TOPIC 1

TECHNICAL CONTROL

INTRODUCTION

In a publication designed to provide communications skills within a technical control facility, it is fitting to quote from a speech made by a former Chief of Naval Operations (CNO), Admiral Forrest P. Sherman:

> "Successful communications systems do not just happen. They represent the combined skills of the engineer, the craftsman, the technician, and the operator. They reflect the countless hours spent at drawing boards and in the development laboratories of a vast electronics industry, the painstaking work of artisans and trained installation teams, the carefully drawn plans of the tactician, and the proficient hand of the operator who ultimately mans the controls."

Your skill and knowledge as a technical controller are very important in ensuring the mission accomplishment of naval communications. That mission is to provide and maintain reliable, rapid, and secure communications (based on war requirements) to meet the needs of naval commands, facilitate naval administration, and satisfy the Joint Chiefs of Staff (JCS).

For one person to know all there is about existing Technical Control Operations (TCO) is virtually impossible. This module is designed as a training tool and a basic guide for technical control personnel.

With the variety of equipment now available to different Naval Security Group (NAVSECGRU) and Special Intelligence Communications (SPINTCOMM) sites, the missions and types of equipments used vary. We will identify the most commonly used equipment and give a general introduction to the Technical Control Facility (TCF). Every effort has been made to obtain the most current information.

TECHNICAL CONTROL FUNCTIONS

Technical control is the function of controlling the performance of a telecommunications system. Its objectives are to

- maintain the operational status of the system to meet communications requirements;
- provide quality assurance and quality control;
- provide alternate routing;
- provide patching, testing, and direction;
- provide user education; and
- provide coordinating, restoring, and reporting functions necessary for effective maintenance of transmission paths and facilities.

Technical control is a distributed function. It is performed through the coordinated actions of personnel at different points throughout the system.

DUTIES AND RESPONSIBILITIES

Your duties and responsibilities as a technical controller will vary, depending on your command's size and mission. TCO is an integral section of each NAVSECGRU and SPINTCOMM station, because traffic flow is dependent

