COMMUNICATIONS- ELECTRONICS (C-E)
MANAGER'S HANDBOOK

1.   This Air Force Qualification Training Package (AFQTP) has been developed to provide information on Communications Electronics (C-E) systems likely to be encountered by senior NCOs as they assume C-E management responsibilities.

2.   Review Air Force publishing bulletins and AFIND 8 to identify available training materials.

3.   Maintain this AFQTP IAW AFIs 36-2201 and 36-2233. Routine changes will be accomplished via page changes and urgent changes will be disseminated via message. Submit recommended AFQTP improvements/ corrections to the 81 TRSS Qualification Training Flight (81 TRSS/TSQS), 601 D Street, Keesler AFB MS 39534-2229.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL

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Deputy Chief of Staff/Installations and Logistics

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Handbook

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PREFACE

Resource constraints in the Air Force are impacting the availability of our most valuable resource - manpower. This condition which will continue to exist in the future, makes it essential for the work force to be effectively trained to perform duties within each level of an Air Force Specialty (AFS). This handbook is another tool that will enable the Air Force and each MAJCOM to place the needed emphasis on total career field training. This handbook is identified as a mandatory training requirement in several Career Field Training Education Plan.

The information in this handbook is intended for use by Air Force Communications-Electronics (C-E) Managers. It provides information gathered through subject matter experts and the members of the Maintenance and Training Advisory Group, to familiarize senior NCOs on C-E systems likely to be encountered by senior NCOs as they assume C-E management responsibilities.

The contents of the handbook are not to be used as a basis for inspections of evaluation. The handbook is a specialized publication for familiarization and training purposes only; it is **NOT** a technical reference.

This handbook was published 1 August 93 by the 81st Training Support Squadron. This latest revision was revised by TSgt Billy J. Colson and SSgt Martin F. Rivera members of "TEAM WIRE" at the 81 TRSS/TSQ at Keesler AFB MS.

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AIR TRAFFIC CONTROL AND LANDING SYSTEMS — ATCALS

ATCALS comprises an assortment of electronic systems to support the Air Force flying mission. To best describe these systems, we divided ATCALS into four major areas: Radar Systems, Air Traffic Control Radio Systems, Navigation Systems, and Meteorological Systems. This is a basic orientation designed to give you some insight on what these systems do and how they do it. You will not become a systems expert nor will you be expected to; however, this information might just be what you need to perform your job more effectively and efficiently.

RADAR SYSTEMS

Airport Surveillance Radar - ASR: In air traffic controller language, this is the primary radar system. The two most predominant systems utilized throughout the Air Force at fixed communications units are the AN/GPN-12 and AN/GPN-20 Radar Sets. The AN/GPN-12 is a transportable dual-channel radar system with a tower mounted antenna and remote operator controls. The AN/GPN-20, being the newer of the two, is a relocatable, solid-state, all-weather radar with dual-channel, frequency diversity, remote operator controls, and a dual-beam tower mounted antenna. Both radars provide controllers with range and azimuth of aircraft within a 60 nautical mile radius of the physical location of the antenna. Radar return information is displayed on a radar indicator in the Radar Approach Control (RAPCON) facility and is used to control air traffic within assigned air space. The Air Force also has one AN/GPN-25 system installed at Nellis AFB NV. This is a dual-channel solid-state digital radar with the added feature of being able to display moving target ground speed.

The Air Force will replace existing ASR systems with a new Digital ASR (DASR) beginning in FY99. The DASR includes the functionality of the secondary surveillance radar and, therefore, will replace both the ASR and AN/TPX-42 Interrogator Set. Currently, funding is available to procure 20 DASRs for CONUS installation. The Air Force Flight Standards Agency (AFFSA) is working to secure additional funds through the POM process to replace all Air Force ASRs (GPN-12s and 20s) worldwide.

AN/TPX-42 IFF/SIF Systems: This is a secondary radar system that provides selective identification of aircraft within a 200-mile radius of the antenna location. The ground transmitter sends out a series of pulses which the aircraft transponder receives, decodes, and then formulates a reply. The reply from the aircraft, another series of pulses, is decoded by ground equipment, and displayed on the ASR indicators in the form of altitude and aircraft identification codes. The system also provides audio and discrete symbols to depict an aircraft emergency, communications failure, and hijack. The equipment is divided into four major sections: antenna system, interrogator

group, signal processing, and indicator control group. As with the ASR data, this information is used for the same purpose-—to control aircraft.

Programmable Indicator Data Processor - PIDP: This is a modification of the basic IFF designed to expand its capabilities. It enables controllers to add information to the ASR displays vital to the safe control of aircraft. In addition to altitude and identification codes, it may add call signs, arrival times, enroute traffic information, etc. This is the system that serves as the interface between all associated air traffic control facilities. It is the heart of your automated information.

There is a joint DoD/FAA program underway to replace the PIDP and associated radar displays. This is expected to be available for Air Force procurement in 1999. AFFSA is working to secure additional funds through the POM process to replace all Air Force radar display systems.

Radar Control Indicators: Part of the TPX-42 System, these indicators display radar information, both primary and secondary, along with video maps, to provide air traffic controllers an effective tool to control aircraft. The number of indicators located in the RAPCON is a direct function of the local air traffic control mission.

Moving Target Indicator - MTI: The MTI uses primary radar returns which have been processed to compare range and azimuth information on a pulse-to-pulse basis and eliminate all fixed ground returns. As a result, only moving targets are displayed on the respective system indicators.

AN/GPA-131 Video Mapper: The AN/GPA-131 generates and supplies five different air space maps to the radar control indicators. Normally map information displayed consists of restricted areas, air space, approach routes, permanent echoes used for verification of radar azimuth orientation, hand-off points, holding zones, etc. Each radar position can select any one or all of the maps. One of the maps is usually a representation of the runway centerline and is used by controllers to vector aircraft to the approach end of the runway. The AF will replace the AN/GPA-131 Video Mapper with a PC-based digital video mapper system. Delivery will commence in 1997.

Video Mapper Replacement Program: This program is replacing the GPA-131 Video Mapper System. The GPA-131 uses obsolete vacuum tube technology and has a mean time between failures (MTBF) of about one thousand hours. Excessive maintenance and support costs of the current hardware and a declining ability to support this obsolete system can be eliminated by procurement of a commercial system which is currently available. The MTBF will be increased to about 80 thousand hours with procurement of the new solid-state equipment planned for the replacement program. The replacement equipment will simplify operator map generation. Facility requirements will be reduced from a large

floor mounted unit to a unit smaller than a typewriter. This equipment is critical to air traffic control operations. FY94 procured funds for 82 systems and FY95 has procured 84 systems and completed the program.

Video Map Generator, Model 102-G/12: The Video Map Generator (VMG) produces high accurate digital video maps for use with military and civilian analog radar Plan Position Indicator (PPI) displays. Video maps are overlaid onto the PPI displays as video signals and can be adapted to short and long range radar. A 19-inch rack mounted unit, the VMG connects directly to the analog PPI display. Digital map information representing geographical data, air routes, graphics, beacon, and NAVAID positions are stored on memory card modules in the VMG. Each VMG can contain up to 10 reprogrammable, nonvolatile memory module cards. Each memory card represents an overlay map layer which can be displayed on the radar PPI display. Data for overlay maps is generated off-line on a commercial desktop 80386 PC (normally furnished by the customer) and stored on a hard disk. Floppy disks can also be used for storage of map data and for modification of data. The map information is transferred from the PC to each memory module card via a map memory burner unit (part of the hardware set). The VMG model 102-G/12 can accommodate up to 12 PPI display connections. Each PPI display can have its own remote control unit (RCU) to select any one of the 10 map overlays or a combination of overlays. The VMG model 102-G can accommodate 8, 12, or 16 PPI displays, respectively, and allow each PPI display to independently select its overlay map (or combination of maps) using an RCU.

The AN/GPN-12 Airport Surveillance Radar (ASR) is being replaced with the AN/GPN-20. This is not a new procurement action. GPN-20s from base closures will be used to source replacements.

Digital Bright Radar Tower Indicator Equipment (DBRITE): The DBRITE is a video display depicting ASR radar information for use by tower controllers. The system employs the use of a high persistence cathode ray tube (CRT) so it may be viewed in a high ambient light environment such as a tower cab. The information displayed in the tower is the same as seen in the Radar Approach Control Center (RAPCON). It furnishes alphanumeric data which speeds positive identification of aircraft targets and provides better target resolution. At locations with a radar approach control equipped with the PIDP or the Automated Radar Tracking System (ARTS II/III), DBRITE allows tower controllers to perform semi-automated hand-off to adjacent air traffic control facilities. DBRITE interfaces with nearby air traffic control radar facilities and their associated systems (TPX-42 beacon system, PIDP, ARTS-II/III).

Precision Approach Radar - PAR: This radar system provides altitude, range, and flight course information to air traffic controllers to direct aircraft to the runway during periods of reduced visibility and IFR conditions. The radar set is housed in a shelter and sited close to the edge of the runway and near its mid-point. The antenna, rotatable from one end of the runway to the other, is always pointed

toward the approach end of the runway to provide radar coverage of inbound aircraft in the airfield landing pattern. The controller issues azimuth and elevation advisories to the pilot until the aircraft reaches the elevation decision height point, approximately one-half mile from the touchdown point. The AN/GPN-22 is a solid-state digital dual-channel precision radar with a usable range of 20 nautical miles. This radar is the most complex, is computer controlled, and employs some of the latest in radar technology. The AN/FPN-62 is a dual-channel solid-state radar with a usable range of 15 nautical miles.

NOTE: All the PAR radar systems are capable of providing approach information to multiple runways when mounted on a turntable which serves to realign the radar antenna to the desired runways. The exception to this is the AN/GPN-22 which utilizes a fixed equipment shelter but with the antenna mounted on a separate rotating base.

The AN/FPN-62 Precision Approach Radar (PAR) is gradually being replaced with the AN/GPN-22; however, not all fielded FPN-62s will be replaced. MAJCOMs are assessing the need to retain the remaining FPN-62s. This is not a new procurement action. GPN-22s from base closures, and bases where PAR is no longer a requirement, will be used to source replacements.

Mobile Radar: These systems are designed to provide complete air traffic control support within the tactical environment. They consist of ASR, PAR, IFF, mapping equipment, radio communications, interface capabilities for wire communications, and are also capable of interfacing with trainer equipment to provide controller efficiency training. The AN/TPN-19 is the most modern of our tactical radar systems. It's a very complex system employing state-of-the-art technology and many innovative controller support features. The AN/MPN-14K, dubbed the "Sustainability Modification", is composed of a two-trailer configuration with one PAR, three ASR displays, and all the communications support required for equipment and personnel. Upgrades to the TPN-19 are needed for life extension purposes. Although most funding to modify critical elements of the TPN-19 (controller displays, communications, etc.) have been removed, some money is available to replace some of the existing equipment/operations shelters. Shelter replacement is scheduled to commence in 1997. The long range objective is to replace the TPN-19 with a new mobile radar approach control facility.

Weather Radar: A radar system designed to provide base weather forecasters the ability to track storms within 100 nautical miles. A search type radar that detects, displays, and records true height, azimuth, and range of atmospheric conditions—storms, precipitation, and other weather phenomena.

Meteorological Radar Set - AN/FPS-77: This is a lightweight local storm detection and tracking radar system with a range of 1 to 200 nautical miles. In addition to the normal rotational scan capability

typical of radar systems, this system's antenna can be manipulated to vertically scan storm clouds. The FPS-77 system is not logistically supportable and is being replaced.

Meteorological Radar Set - AN/FPQ-21: The AN/FPQ-21 is a fixed, C-band, storm detection radar capable of detecting and displaying precipitation targets located within 450 KM (243 NM) of the radar antenna system. The range applies equally to all three scopes: the Plan Position Indicator (PPI), Azimuth Indicator (A), and Range/Height Indicator (RHI). The vertical scale of the RHI indicates a maximum height of 21 KM (68,900 feet) in 1 KM intervals. The major subassemblies of the AN/FPQ-21 are the main console, the real-time scan converter, the receiver/transmitter group, and the antenna group.

Weather Surveillance Radar-88D - WSR-88D: The WSR-88D is a nationwide network of weather radar satisfying the weather mission needs of the Department of Commerce, Department of Defense, and Department of Transportation. These mission needs include warnings of hazardous weather, flash flood predictions, general weather forecasts, ensuring safety of flight, water resource management, protecting resources on military installations worldwide, and planning military operations of the Air Force, Army, and Navy. The radar is an S-Band Doppler system with a high stability klystron transmitter; a low sidelobe narrow beamwidth antenna; a wide dynamic range, high linearity receiver; and a digital signal processor. WSR-88D produces a variety of weather radar products, and by using automatic meteorological computer analysis, it detects and localizes potentially dangerous conditions and phenomena, and alerts the forecaster. The WSR-88D replaces existing aging weather radar. Principal User Processors (PUPs) or displays are installed at additional locations. Information will originate from the radar, be processed at the collocated computer, and be disseminated to the individual processors through dial-up and dedicated communication lines.

Tactical Weather Radar - AN/TPS-68: The AN/TPS-68, Meteorological Central, Semi-Automatic (Tactical Weather Radar), is a C-Band search radar that can be operated and transported in an 8 x 8 x 12 ft shelter. The unit is self-contained, needing only a prime power source for operation. It can be used in the TAC bare-base concept or as a gap-filler radar at established airbases. Four people can set up and be operational in four hours. Areas of precipitation are displayed on PPI, RHI, and AR scopes and measured as to size, location, height, and intensity. Maximum display range is 200 NM for the PPI and AR, 100 NM for the RHI. When the AN/TPS-68 is used as part of the Tactical Weather System, the display console is relocated to the Base Weather Station unit via a 250 foot cable. After initial turn-on, the radar can be operated entirely from the display console.

The AN/TPS-68 Tactical Weather Radar will be replaced, before the year 2000, by a NEXRAD-like system. An Operational Requirements Document is being developed to support this requirement. The replacement system

will probably be one-half or less the size of the current TPS-68 and will have most, if not all, of the functionality of a NEXRAD system.

AN/GPN-T4 Radar Signal Simulator: This is a computer controlled transportable simulator designed for on-site proficiency training of air traffic controllers. This system interfaces and simulates targets for ASR, PAR, and IFF. Ground speed, turn rates, flight characteristics, etc., of different aircraft can be duplicated to provide a realistic aircraft control environment. The system is capable of generating 40 simulated aircraft targets. Up to seven controllers can train simultaneously using this system.

NOTE: Personal Computer (PC)-Based Radar Simulator Modification: It was recently determined to field a new PC-based simulator rather than modify the existing T-4 due to its age and rapidly approaching unsupportability. A PC-based simulator will replace the T-4 with state-of-the-art-technology to include voice recognition training capability. It will be site specific to provide for the most realistic training capability possible.

AN/GPN-T5: The T5 performs the same functions as the AN/GPN-T4 except with reduced target capacity. The T5 will only generate three simulated aircraft targets versus 40.

AIR TRAFFIC CONTROL (ATC) RADIO SYSTEMS

Control Tower and Radar Approach Control (RAPCON) Communications:

OJ-314 (V)/FSC, Standard Communications Control System (SCCS):   The purpose of the OJ-314 is to provide a communications interface between the Air Traffic Controllers, aircraft, and all other functions and agencies necessary to accomplish ATC operations.   The OJ-314 is what the controllers use to safely and effectively control military and civilian aircraft entering and departing Air Force installations.   Most bases have an OJ-314 in both the tower and RAPCON.   The system is basically a large voice switch enabling the controllers to communicate via land lines, radios, and intercoms.   There are approximately 20 different models of the OJ.   However, they all do the same basic functions. The usual differences between models are the number of positions, number of radios, number of land lines the system can accommodate, and varying intercom configurations.

NOTE: Beginning in FY97, the Air Force will begin replacing the OJ-314 with the new Voice Communications Switching System (VCSS).   It will provide the same voice and radio control capabilities in addition to being solid-state and computer programmable.

Ground To Air Transmitters and Receivers: Very high frequency (VHF) and ultra high frequency (UHF) radio transmitters and receivers are controlled by the OJ-314 and are used to communicate between the RAPCON/Control Tower and aircraft.   In a normal configuration, single channel radios with dedicated frequencies are assigned specific purposes, i.e., ground control, approach, departure, emergency, etc. The mission determines the number of radios at any location; sufficient redundancy ensures controllers always have radio communications available to control air traffic.   At a typical ATC facility, there are primary radios (on-line, in use), back-up radios (on-line, not in use), and spares (available to be tuned to a desired frequency and placed on-line).   In addition, multi-channel transceivers are available that can be remotely tuned from either the tower or RAPCON, whichever the radio supports, and placed on-line in lieu of a back-up radio.

Tape Recorders and ATIS: Two types of tape recorders are used within the air traffic control arena: The AN/GSH-56 20-channel recorder and the AN/GSH-57 40-channel recorder.   These units are used to log or recall all conversations between flight control facilities and aircraft.   Air Traffic Control management determines the requirement for recording within the facility.   Normal recording configurations include: All positions in the OJ-314, selected land lines, the guard frequencies, and some critical primary frequencies.   Recording is accomplished by routing signals to be recorded to the unit where they are magnetically stored on tape reels.   Each unit has two decks; one is continually recording while the other is ready to start in the event of a malfunction.   The Air Traffic Information System (ATIS) is an automatic information system linked to a VHF/UHF transmitter.   Pre-

recorded airfield advisory information is automatically transmitted at timed intervals over the airways on a specific frequency.

Peripheral Systems:

COMEX DIGITAL DECK - CDD-1000: The CDD-1000 recorder/reproducer is an advanced solid-state voice storage and announcement system that continuously transmits a recorded message to broadcast facilities via telephone lines. The system can house up to 12 message cards, each with a storage capacity of approximately 33 seconds, for a possible total of 6.5 minutes of recording capability. When installed, the CDD-1000 can record and play back vital information such as air weather and runway conditions routinely supplied by air traffic controllers to pilots. Information may be simultaneously transmitted via radio channel and telephone. It is commonly used to record and transmit the Air Terminal Information System (ATIS) information.

Pilot to Forecaster: Just as the term implies, the systems consist of VHF/UHF radio equipment and is used by the base weather station to inform aircraft of local weather conditions or other pertinent weather data. Normally interfaced with an OK-423 remote head.

Pilot to Dispatch: Basically, the same system as the Pilot to Forecaster; however, this system is used by base operations to give clearance delivery advisories to pilots.

AN/TRN-42(V) Runway Supervisory Unit - RSU: Provides operating personnel the means to control aircraft on the ground and in the air within a designated control zone through visual means. The unit consists of a shelter containing an operator's console, two radio rack assemblies, book case, and storage assembly.

Mobile/Backup System:

AN/TSW-7 Mobile Tower: Primarily used by units with a mobility mission, the TSW-7 can be used as an alternate or backup system to control aircraft in the event a tower is rendered inoperative or undergoing renovation. The TSW-7 contains UHF/VHF radios, hookups for land lines, and has the capability to be elevated.

Control Tower and Rapcon Communications: The heart of the ATC communications system, the OJ-314 system provides the necessary communications interface capability to allow air traffic controllers to effectively perform their mission. The OJ-314 (V)/FSC distributes radio, land line, intercom, and silent monitor signals between a number of operators, the signal sources, and a voice recorder unit. The OJ-314 also distributes a Request/Acknowledge Coordination System between Radar Approach Control (RAPCON) and Air Traffic Control Tower personnel. A backup battery system supplies power to the OJ-314 for up to 20 minutes in the event commercial and emergency generator power are

lost. OJ-314 system configurations vary in number of positions and equipment used, depending upon the assigned ATC mission.

