deactivation reports may be used to conclude this action; if the situation permits or warrants it, however, verbal notification will suffice.

g. After the CSCE receives verification of subscriber termination, the CSCE notifies the controlling CNCE to begin closing down the trunking system. The CNCE then directs operating personnel of the terminal equipment (carrier, multiplex, or radio) to notify all relays and terminals in the system to close down. Each one closes, in turn, beginning with the most distant point, thus assuring that all units in the system are notified of the action to close and, in fact, do close.

h. After receiving verification that the entire system has closed, the CNCE files an activation/deactivation report with the CSCE and then closes down. The CSCE, at this point, records the time of closure and reports to higher headquarters that the system is closed, and any communication required is over single channel radio nets.