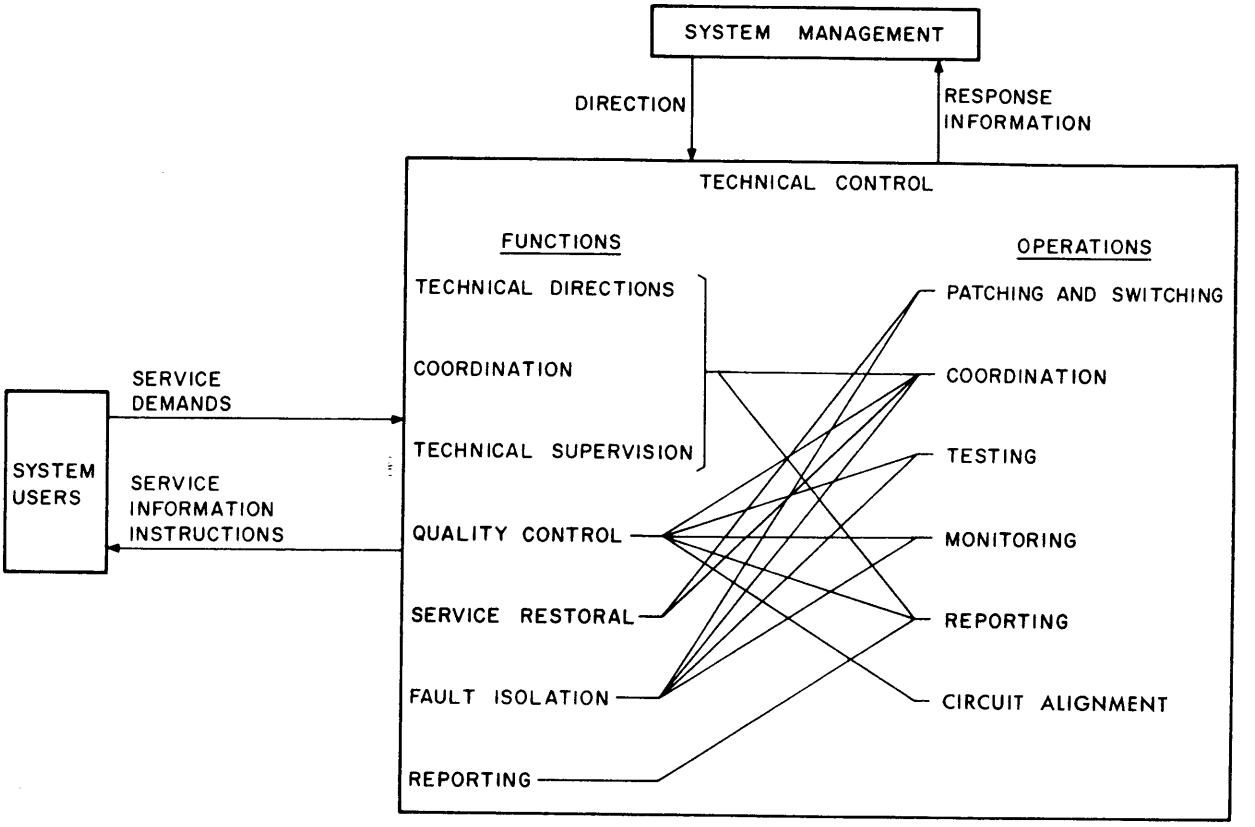

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Figure 1-1.—Technical control responsibilities, functions, and operations.

upon the quality of circuits and equipment provided.

The role of the technical controller is of paramount importance in analyzing circuit and equipment deficiencies. The quality and quantity of traffic passed on any circuit is directly related to the efficiency of the technical controller. The following are some of the specific duties of a technical controller:

- Maintain a constant watch over all circuits by use of page printers, distortion analyzers, meters, and oscilloscopes to ensure that circuits are operating properly.

- Conduct special circuit or in-station system performance tests.

- Analyze all factors involving circuit interruptions, failures, or disturbances, and initiate appropriate preventive or corrective action.

- Exercise technical control over the remotely operated cryptographic facilities and traffic sections. (This control will be limited to technical functions necessary to maintain continuity and quality on operational circuits.)

- Coordinate with circuit-supplier facilities on circuit interruptions, frequency changes, frequency checks, circuit restoration, equipment performance tests, and similar technical functions.

- Report immediately all circuit outages (including those attributed to in-station difficulties) to the commercial circuit suppliers or to the Defense Communications System (DCS).

- Substitute equipment by patching.

- Provide patching service for teletypewriter conferences and emergency circuits.

Evaluate new or replaced equipment installed on an operational circuit.

Coordinate with local and distant facilities in the performance of the previously mentioned functions.

Maintain required logs and records to provide a comprehensive picture of circuit conditions at all times.

Conduct on-the-job training for lesser qualified controllers.

To combine communications circuits into a network, the principles of system engineering must apply. The system has a common purpose, compatible equipment, and standard procedures and practices. These procedures and practices assist technical controllers in working with adjoining stations and in coordinating with commercial or DCS circuit-supplier facilities. A few of the major coordination problems confronting a controller are circuit interruption, frequency changes, circuit restoration, and equipment performance tests. Standardization of equipment, procedures, and practices also permits the transfer of personnel throughout the system with a minimum amount of training.

All the interrelated functions of technical control are performed through the following operations:

Patching and switching: To restore service, provide access to specific facilities, conduct tests in fault isolation, and monitor performance.

Coordination: To perform technical control activities, interface with maintenance personnel, and communicate with users on matters affecting their use of the system.

Testing: To isolate faults by inserting and measuring test signals; provide periodic, routine assessments of system status; and assist in circuit-alignment procedures.

Monitoring: To detect trends of deterioration, assess the current condition of circuits, and measure traffic usage.

Reporting: To inform system management personnel and Operations and Maintenance (O&M) agencies of system status, both routinely and by exception.

Circuit alignment: To provide and maintain circuit operating parameters within specified performance limits.

See figure 1-1 for a diagram of technical control responsibilities, functions, and operations. This illustrates the relationship of technical control to overall system management, and between technical control functions and operations.