Field Distribution System - FDS: The FDS is used to distribute flight plan data, weather data, and general information messages between the FAA's Air Route Traffic Control Center (ARTCC) computer, Air Force remote air traffic control towers, and radar control facilities. The system consists of the following equipment: Zenith Z-248 personal computer, Centronics 250 printer, Fame III monitor, OC8000 multiport RS422 interface card, Wesporcorp keyboard, Paradyne MODEM, and FAA developed software.

AN/GSC-37(V) Communications Control and Distribution System - CCDS: Consists of a request/acknowledge system and a modification of the Communications Control Console Group OA-7621(V)/FSC-52(V). As a self-contained modular system it provides all the control and distribution of communications required for operation of the Landing Control Central AN/GPN-24(V). It serves as the primary interface between the operational positions and the remote radios, land lines, and intercoms. Control and status displays in the supervisor, ASR, and PAR module group assemblies permit supervisors, controllers, and assistants to communicate with aircraft and each other as desired. Intercom capabilities also permit communication with the ASR and PAR facilities and with the control tower. The request/acknowledge portion of the CCDS permits visual communications, using colored status displays, between ASR and PAR controllers and the control tower.

COMEX DIGITAL DECK - CDD-1000: The CDD-1000 recorder/reproducer is an advanced solid-state digital voice storage and announcement system that continuously transmits a recorded message to broadcast facilities via telephone lines. The system can house up to 12 message cards, each with a storage capacity of approximately 33 seconds, for a possible total of 6.5 minutes of recording capability. When installed, the CDD-1000 can record and play back vital information such as weather and runway conditions routinely supplied by air traffic controllers to pilots. Information may be simultaneously transmitted via radio channel and telephone.

AN/TRN-42(V) Runway Supervisory Unit - RSU: Provides operating personnel the means to control aircraft on the ground and in the air within a designated control zone through visual means. The unit consists of a shelter containing an operator's console, two radio rack assemblies, book case, and storage assembly.

Surveillance Restoral Vehicle/Tower Restoral Vehicle - SRV/TRV: The SRV/TRV provides the Air Force with highly mobile quick response control tower and secondary radar beacon air traffic control capabilities to meet critical wartime mission requirements in the Alaskan, European, and Pacific theaters in the event a base's primary tower and/or surveillance capabilities are destroyed. The design incorporates a high degree of commonality between the two systems. Both the SRV and TRV include a four wheel drive truck, modified (pop-

up/down) shelter, radios (HAVE QUICK/SINGARS/INTERBASE), land line communications, and towable trailer housing a power generator, spares, and support equipment. The SRV/TRV units can be deployed together or separately.

Pilot to Forecaster: The system consists of VHF/UHF radio equipment and is just as the term implies, used by the base weather station to inform aircraft of local weather conditions or other pertinent weather data. It is normally interfaced with an OK-423 remote head.

Pilot to Dispatch: Basically, the same system as the Pilot to Forecaster; however, this system is used by base operations to give clearance delivery advisories to pilots.

Tape Recorders and ATIS: Two types of tape recorders are used within the air traffic control arena AN/GSH-56 20-channel recorder and an AN/GSH-57 40-channel recorder. These units are used to record all conversations between flight control facilities and aircraft. In addition, certain land lines, as determined by air traffic management, are also recorded. As a general rule, there are usually two recorders at a typical air traffic control facility. One supports the control tower and the other the RAPCON. Each recorder has two tape decks—one on-line and the other in the standby mode, ready just in case the on-line deck fails. Air Traffic Information System (ATIS) is an automatic information system linked to a VHF/UHF transmitter. Pre-recorded airfield advisory information is automatically transmitted at timed intervals over the airways on a specific frequency.

NAVIGATIONAL SYSTEMS

Fixed Navigation Systems

Tactical Air Navigation System - TACAN: The TACAN provides electronic information to aircraft during approach/departure to/from a particular airfield or enroute to a distant airfield. Information transmitted by the station consists of angular bearing relative to magnetic north, station identification, and distance information relative to that ground station. This all serves to determine the geographic position of the aircraft. The TACAN periodically transmits its identification call sign in Morse code to enable aircraft to determine which ground station they are using. Distance reply signals are transmitted upon request—TACAN receives an interrogation code from an aircraft, delays it and retransmits the same code back to the aircraft. The time, measured in microseconds, it takes for the code to reach the aircraft determines the distance from the ground station. Approximately 100 aircraft can interrogate the TACAN at any given moment. The usable distance of the TACAN, as checked by the FAA, is usually 40 nautical miles (NM), but it can be received up to 200 NM (Line-Of-Site) away. Most military aircraft are equipped with an Instrument Landing System/VHF Omni-range (ILS/VOR) receiver, TACAN transponder, and LF beacon receiver. Helicopters primarily use the VOR and LF Beacons. The AN/FRN-45 TACAN is the current system. It's a solid state, single transmitter, dual monitored system using late 1970's, early 1980's technology. The TACAN operates on a fixed channel in the 962-1213MHz range and the channel assignments are identified in AFM 55-8 (AFI 11-223). Most TACANs are scheduled to be replaced with the Global Positioning System (GPS) around 2005. TACAN is primarily used by military, not civilian aircraft.

Instrument Landing System - ILS: The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway. The ground equipment consists of two highly directional transmitting systems: the localizer and glideslope. The localizer operates on one of 40 channels within the frequency range of 108.10 to 111.95MHz and provides the aircraft with course guidance to the runway centerline along the approach path. The glideslope operates on one of 40 channels within the frequency range of 329.15 to 335.00MHz and provides descent (glide angle) information to aircraft down to the lowest authorized decision height specified for the runway. The decision height is the point where the pilot must have visual contact with the runway or may not attempt to land. The glideslope glidepath is usually adjusted for 3 degrees above horizon. Some airfields are also equipped with marker beacons operating on 75MHz to inform aircraft of their specific distance from the touchdown point along the approach path. An outer marker normally indicates a position at which an aircraft, at a specific altitude, will intercept the ILS glidepath. A middle marker usually indicates a position 3,500 feet from the landing threshold. The inner marker usually indicates a point where the aircraft is at a designated decision height between the middle marker

and landing threshold. The present ILS system in use is a solid-state, dual transmitter, dual monitor AN/GRN-29 system using 1970's technology. Most ILSs will be replaced with the Global Positioning System (GPS) around 2015.

VHF Omni-directional Range System - VOR: A radio-navigation aid for aircraft operating in the frequency range of 108.0 to 117.9 MHz, the VOR provides an Omni-directional composite radiation pattern consisting of a reference (9960 Hz subcarrier, frequency modulated at 30 Hz) and 30 Hz variable signal. An aircraft is provided bearing (azimuth) information through phase comparison of these signals. The VOR also transmits a facility identification in Morse code and is capable of transmitting voice or ATIS messages. Primary users of this system are civilian and military aircraft not equipped with TACAN equipment. The current system is the AN/FRN-44, a single transmitter, dual monitor VOR using late 70's, early 80's technology. Most VORs are scheduled to be replaced with the Global Positioning System (GPS) around 2005.

VHF Omni-directional Range Tactical Air Navigation System - VORTAC: A facility consisting of two components, a VOR and TACAN, the VORTAC provides three services: VOR azimuth, TACAN azimuth, and TACAN distance measurement (DME) information for aircraft. Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so pilots using VOR azimuth with TACAN distance can be assured that both signals are being received from the same ground station. The frequency channels of the VOR and TACAN at each VORTAC facility are paired in accordance with a national frequency assignment plan. The current system is the AN/FRN-43, it consists of an AN/FRN-44 VOR and AN/FRN-45 TACAN. Most VORTACs are scheduled to be replaced with the Global Positioning System (GPS) around 2005.

Global Positioning System (GPS): GPS is being planned to augment/replace TACANs, VORs, and NDBs in the future. GPS is also being evaluated as a potential materiel solution for precision approach and landing to replace the Instrument Landing System (ILS).

Fixed Base Microwave Landing System - FBMLS: The FBMLS is a new precision aircraft approach and landing system designed to provide fully automatic approach and landing guidance down to International Civil Aviation Organization (ICAO) Category III (O' decision height) minimums. The FBMLS is made up of azimuth, elevation, and DME. Ground radiated signals are processed by an airborne receiver to position the aircraft to the instrument runway. Since GPS, with ground augmentation stations, will probably be able to provide precision approach and landing information to pilots, the FBMLS program has been halted.

Non-Directional Beacons - NDB: Another radio aid for aircraft navigation, the NDB transmits an Omni-directional low frequency radio beacon in the frequency range of 200 to 1,750kHz. It is used by aircraft to determine position relative to the ground station. Normally used as airspace boundary markers, these systems have the

capability of long or short range transmission. As with all navigation systems, this one also transmits a station identification code. Primary users are small aircraft and Army helicopters. The AN/URN-5, early 1950's tube type equipment, is the current system which depot says they can still support. However, most locations have replaced the tube type with a solid state NAUTEL system. GPS should also replaced the NDBs around 2005. NDB only provides bearings from aircraft to station information, not distance information.

Remote Status Indicators: Navigation equipment status is displayed on a remote status indicator located in either the control tower, RAPCON, or equivalent location.

Flight Inspection Requirements: All systems must be periodically flight inspected to verify the radiated signal is usable, no new flying restrictions apply, and the equipment is operating within prescribed standards. Flight inspections are performed by FAA. Non-periodic flight inspection requests are submitted by the unit Chief of Air Traffic Control Operations (CATCO). Flight inspection intervals are determined in AFM 55-8 (AFI 11-225). During flight inspections with monitors, scheduled downtime is required because equipment is checked in both normal and alarm conditions. An AN/PRC-113 radio, or equivalent, is required to communicate between ground technicians and the flight check aircraft. A qualified technician is required at each site to make necessary equipment adjustments. As a courtesy and when requested, ground transportation is provided to flight check personnel. Any deviations to the published information available to the aircrews **must** be published by Airfield Management on the NOTAMS system.

Unique Training Requirements: All Navigation Systems personnel assigned to a work center are subject to the Maintenance Standardization Evaluation Program (MSEP), annual training by CE to operate generators, hearing tests (if required by environmental health), CPR/Buddy Care qualification, lockout/tagout procedures, and climbing certification for glideslope and/or TACAN antenna towers. They must also be certified to operate a vehicle on the flight line.

Power Requirements: Primary power is normally provided by a commercial power source. All fixed navigational equipment is required to have an auxiliary power source which should be equipped with an auto-start system (commercial to generator and vice versa). The ILS and VOR have battery backup power (lasting at least 30 minutes) in addition to generators (battery back-up does not satisfy the requirement of auxiliary power source). An Uninterruptible Power Supply (UPS) is authorized for the TACAN. The UPS acts as a filter and line conditioner so power spikes and surges are isolated from the TACAN system. The kilowatt (kW) rating, battery capacity, and load of the UPS determines how long it provides power. This is usually from 5 to 30 minutes, plenty of time for the auto-start generator to come on-line during commercial power outages. Auto-start systems must be tested each time generators are scheduled to be run.

Tactical Navigation Systems

Tactical Air Navigation System - TACAN: The AN/TRN-26 and -41 Mobile TACAN systems are located at combat communications and/or ANG units and are deployed for tactical air bases (TAB), interim mission support (IMS), and emergency mission support (EMS). Some AN/TRN-41 TACANs are supported by O&M under Quick Wartime Restoral of ATCALS Equipment and Systems (QWRATES). *(NOTE: HQ CSC is responsible for the only mobile glideslope and VOR in the AF inventory. Their primary mission is site feasibility studies.)* The primary mobile TACAN used is the AN/TRN-26. The system is considered solid-state (only three tubes), medium-power/dual transmitters, and dual monitors. It is lightweight and highly mobile. The shelterized -26B configuration provides for long-term support. It is scheduled for improvements when funding is obtained. This system is the workhorse of the combat communications and ANG units. The AN/TRN-41 (newest to inventory) is a one-man, lightweight, portable air-droppable system. The system is completely solid-state; low-power/single transmitter with an internal monitoring system. It's scheduled for improvements when funding is obtained. The system has a "demand only" mode capability. It's available at 3 CCGP, selected AMC units (combat controllers), and at O&M units for QWRATES.

TRN-45 Mobile Micro Landing System (MMLS) AFSOC: Tactical/Deployable precision approach for limited landing. Used to overcome the lack of a portable Precision Landing System (PLS) that is compatible with the theater aircraft infrastructure, C-130 cargo capacity, and the C-130 operating environment.

Instrument Landing System - ILS: The AN/GRN-31 Glideslope is used for site feasibility studies for fixed base location. It is maintained by 838 EIS.

Remote Status Indicators: Primarily depends on mission. Equipment status may be displayed via a remote status indicator located in either the control tower, RAPCON, or equivalent location.

Flight Inspection Requirements: Deployed systems are required to have commissioning and normal periodic flight inspections to verify the radiated signal is usable, no new flying restrictions apply, and the equipment is operating within prescribed standards. Systems deployed to combat zones or required for emergency support can be operated if conditions listed in AFI 11-225 are met. Flight inspections are performed by FAA. Supported unit CATCOs will provide facility coordinates and request the commissioning/non-periodic flight inspections. Flight inspection intervals are determined in AFI 11-225. An AN/PRC-113 radio or equivalent is required to communicate between ground technicians and flight inspection aircraft. During a flight inspection with monitors, scheduled downtime is required because equipment is checked in both normal and alarm conditions.

Unique Training Requirements: The same requirements as those required for fixed systems apply.   Additionally, mobility training to meet combat communications or ANG unit requirements apply.

Power Requirements: Commercial or generator; normally generator.   The auxiliary power source for mobile TACANs is not equipped with an auto-start system (commercial to generator and vice versa).   If an auto-start system is required, the supported unit must provide all required parts, manpower, etc., for installation, maintenance, and testing.

Global Positioning System - GPS

GPS is a space-based radio positioning and navigation system that provides extremely accurate three-dimensional position, velocity, and system time to users anywhere on or near the earth.   In one proposed configuration, six satellites will transmit a composite signal at two L-Band frequencies consisting of a protected navigation signal and a clear navigation signal.   The signals contain data such as satellite position, atmospheric propagation correction data, and satellite clock bias information.   The system is passive and, therefore, unsaturable. A navigation system's accuracy is generally unaffected by weather phenomena and a pseudo random noise signal structure provides a degree of security and resistance to jamming.

Impact of GPS on ATCALS: Applications that are candidates for GPS, either as the primary navigation or time source, or as a secondary/backup to other existing or planned resources are: terminal area navigation; nonprecision instrument approach precision ranging (DME/P) function for precision landing services; microwave landing system; precision approach radar; primary limited precision landing service for bare base operations; air derived position (indirect surveillance); and identification functions for future military or civil integrated communications, navigation, identification systems; site surveying for fixed ATC assets; sighting and registering tactical ATC assets; and clock time (GMT) synchronization.

Nonprecision Approach Control: GPS could possibly allow direct intercepts with final approach course, remove the need for final offset-to-runway correction, and allow every point in the two-dimensional earth plane to be a potential procedural reference fix.

Precision Approach/Landing: Access to the higher accuracy modes may allow GPS-equipped aircraft to perform precision approaches to Cat I and possibly Cat II minimums.   Multiple, curved approaches are also possible with sophisticated avionics.   GPS precision landing procedures will be developed first for tactical aircraft under wartime ASLAR-type procedures.   Every "runway/landing" area could be a precision instrument runway.

Status and Performance Monitoring: The error properties of the GPS will require monitors in the vicinity of the landing area to detect

changes in the performance below an acceptable service level. A method of broadcasting GPS confidence levels and/or changes in the GPS approach procedures in effect will have to be provided. The Airport Terminal Information Service (ATIS) could be used. Also, accurate and timely Notice to Airmen (NOTAM) information will be required. Further, current flight check standards and procedures will have to be revised.

Air Traffic Controller Operations Procedures: Proposed impact on controllers will be minimal. Local procedures and Terminal Instrument Procedures (TERPS) packages will need to be revised. Surveillance requirements, monitoring procedures, and outage reporting will require revision. The potential for human error due to stress, workload, and fatigue would be reduced.

Timing: Presently, there are 24 satellites in service. These satellites provide two-dimensional coverage and three-dimensional fixes (at least four satellites in view), for an average coverage of 22.5 hours a day. Installation of GPS receivers is currently on-going with more than 10% of military aircraft GPS equipped. When proven fully reliable, the GPS system should replace the existing TACAN, VOR, NDB, and possibly the ILS systems.

National Airspace System - NAS

NAS Interface: The principal civil navigation system is the VOR. Military aircraft use the TACAN. Both are placed in heavily traveled areas. Airways are comprised of line segments between these navigation facilities. The nondirectional beacon (NDB) is used where air traffic demand for an air route is not great enough to justify a VOR. NDBs are used for enroute guidance and fixes as well as being part of the landing systems. The present airport electronic approach and landing system is the ILS. Precision approach ILS provides both azimuth and elevation guidance to a runway.

NAS Plan: The FAA plans to improve the air traffic control and air navigation system in terms of safety, capacity, and economy. Benefits are expected to be substantial. Improvements planned are the upgrade of ground-to-air systems to solid-state; provision for remote maintenance monitoring; and matching the location of navigation, surveillance, approach and landing systems, and communications facilities with the projected demand. Coverage will be provided, where it is required and not available today, through studies to identify candidates for consolidation or relocation. In short, the FAA plans to develop a nationwide system of navigation, surveillance, and communications, as well as weather radar coverage, through a networking concept.

METEOROLOGICAL SYSTEMS

A large number of sensors and electronic equipment gather meteorological information in support of Air Force weather operations. The primary focal point for worldwide dissemination of weather information is the Base Weather Station (BWS). Other dissemination sources include: solar observatories, tactical operations, centralized weather facilities, and rawinsonde sites. Information is provided to the Air Force flying community via face-to-face briefings, by airborne radio contacts, and through an Automated Weather Distribution System (AWDS).

Fixed Meteorological Equipment

AN/GMQ-11/20: The mechanical/analog AN/GMQ-11/20 wind systems (for base weather use) are being replaced by the AN/FMQ-13, digital wind system. The digital wind system includes a digital indicator and line printer recorder. The AN/GMQ-32 system has no upgrade plans, but will be depot supportable to the year 2002.

AN/FMN-1/1A Runway Visual Range Computing Set: Provides continuous measurement of visibility next to the runway. The AN/FMN-1A receives inputs from the AN/GMQ-32 transmissometer, a day/night detector, and the runway light intensity switch. It computes a one minute average of the runway visual range, and provides a readout in hundreds of feet within a range of 1000 to 6000 feet. It consists of a computer and display in one case located in the Base Weather Station. Weather personnel use the data to inform the flying wing of current visibility and to determine if the airfield is within safe field minimums to launch or recover aircraft. AN/FMN-1A is a solid-state upgrade of the AN/FMN-1 (used an optical/mechanical drum as a data look-up table).

AN/GMQ-32 Transmissometer: Provides measurement of transmittance (visibility or clarity) near the approach end of the runway. Consists of a projector that transmits a constant beam of light, a receiver that measures the intensity of the received light, and an indicator which provides a visibility readout. An indicator/recorder displays this information in the form of percentage between 0 - 100, which the weather observer converts to distance. Most systems have a projector/receiver at both ends of the runway to measure visibility at the active end of the runway. Base Weather Station receives the data, disseminates the data locally, and includes the information in their observations which are disseminated to all other Air Weather Service Agencies. The AN/GMQ-32 is also used to feed the AN/FMN-l/1A visibility information. Readings from the AN/GMQ-32 are the prime factor used to determine if visibility is sufficient to safely launch and recover aircraft.

Runway Visual Range System - RVR 400: Used to support Category II instrument landing systems. It provides an automatically derived visibility measurement displayed in digital form. The displays may be

installed in panels in the control tower, GCA ACP/control, and RAPCON. The system computes RVR values from data furnished by the AN/GMQ-32 Transmissometer, a day/night detector, and runway light settings. The RVR system consists of a signal data converter with power supply and control, remote display programmer, and remote display slave.