PHYSICAL STRUCTURE OF TECHNICAL CONTROL SYSTEMS

To perform technical control operations, a number of equipment categories are necessary. For example, patching requires jackfields and patch cords. When patching is augmented by switching, a variety of switches are necessary. In many newer installations, switching replaces manual patching. Testing, monitoring, and circuit alignment require the use of test equipment, as well as patching and switching equipment. The monitoring operation also uses alarms. Coordinating and reporting require special systemwide communications channels, called *orderwires*. Intercom systems provide for local coordination.

When jackfields are installed in a standard electronic equipment rack, the result is a *patch bay*. When a standard electronic equipment rack includes test equipment, it is called a *test bay*. A combination of patching (or switching) and test equipment in one or several bays is called a *Patch and Test Facility* (PTF). A PTF is usually associated with a subsystem to a specific transmission medium. It contains all of the equipment needed to monitor and test that subsystem for maintenance purposes. PTFs also have necessary orderwires and intercom systems to perform coordination within the overall technical control function.

Although PTFs are actually facilities used for exercising technical control, the term *Technical Control Facility* (TCF) refers to the equipment assembled at a higher organizational level. Moreover, the assembly of the equipment is arranged along certain formal patterns. This provides for standardization throughout the telecommunications system and with other telecommunications systems following the same

rules. See figure 1-2 for the relationship between TCFs and PTFs.

COMMUNICATIONS SECURITY IN TECHNICAL CONTROL

Communications security in technical control is where electronic circuits, components, equipment, and systems handling *classified*, plain-language information in electrical signal form (RED) are separate from those handling encrypted or *unclassified* information (BLACK). The terms *RED* and *BLACK*, as used in this concept, clarify specific criteria relating to, and differentiating between, such circuits, components, equipments, and systems, as well as their locations.

Separate TCFs or PTFs may be used in RED and BLACK areas, or there may be separate RED and BLACK areas in a TCF or a PTF. When this occurs, the RED and BLACK equipments must be physically and electrically separated. Communications security (COMSEC) interfacing with the communications system and with each other are governed by the engineering and installation plans for the particular equipment and system. In the Navy, these are Space and Naval Warfare Systems Command (formerly Naval Electronics Systems Command (NAVELEXSYSCOM)) standard plans. A typical facility is shown in figure 1-3.

DEFENSE COMMUNICATIONS SYSTEM (DCS)

The purpose of the National Security Act of 1947 was "to provide for the effective strategic direction and operation of the Armed Forces under unified control." Effective strategic direction required unified and efficient communications facilities—a common communications system linking all defense activities together. The result was the DCS.

Since 1961, communications procedures (other than for tactical communications) have been standardized throughout the Department of Defense (DOD) by the DCS. The DCS, as part of the overall national communications system, comprises the major portions of the individual

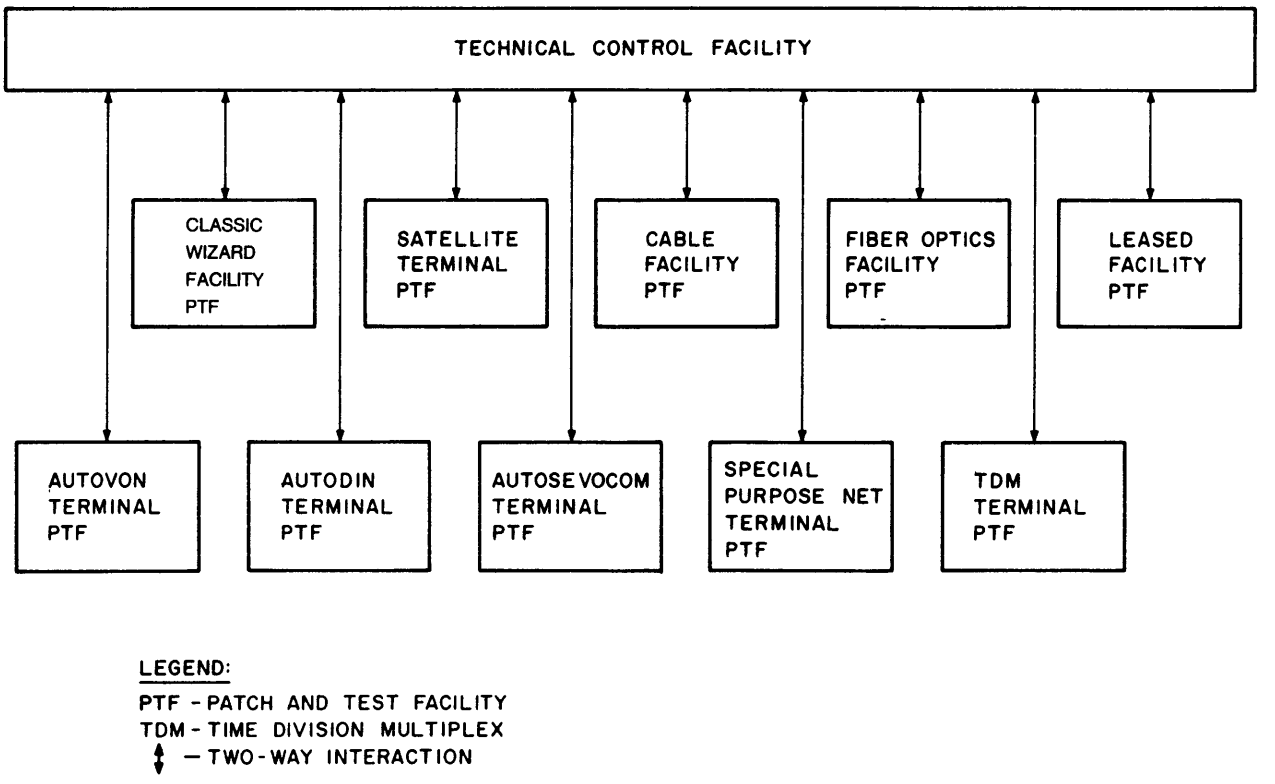

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Figure 1-2.—Relationship between the technical control facility and the patch and test facilities.