System Upgrade, Runway Visual Range - SURVR: Future program to replace existing RVR fixed meteorological systems (AN/GMQ-32, FMN-1, and RVR 400). SURVR measures transmissivity and automatically computes and displays digital RVR readings within a range of 50 to 6,500 feet. This system is being developed to support Category III landing criteria using new Microwave Landing System (MLS) technology.

AN/FMQ-8 Temperature and Dew Point Measuring Set: Provides continuous monitoring of ambient air temperature and dew point (temperature at which air becomes saturated and produces dew). It consists of a sensor, sensor interface, indicator, and modems to communicate with the indicator. The sensor, usually located near the center of the runway, measures the temperatures using temperature sensitive resistors. Free air temperature is measured from -80 to +130 degrees Fahrenheit. Dew point is measured from -50 to +90 degrees Fahrenheit. The AN/FMQ-8 temperature/humidity set will be modified to replace the chilled mirror humidity sensor with a capacitive humidity sensor. The modification should have been fielded in the Spring of 1996. There are future plans to replace the pacer card with a diagnostics card. Base Weather Station receives the temperature and dew point information, disseminates the data locally, and uses the information in their observations which are disseminated to all other Air Weather Service agencies.

AN/FMQ-13 Surface Wind Measuring Set: Consists of the sensor, indicator, and line printer recorder. The computerized sensor is sited at key locations on the runway to detect the speed and direction of the wind. This information is remoted to indicators normally located at the base weather station, base operations, and RAPCON/tower. The recorder is located at the base weather station to record wind trends. The speed and direction of the wind affect which end of the runway will be used as the active/approach end. Wind conditions also impact aircraft maintenance operations on the parking apron. The system can measure wind speed from 0 to 150 knots (using the ruggedized sensor) and direction by utilizing two orthogonal thick-film platinum element pairs.

AN/GMQ-34 (CT-12K) Laser Ceilometer: Provides measurement of cloud heights up to 12,000 ft during overcast or cloudy conditions. Consists of a CT-12K Laser Ceilometer, IP-1456 digital cloud height indicator, and a Signal Error Detector (SED) interface board. Most systems have a CT-12K Ceilometer unit at both ends of the runway to allow measurement of cloud heights at the active end of the runway. Base Weather Station receives the cloud height information and disseminates the information both locally and remotely as part of the standard weather observation. During periods of low ceilings, the system is used to determine if

aircraft, and what category of aircraft/pilot, can be safely launched and recovered.

ML-658/GM Digital Barometer/Altimeter Setting Indicator - DBASI: A self-contained rack-mounted solid-state unit that provides measurement of barometric pressure in both inches of mercury and millibars; it also converts these measurements into altimeter settings. Base Weather Station receives and disseminates the barometric pressure information both locally and remotely as part of the standard weather observations. Information is used to determine proper altimeter setting for aircraft and in weather forecasting.

ML-563/UM Barograph: The ML-563/UM is a portable, precision instrument which measures and records atmospheric pressure. It provides a continuous record on a rotating cylinder paper chart. The barograph consists of a pressure measuring and registering mechanism, a pen, and a chart. The pressure measuring mechanism is an aneroid cell. The barograph is used to determine the amount and characteristic of the pressure tendency for a 3-hour period ending at the time of observation.

Lightning Detection System: Provides measurement of amplitude, polarity, and flash count of cloud to ground lightning within approximately 30 nautical miles. Consists of a sensing element, small computer, and display. The sensor is connected to the computer via a dedicated land line. Repairable sensor circuit cards or assemblies are given to the owner/operator for shipment and repair by the manufacturer via AF Form 9. Used by Base Weather Station to provide lightning warnings to all base agencies.

Local Weather Distribution System - LWDS: Provides dissemination and display of alphanumeric, graphic, and imagery weather data to displays located throughout the base. System can display dial up radar and GOES satellite imagery received at the Base Weather Station. Consists of small computers, modems, communication controllers, graphics tablets, printers, and display units. Maintenance concept is to utilize small computer maintenance work centers, and removal and replacement of faulty controllers. Faulty controllers will be returned to manufacturer for repair by the owner/operator via AF Form 9. Used by Base Weather Station to disseminate weather information, warnings, and advisories to base operations, control towers, radar approach facilities, command post, and local flying units.

Tactical Meteorological Equipment

The AN/GMQ-34: The AN/GMQ-34 (CT-12k field equipment and IP-1456 indicator), laser cloud height set has replaced the AN/GMQ-13A, mechanical rotating beam ceilometer. The AFCC developed Signal Error Detector (SED) interface card is being upgraded with a microprocessor based interface card, under TCTO action.

Tactical Meteorological (TACMET):   The AN/TMQ-34 tactical weather station, AN/TMQ-36 tactical wind set, and AN/GMQ-33 tactical laser cloud height sets are scheduled to be merged into a complete automated assembly or COTS consolidated forecasting system purchased. Upgraded system is tentatively scheduled for year 2000 fielding.

AN/TMQ-34 Tactical Meteorological Observing Set (TMOS): Provides measurement of temperature/dewpoint, wind speed and direction, and barometric pressure in a tactical environment. The system is an operator maintained, self-contained, battery operated portable unit with a maintenance concept of removal and replacement of line replaceable units. Used by any Base Weather Station with mobility requirement and Combat Communications.

AN/GMQ-30 Digital Wind Measuring Set: Measures wind speed and direction. Wind speed 0-100 knots; wind direction 0-360 degrees. The system also measures wind gusts. The system consists of wind measuring group, wind direction and speed recorder, signal data converter, and digital display indicator.

AN/TMQ-36 Tactical Wind Measuring Set: An operator maintained, self-contained, portable unit that provides measurement of wind speed and direction. A tactical system that can be set up in a few hours, consisting of a wind speed sensor, wind direction sensor, mast, remote displays, printer/recorder, and a battery charger. The system also provides wind particular information such as gusts, gust spread, peak wind, variability, and standard deviation. Information can be read from the local display or one of three remote display units and/or the recorder unit. The maintenance concept is remove and replace line replaceable units. Used by Base Weather Station with a mobility requirement, Combat Communications, and at airfields and ranges where a permanent fixed wind system is not justifiable. Customers can vary from weather personnel to range operators, and information is normally used in direct support of a flying mission.

AN/TMQ-43, Small Tactical Terminal (STT): The STT comes in three configurations: Basic STT (B-STT), Enhanced STT (E-STT), and Joint Task Force Satellite Terminal STT (JTFST STT). All units have the capability to receive and process DMSP Real-Time Data Smooth (RDS), receive and process automatic picture transmission data from NOAA, METERO, and FENG-YUN satellites, and receive and process Weather Facsimile from GOES, GOES-NEXT, METEOSAT, and GMS satellites. The E-STT has these basic capabilities and can also receive and process DMSP Real-Time Data, NOAA High Resolution Picture Transmission, and one polar and one geostationary satellite simultaneously. The JTFST has all the above capabilities plus the separation between antenna and terminal can be up to seven miles, it can receive and process high resolution geostationary imagery from GOES, GMS GOES-NEXT, and METEOSAT satellites.

AN/GMQ-33 Tactical Laser Cloud Height Set: The AN/GMQ-33 is an operator maintained, self-contained, battery operated portable unit that provides measurement of cloud base heights up to 3,000 feet. Consists of a laser/receiver and readout unit and a tripod. Maintenance concept is remove and replace line replaceable units. Used by Base Weather Stations with a mobility requirement and Combat Communications. The system is used in a tactical environment and directly supports Army and Air Force units at landing/drop zones, base fields, and special operations fields.

Transportable Automated Weather Distribution System - TAWDS: Provides alphanumeric and graphics display of weather information and Notice to Airman (NOTAMs) at the Base Weather Station and other base agencies. The system consists of a communications/data management computer with modems, graphics workstations where a forecaster can call up a large variety of displays for briefings and analysis, and several smaller workstations that can display current observations, NOTAMs, and other weather related information. Workstations are made up of small computers, modems, and display devices. The communications/data management computer receives data from Air Force Global Weather Central and Air Weather Network. Maintenance concept is remove and replace line replaceable units using Air Force technicians with contractor assistance. The TAWDS is self-contained in a standard shelter and can be set up by a team of technicians and operators in a few hours. Used by Base Weather Station personnel to analyze and forecast weather conditions and for generation of weather briefings for commanders and air crews. TAWDS is designed for use in a tactical environment.

Tactical Weather Analysis Central - TWAC and Tactical Air Base Weather Station - TABWS: TWAC and TABWS consist of the following shelters: A, the AN/TMQ-28 Semiautomatic Meteorological Station; B, the AN/TCC-76 Communications Central; C, the AN/TCC-77 Communications Central; and D, Electrical Equipment Shelter. Shelter A provides the weather forecaster with a work area and displays for all of the weather information gathered and disseminated by the other shelters. Shelter B is the terminal point for all weather information to include facsimile and teletype that is received via land lines. Shelter C provides reception, recording, and transmission of weather information from VHF sources, HF sources, and land lines. Shelter D is used for equipment storage and maintenance work area. Tactical meteorological equipment (AN/TMQ-34, AN/TMQ-36, AN/GMQ-33) used for measuring local weather conditions is housed in shelter B, and there are local communications between A, B, and C. Van configuration is determined by mission and determines whether the system is a TWAC or TABWS. TWAC and TABWS are operated and maintained by the combat communication units. They are used for Tactical Air Bases, operated by Air Weather Service forecaster and observer personnel, and directly support tactical flying operations.

Battlefield Weather Observation and Forecast Systems - BWOFS: BWOFS is composed of two separate, complementary parts. The data acquisition

portion of BWOFS is PRESSURS. This system obtains weather observations from enemy controlled and data denied areas. Collection systems include meteorological satellites and weather sensors aboard unmanned aerial reconnaissance vehicles (sensor vehicle acquisition is currently unfunded). AFGWC creates weather forecast models from simulations based on acquired data and provide EOTDA inputs. EOTDAs are system-specific forecasts of performance of Electro-Optical (E-O) precision guided munitions, reconnaissance, navigation, and target acquisition systems operating in the visible, infrared, laser, and millimeter wavelengths. EOTDA software resides and operates on theater command and control networks (CTAPS) and small computers for base weather stations and forward location support. EOTDAs improve combat effectiveness by enabling weather personnel to inform battlefield commanders and planners when and how the environment will affect the use of E-O systems. The link between AFGWC and the DCS entry point is accomplished by dedicated circuit and by terminating either end using a COTS synchronous modem. From there, links will be accomplished over command and control systems (TACS).

Weather Facsimile and Teletype HF Recording System: Receives radio facsimile weather charts and radio teleprinter (RTTY) text broadcasts. Receives signals from World Meteorological Organization and host country National Weather Service broadcasts. The recorder automatically switches from fax to RTTY reception when receiving from transmitters equipped with RTTY identifier tones. It is designed for mobile, tactical use and consists of a recorder, two antennas, and cables that fit into a ruggedized carrying case.

Contract Maintained Meteorological Systems

Automated Weather Distribution System - AWDS: Provides alphanumeric and graphics display of weather information and NOTAMs at the Base Weather Station and other base agencies. The system consists of a communications/data management computer with modems, graphics workstations where a forecaster can call up a large variety of displays for briefings and analysis, and several smaller workstations that can display current observations, NOTAMs, or other weather related information. Workstations are made up of small computers, modems, and display devices. The communications/data management computer receives data from Air Force Global Weather Central and Air Weather Network. Used by Base Weather Station personnel to analyze and forecast weather conditions and for generation of weather briefings for commanders and air crews.

Continental Meteorological Data System - COMEDS: The primary collection and dissemination system for military weather data and NOTAM bulletins in the United States. It consists of multipoint circuits, hubbed from the Air Force Weather Stations, Air Weather Network, and Air Force Global Weather Central (Offutt AFB NE). Consists of processing and display unit, keyboard, modems, and optional printers. System uses leased lines. Used by Base Weather Station and

occasionally used by Base Operations and local flying organizations. Information is used for weather analysis and briefings in support of both local and long distance flights.

Air Force Digital Graphics System - AFDIGS: This system provides weather charts/maps of atmospheric conditions developed by Air Force Global Weather Service via satellite link to various user locations worldwide.   Consists of an antenna, receiver, and a graphics printer processor.   Antenna and receiver are normally connected to the printer processor by dedicated land lines.   These charts are used by Base Weather Station for weather forecasting and to provide worldwide weather information for flight/mission planning.

Geostationary Orbital Environmental Satellite - GOES: Provides satellite pictures of atmospheric conditions throughout the United States.   Satellite data, received every 30 minutes and displayed in "shades of gray", is distributed via land lines by National Weather Service.   Consists of monitor, printer (commonly called visorfax), keyboard, and optional dial up radar.   Used by Base Weather Station personnel for weather forecasting and analysis in support of the flying mission.

Specialized Weather Equipment

AN/GMD-5 Rawinsonde Set: A transportable radio direction finder used to automatically track a balloon-borne radiosonde to altitudes in excess of 100,000 feet and to horizontal distances of approximately 120 miles to measure temperature, dewpoint, barometric pressure, and winds aloft. The system tracks the radiosonde which is carried into the upper atmosphere by a helium filled balloon or a specially designed small rocket. The tracker unit converts down linked meteorological data into a summarized weather profile. The system comes in both a fixed and mobile configuration and consists of a radiosonde, tracker unit, data processing unit, and control console. The system is used by Rawinsonde qualified Air Weather Service personnel. The information is disseminated the same as a weather observation for use by flying organizations, weather forecasters, and other agencies.

Solar Electro-Optical Network - SEON: Provides data to the Space Environmental Support System that is responsible for alerting the DoD of disruptions to the surveillance and warning systems, radio frequency management, satellite tracking and orbital predictions, and satellite hardware systems by observing and reporting solar data continuously and automatically. The network consists of five Solar Optical Telescopes (AN/FMQ-7), four Solar Radio Telescopes (AN/FRN-95), and their associated information systems distributed among six worldwide locations. The six sites are: Holloman AFB NM (optical), Ramey PR (optical), Palehua HI (optical and radio), Learmonth, Australia (optical and radio), Sagamore Hill, MA (radio), and San Vito IT (optical and radio). SEON Phase I replaces unsupportable equipment at these locations to sustain current solar monitoring capabilities. It also provides documented, structured software for the SEON system. The goal of the program is to procure one integrated system, totally Air Force supported and maintained, while replacing unsupportable equipment items at each site. There is also a SEON Upgrade/Replacement Phase II program which provides for research and development (RD) to improve the network's solar radio/optical monitoring capabilities. SEON Phase II is dependent on the completion of SEON Phase I. There is one Central Repair Activity at Holloman AFB NM that supports all SEON locations with maintenance assistance and serviceable components. Used by Air Weather Service operators, the data is disseminated by Air Weather Service to appropriate agencies within the DoD.

Digital Ionospheric Sounding Set - DISS: The AN/FMQ-12 determines the vertical heights and electron densities of reflecting layers in the ionosphere up to the layer of maximum density. This is accomplished by transmitting a burst of high frequency energy and measuring the time and strength of the returned signal. The data is used to evaluate the state of the ionosphere and predict future conditions.

Defense Meteorological Satellite Program - DMSP: Joint Service meteorological satellite system consisting of two sun synchronous, polar-orbiting satellites. Orbits are designed so each satellite

observes a location on the equator twice per day at 12-hour intervals. On-board sensors provide high resolution cloud imagery, remotely sense vertical temperature structure, and observe lower resolution microwave phenomena which can be related to wind speed, soil-moisture, atmospheric structure, and ice identification. Data is encrypted and transmitted continuously and is also stored on-board the spacecraft for later playback to centralized facilities. The Mark IVB and STT are currently used to receive this data. The primary purpose is to provide timely global visual and infrared cloud cover and other specialized meteorological data to Air Force Global Weather Service in support of special strategic missions.

AN/TMQ-37, DMSP MARK IV Terminal: The MARK IV system consists of an antenna, digital processor, an image processor with associated signal monitoring and test equipment racks, a magnetic tape recorder for archive of satellite data, an image generating subsystem, a hard disk subsystem (used for replay of satellite passes), and an emergency generator. The Mark IV is self-contained in a standard shelter and can be set up by a team of technicians and operators in a few hours.

AN/UMQ-35, DMSP MARK IVB Terminal: The MARK IVB system provides timely environmental data bases and images from remotely-sensed satellite observations to users and external communications/processing systems. The MARK IVB system is a stand-alone system consisting of a tracking (polar orbiting satellite) antenna and a pointing (geostationary satellite) antenna, a processing area containing a console for operator/maintenance personnel to control/monitor the system and to perform routine maintenance. Forecasters use the user workstation to generate products. To prevent loss of data due to facility power failure, the processing area has a 10 kilo-volts-amperes (KVA) uninterrruptible power supply (UPS). The user workstation has a 850 volt-ampere (VA) UPS. The three areas are physically separated. Communications are through fiber optic cables that connect the areas. The antenna area cannot be located more than 1500 feet from the processing area. The processing area cannot be located more than 10 miles from the user workstation.

Rapid Deployment Imagery Terminal - RDIT: Provides the DMSP data reception to weather support forces deployed in support of tactical operations. The RDIT is composed of three subsystems: antenna (1.4 meter parabolic dish), data acquisition subsystem (DAS), and processing subsystem (PS). The DAS and PS components are set up into a desktop configuration, which supports the system's two monitors, two keyboards, and a printer. A 3-kilowatt generator is provided for power. The RDIT is an interim solution to satellite requirements and will be replaced by the DMSP Small Tactical Terminal system when fielded.

NOTE: *The vast majority of weather information gathered by the different equipment is disseminated as a weather observation. Weather observations are used locally to support the base flying mission and develop weather forecasts. The weather observations are also used by*

other military units, National Weather Service, and Air Weather Service to develop long range forecasts, historical information, support civilian flight operations, and the weather forecasting mission of allied governments. However, there are also instances when the weather information is restricted for use by specific agencies and given the appropriate protection.

Satellite Data Handling System - SDHS: The SDHS is a weather graphics and imagery system composed of forecaster workstations networked together with a high-speed data handling system. SDHS will accept, store, and display conventional meteorological data using a computer system with display terminals. The system is part of the Air Force Global Weather Central (AFGWC) located at Offutt AFB. SDHS can combine data from numerous meteorological satellites and conventional weather data sources. Using SDHS, the weather forecaster can display a variety of weather products and graphic displays using a wide range of weather data sources. The SDHS upgrade acquires hardware and software to provide the SDHS with additional data processing capabilities for the display data base, master support processing, satellite data ingest, forecaster console, and internal data distribution subsystems. The added capabilities consist of improved image processors, increased data storage, more data processors, and improved communications. Software upgrades include improved capability to convert between text data and alphanumeric products, to convert imagery to pixel products, to handle Automated Forecasting and Observing System (AFOS) products in variable exception vector format, to backup National Weather Service (NWS), to handle communications interface and data exchange products from NWS and the Navy, to automate product scheduling and management, to control graphic displays, to automate the generation of vector graphic products, to generate SDHS vector files and plot list text files, and to ingest and display Next Generation Weather Radar (NEXRAD) data.

Global Weather Intercept Program - GWIP: The GWIP is a joint Air Force-Navy program to collect foreign alphanumeric weather data not available from the World Meteorological Organization Global Telecommunications System. This data is collected by intercepting selected weather data radio broadcasts. Intercepted data is entered into the AWN and transmitted to AFGWC and the Navy's Fleet Numerical Oceanography Center. Each GWIP site has at least one independent around-the-clock HF radio-receiver position with backup receivers for redundancy.