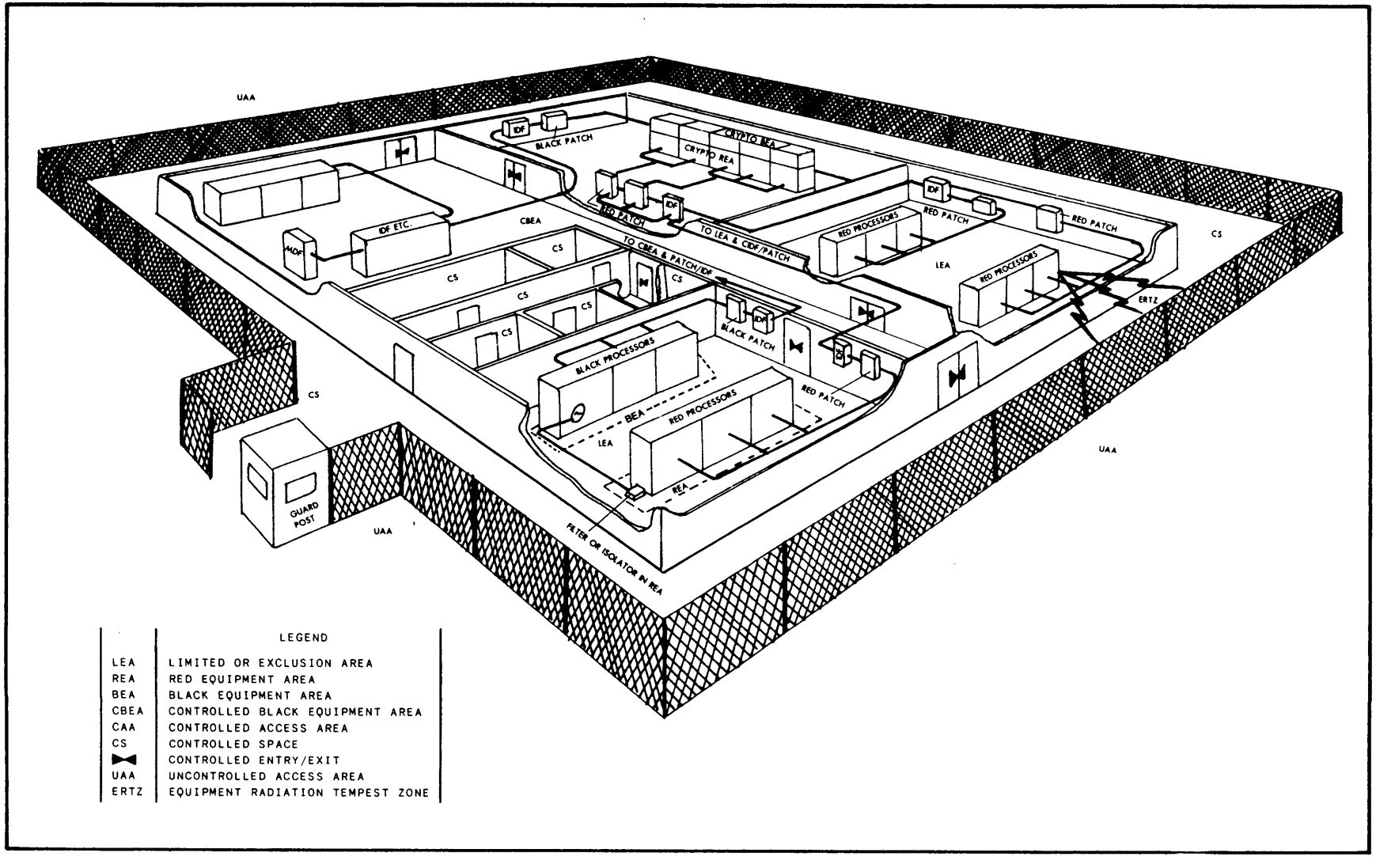

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Figure 1-3.—Typical facility.

Navy, Army, and Air Force long-haul, point-to-point, and store-and-forward communications complexes. Together, these complexes provide a single system, responsive to DOD's worldwide communications needs. The military departments maintain and operate their assigned portions of the DCS, but they are responsive to the overall operational direction and supervision of the Defense Communications Agency (DCA) (the management agency for the DCS). All naval DCS facilities are ashore. Most message traffic flowing between ship and shore commands travels over DCS circuits at some point between the originator and the addressee. Because a DCS relay station serves a geographical area rather than a particular service, each station can relay messages for all military services within its area.

With certain exceptions, the DCS includes all DOD circuits, terminals, control facilities, and tributaries, regardless of their military department. The DCS normally does not include shore, ship, and airborne communications facilities of broadcast, ship-to-ship, ship-to-shore, and ground-air-ground systems. Tactical organizations are also excluded from the DCS.

A complex of communications control centers maintains operational control and supervision of the DCS. The functions and tasks associated with the control centers are to

- tabulate, assemble, store, and display information on current conditions of the system components;
- allocate channels and circuits to meet requirements of authorized users; and
- perform continuous system analysis and other necessary tasks.

The principal objective of the control center system is to ensure the greatest possible responsiveness of the DCS to its user's needs.

Communications control centers receive and process performance data, based on hourly and spot reports made by the various DCS reporting stations on its networks, circuits, channels, and facilities. These reports include the DCS's status at all times. The control centers know of any traffic backlogs, conditions of circuits, status of installed equipment at switching centers throughout the world, and status of any user's channels. With this knowledge and that of alternate route capabilities between any two points, spare capacity, and radio-propagation conditions, the control centers restore elements and reallocate channels, according to user needs and priorities.

The Director, DCA exercises operational direction of the DCS through the DCA Operations Control Complex (DOCC). The DOCC coordinates with cognizant O&M management agencies and users in resolving communications problems exceeding the capabilities and resources available at the DCS facility level.

The organizational structure is pyramidal, as shown in figure 1-4. The National Communications Systems/Defense Communications Agency Operations Center (NCS/DCAOC) is the central control element of the DOCC. It is located at the DCA headquarters, Washington, D.C. This complex maintains status information on major trunking and vital circuits throughout the world. Direct critical control circuits with DCA field elements coordinate restoration actions. DCA Area Communications Operations Centers (ACOCs) report to the NCS/DCAOC; they exercise operational direction over specific geographical areas.