FIXED BASE COMMUNICATIONS

STANDARD BASE LEVEL SYSTEMS

Standard Base-Level Computer - SBLC: The SBLC extends automated data processing support to base-level users (through 2003) by fielding upgradable/expandable hardware from a single contractor's series of automatic data processing equipment. SBLC provides data processing

support for Accounting and Finance, Military and Civilian Personnel, Maintenance, Transportation, Operations (aircrew), and other base-level activities including MAJCOM-unique applications. Large automated data systems (ADS), such as the Core Automated Maintenance System (CAMS), fund for central site hardware to support their own programs during implementation; however, any subsequent workload increases after implementation are the responsibility of the SBLC program manager. Other smaller ADS add requirements for central site support which, in themselves, do not warrant upgrades, but cumulatively cause major hardware upgrades. Without continued expansion of the SBLC host site hardware to meet these increased workload demands, overall mission support capability becomes degraded. Without SBLC upgrades, Data Processing Centers will not be able to support operational mission requirements. Base Assistance Team Mobile (BATMOBILE) - a contingency processing capability for the SBLC finally exists. BATMOBILE provides communications for a base's terminals to a remote computer.

Operatorless Environment - DARKROOM: DARKROOM provides the hardware/software to support movement to an operatorless environment at SBLCs. A "darkroom" environment is a computer room controlled entirely by the computer and requiring no human intervention. At a typical SBLC, nine computer operators are required to operate seven days a week. This number can be reduced by implementing some technological advancements. A complete "darkroom" is not possible at all SBLCs; however, the number of computer operators can be reduced. This program will be implemented in three phases. Phase I will have little to no impact on the user. It consists of: eliminating printing at the host, permitting access to the host by batch users, reducing facility access, installing HAMPS, and optimizing operator time. Phase II requires application developers to modify their systems and requires a significant effort to achieve. It consists of: eliminating console requests, reducing tape usage, evaluating hot stage, evaluating total elimination of tape usage, installing environmental monitors and alarms, and evaluating electronic data interfaces. Phase III requires additional hardware and software modifications. It will take even more time and effort to achieve than Phase II; it consists of: distributed processing; dedicated user systems; implement hot stage; remote systems monitoring; implement electronic interfaces and releases; and implement expert/artificial intelligence systems.

Transportable Shelter System - TSS: TSS is a transportable Sperry 1100/60 Phase IV computer system, contained in DoD standard shelters of the "double wide" configuration. The shelters deploy in 8 X 8 X 20 ft shipping containers for the Phase IV equipment, environmental control units, racks, storage, maintenance bench, maintenance manuals, support equipment, tools, spare parts, and supplies. The "double wides" are connected by a sealed doorway at their abutting ends. The Phase IV computer equipment is modified to provide anti-shock mounting bolt-down capability, cabinet strengthening, cable routing flexibility, and alternate air conditioning passages. The entire system (including power generators) is air, land, and sea transportable. There are 18

systems pre-positioned at selected overseas sites that can be deployed to needed locations.

Defense Message System - DMS: DMS is an architecture and implementation strategy with the goal of improving writer-to-reader service. It isn't a program in itself, but consists of many service initiatives concerning electronic messaging. DMS consists of all hardware, software, procedures, standards, facilities, and personnel used to exchange messages between organizations and individuals within DoD. DMS is centered around the principles of standardization and interoperability, while preserving adaptability for implementing service unique functionality and customization. The DMS Working Group (DMSWG) was formed to assess the future of DoD's message system given the termination of the I-S/A AMPE program. Its prime objective was to define the DMS baseline and develop a target architecture based on achievable technology that satisfies future message service requirements. HQ USAF has developed the Defense Message System - Air Force (DMS-AF) as the Air Force approach to DMS. In conclusion, while the DMS is a system in the sense that its components work together to perform a function, it is, and will continue to be, the result of many separate development and acquisition activities.

DoD Red Switch Project - RSP: RSP provides a reliable, high-quality, digital secure voice subsystem for command and control users within physically secure enclaves. It provides a minimum of 12 red switches to the National Military Command Center (NMCC), the Alternate National Military Command Center (ANMCC), and the 10 CINCs. A total of six Air Force red switches are included in this project. The DoD RSP is part of the Air Force Secure Telephone Systems Program (STSP). The hardware and software used to satisfy the requirements of the RSP is called the Red Telephone Switching Subsystem (RTSS) made by GTE. Within STSP, there's a provision for the procurement of RTSSs to satisfy requirements in addition to those of the RSP which may be either MAJCOM-unique or an extension of the DoD Red Switch Project Network.

Command and Control Switching Systems - CCSS: CCSS consist of secure and/or nonsecure command & control switches which support all levels of C^2 from base/wing up to the Commander-In-Chief level. The systems allow users to talk securely within the protected enclave, and by using COMSEC interfaces to talk to external users. These COMSEC interfaces include STU-II, STU-III, KY-3, VST/VTT, KY-57/58 Tactical, KY 68/78 DSVT, KG-81/94 T-1s and other systems. CCSS provides a significant conferencing capability, not only between internal users, but with external COMSEC users as well. This capability makes the CCSS a dissimilar system "integrator" or interoperable machine. On the nonsecure side, the system acts as a standard command post/center system by interfacing with 4-wire DSN, standard base systems, commercial service, leased hotline service, land mobile radio, and UHF/VHF air to ground systems.

Standard Automated Remote to Autodin Host - SARAH: SARAH is comprised of SARAH Lite for message development and SARAH Comm which serves as the communication software interface for the Autodin Host. This suite of software, SARAH, usually is run on a 386/486 computer. It's designed to provide a 5 1/4 inch floppy disk and remote workstation capability to base communication centers. The capabilities provide base communication center (BCC) customers an alternate method for their data exchange needs. SARAH permits over-the-counter transfer of diskettes in place of cards and paper tape. To provide this capability to BCCs with equipment which isn't capable of supporting backside remote terminals, a communication line splitter is also being procured. These AUTODIN Interface Devices (AIDs) are designed to split the incoming AUTODIN communication line into four lines. One line would be used for the BCC main equipment, one for the SARAH workstation, one for the SBLC System, and one for future needs such as a remote terminal in the base command post. The traffic will be routed to these systems based on message routing criterion. The SARAHs to be used at the sites that have an AF Automated Message Processing Exchange (AFAMPE) will be connected to the backside of these systems as remotes. Unclassified floppy disks can be generated in an originating office, using SARAH software, on non-TEMPEST microcomputers, provided they meet minimum configuration requirements (i.e., 640K embedded memory and 10 Mbyte hard disk drive).

Host Autodin Message Processing System - HAMPS: HAMPS is a Mode I electrical interface between SBLC and AUTODIN. HAMPS is comprised of the hardware, software, and communication components necessary to perform all the functions for the receipt, processing, storage, and transmission of unclassified data pattern messages of fixed or variable length to and from AUTODIN and the DPC. Message security and integrity is ensured through a series of checks performed throughout the message processing path. Statistical and historical capabilities are also available for backup and longer term analysis and evaluation. As a minimum, the system will perform error detection, circuit/channel management, distribution and routing, First-In-First-Out message handling, protection of message integrity, accountability and security, logging and compilation of operating and management accommodate on-line and off-line data and program files, and message retrieval and disposition from disk and history files. Hardware is site dependent.

BASE INFORMATION DIGITAL DISTRIBUTION SYSTEM - BIDDS

BIDDS implements an integrated voice and data switching and distribution system at Air Force bases and other military department installations worldwide. It will provide a standard base-level information transfer utility to meet current and future mission requirements, and also provide for the evolution to an Integrated Services Digital Network (ISDN) standard architecture. BIDDS is a systems approach incorporating applicable Air Force communications and computer architectures. BIDDS is composed of the Integrated Digital Telecommunications System (IDTS), the BIDDS Management System (BMS),

the Quality Assurance Test System (QATS), and the Distribution System/Premise Equipment (DS/PE).

Integrated Digital Telecommunications System - IDTS: IDTS provides state-of-the-art digital switching systems supported by applicable carrier equipment, maintenance analysis facilities, and operator/attendant consoles. The IDTS is to be engineered, furnished, installed, and tested by the IDTS contractor. IDTS will be acquired under three contracts.

Distribution System/Premise Equipment - DS/PE: The DS/PE portion of BIDDS provides telecommunications transmission media from the base telephone switch to the end user.

Maintenance Services: At locations without Air Force "blue suit" maintainers, maintenance services will be acquired using a Performance Work Statement.

DIAL CENTRAL OFFICE

Digital Telephone Switching System Background: Prior to 1982, the telephone systems were electromechanical (analog) of 1920's and 1930's vintage. There was insufficient capacity to meet present and future needs. The central offices were difficult to expand and manpower intensive. Being command supported, there were all different kinds of switch systems installed. Cross-Bar, Step-by-Step, X-Y, and ESS were some of the most common.

The current concept was conceived in 1979. SM-ALC procured a commercial off the shelf digital telephone switching system; however, spares were not assigned stock numbers nor stored/maintained at any Air Logistics Center. A one year supply of operational spares were purchased/delivered with each system. No technical order numbers were assigned to the commercial manuals. Centralized support for the life of the system is provided by SM-ALC. SM-ALC provides configuration management (retrofit and modifications), contract depot support, and MAJCOM funded expansions. An illustration of a typical DMS-100 system is shown below.
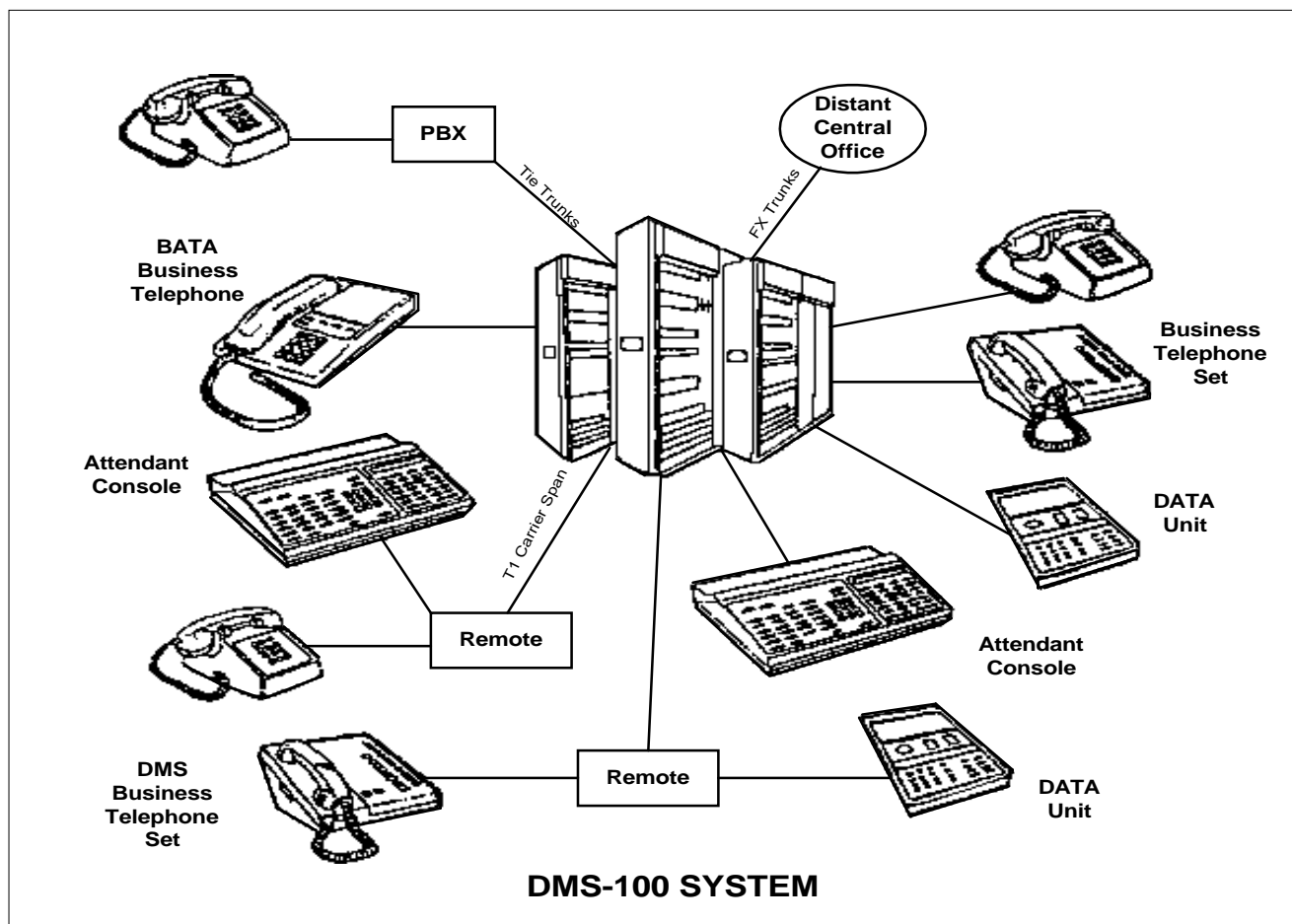
DMS-100 SYSTEM

Digital System Overview: The DMS-100/200 configurations have the same basic internal arrangements, consisting of four main functional areas: the Central Control Complex (CCC) area, the Network Module (NM) area, the Peripheral Module (PM) area, and the Maintenance and Administration area. Refer to the block diagram below, as we discuss this configuration.

The CCC is comprised of those modules which direct and control the operation and functions of the DMS-100/200. The CCC contains a group of four units which act together to evaluate incoming messages, to formulate proper response, and to issue instructions to subsidiary units.

The NM area provides the switching of calls within the DMS-100/200. A NM was fully duplicated for reliability. The DMS-100/200 network consists of up to two duplicated NMs. A fully duplicated network solves many problems associated with switch expansion (i.e., junctor rearrangements) and allows fault recovery without degrading traffic.

DMS-100 BLOCK DIAGRAM
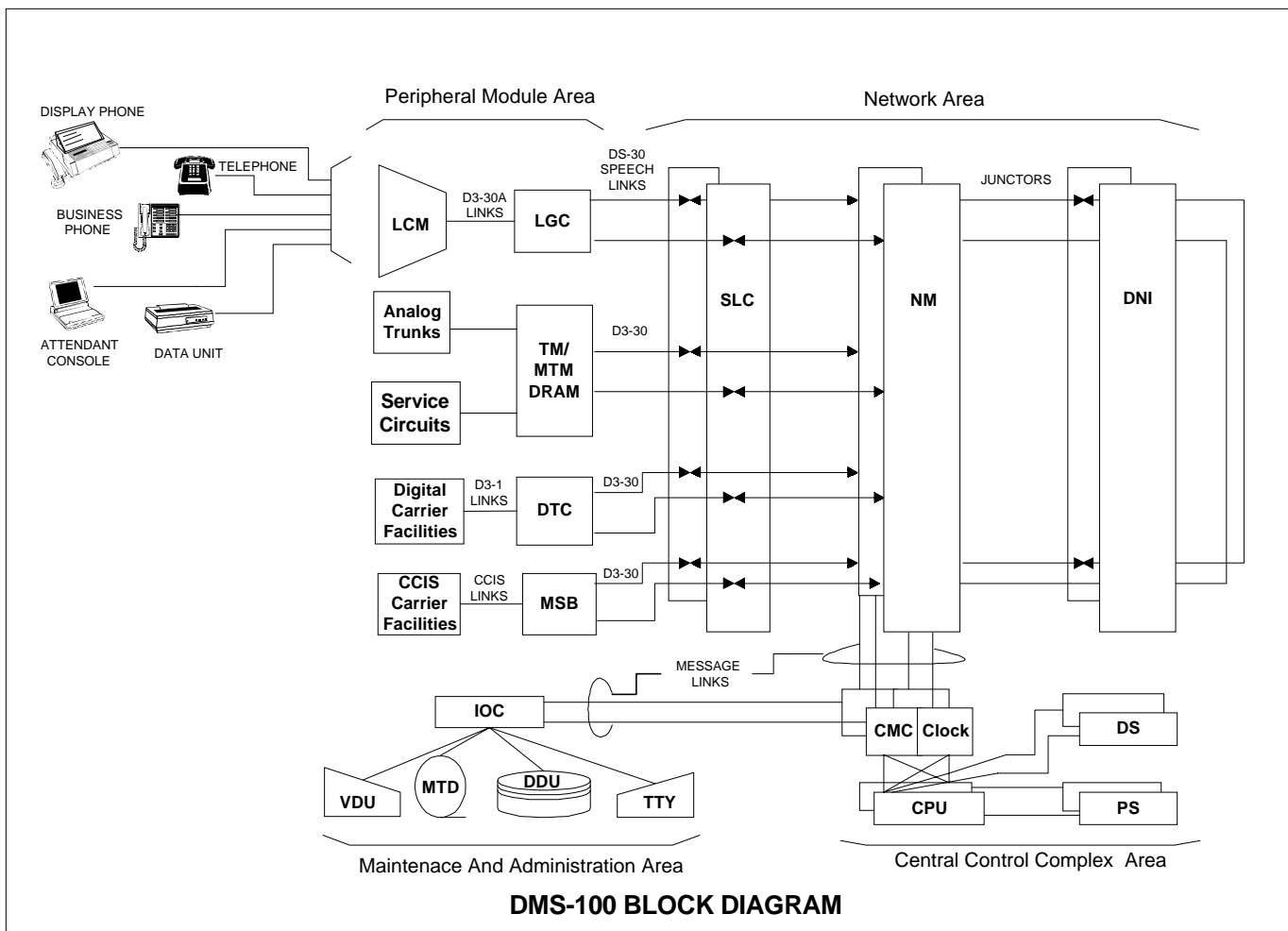
The PM area provides the interfaces between the DMS-100/200 and telephone instruments, data units, and digital and analog trunks. The PMs, which are microprocessor controlled, are also responsible for:

- Scanning the lines in the modules for changes of circuit state
- Performing timing functions for call processing
- Collecting and storing digits
- Generating digital tones
- Sending and receiving signaling and control information to and from
  the CCC
- Providing integrity checking of the network

The DMS-100/200 has a unique interface to the diagnostic, maintenance, and administrative functions of the system via the Maintenance and Administration Position (MAP). It provides a continuous display of the status of all DMS-100/200 subsystems. Hardware failures and corresponding alarm conditions will be reflected in the MAP system status display under the appropriate subsystem. When problems are encountered, the MAP software explores each level of individual subsystems. The user can isolate and examine each level in progressively greater detail until the fault is found.
The DMS-100/200 has inherent techniques to check machine performance automatically and manually. Automatic or manual routine tests are executed on a regularly scheduled basis as designated by test personnel. Manual testing is performed using portable test equipment from jack appearances at the MAP. Diagnostic testing takes place during call processing providing fault resolution for the CCC, NM, MTM, and the peripheral equipment.

DMS-100/200 is a base-level integrated telecommunications system providing efficient high capacity digital communications transfer.

LAND MOBILE RADIO SYSTEM

Land Mobile Radio (LMR) Systems are designed to provide Air Force bases with radio communications where mission essential requirements cannot be satisfied by telephone or other existing communications facilities. LMR systems include base pager, trunking, and cellular telephone systems:

Base Pager System: Base Pager Systems permit only one-way communication. The operation begins by dialing an access code into a telephone. The signal is then transferred through the telephone exchange to the system encoder. The encoder converts the access code into a cap code for which it has been keyed and sent to the base station where it's converted into a radio signal that's received by the appropriate pager.

Trunking System: Land Mobile Trunking is a spectrum conservation technique which can permit more efficient use of the land mobile spectrum by enhancing the accommodation of future land mobile

requirement and reducing the current congestion in the land mobile frequency bands. The use of trunked LMR systems in lieu of conventional systems can reduce the number of channels required for a particular grade of service, improve channel access, and provide a more flexible LMR system. In general terms, trunking can be described as a communication system that has the capability of serving more users than there are channels available by sharing common trunk lines (communication channels), and switching users to available channels using various switching techniques.

Cellular Systems: Cellular telephones are full duplex "radios" with built-in signaling and control options, giving them the appearance of telephones. Cellular systems are point-to-point; they do not support broadcast operation. These systems are designed primarily for civilian use, use commercial frequencies, and are civilian controlled and owned. They cannot be allotted for exclusive military use in the United States; therefore, cellular systems should only be used for administrative purposes such as TDY and for VIPs. They should not be used for operational, command and control, or tactical purposes. Cellular systems use two frequency bands — 824-849 MHz for the phones themselves, and 869-894 MHz for cell site equipment.

LMR systems are either one-way or two-way systems. One-way (usually paging) systems consist of a transmitter and several receivers, but may also include an encoder and telephone patch if individual unit alerting is required. Two-way systems may be configured in a number of ways, but basically allow for communication between two or more separate locations or individuals, each with a radio (portable, mobile, or base station) or linked by telephone cable to fixed radio (base station or repeater) with a radio remote. LMR systems provide radio network control and management for the following typical networks: command and control; base security, law enforcement; fire/crash department; medical; Petroleum, Oil, and Lubricant (POL); aircraft maintenance; ramp control; base operations; civil engineering; maintenance expedite; communications-electronics job control; supply; explosive ordinance detail; etc. The equipment can be classified into three basic categories: Fixed, portable/mobile, and ancillary equipment.

Fixed Equipment: Includes such item as base stations, repeaters, control equipment, and signaling equipment.

Portable/Mobile: Includes portables (hand-held radio transceivers), mobiles (transceivers designed for vehicle installation), porta-mobiles (can be removed from vehicle and used as a portable), and pagers.

Ancillary Equipment: Includes such items as antennas, batteries, battery chargers, microphones, converta-comms, control heads, cables, and headsets.

CABLE PLANT

The Cable Plant may be installed overhead on poles (aerial cable), underground in conduits (underground cable), or buried in direct contact with the earth (buried cable). Two types of cable plants described below can be installed using any combination of underground, buried, and aerial cable.

Exchange Cable Plants: The exchange cable plant or administrative cable plants consist of cables that join the dial central office (DCO) and the individual subscriber's end instruments (usually telephones).

Trunk Cable Plants: The trunk cable plant facility consists of cables that join two or more centers or facilities (usually dial central offices) together.

Underground Cable: The term "underground cable" describes cable installed in underground conduit.

Buried Cable: Buried cable is installed beneath the surface of the ground without conduit protection. Buried cable is placed in trenches dug for that purpose or placed by means of a special cable-laying plow.

Aerial Cable: An aerial cable is supported by a suspension strand to which it is attached by lashing. Aerial cable lines are more susceptible to both physical and electrical damage than either an underground or buried cable line.

Cable maintenance is becoming more fiber optic oriented. This career field will take a more equipment/system approach to maintenance. More detailed training in fiber optics transmission, LAN/WAN topologies, media, and protocols is required to maintain the base information transfer highway. The ability to transmit information at rates greater than 100 Mbps over twisted pair cables has increased the need to install, maintain, and manage inside wiring as an integral part of the information transfer network.

TELEPHONE SYSTEMS

Telephone Systems personnel (formerly Inside Plant) maintain the telephone switching system in the dial central office (DCO), cable maintenance provides connectivity from the DCO to every work area on base via the base cable distribution plant, and Telephone System personnel (formerly Outside Plant) installs the subscriber interface. Telephone System personnel provides the FINAL communications link to base subscribers through the installation of customer premise equipment (CPE) on the subscriber's desk. CPE may be comprised of analog/digital single and multiline telephone instruments and telephone key systems. Equipment responsibilities may extend to MODEMs, multiplexers, T-carriers, line drives, data transmission media systems, and fiber optic systems. Requests for new service or changes to existing service are routed to the communications unit. Once the requirement is validated and job site surveyed, a work order is provided to Telephone Systems personnel who order supplies and equipment, schedule the work to be accomplished, and coordinate with the customer until the service order is completed. After installation, Telephone System personnel continue to perform day-to-day maintenance on all CPE installed.

Telephone switching will continue to evolve into computer software driven digital systems. Mergers with data switching and further migration to switching of data and voice over the same channel is possible. To keep pace with technology, we anticipate installing and maintaining a cellular switching capability. This advancement enables the use of number portability which provides the customer a capability to be contacted anywhere with a single telephone number.

More highly reliable systems, software driven self-diagnostics, and built- in test equipment with remote monitoring equipment will reduce the maintenance work load related to the telephone switch. We will rely more on contract provided depot level logistics support with board swapping as the primary maintenance required on most systems.

There will be significant changes in customer premise equipment. Wireless LANS, portable telephones, data over voice, and video will be capable of transmission over the same wire or channel.
With the implementation of the DoD single line policy, **the use of key telephone systems will be greatly reduced**. Nailed up service with smart cross connects will make it possible to have a customer pick up a telephone and plug it into a wall jack, enabling immediate access to their telephone number.

With a wireless system, customers will be able to relocate within a building and still have access to the building's telephone network. This will reduce the workload for customer premise equipment.

INSTRUMENTATION AND TELEMETRY SYSTEMS MAINTENANCE

Edwards AFB:

The Advanced Range Instrumentation Aircraft (ARIA) fleet is undergoing its third major upgrade since its inception. All six subsystems are being upgraded to keep pace with the remainder of the space launch and missile test community. The antenna control system will be replaced in the near future using a 90 MHz, pentium-based, system to provide automatic and manual control. New antenna feeds and down converters have also been purchased to support future Chinese missile launches. The data separation section is being converted to a pentium-based system. It integrates an Acromatics box with pentium PCs and Astromed strip-chart recorders. The Acromatics box is a VME-based system that includes bit synchs, decommutators, etc. The receiver section is upgrading to Microdyne MR-700 single channel telemetry receivers and 1620 PC combiners. The software (using Labview) has been locally developed to control the suite of 12 receivers and 6 combiners. The recorder and timing section is upgrading from USH-30 wideband recorders to new Racal Storehorse DD-4 double density recorders and Datum 9390 GPS-based timing receiver systems. This section is also controlled by Labview software. The communication subsystem is being upgraded with secure voice and data communication via satellite using INMARSAT and LST-5D (DAMA).

The 412th Test Wing is replacing their TEAC triple deck 8mm recorder/merlin data encoder combinations with DCRSi 75 data recorders. This will significantly increase data quality and reliability as well as enable data capture rates above 2.3 MHz (TEAC/Merlin upper limit).

Data acquisition systems for the Speckled Trout program are now VME-based with MIL STD 1553, ARINC 429, and PCM bit stream capability. Data is archived to internal 4 gigabit hard drives. Current upgrades will allow integration with the Ampex DCRSi 240 Digital Recorder. These upgrades will store up to 48 gigabits of information on one tape.

The 412th Test Wing continues to provide research and development and test and evaluation support for B-1, C-17, F-15, F-16 programs, USAF Test Pilot School, automated jet engine test cell, as well as mechanical/electrical Class II modification of DoD aircraft. Support will expand to the F-22 when it comes on line.

Hill AFB:

A new technology called high-speed parallel-processing of digitized signals in place of time-division multiplexing is currently being explored. To aid in analysis of this data, commercial products such as "Labview" and UNIX based "H-TMS" are being employed. Operator interface with these software packages is necessary to control and understand the output data. Though these types of software are touted as user friendly, the level for understanding these packages to verify data accuracy is quite in-depth. A massive workload increase in the area of aging/life cycle testing is being noticed. As the shrinking Air Force dollar continues to strike at replacement and upgrade programs, more item managers are looking for approval to extend explosive items beyond their originally designed shelf-life.

Vandenberg AFB:

Technicians have recently reengineered their digital test set used to power and check instrumentation telemetry wafers. New components have been incorporated along with power supplies and a Sun computer workstation to form a revised digital test set. This modification was necessary to support contractor upgrades to Minuteman III instrumentation wafers and missile guidance systems. The digital test set now consists of the following components; three 16-Channel D/A Converters (DAC-Racal 6061), Arbitrary Waveform Generator (ARB-Tek VX4790), Arbitrary Pulse/Pattern Generator (APG-Tek 73A-270), Analog/Digital Input (ADI-Tek VX4286), Digital Multimeter (DMM-Wavetek 1362), Universal Counter (HP-E1420B), Digital Test Module (DTM-Tek VX4820), Scanner/Multiplexer (Racal-1620-35, opt 1), and general purpose single pole double throw switches (Racal-1260-17).

Equipment recently introduced to the 576th Flight Test Squadron include the 8566B Spectrum Analyzer, 8753 Network Analyzer, and the 85946A S-Parameter Test Set. These all were obtained to replace antiquated equipment.

Reorganization has resulted in a merge of instrumentation personnel originally assigned to the 30th Maintenance Squadron and 576th Test Squadron. This merge has resulted in the 576 Flight Test Squadron which falls under the Space Warfare Center at Falcon AFB, CO.

Barksdale AFB:

The 49th Test Squadron is upgrading their Airborne Data Acquisition Systems (ADAS) with multi-application recorder/reproducer systems (MARS II). These 20 gigabit systems are recognized as an industry standard for recording analog, PCM, as well as MIL-STD-1553 avionics data.
The 49th Test Squadron is currently being studied to move its organization to Eglin AFB. This move could result in reduced instrumentation manning to the Test Squadron.

Tyndall AFB:

Technicians provide support for the Weapons Systems Evaluation Program (WSEP). They are responsible for data acquisition of weapons scoring information through telemetry. They also operate and maintain all telemetry support equipment.

AIM-120 AMRAAM has been recently incorporated into the WSEP. This missile system places greater challenges to telemetry capture and recording due to the 1.8 Mbit/sec data rate in addition to frequent multi-shooter, multi-target environments, not to mention longer flight times. Telemetry systems easily handle the data rate, but there are only two ground-based antenna systems; this requires use of other range ground stations or the E-9A which has only recently been realistically incorporated into mission profiles.

US Navy Tomahawk cruise missile flight tests. The E-9A is the only asset that supports the Navy in this instance. The E-9A records and relays data for flights over land and water, some lasting four hours. The Navy is so impressed with the E-9A's data quality, they call it the "telemetry system of choice" for their Tomahawk mission.

Interim Vector Scoring System (IVS). As the name implies, this system is an interim upgrade to the Digital Doppler Scoring System (DIGIDOPS) presently used on full-scale and sub-scale drones while the Non-cooperative Airborne Vector Scoring System (NAVSS) is developed. The data rate of IVS is approximately 10 Mbits/sec, requiring some equipment upgrades.

Next Generation Target Control System. This system, still in development, is the next step in target control. It eventually will provide added safety and security to both drone control and missile flight termination capability. It's data rate is expected to be around 50 Mbits/sec. There are many hurdles to jump before this system is even tested, for instance: incorporation of GPS into the data stream; encryption techniques; and channel selection and frequency band availability.

Currently replacing the aging VAX 8700 with a LORAL 550, VME-based telemetry data processing system using a "Windows" environment through a SUN workstation. This system occupies 17 inches (vertically) of a 19 inch rack compared to the 10 x 10 foot area presently used by the VAX. The system contains five decommutators, one bit sync, two digital to analog converter (DAC) boards (containing 32 DACs and 32 discretes a piece), one A/D converter, and a field programmable processor. Advantages: Processes real-time displays using bar graphs, meters, chart displays and display panels, thus eliminating strip chart recorders. In addition, it can be programmed to visually and audibly warn operators of "out of limits" conditions.

Installed two new Loral DBS-430 dual bit synchs that will increase our data handling capability from two Mbit/sec to 50 Mbit/sec in addition to reducing space requirements.

Added one Astromed K-2, 32-channel recorder that provides variable data width (all the previous being fixed width) displays as well as the capability to program set-ups using an onboard floppy disk. This recorder will be a welcome addition to the present complement of five Western Graphtec 8-channel strip chart recorders, five Astromed 95000 16-channel recorders, and three Astromed 9500 8-channel recorders.

Two RACAL Storeplex recorders are being prepared for upcoming high data rate tests. These recorders use a tape cartridge and are capable of data rates as high as 50 Mbit/sec.

The E-9A has undergone extensive improvements to telemetry capture capabilities. The receivers are being upgraded to process 50 Mbit/sec and one of two RACAL Storehorse recorders has been replaced with a Storeplex recorder similar to the telemetry ground station.

Keesler AFB

The three-level resident course is replacing their Gould 2800S strip chart recorders with Astromed 95000 thermal array recorders.

THE DEFENSE COMMUNICATIONS SYSTEM — DCS

DCS COMPOSITION

DCS is a composite of DoD owned and leased telecommunications subsystems and networks comprised of facilities, personnel, and material managed by the Defense Information Systems Agency (DISA). It provides the long-haul, point-to-point, and switched network telecommunications needed to satisfy DoD and selected government agency requirements.

Fixed, Transportable, and Mobile Facilities Included in DCS: Switching and relay facilities, to include associated software, of the general purpose (common user) networks such as AUTODIN, Defense Switched Network (DSN), Defense Data Network (DDN), and Inter-Service/Agency Automated Message Processing Exchange (I-S/A AMPE).

Transmission media and circuits including commercially leased, that provide user and subscriber connection to, or interconnect, the switching and relay facilities of the DCS general purpose (common user) networks, or that interconnect the switching and relay facilities or the user and subscriber terminals in special purpose and operational (dedicated) networks that are authorized use of the DCS.

The assets of the Defense Satellite Communications System (DSCS), except any portions specifically excluded from the DCS.

Fixed, Transportable, and Mobile Facilities Not Included in DCS: The mobile and transportable communications facilities organic to the Army or Air Force fleets, Fleet Marine Forces; ship/ship, ship/shore/ship, air/air, ground/air/ground, and other tactical telecommunications; post, camp, base, and station user and subscriber facilities; the on-site telecommunication facilities associated with, or integral to, weapons systems and missile launch complexes.

Generally, the interface point of post, camp, base, or station (fixed or mobile) facilities (non-DCS) with the DCS is established at the main distribution frame of the user or customer facility. In specific cases, if required, the interface point may be any other point agreed to between DISA and the services or as prescribed by the Joint Chiefs of Staff. In particular, for DSN, current switch technology requires a functional division that occurs as part of the software programs in a computer.

DCS CONTROL

Within the overall responsibility and authority for operational direction and management control, the DISA has defined the following broad functional areas of system engineering, system management, and system operation. The part of the systems operation process that controls the DCS is called systems control.

This is the function which ensures user-to-user service is maintained on a real-time basis under changing traffic conditions, user requirements, natural or manmade stresses, disturbances, and equipment disruptions. System Control includes facility surveillance, traffic surveillance, network control, traffic control, technical control, and SATCOM control. Systems control must be capable of the following responses.

Actions based upon a previously decided course of action in response to a specific condition. These changes may result in reconfiguration of the system networks or facilities, and are based on a variety of engineering factors, or upon operational performance or traffic analysis indicators which may be anticipated during system, network, or facility operations, or upon user demands on the existing system for service.

Reactions to unanticipated events such as natural or manmade disturbances including equipment failures, circuit outages or degradations, or unusual traffic demands.

The systems control design supports DISA and the MilDeps, in the performance of management, operation, and maintenance activities. Additionally, system control builds upon the inherent monitoring and control features of DCS and non-DCS facilities to assist in the execution of related management activities.

DCS CONTROL HIERARCHY AND RESPONSIBILITIES

DCS Control is structured within five hierarchical levels. The first two levels are normally DISA operated and staffed; the remaining three levels are operated and staffed by the MilDeps.

LEVEL 1 - Worldwide (NCSDISA/OC): Worldwide control is exercised at the DISA Operations Center. The actions taken at this level are to ensure the timely and satisfactory resolution of problems of a persistent, unusual, or complex nature. Theater Operations Centers report directly to the DISA/OC.

LEVEL 2 - Theater Area Communications Operations Centers (ACOC) and Defense Satellite Communications System (DSCS) Operations Centers (DSCSOC): More than one ACOC is established to provide operational direction in the proximity of DCS operations and to enhance system survivability. DSCSOCs are considered to operate at level 2 of the DCS hierarchy, but differ in that while the ACOCs are operated and maintained by DISA personnel, the DSCSOCs are operated and maintained by the individual service operating the host earth terminal. Each ACOC will designate an Emergency Relocation Site (ERS) for contingency operations as appropriate. The ACOCs also become the operations manager for the overseas CINCs for restoral, reconstitution, and extension when the CINC assumes temporary operational control of the

DISA field organization and the DCS within its assigned geographical area.

LEVEL 3 - Facility Control Offices (FCO) and Network Control Offices (NCO): FCOs are a MilDep operations and maintenance level 3 facility within the DISA control hierarchy that provides technical supervision over levels 4 and 5 facilities within a designated geographical area. The FCO structure parallels the DCS reporting system to provide a logical flow of operational and technical information from DCS facilities to the FCO, and from the FCO to the DISA area ACOC. FCOs improve the management and survivability of the DCS. Military service boundaries do not restrict an FCO in fulfilling system management responsibilities. NCOs are also MilDep level 3 facilities similar to the FCOs. However, the NCO is assigned on a functional basis rather than a geographical basis. The purpose of an NCO is to provide positive control of circuits in support of a DCS specialized network. As such, the functional responsibilities of an NCO are limited to the network for which it has been assigned.

LEVEL 4 - Technical Control Facilities (TCF): DCS TCFs are MilDep operated and maintained facilities responsible for DCS transmission links, trunks and circuits. Although several control facilities may exist at one geographic location, only one facility may be assigned as a TCF. DCS TCFs must have the physical and electrical capabilities necessary to perform all technical control functions outlined in DISA circulars. DCS TCFs report directly to their assigned FCO.

LEVEL 5 - Patch and Test Facilities (PTF): DCS PTFs are MilDep operated and maintained facilities that are also responsible for DCS transmission links, trunks, and circuits. DCS PTFs have the same functions and responsibilities as TCFs with the exception that the physical and electrical capabilities may be limited. DCS PTFs report directly to a DCS TCF. If a DCS TCF is not assigned in the geographic area, then reporting responsibility is direct to the FCO. A PTF is normally peculiar to a specific facility; thus, its control activities are focused on local equipment using provisions built into the particular communication subsystem design.

DEFENSE SWITCHED NETWORK — DSN

The DSN is more than the replacement of the Automatic Voice Network (AUTOVON). It is the primary Defense Communication System (DCS) command and control information transfer network. It not only provides for the familiar worldwide voice telecommunications services for command and control elements and their supporting activities engaged in logistics, personnel, engineering, and intelligence, it will also provide data and video services, reflecting the advances in technology in the information age.

In 1982 the DSN was designated by the Office of the Secretary of Defense and the Joint Chiefs of Staff as the provider of long distance

communications service for the Department of Defense. The DSN is designed as a primary system of communication during peacetime, periods of crisis, and pre-attack, theater non-nuclear, and post attack phases of war. The network assures nonblocked service for users with Flash or Flash Override precedence capabilities. Key users include the National Command Authority, Commanders in Chief of the Unified and Specified Commands, and strategic and tactical subordinate commanders.

Based on the integration of military departments communications upgrade programs, the DSN consists of four subsystems: switching, transmission, timing/synchronization, and administration/network management. The DSN switching subsystem consists of multifunction, stand-alone tandem, end office, and remote switching units. Utilizing transmission, timing, and control elements of the DCS, they interconnect all military locations worldwide, and provide end-to-end long distance common-user and dedicated telephone, data, and video services. The DSN is operational on a worldwide basis. It includes the old AUTOVON, European Telephone System (ETS), Korea Telephone Upgrades (KTU), Oahu Telephone system (OTS), Defense Commercial Telecommunications network (DCTN), and others.