At the three operational control levels (sector, nodal, and station), coordination is exercised between elements at a common level, as well as upward and downward through the hierarchial structure. Thus, at the sector control level, a Facility Control Office (FCO) coordinates with other FCOs, directs operations at the nodal control level, and furnishes information to the theater ACOC. At the nodal control level, the major TCF coordinates nodal control activities with other major TCFs, directs operations at the station control level, and reports to the appropriate FCO.

Technical control instructions are executed by TCFs at the station control level. The TCFs also furnish the reports required by the major TCFs at the nodal control level. They coordinate with each other in carrying out these functions. The TCFs are organizationally and electrically positioned between the transmission facilities and the switching or network facilities. See figure 1-5. They are usually designed as integral parts of the transmission facilities and are physically collocated with them.

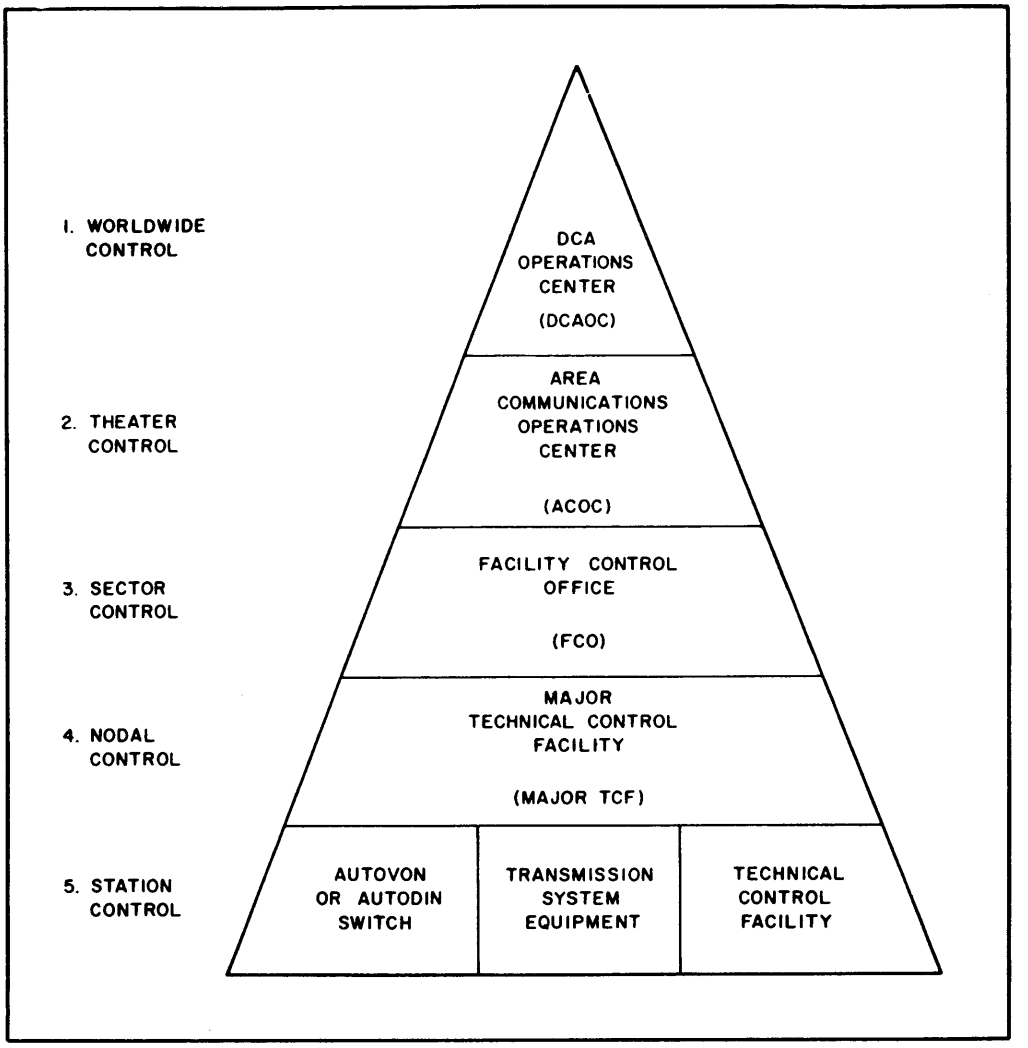

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Figure 1-4.—Organizational structure of DCS systems control.