The growth of the network is readily apparent. DSNs overseas have four times as many tandem nodes as the old AUTOVON. The full overseas DSN, including end offices, will be fifteen to twenty times larger than AUTOVON. The result is greater accessibility to the network for users, and a more robust and survivable system to support mission requirements.

In addition to nonsecure voice, data, and video services, DSN provides transmission, switching, and support services for Secure Telephone Units (STU-IIIs), the Red Switch Project Network (RSPN), and the Defense Data Network (DDN).

The DMS-100 family of switches is the primary equipment used in the DSN. The DMS-100 control architecture is based on a specialized central control system and on extensive use of microprocessors in the peripheral subsystems. This distributed processing structure achieves, in incremental steps, a large processing capacity while maintaining graceful growth characteristics and providing the high reliability expected of modern switching systems. All DMS-100 switches have the same basic configuration, consisting of four main areas: the Central Control Complex, the Peripheral Modules, the Switching Network, and the Maintenance and Administrative Position.

The Central Control Complex (CCC) directs the actions of the network and various peripheral devices involved in switch operations. In addition, the CCC monitors and analyzes the performance of the peripheral devices. The CCC contains the Central Processing Unit (CPU) which provides access to the stored programs and network data contained in the Program Store and Data Store memory modules respectively. The CPU utilizes this data to decide what action is required to satisfy the needs of the network and subsequently issues commands to carry them out.

The Peripheral Modules (PM) scan the trunk or line circuits and detect change of states on the transmission facility; provide timing of call processing functions; collect and store dialed digits; and generate digital tones.   The PMs include Line Modules, Trunk Modules, and digital Carrier Modules.

The Switching Network (NET) provides the interface necessary to connect the originating and terminating PMs.   It provides four stages of time switching; two by an incoming crosspoint time switch and two by an outgoing crosspoint time switch.   Each time switch has eight ports, each port handling 32 channels between the NET and PM.   The NET also distributes the control messages to and from the PM and CPU.

The Maintenance and Administration Position (MAP) is the primary man-machine interface between maintenance personnel and the various maintenance subsystems.   It provides maintenance personnel with the information and tools necessary for efficient diagnosis and identification of system faults at a level where the fault can be corrected by replacement of a card.   The MAP also allows line and trunk testing, operational measurements, network management, and service order changes.

DIGITAL EUROPEAN BACKBONE — DEB

The DEB program replaces existing analog microwave equipment in the DCS in Italy, Germany, Belgium, Holland, and the United Kingdom with digital microwave and bulk encryption equipment. This upgrade involves buildings, or expanding facilities and towers. The main objectives of the program are to reduce OPSEC problems on microwave lines (through bulk encryption) and to improve service to users by doubling system capacity while increasing system efficiency, tactical interconnect capability, and survivability. There are four phases to the DEB program.

Phase I was implemented in 1979, which brought the first digital link service from Coltano, Italy, to Vaihingen, Germany. The first phase installations paved the way for the next generation of digital multiplexers and radios.

Phase II was implemented in Germany during 1984 and 1985, extending digital service from Reese-Augsberg to Schoenfeld. This phase brought digital connectivity to Ramstein AB, Germany, and Heidelberg, Germany.

Phase III extended digital service to the United Kingdom through Belgium in 1988. This link also provides digital connectivity to shape a quad-diversity line of site digital communications system and provides connectivity across the English Channel.

Phase IV provides additional link connectivity between facilities of the Central Region and the United Kingdom. The current status is as follows:

> All construction of towers and building are complete, with 95% of all equipment installed.
> Sites in Italy, Belgium, and Holland are complete.
> A number of sites have been implemented in the United Kingdom and Germany.
> Due to base closures, numerous sites and links in the United Kingdom and Central Region were canceled.
> Ongoing upgrades provide reduced manpower requirements, increase flexibility, and improve quality of service needed for high-tech data and voice systems.

DIGITAL EUROPEAN BACKBONE
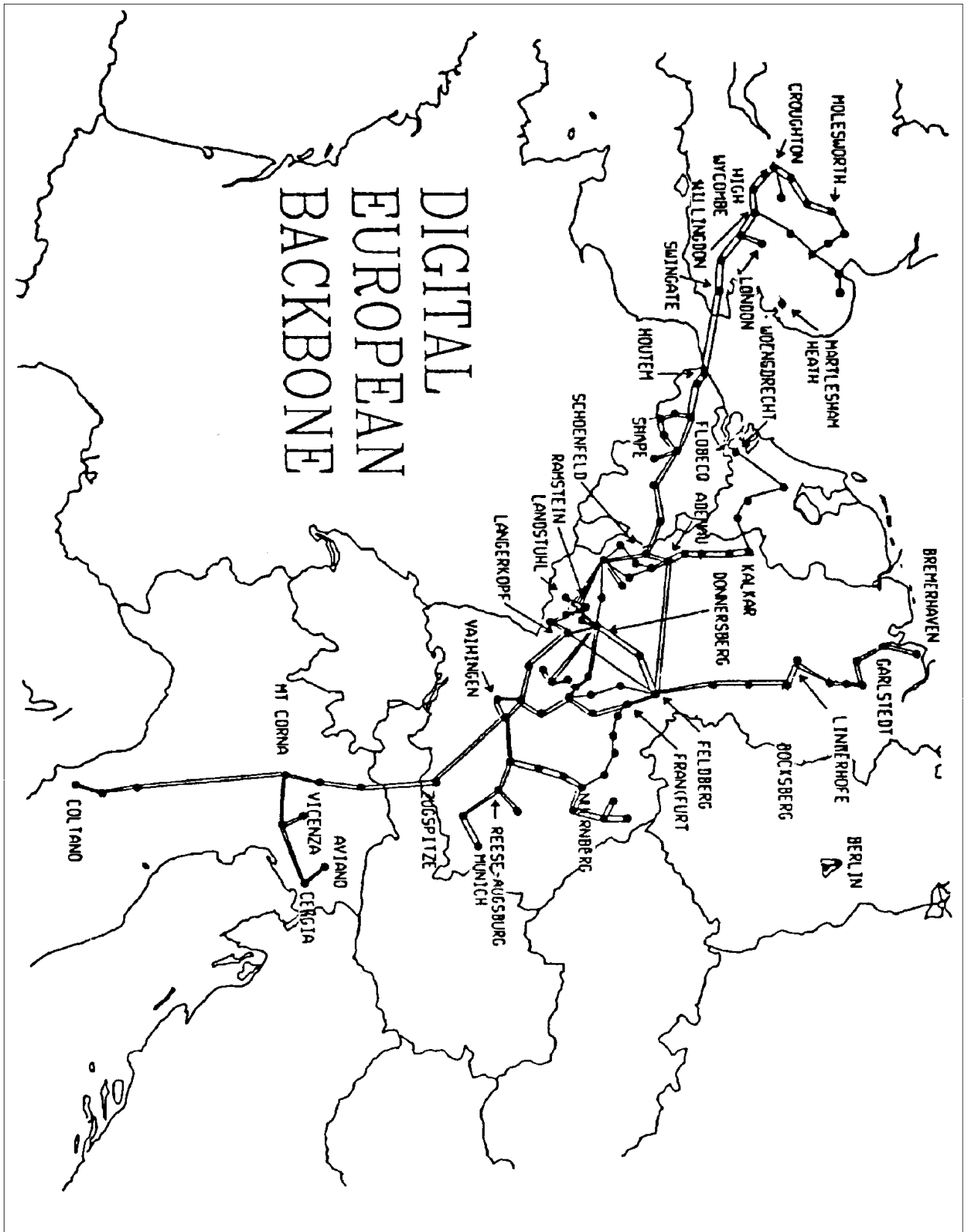
Defense Information Infrastructure (DII) Europe: An initiative to replace DEB and other legacy parts of the terrestrial transmission system in Europe is presently being planned and implemented. This megasystem will be called Defense Information Infrastructure — Europe (DII Europe):

The first phase will replace the aging Transmission Monitoring and Control (TRAMCON) system with a Unix-based Telecommunications Management Network (TMN).

The next phase will replace legacy equipment (AN/FCC-99s, DPASs, AN/FCC-98s and AN/FCC-100s) with modern switching equipment, such as the Integrated Digital Network Exchange (IDNX)-90. The DEB microwave radios will be retained.

The last phase will replace the DEB radios with modern SONET radios running at 155 Mb/s. SONET radios incorporate the best of optical and terrestrial radio systems and have the capability to transmit over fiber optic cable or via line-of-sight transmission. This initiative will be a trend setter for military systems in the Pacific.

Optical Transmission: The Air Force will continue to invest heavily in fiber optics transmission to build the *Air Force Superhighway 2000*. This work will support the Reachback concept of supporting combat troops from the CONUS bases.

MYSTIC STAR NETWORK

The Mystic Star Network is a Defense Communications Agency worldwide communications system. Mystic Star is designed to support the National Command Authority by providing reliable, rapid, high quality, air/ground-air point-to-point voice and data communications to the President, Vice President, cabinet members, foreign heads of state, and other senior government and military officials while aboard Special Air Mission (SAM), Very Important Persons (VIP), or Command aircraft and other locations anywhere in the world. Mystic Star includes the SAM Ground Communications Network. The network consists of a network control station (NCS); ultra high frequency (UHF) satellite terminals; high frequency (HF), high power radio stations; and ancillary communications subsystems. Dedicated interstation lines connect each station to the NCS located at Andrews AFB. The NCS has dedicated landline connectivity to principal-level ground subscribers in the Washington, D.C. area. Communications between the mission aircraft and ground subscribers through the NCS is available using several transmission modes. The modes of transmission are clear voice, privatized and secure voice, and clear and secure message data. The entire Mystic Star system is controlled by the NCS operators through the communications management system (CMS). The CMS is a computer-controlled electronic switching system, capable of supporting up to 500 interconnects. The NCS can remotely control the equipment at each of four SATCOM and nine primary, five secondary, HF radio ground entry

points (GEP) located throughout the world. Fourteen of the HF GEPs are supported by the USAF Global System.

USAF GLOBAL HIGH FREQUENCY (HF) SYSTEM

The USAF Global High Frequency (HF) System is an HF Network of single-sideband (SSB) radio stations strategically located throughout the world. The system provides continuous, rapid, reliable, real-time, two-way communications to any DoD aircraft, ships, and ground alliances regardless of their locations. It is capable of supporting Command and Control, Special Purpose and Contingency Air/Ground, point-to-point, and ship-to-shore communications supporting both voice and data. The Global HF System consists of 15 independently operated, high frequency (HF), high power radio stations strategically located throughout the world (located at MacDill, McClellan, Thule, Elmendorf, Albrook, Hickam, Anderson, Yokota, Lajes, RAF Croughton, Incirlik, Ascension, Offutt, and Andrews.) Bayonne has a civilian operated Global HF Station using URCLLG equipment. It operates Monday through Friday from 0800-1600 EST. Each station is assigned a specific command and control zone. The system or individual stations are not dedicated to any service, command, or other activity. They support all authorized users on a traffic-precedence basis. Each station operates three published frequencies, 24 hours per day, serving common-user subscribers. Unpublished discreet frequencies are available for special mission and radioteletype support. There is no standard station configuration. Typically, a GCCS station consists of a communications relay center (CRC), a transmitter site, and a receiver site. These facilities are visually linked together through a systems control facility via microwave and/or land lines. Equipment includes a mixture of Scope Pattern (fixed tune) and Scope Control (remote tune) radios and operations consoles. GCCS supports over 40 types of missions and traffic including Mystic Star Presidential support; National Emergency Airborne Command Post (NECAP) support; Worldwide Airborne Command Post (WABNCOP) support; Commander in Chief (CINC) Emergency Action Message (EAM) support; aircraft advisory support (Foxtrot broadcasts); airborne reconnaissance; nonsecure voice phone patching; message receipt and relay; and secure/nonsecure air-ground-air radio teletype (except Ascension and Thule); and support for aircraft which are experiencing airborne emergencies.

DEFENSE MEDITERRANEAN IMPROVEMENT PROGRAM — DMIP

DMIP is a program to upgrade the communications systems in Turkey and provide out of country connectivity to Italy. The complete system of four satellite terminals and three terrestrial links in Turkey and one satellite terminal in Italy are installed and operational as part of the DCS. Terminals are located at Ankara, Incirlik, Izmir, Pirinclik, and Coltano, IT. Two additional out of country terrestrial links were leased in support of Desert Shield/Storm and are still in operation. Terminal equipment consists of Satellite Transmission System RF equipment and Timeplex Link 2 multiplexers. All links are 2.048Mb (CCITT) leases providing 45 channels. The links are bulk encrypted using KG-94/CCITT cryptos. The network, as illustrated below, is operated and maintained by the Turkish Post Telephone Telegraph (TPTT).

DMIP COMMERCIAL LINKS
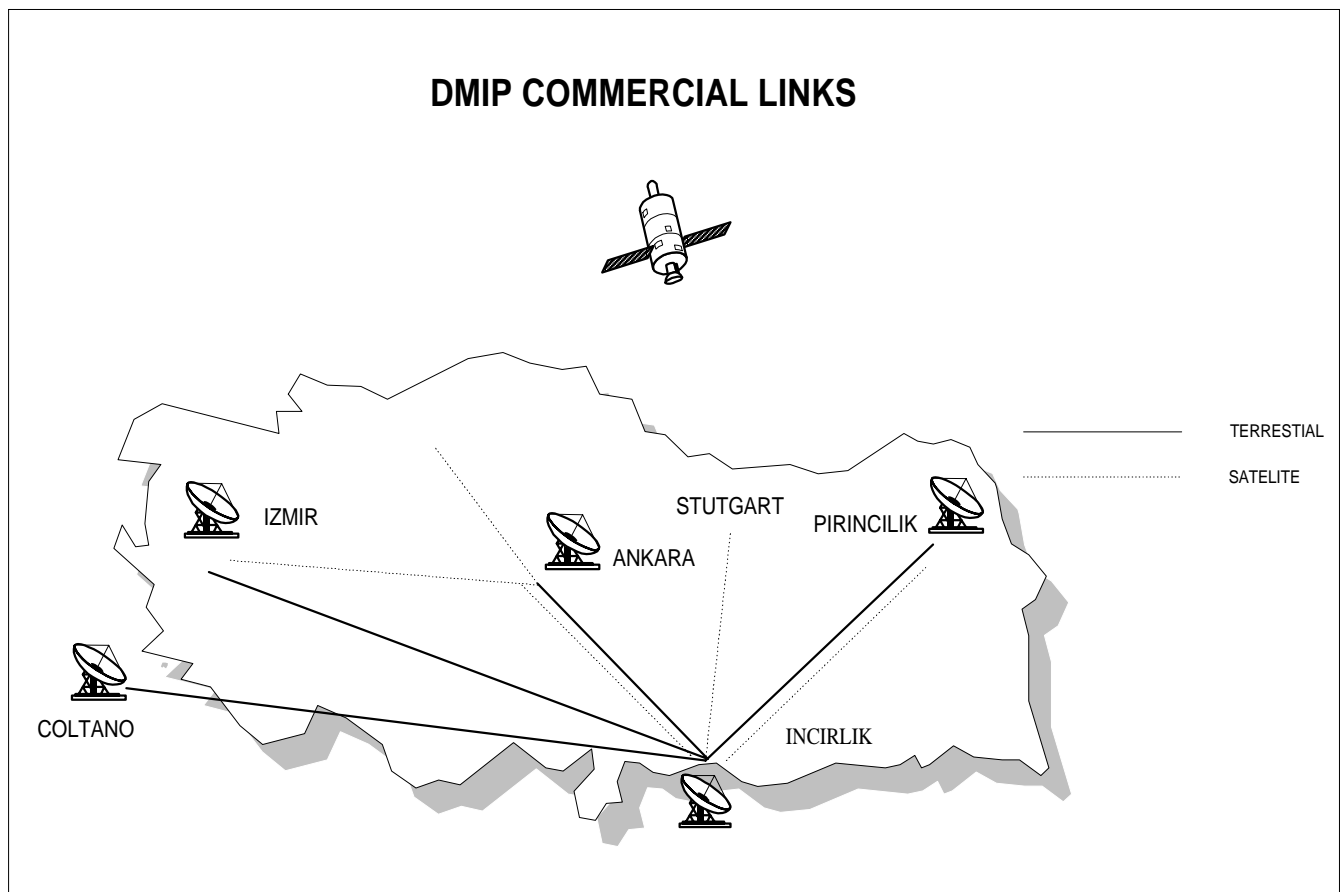
UHF SATELLITE TERMINAL SYSTEM - USTS

The Ultra High Frequency (UHF) Satellite Terminal System (USTS) provides airborne users, fixed ground installations, and transportable elements with beyond-line-of-site (BLOS) secure and nonsecure voice and data communications. The major components of the USTS include the satellite terminal and the network control station (NCS) equipment. The terminal is a single configuration, transportable system designed for both ground and airborne use. The terminal contains a single

channel, half duplex receiver/transmitter. It employs time division Demand Assigned Multiple Access (DAMA) techniques to provide shared use of 5 and 25kHz channels on satellite transponders. The NCS, in addition to terminal functions, provides centralized control of the multiple access to two satellite channels and other functions required to provide global communications coverage. USTS is designed for use with nonregenerative (nonprocessed) channels of the Air Force Satellite (AFSAT).

SCOPE COMMAND

Scope Command modernizes and expands aging high frequency (HF) radio equipment supporting Mystic Star, Global Command and Control (GCCS), and Defense Communications (DCS) HF entry and point-to-point systems. Scope Command will improve and expand capabilities by procuring next generation equipment capable of accommodating military standard (MIL STD) 188-148 (Anti-Jam) and MIL STD 188-141A (Automatic Link Establishment) technology. Scope Command will also consolidate GCCS/Giant Talk operations at Yokota, Elmendorf, McClellan, and RAF Croughton.

CENTER — NMCC NATIONAL MILITARY COMMAND

COMMAND, CONTROL, AND COMMUNICATION SYSTEMS

The NMCC, along with the Alternate National Military Command Center (ANMCC) and the National Emergency Airborne Command Post (NEACP) comprise the National Military Command System (NMCS). The NMCS provides the National Command Authorities (NCA) with warning and intelligence data upon which accurate and timely decisions can be made, apply the resources of the Military Departments (MILDEPs), assign military missions, and provide direction to Unified and Specified Commands. The command and control of day-to-day and crisis operations at the national level is monitored and executed through the NMCC. Consequently, the NMCC must be capable of providing the communications required to receive information and transmit decisions to U.S. military forces under all conditions of peace and war. In addition, within the NMCC, there are a number of systems to distribute and process audio, video, and data.

The 7th Communications Group Directorate of Logistics provides maintenance support to a number of these systems. The systems the 7CG maintains are divided into four disciplines with a separate work center assigned to each. They are Computer Maintenance, Radio Maintenance, Information Distribution Systems Maintenance, and Secure Voice Maintenance. A description of the major systems each work center maintains follows.

Computer Maintenance

Command Center Processing and Display System - CCPDS: In the NMCC, the CCPDS is located in a High-altitude Electro-Magnetic Pulse (HEMP) protected facility. The processor receives data from Precision Acquisition Vehicle Entry Phased Array Warning System (PAVE PAWS), Ground Communication Network (GCN), and Missile Warning and Display System (MWDS) sites. The data is transmitted via Jam Resistant Secure Communication (JRSC) circuits. The NMCC's CCPDS provides Tactical Warning and Attack Assessment (TW/AA) data to surveillance officers in the Emergency Actions Room and the National Military Intelligence Center (NMIC).

Warning Display Terminal - WDT: The WDT acts as a partial backup for the CCPDS. The WDT, located in the Emergency Actions Room, interfaces with Missile Warning TTY (MWTTY) and European Warning circuits.

Theater Display Terminal - TDT: The TDT collects and displays missile warning data in graphic format for the European theater. The TDT, also located in the Emergency Actions Room, is a Sun 3/260 minicomputer.

Radio Maintenance

AFSATCOM IEMATS Microprocessor System - AIMS: The Improved Emergency Messages Automatic Transmission System (IEMATS) uses AFSATCOM for transmission of emergency action messages through the AIMS. AIMS provides an interface to the AFSATCOM radio equipment in the NMCC.

NMCC Sound Distribution System: The sound system provides sound reinforcement within the Emergency Conference Room (ECR) and the Operations Directorate Conference Room (ODCR) and distribution of secure and nonsecure sound throughout the NMCC. The sound can also be extended to the ANMCC and other selected non-NMCC sites. The system consists of various microphones and loudspeakers within the conference rooms and the associated amplification and level control equipment. The system controls the interconnection with the Display Information Distribution System (DISIDS--explained later), RED telephones, BLACK telephones, audio recording and playback equipment, and the speakers located throughout the NMCC.

NOTE: In addition to the systems and equipment described above, the Radio Maintenance work center also maintains Single Channel Transponder Injection Subsystem - SCTIS and Ground Wave Emergency Network - GWEN equipment described elsewhere in this document.

Information Distribution Systems Maintenance

Display Information Distribution System - DISIDS: DISIDS is a color cable TV and audio system. The heart of DISIDS is a video and audio distribution switch. The switch accepts up to 60 secure and nonsecure inputs from inside and outside the NMCC. It controls distribution of these inputs to 160 user monitors throughout the NMCC and its contiguous organizations. Present DISIDS inputs form sources external to the NMCC include commercial television and radio and Joint/Service/DIA TV. NMCC inputs include live or recorded TV from the Visual Recording Studio (explained later), live TV from camera in the NMCC's conference rooms, and CCPDS. A computer controls access to secure channels. Not everyone has access to all channels.

Visual Recording Facility - VRF: Within the NMCC is a full production video studio. The facility has a state-of-the-art multi-format editing center, a recording cell with ten VCRs to record news and other commercial programs, and a Grass Valley 1680 Production Switcher. The VRF has four DISIDS inputs that can be used to input almost anything into DISIDS. The VRF can also dub and enhance video from any source.

NMCC Conference Rooms: The ECR and ODCR have a variety of large screen wall displays, primarily Barco projectors, 35mm projectors, DISIDS inputs/monitors, and transparency projectors. A Conference Management Table controls all of these to present a professional integrated presentation. In addition, the rooms are equipped with room status displays. The displays show the current condition of the room: phones

off hook, door open, door secure, microphones on, sound being distributed out of room. Only when the room is isolated can classified discussion take place. The conference rooms also have cameras equipped with pan and tilt motors. The VRF controls the cameras. Each conference room has an eight zone clock to show the time worldwide. In addition to the ODCR and the ECR, the major facilities, there are conference rooms in the Current Actions Center, the Current Situation Room, and the Crisis Management Room.

Secure Voice Maintenance

Central Locator System - CLS: The CLS, located in the Emergency Actions room, is a TEMPEST approved Z-150 that is connected to the Federal Emergency Management Agency (FEMA) via a KG-84 encrypted circuit. The system provides the NMCC with current location and data on all top government officials.

Red Telephone Switching System - RTSS: The RTSS is a new digital secure voice switch. It replaced the old FTC-48. Unlike the FTC-48, the RTSS will be HEMP protected. Its digital technology will allow it to be a part of DoD and RED switch networks. The switch became operational in Oct/Nov 1991.

CHEYENNE MOUNTAIN COMPLEX — CMC

The CMC functions as the command, control, communications, and intelligence (C3I) facility for NORAD/USSPACECOM. It houses automated data processing equipment (ADPE) which processes and displays the data used to provide attack warning information to NORAD/USSPACECOM and the National Command Authorities (NCA).

The missions of the North American Aerospace Defense Command (NORAD) and United States Space Command (USSPACECOM) include early warning and tracking of potential threats to North America. The missions are performed through an Integrated Tactical Warning and Attack Assessment (TW/AA) system which includes ballistic missile, atmospheric, and space sensors; command centers, correlation centers, and intelligence indicators; and communications. To satisfy operational requirements while improving combat effectiveness, modifications, replacements, and enhancements are required to the existing Integrated TW/AA systems. The Cheyenne Mountain Upgrade (CMU) program provides some of these modifications, replacements, and enhancements.

AN/FSC-109 Survivable Communications Integration System - SCIS: The SCIS is an automated communications and message processor that provides timely, reliable, error-free delivery of critical information. SCIS uses available, survivable communications media to pass critical ITW/AA message traffic between 12 sensors, 2 correlation centers, and 8 forward users. The primary flow of data is from the sensor sites using Survivable Sensor Data Network to the correlation centers. Correlated data from the correlation center is distributed to the forward user sites using the Survivable Correlated Data Network. The Very Survivable Sensor Data Network provides a survivable link from the sensor sites to the forward user sites, bypassing the correlation centers. These communications systems include the Jam Resistant Secure Communications (JRSC) system and Milstar. SCIS, AN/FSC-109(V), uses a fault-tolerant VAX computer that provides high levels of availability and reliability for a variety of applications. Hardware redundancy and failover techniques ensure uninterrupted operation in the event of a single point of failure anywhere in the system. Modular components simplify repair and maintenance procedures, reducing the time required to bring components back into service. It operates as a stand-alone or as the boot or satellite node for a local area VAX cluster. It has expansion capabilities in the areas of main memory, input/output (I/O) devices, synchronous communications adapters, and disk storage. A functionally equivalent subsystem will be provided to the Space and Warning Systems Center (SWSC) to be used for future Integrated TW/AA system integration testing. Correlation centers for SCIS are at Cheyenne Mountain AFB to support NORAD and at the Offutt Tech Control Facility to support APCC.

Survivable Communications Integration System Fallback - SFB: The SFB was implemented due to schedule adjustments in the SCIS program. SCIS was not available in time to support some of the scheduled Cheyenne

Mountain Upgrade (CMU) acquisitions, particularly the Command Center Processing and Display System Replacement (CCPDS-R) program.

The purpose of SFB is to provide the following SCIS functions in order for CCPDS-R to become operational:

- Current Message Set (CMS) to Standard Survivable Message Set (SSMS)conversion at the Ballistic Missile Early Warning System (BEMWS) I and the Perimeter Acquisition Radar Attack Characterization System (PARCS) sensor sites. Space and missile warning message separation is provided at the BMEWS I sensor site.

    •A communication interface for the Processing and Display system (PDS).

    •A Survivable Correlated Data Network (SCDN) from the correlation centers to forward user sites for the transmission of the Correlation Center Output Message Set (CCOMS).

AN/FYC-14 Communications System Segment - CSSR: The CSSR provides the mechanisms for communication between the various mission and/or support ADP systems. The system performs line protocol handling, recording, message formatting, integrity control, routing, and automated technical control of circuits. There is CSSR equipment for CMAFB and an equivalent set is installed at the SWSC for software and hardware development, testing and training. A CSSR subset, Message Processing only, will be installed at APCC.

AN/FYQ-109(V) Space Defense Operations Center - SPADOC IV: SPADOC IV replaces the manually operated Space Defense Operations Center and provides a centralized command, control, communications, and intelligence capability. It serves as the nerve center for the Space Defense Command and Control System. SPADOC IV manages space defense, allows the maintenance of United States and foreign objects catalog through the year 2010, and interfaces/integrates with the CMAFB CSSR. It combines emerging space surveillance operations and forces to support tactical assessments of potential threats against United States space assets, so that the information can be provided to key decision makers, response can be planned and executed, military forces can be alerted, and survival action can be accomplished. A functionally equivalent subsystem will be placed in the SWSC for software and hardware development, testing, and training.

AN/FYQ-123 Granite Sentry: Provides hardware, software, and facilities in phases to upgrade or replace portions of the North American Aerospace Defense Command (NORAD) Computer System (NCS), providing enhanced capabilities in the NORAD Command Center (NCC), Air Defense Operations Center (ADOC), and the Operations Planning Staff (OPS) (previously referred to as the Battle Staff Support Center (BSSC). Other centers throughout the Cheyenne Mountain Complex (CMC) and Peterson Air Force Base, CO, will receive Interactive Message

Processing System (IMPS) workstations, Video Distribution System (VDS) monitors, and in some cases both. Granite Sentry provides CMAFB with new air defense processing and display capabilities. These displays show air defense force status, sensor information, and the current air defense situation in both the ADOC and NCC. A major portion of Granite Sentry effort involved reconfiguring the ADOC and Interim Command Post facilities and integrating the various equipment necessary to support the air defense operations. An NCC capability was delivered in Dec 91. Missile warning display information on new Granite Sentry workstations replaced the existing Graphic Display Consoles. A VDS was also delivered, which provided a video switching capability with large group displays and video monitors installed in the NCC, Federal Emergency Management Agency/National Warning Center (FEMA/NWC), and OPS. Granite Sentry provides redundant VDS capabilities, installing VDS in the Weather Support Unit (WSU) and ADOC, and enhancing IMPS capabilities. Granite Sentry has interfaced with the CSSR system during the October 1993 time frame. Air Correlation Center Output Message Sets (CCOMS) has been generated and transmitted to the forward users. CCPDS-R displays are available in the NCC via VDS. The OPS has been upgraded in the same time frame. The primary capabilities have been developed for the processing of nuclear fallout prediction, nuclear/biological/chemical reporting, and continental airborne reconnaissance for damage assessment monitoring functions. Integrated and space display capabilities is provided in the NCC via the VDS. Granite Sentry will also deliver a functionally equivalent system to the APCC at Offutt AFB, NE. A functionally equivalent subsystem is in place in the SWSC for software and hardware development, testing, and training.

AN/FYQ-124 Command Center Processing and Display System Replacement - CCPDS-R:
The CCPDS-R is the replacement program for the CCPDS. The CCPDS-R is located in a High-altitude Electro-Magnetic Pulse (HEMP) protected facility in the National Military Command Center (NMCC). The processor receives data from Precision Acquisition Vehicle Entry Phase Array Warning System (PAVE PAWS), Ground Communication Network (GCN), and Missile Warning and Display (MWDS) sites. The CCPDS-R is a VAX computer system that provides a high level of availability and reliability. It uses redundant hardware to ensure uninterrupted system operations. It has expansion capabilities in the areas of main memory, input/output (I/O) devices, and disk storage.

Joint Surveillance System (JSS): This program is a joint USAF/FAA radar use program that provides surveillance data in support of the Air Defense System. Under the FAA Air Force Radar Replacement (FARR) Program, JSS will migrate from the old electronic tube, two dimensional surveillance and height finder radar systems, AN/FPS-93, to the solid state, state-of-the-art, highly reliable, three dimensional long range radar, Westinghouse ARSR-4. Also under the ROCC-SOCC Modernization Program, the current antiquated, proprietary computer system, AN/FYQ-93, will be replaced with a faster, state-of-the-art, Commercial Off-the-Shelf (COTS), distributed computer system.

Modular Control Element (MCE), AN/TYQ-23: Is the replacement for the 407L's AN/TSQ-91, Tactical Operations Center. The MCE is a dedicated system which receives and processes data input from ground surveillance radar, and displays enemy targets and friendly aircraft tracks on four self-contained operator consoles. It supports and manages aircraft identification and classification, intercept/weapons calculations, simulation, communications, threat evaluation, weapons control, and built-in-test monitoring/fault isolation. Each MCE includes a complete set of communications (radio, telephone, and crypto), a voice communications access unit, and four dual-display operator consoles.

Air Force Mission Support System (AFMSS): Provides air crews and mission planners with a computer planning system for peacetime and wartime air missions. The AFMSS consists of three major subsystems: the Mission Planning Subsystem (MPS), the Data Preparation Subsystem (DPS), and the Portable Mission Planning Subsystem (PMPS). All hardware maximizes the use of non-developmental items. AFMSS uses multi-user "high end" computer workstations (one to four stations). The workstations are packaged in rugged transit cases for mobility and rapid setup and are deployable worldwide using a single 463L pallet. Each subsystem is a two person portable, set up time not to exceed 25 minutes. A non-deployable version will be available for applications that don't require mobility. It typically consists of one to four planning stations with one text printer, one color printer for every two planning stations, removable secondary memory devices, two 3-1/2 floppy disk drives, two 5-1/4 inch floppy disk drives, and four loader/reader devices for Data Transport Device (DTD) media.

Alternate Processing Correlation Center - APCC: The APCC supports Integrated TW/AA as a peacetime alternate processing and correlation center capable of operating through early/trans attack until physically destroyed. Its location, approximately 390 miles from USSPACECOM and NORAD Headquarters, greatly reduces the probability that a single natural disaster could destroy both correlation centers. Time sensitive missile warning data arrives simultaneously at the NORAD and USSPACECOM CC, though not necessarily identical, the information and data is provided for the mission operators. Functional equivalency implies that a decision maker will reach the same conclusion after reviewing all data. Communication links between the APCC and the CMC provide data the mission operators need to verify functions equivalency. The APCC provides facilities to accomplish Missile Warning functions for Integrated TW/AA. The APCC is also the primary source of missile warning information for USSTRATCOM. In return, USSTRATCOM provides intelligence information to the APCC. The APCC is made up of the following components: SCIS (located in the Offutt Tech Control Facility); CSSR (only the MPDS portion); CCPDS-R; Granite Sentry; intelligence terminal; Worldwide Military Command and Control System (WWMCCS) ADPE Modernization (WAM) terminal; Subscriber Terminal (ST); Warning Display Terminal (WDT); and a wideband link from CMAFB to the APCC that will support the exchange of correlated data and other mission support information.

NATO INTEGRATED COMMUNICATIONS SYSTEM — NICS

NICS was designed to blend military and civilian communications systems to meet NATO's increasing communications requirement. NICS provides a modern automatically switched common-user telephone and telegraph network covering all of NATO. NICS is composed of the ACE (Allied Command Europe) HIGH system, NATO Satellite Communications (SATCOM) System, Initial Voice Switched Network (IVSN), Telegraph Automatic Relay Equipment (TARE), and Post Telephone and Telegraph (PTT).

The ACE HIGH System: The ACE HIGH system is a Frequency Division Multiplex (FDM) analog transmission network comprising a total of 49 tropospheric scatter links and 41 line-of-sight (LOS) microwave links. It is the primary terrestrial transmission backbone for ACE. As such, it's used extensively to provide dedicated voice, telegraph, and data circuits in support of NATO command and control. ACE HIGH provided communications from Northern Norway to Eastern Turkey. The system is over 30 years old. Due to the large frequency bandwidth and high maintenance costs, it's being quickly phased out of the NATO inventory and replaced by digital systems.

NATO SATCOM System: NATO SATCOM is in Phase III of its development and consists of two segments. The space segment consists of four satellites, one operational and three spare. Each was designed for a seven year life, with the first launched in Apr 76 and the last in Nov 84. The ground segment consists of 21 fixed and 2 transportable terminals. The system is designed for digital traffic on a single destination carrier. The analog voice channels are converted into digital stream by PCM and Delta Modulation before being multiplexed by Time Division Multiplexing (TDM).

Initial Voice Switched Network - IVSN: A contract was awarded to ITT North Electric Company to manufacture, deliver, and install 24 access switches for a NATO-wide network. Two other switches were purchased for testing and training. The IVSN forms a dedicated switching system which overlays the normal switched networks of the host countries. The network supports 3,500 indirect NICS subscribers (INS) and 1,500 direct NICS subscribers (DNS). INS equipment is connected to the IVSN via a PABX or foreign network; therefore, their access is limited. DNS use 4-wire telephones and can connect low/medium speed data terminals, crypto control units, 2-wire dual tone multi-frequency (DTMF) or dial pulse phones, and static multi-access terminals. Digital encryption equipment (DEE) is combined with common channel signaling (CCS) equipment to provide secure inter-switch signaling and control.

Telegraph Automatic Relay Equipment - TARE: The TARE provides a 75-1200 bps, synchronous, secure (encrypted), store and forward message system. It consists of four computer controlled message distribution centers and can support up to 500 subscribers (teletype addressees).

Post, Telephone, and Telegraph - PTT: Commercial (civilian) telephone companies.

NATO COMMAND AND CONTROL SYSTEMS

Status Control, Alerting, and Reporting System - SCARS II: SCARS II was designed to allow centralized command and control of military resources during a wide spectrum of conditions. For this reason, SCARS II installations are integrated using IVSN as the primary means for medium speed communications at a speed of 600 bps. A SCARS II system consists of Tempest and redundant Central Processing Units (CPU), Front End Processors (FEP), disk packs, printers, and monitors. Due to the extremely slow acquisition process within NATO, this late 80's system implementation uses early 70's computer technology.

EIFEL II: EIFEL II is a product of the German Federal Ministry of Defense and runs on Siemens computer equipment. It is an automated tactical command and control system which is used to aid mission planning, controlling, tasking, monitoring, and evaluation of conventional offensive air operations for six nation's forces in the Central European Region. EIFEL II consists of a computer within the Allied Tactical Operations Center (ATOC) and remote Siemens personal computers, crypto equipment, modems, and printers at over 90 locations in the Central Region, including wings, ASOCs, CRPs, FOLs, COBs, and other locations.

NATO Secure Voice - NSU: NATO uses STU-II, SPENDEX 40, and Elcrovox systems for secure voice. Elcrovox is the most widely used secure voice system within NATO and supports voice encryption. Elcrovox is not compatible with STU-II, SPENDEX 40, or STU-III. Elcrovox is used primarily between NATO headquarters and intermediate headquarters.

DEFENSE SATELLITE COMMUNICATIONS

Defense Satellite Communications System/Jam Resistant Secure Communications - DSCS/JRSC: The DSCS/JRSC program provides critical command and control to DoD users who require responsive, survivable communications service during crisis and nuclear war. DSCS provides reliable, high quality, worldwide SHF satellite communications to support unique, common-user, and vital DoD communications-computer systems. A typical Air Force application provides long-haul DCS and ground tactical communications. JRSC uses the DSCS satellite connectivity to support the Integrated Tactical Warning and Assessment (ITW&A) Network and C3 for selected CINCs during all levels of conflict. JRSC modifies the DSCS system to provide jam-resistant, secure, hardened capabilities. Ground terminals include AN/GSC-39, AN/MSC-46, AN/GSC-49, AN/GSC-52, AN/TSC-54, and AN/FSC-78. There is a digital communications satellite subsystem (DCSS) and interconnect facilities which connect earth terminals and the DCSS equipment to the

DCS tech control facilities. The AN/GSC-49, AN/GSC-52, and AN/FSC-78 are augmented with JRSC equipment.

Military Strategic-Tactical Relay - MILSTAR: The MILSTAR Satellite Communications System is a new generation communications system to meet the projected minimum-essential wartime operational requirements associated with military communications. The program objective is to develop and deploy an affordable terminal and satellite system with jam-resistant capability to satisfy specified strategic and tactical long-haul and local communication requirements. MILSTAR will be comprised of a Space, Mission Control (MCS), and Terminal Segment. MCS provides the collective equipment, facilities, and support to provide space segment control and to support communications control. MILSTAR will employ terminals developed by the Army (the MILSTAR Single Objective Tactical Terminals or SCOTT), Navy, and Air Force and will be deployed on airborne, shipboard, and ground platforms. Ground terminals include fixed and transportable terminals. A MILSTAR terminal has the capability to access the satellite by using a circuit or network. The terminal shall provide EHF uplink and SHF downlink interfaces to the MILSTAR and Fleet Satellite Communications interfaces to user equipment groups. Some Air Force terminals will also provide interface to the Mission Control Element (MCE) of the MCS. The system will also include a UHF capability for backward compatibility with existing military satellite communications systems.