DCS TRANSMISSION FACILITY: SATELLITE EARTH STATION LOS MICROWAVE TERMINAL TROPO TERMINAL HF RADIO STATION CABLE TERMINAL FIBER OPTICS TERMINAL LEASED LINES TERMINAL	TECHNICAL CONTROL FACILITY	DCS NETWORK OR SWITCHING CENTER: AUTOVON AUTODIN AUTOSEVOCOM SPECIAL PURPOSE AND NON-DCS COMMON USER NETWORK TERMINAL OR SWITCH

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Figure 1-5.—Relationship of TCF to DCS.

DEFENSE COMMUNICATIONS AGENCY (DCA)

The DCA was organized in 1960 to ensure establishment and operation of an integrated communications system to meet DOD needs. Portions of the communications assets of the three military services were placed under control of the DCA, and were then combined to form the DCS. Before that time, the Army, Air Force, and Navy had operated three separate, strategic communications systems. Each was independent of the other, and all were incompatible.

The DCS has a director; a deputy director; three offices of the assistant director (plans and policy, program implementation, and operations), each filled by a flag officer or a general ranking officer; a headquarters establishment; and other subordinate units, facilities, and activities as established by or specifically assigned to the agency. Under the Assistant Director for Program Implementation, there are program managers for the principal DCS programs (for example, automatic voice network (AUTOVON), automatic secure voice communications (AUTOSEVOCOM), automatic digital network (AUTODIN), Defense Special Security Communications Systems (DSSCS), and satellite communications (SATCOM). These systems, all integral parts of DCS, are covered more fully in *Satellite Communications*, CTO 3&2 series, module 5, and in *Automated Data Communications Systems/Introduction to Data Communications*, CTO 3&2 series, module 3.

To ensure that the DCS became a reality, the DOD established the DCA and tasked it with creating and managing the worldwide military communications complex. In this topic, you will find information about the DCA in terms of its management of the DCS. Although we will primarily discuss the DCA, we cannot really separate you from the scene. You, in your job as a technical controller, are a part of the management team. You help manage the part of the DCS that passes through your TCF. You will be working within a framework of policies and procedures prescribed by the DCA.

MISSION OF THE DCA

Managing a large and complex system such as the DCS is, by no means, easy. Merely to list the management responsibilities and functions of the DCA would take a large portion of this module. The DCA is responsible for the proper management of the DCS, but the operation and maintenance of the DCS components are the responsibility of the military departments, through their O&M agencies. The Commander, Naval Telecommunications Command (COMNAVTELCOM) is the O&M manager for DCS elements assigned to the Navy. COMNAVTELCOM also serves as the Navy's coordinator in planning, programming, and implementing plans for the DCS, Worldwide Military Command and Control System (WWMCCS), and the National Communications System (NCS).

The DCA performs system engineering for the DCS. It ensures that the DCS is planned, improved, operated, maintained, and managed efficiently and economically to meet the long-haul, point-to-point, and switched-network telecommunications requirements of the National Command Authorities (NCA), DOD, and, as authorized and directed, other governmental agencies.

NATIONAL COMMUNICATIONS SYSTEM (NCS)

In August 1963, the NCS was established by a presidential directive. Its purpose was to provide a unified governmental system to link together, improve, and extend, on an evolutionary basis, the communications facilities and components of the various federal agencies. The NCS now provides necessary communications for the Federal Government under all conditions, ranging from peacetime and cold-war situations to national emergencies and international crises, including possible nuclear conflict.

The Special Assistant to the President for Telecommunications advises the President and provides policy guidance on development and operations of the NCS. This special assistant also monitors implementation of the NCS.

The Secretary of Defense (SECDEF) serves as the executive agent for NCS. The Director, DCA is the manager. COMNAVTELCOM acts as the Navy's point of contact, and coordinates communication matters affecting Navy-operated components with the NCS manager.

Components of the NCS are

- DCS;
- State Department Diplomatic Telecommunications Service (DTS);

  General Services Administration (GSA) Federal Telecommunications System (FTS), including the Advanced Record System (ARS);

  National Aeronautics and Space Administration (NASA);

  Federal Aviation Agency (FAA);

  Department of Commerce weather networks;

  Department of Interior Trust Territory Pacific Islands; and

  Federal Communications Commission (FCC) emergency action notification network.

Some Navy-owned and -operated communications facilities are components of the DCS and, as such, may be components of the NCS, governed by NCS rules and procedures. However, the DCA provides direction for the NCS.

U.S. MILITARY COMMUNICATIONS ELECTRONICS BOARD (USMCEB)

The USMCEB coordinates military communications electronic matters within DOD and NCS, and provides this guidance, direction, advice, and assistance for DOD components.

The USMCEB is composed of the senior communications officers of the Navy, Air Force, Marine Corps, Army, JCS, and DCA, as well as a representative from NSA. The Director, DCA is the chairman of the board; the Navy member is the Director, Naval Communications. The USMCEB prepares Joint Army-Navy-Air Force Publications (JANAPs) and participates in developing Allied Communication Publications (ACPs) in coordination and cooperation with the appropriate Allied nations.

NAVAL TELECOMMUNICATIONS SYSTEM (NTS)

The NTS is a complex of terminal, transmitting, switching, cryptographic, and controlling devices that collectively provide the electrical and optical communications capability for the

- exercise of command and control over the naval operating forces;
- transmission of operational information to and between units of such forces; and
- administration of forces, shore establishments, and other components of the Navy.

Organizationally, the NTS provides electrical and optical communications from the commanders in chief (CINCs) and naval commanders of all naval forces under their command. Conceptually, the NTS includes portions of the DCS transmission systems and NCS and DCS switched networks, as well as fleet support nets (such as broadcast, ship-to-shore, and air-to-ground) and direct interunit fleet nets. The DCS, not the NTS, services most shore establishments.

For definition and system-engineering purposes, the NTS includes all end-terminal-processing equipments necessary for the communications function of end-to-end information and data transfer. This includes all media for the transmission, emission, or reception of signs, writing, images, and sounds or information of any nature by wire, radio, visual, electromagnetic, electro-optical, or acoustical systems. Unless specifically exempted, all such systems afloat, ashore, and airborne are a part of the NTS with the exceptions of

- passive-intercept systems and associated terminals under the control of COMNAVSECGRU, and
- SPINTCOMM and critical intelligence communications (CRITICOMM) terminals.

CRITICAL INTELLIGENCE COMMUNICATIONS (CRITICOMM) SYSTEM MANAGEMENT (CSM)

The Director, National Security Agency/Chief, Central Security Service (DIRNSA/CHCSS) monitors and controls traffic movement

within the CRITICOMM system. This responsibility is fulfilled through a near-real-time reporting system that established CSM as the focal point for all CRITICOMM reporting and control actions. An important function of CSM, and of all CRITICOMM facilities, is to keep the users fully apprised of current traffic conditions, communications capabilities, and limitations.

To realize maximum benefits from available resources, CSM must maintain a constant awareness of conditions throughout the system on a timely basis. This responsibility is fulfilled by interpreting and acting upon status information submitted by any of the CRITICOMM stations and AUTODIN switching centers.

Status reporting within the CRITICOMM system is based on the principle of "reporting by exception"; thus, normal operation of allocated circuits or stations need not be reported. Each CRITICOMM station has certain responsibilities for reporting to CSM, in a near-real-time environment. These stations report any information regarding the status of their facilities, circuits, and traffic conditions. Status Reports (STATREPs) and Condition Reports (CONREPs) are the two formatted reports each CRITICOMM station uses to report to CSM on a near-real-time basis.

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