Single Channel Transponder System - SCTS: SCTS has three segments: the space, injection, and the reception segment. The space segment consists of transponders (single channel transponders) aboard DSCS III and other spacecraft. The injection segment includes the Single Channel Transponder Injection Subsystem (SCTIS), selected DSCS terminals, satellite control facilities, National Emergency Airborne Command Post (NEACP), and all communication links to SCTIS nodes from selected command centers. The reception segment consists of AFSATCOM-terminals, SHF receivers at the ICBM Launch Control Facilities, ICBM SHF Satellite Terminals (ISST), SHF receivers collocated with units having a Flaming Arrow Net (FAN) terminal in Europe, Single Channel Transponder Receiver (SCTR), and SHF receivers at command centers receiving SCTIS.

Hammer Rapid Initial Communications Kit - HAMMER RICK: HAMMER RICK consists of lightweight UHF satellite terminals and associated equipment to satisfy early minimum essential command and control needs during force deployment. The terminals provide half-duplex secure voice, secure data, and secure facsimile. HAMMER RICK is the primary means of intra- and inter-theater communications during the first 10 days of a crisis or contingency prior to arrival of larger communications systems. It will also be used for command post to command post communications after larger systems are activated.

CONSOLIDATED SPACE OPERATIONS CENTER (CSOC) COMMUNICATIONS SEGMENT — CS

The CS consists of communications circuits and equipment which includes: multiplexers and demultiplexers, switching and routing equipment, modems, recorders, communications security (COMSEC) equipment, and processors. The CS supports command, telemetry, voice, video, teletype, facsimile, and other data communications and data services internal to CSOC and externally among CSOC, other Air Force Satellite Communications Network (AFSCN) resources, and other government communications services and facilities. In addition to the equipment located at the Colorado site, the CS will also provide interface equipment at selected Remote Tracking Stations (RTS) of the AFSCN.

AN/FSQ-185, Traffic Switch Subsystem: The Traffic Switch Subsystem is composed of a Black Narrowband matrix switch, Consolidated Space Test Center (CSTC) matrix switch, Black Wideband matrix switch, and Red Narrowband matrix switch which provides switching capability between local subscribers, the CSOC CS, and the CSTC/RTS network.

AN/FCC-103, Communication Subsystem: The Communication Subsystem (Narrowband) provides backup capability to the Satellite Communication Control Central network and is primarily responsible for the transfer of low data rate mission command and control data and Backup Secure Voice traffic to the various TRSs that support the CSOC mission. The AN/FCC-103 configuration item consists of Link 1 Multiplexers, Narrowband Control Stations, Government Furnished Equipment (GFE) encryption devices, patch and test facilities, distribution functions, and interface connections with Leased Common Carrier (LCC) circuits.

AN/FSQ-186, Communications Central: The Communications Central (Routing) provides communications connectivity between the various CSOC Segments and CS equipment functional groups. AN/FSQ-186 includes distribution frames, patch and test facilities, timing display and distribution network, various fiber optic modems, multiplexers, secure teletype, and the Switch Bypass. The signals that traverse the routing group are numerous with various data rates, security levels, and protocols. The system is divided into three functional groups consisting of: (a) internal interfaces, (b) external interfaces, and (c) intrasegment interfaces. The internal interface group receives and transmits operations traffic to either the external interface group or other internal users. The external interface group provides connectivity for selective narrowband circuits. The intrasegment interface group provides fiber optic connectivities and signal distribution between CSOC segments.

AN/FSC-120, Communication Subsystem: Communication Subsystem (Control and Monitor) provides the system and capabilities for hardware testing, status monitoring, and configuration control of CSOC communications links. AN/FSC-120 performs the functions of mission operations control

and monitor and technical control. Mission operations support includes configuration/reconfiguration and readiness testing of communications resources during real-time and simulated satellite vehicle control operations. The mission operations function also supports a dual node commanding capability. The technical control function includes fault detection and isolation, restoral of communications services, and circuit quality assurance.

AN/FSH-16, Recorder-Reproducer Set, Signal Data: Recorder-Reproducer Set, Signal Data (Record/Storage/Playback) consists of two functional areas: satellite telemetry data recording/reproducing equipment and secure voice recording/reproducing equipment. The satellite telemetry data recording/reproducing equipment is used to record and playback satellite telemetry; command, control and status data; and Inter-Range Instrumentation Group B (IRIG-B) timing information. The equipment can also be used to simulate satellite information, or as a training and testing aid. The satellite telemetry data recording/reproducing equipment consists of high bit rate 14 track digital data storage devices. The secure voice recording/reproducing equipment is used to record and playback secure voice data information associated with the Satellite Operations Complex Operations Central missions and to log IRIG-B time information.

AN/FSC-117, Communications Subsystem: The Communications Subsystem (Operations Secure Voice) consists of the Operations Secure Voice Switch (OSVS), Restricted Area Voice Switch (RAVS), and Backup Secure Voice (BUSV) equipment. The AN/FSC-117 system provides secure station-to-station and net conference capability between CSOC subscribers and network subscribers located external to the CSOC complex at the CSTC and the network Remote Ground Facilities. The AN/FSC-117 also includes digital and analog multiplex systems, digital and analog patch and test facilities, voice digitizers, GFE encryption devices, distribution functions, and subscriber instruments for the BUSV communication capability. The RAVS system provides station-to-station and net conference capability to subscribers internal to the CSOC complex and an Area Public Address System.

AN/FIC-8, Intercommunication Set: The Intercommunication Set (Administrative Communications) provides unclassified and limited classified voice communication service for CSOC users and selected subscriber stations external to the CSOC complex. The focal point for the AN/FIC-8 system is the GFE Private Automated Branch Exchange digital switch located within the CSOC Engineering and Administrative building. The AN/FIC-8 is divided into two functional areas consisting of the Administrative Voice Telephone routing network and the Public Address (PA) system. The AN/FIC-8 switch provides direct dial, station-to-station, and conference net telephone service, Secure Facsimile send/receive capability through the facsimile interface, and classified voice communications via GFE voice digitizer conversion equipment. The public address element provides two interconnected services, General Use and Security PA, which provide PA capabilities throughout the buildings and grounds at Falcon AFB. These services

provide broadcast capability in each of the separate zones identified as part of both the General Use and Security PA services.

AN/FSC-118, Satellite Communication Control Central: The Satellite Communication Control Central (CSOC-RGF Wideband Data Communications) provides the primary link between CSOC and ten Remote Ground Facilities (RGFs). It provides high speed data and secure voice communications from CSOC directly to the RGFs and makes possible dual node commanding, the commanding of space vehicles from either the CSTC or the CSOC. Simplex point-to-point transmission links are used for communications from CSOC or CSTC to the RGFs, while simplex broadcast transmission links are used for communication from the RGFs to CSOC and CSTC. Point-to-point links contain space vehicle commands and secure voice channels. Broadcast links contain space vehicle telemetry, RGF status/echo telemetry, Inter-Range Instrumentation Group (IRIG-B) timing, and secure voice aggregate signals. The major portion of the AN/FSC-118 equipment consists of Military-Off-The-Shelf (MOTS) Defense Satellite Communication System/Satellite Control Facility Interface System (DSIS) hardware and the MDM 100 Multiplexer.

AN/FSC-122, Communication Subsystem: The Communication Subsystem (CSOC-CSTC Wideband) furnishes communication connectivity between the CSOC, Falcon AFB, and the Consolidated Space Test Center (CSTC), Onizuka AFB, by providing one full duplex 2.048 Mbps data link and two 1.544 Mbps T1 secure voice links. The data link and one voice link are transmitted and received over Domestic (commercial) Communications Satellite (DOMSAT) and the second voice link is transmitted and received over the Defense Satellite Communications System (DSCS). The system is comprised of TDM multiplexers, fiber optic modems, patch panels, doppler buffers, and encryption devices at both Falcon and Onizuka AFBs.

AN/FSQ-172, Timing Subsystem: The function of the Timing Subsystem (Support Segment) is to provide an accurate and stable timing standard and reference frequency source and to distribute the time, frequency, and synchronization signals to system users. Inputs to the AN/FSQ-172 include Long Range Navigation (LORAN-C) timing signals, and National Bureau of Standards (NBS) Station WWVB Timing Signals. Within AN/FSQ-172 there are two cesium beam atomic clocks, each of which produces a 5 Megahertz (MHz) and 1 Pulse-Per-Second (pps) signal. The heart of the AN/FSQ-172 consists of a Fault Sensing and Switching Unit which compares the two cesium standards as well as LORAN-C and WWVB signals. Other AN/FSQ-172 hardware processes these signals to produce 5 MHz Basic Timing, IRIG-B kilohertz (kHz) Universal Coordinated Time, 1 pps Time Synchronization and Status Alarms for use by other CSOC Segments.

DEFENSE SURVEILLANCE AND WARNING SYSTEMS

SPACE SURVEILLANCE

AN/FPS-17 and AN/FPS-79: The AN/FPS-17 consists of two fixed antennas and UHF detection radars, which provide a continuous surveillance fence over key Soviet launch areas. The AN/FPS-79 is a mechanical UHF tracking radar, with an 84 foot dish. The antenna is electrically driven by two motors in azimuth and two in elevation. The AN/FPS-79 is capable of continuous operation in either scan or track mode. Data processing capability is provided by VAX computers. General Electric provides O&M support and performs all three levels of maintenance. The primary mission of the AN/FPS-17 and AN/FPS-79 radar systems at Pirinclik is to collect surveillance data on Soviet space and missile events. As a space surveillance network sensor, the systems perform space surveillance and object identification for US SPACECOM. Additionally, the AN/FPS-79 performs a mission of limited missile warning of Soviet ICBMs launched against North America.

AN/FPS-85 Radar Set: This large phased array radar's 24-hour mission is to detect, track, and identify space objects for the US SPACECOM Space Surveillance Network. Located at Eglin AFB, FL, the transmitter with its 32 million watt output is one of the world's most powerful, and together with its 4,600 element receiver array, it is suitable for both deep space and near earth surveillance.

AN/FPS-128 Radar Set (Saipan): This C-band mechanical "tracker" was removed from the range instrumentation ship, USNS Arnold, overhauled and placed into service as a space surveillance sensor. Its mission is to provide early orbit detection of new foreign launches to the US SPACECOM Space Surveillance Network.

AN/FPQ-14 Radar Set (Kaena Point, HI): This C-band mechanical "tracker" supports test and evaluation of ICBMs launched from Vandenberg AFB, CA. When it isn't "busy" with range operations, the tracker provides space object observations to the US SPACECOM Space Surveillance Network. Thus, the Kaena Point's AN/FPQ-14 is termed a "contributing sensor."

AN/FSQ-114 Ground-based Electro-Optical Deep Space Surveillance System - GEODSS: The GEODSS system (AN/FSQ-114) consists of four operational sites distributed in a global network. The four sites (Socorro, NM; Taegu, Korea; Maui, HI; and Diego Garcia, BIOT) are placed at approximately equal deployment intervals around the earth to ensure sequential and full nighttime optical surveillance is achieved. Surveillance operations are only conducted during clear nighttime conditions. The GEODSS system detects reflected sunlight from satellites and other space objects using specially designed telescopes, very sensitive high resolution television cameras, signal processing computers, and sophisticated software. GEODSS provides real time detection, tracking, and identification of space objects in the deep

space ranges of 3,000 nautical miles to beyond 22,000 nautical miles from the earth. A typical GEODSS site has a three telescope system, two 40-inch aperture telescopes, and one 15-inch aperture telescope.

Maui Optical and Identification Facility - MOTIF: MOTIF is co-located with GEODSS, Site III on Mt Haleakala, Maui, HI. Primary mission is to track and provide SOI data for deep space surveillance. MOTIF consists of two, 48-inch telescopes mounted on a single pedestal (B-29 and B-37 telescopes), two low-light level televisions, a compensated imaging system, and a Harris computer system. The equipment at MOTIF is cross utilized between the RADC owned and operated AF Maui Optical System (AMOS) and the Air Force owned MOTIF system.

SATELLITE TRACKING

AN/GKC-1(V) Satellite Tracking Set: Consists of the following seven major equipment groups; control console, antenna control, test control, receiver, transmitter, data processing, and timing. The Satellite Tracking Set is the front end initial processing section for downlink data from a geosynchronous satellite. It receives, demodulates, and re-synchronizes Link 1 and Link 2 telemetry data at a frequency of 2.2-2.3 GHz. The telemetry data is then supplied to the data reduction center processors for final processing. The Satellite Tracking Set also has high power transmit equipment used for uplink command and control of the mission satellite.

AN/GSQ-238 Digital Communications Control Set: The AN/GSQ-238 acts as the hub of a wide area network supporting national military command authorities. The hub receives and processes tactical data messages from a high speed network and distributes these messages to terminals on a low speed network. The AN/GSQ-238 also receives plain text messages from remote terminals and routes these messages to other terminals in the network. The AN/GSQ-238 consists of two groups of equipment. The communications manager group controls all communication interface and message processing functions. The link routing group controls all the communication links to be cross-patched and monitored.

AN/GYQ-15 Data Reduction Central - DRC: The DRC consists of all elements required for the processing of raw satellite telemetry and mission data received from the AN/GKC-1 Satellite Tracking Set. The DRC provides the processed data to a tactical operations center for analysis by satellite operations personnel and satellite engineers. The processed data is also provided to other external users via the Ground Communication Network (GCN) Data Distribution Central (DDC). The primary processing equipment used in the DRC consists of IBM System 370, Model 3033, computers with associated peripherals.

AN/MSQ-118 Satellite - Ground Equipment Mobile Satellite Communications: A self-contained, modified tractor-trailer consisting of a tractor, power generation unit, environmental control unit, operation shelter, and semi trailer. The operations shelter

incorporates data processing equipment and communication equipment. A phase-array antenna mounted on the side of the operation shelter receives satellite telemetry data from a geosynchronous satellite. The processed mission data is provided to an AN/MSQ-120 communication unit for transmission to external users.

AN/MSQ-120 Ground Equipment, Mobile Communication System: A self-contained modified tractor-trailer that consists of a tractor, power generation unit, and a Jam Resistant Secure Communication Terminal (JRSCT) mounted on a semi trailer. The JRSCT is a modified AN/GSC-49 mobile Spread Spectrum Satellite terminal capable of providing secure voice and mission data transmission through communication satellites to worldwide users. Mission data and secure voice communications are provided to the AN/MSQ-120 from the AN/MSQ-118 units.

AN/FSQ-132 NAVSTAR Master Control Station - MCS: MCS serves as the Global Positioning System (GPS) mission control center, receiving and processing information from each of the ground antennas (GA), monitor stations (MS), and the prelaunch compatibility station (PCS). MCS consists of data processing, control, display, communication equipment, and associated software required to perform resource allocation, generate navigation messages, perform satellite health and housekeeping functions, and determine operations capability for both up- and out-channel reporting. Additionally, MCS provides the equipment to support voice and data communications between MCS, GAs, MSs, and PCS. MCS has the capability to remotely operate up to five GAs and six MSs simultaneously. Current MCS throughput capability supports simultaneous contact with four satellites for commanding, navigation message uploading, and telemetry receipt. MCS data processing is performed by two loosely coupled IBM processing units and supporting hardware and software. The primary processor maintains constant communications with each of the GAs and MSs. The secondary processor serves as backup and supports off-line pre- and past- mission analysis and data base preparation.

AN/FRC-178 NAVSTAR Ground Antennas - GA: GAs are active S-band transmission and reception stations that provide the interface to the space vehicle. They are used to command in real time or perform time-specified command strings and store the most recent eight hours of telemetry for playback. Each antenna has a 10-meter parabolic dish with a pointing accuracy of 0.1 degree, and can provide 360 degree horizon-to-horizon coverage. The GAs are used by the MCS to observe space vehicle state of health via telemetry, to command on-board space vehicle functions, and to upload the navigation message.

AN/FSN-5 NAVSTAR Monitor Stations - MS: MSs are passive L-band tracking stations which contain receiving units, processors, a multipath-resistant omni-directional antenna, meteorological equipment, high-stability cesium frequency standards, and communications equipment linking the station to the MCS. MSs are capable of receiving L-band signals from 11 satellites and the test transmitter simultaneously.

They also collect local meteorological data and perform limited data processing. All tracking and meteorological data is forwarded to the MCS. Tracking data collected by the MS includes pseudo-range and accumulated delta range measurements taken every 1.5 seconds on both L1 and L2, along with the actual navigation message being documented.

AN/FSQ-171, Fairchild Satellite Operations Center - FSOC: The FSOC is part of the command, control, and communications (C^3) segment of the Defense Meteorological Satellite Program (DMSP). DMSP is a space-based satellite system used to collect and disseminate global visual and infrared cloud data and other specialized meteorological, oceanographic and solar-geophysical data required to support worldwide DoD operations. The FSOC consists of four major subsystems: the Data Acquisition Subsystem (DAS), consisting of two antennas used to track the DMSP satellites; DAS uplinks commands and down-links mission data and satellite telemetry; the Processing Subsystem (PS), consisting of six high speed computers used to process the telemetry data for engineering analysis of the satellites' state of health and to send command through the DAS to the satellites; the Communications Subsystem (CS), consisting of the multiplexers/demultiplexers, modems, cryptos, and other equipment used to communicate with other systems of the DMSP C^3 ground segment; and the Switching Subsystem (SS), which contains the system configuration and control equipment to route data between the other subsystems.

AN/FSQ-175, Multipurpose Satellite Operations Center - MPSOC: The MPSOC is part of the command, control, and communications (C^3) segment of DMSP. The MPSOC consists of three major subsystems: the Processing Subsystem (PS), consisting of six high speed computers used to process the telemetry data for engineering analysis of the satellites' state of health and to send commands to the satellites through remote site antenna systems; the Communications Subsystem (CS), consisting of the multiplexers/demultiplexers, modems, cryptos, and other equipment used to communicate with other systems of the DMSP C^3 ground segment; and the Switching Subsystem (SS) which contains the system configuration and control equipment to route data between the other two subsystems.

AN/FSQ-128 Operations Central: Provides the capabilities necessary for the user and staff to command and control Air Force Satellite Control Network (AFSCN) resources in support of satellite and space defense operations.

AN/FSQ-189 Satellite Configuration Control System: Also known as Mission Control Complex-1B (MCC-1B), its function is to support telemetry processing and analysis, command planning and execution, acquisition and tracking, equipment control and status, orbit determination, and planning for the Defense Support Program (DSP), Global Positioning System (GPS), and Defense Meteorological Satellite Program (DMSP). Command and control for satellite and ground equipment management is initiated through computers located in the MCC and sent

via the communications system to the remote tracking stations (RTS) for processing or routing to the satellite being addressed.

AN/FSQ-190 Satellite Configuration Control System: Also known as Mission Control Complex-1A (MCC-1A), its function is to support telemetry processing and analysis, command planning and execution, acquisition and tracking, equipment control and status, orbit determination, and planning for the Defense Support Program (DSP), Global Positioning System (GPS), and Defense Meteorological Satellite program (DMSP). Command and control for satellite and ground equipment management is initiated through computers located in the MCC and sent via the communications system to the remote tracking stations (RTS) for processing or routing to the satellite being addressed.

AN/FSQ-191 Satellite Configuration Control System: Also known as Mission Control Complex-2 (MCC-2), its function is to support telemetry processing and analysis, command planning and execution, acquisition and tracking, equipment control and status, orbit determination, and planning for the Defense Satellite Communications System (DSCS), North Atlantic Treaty Organization (NATO) III program, and Fleet Satellite Communications (FLTSATCOM). Command and control for satellite and ground equipment management is initiated through computers located in the MCC and sent via the communications system to the remote tracking stations (RTSs) for processing or routing to the satellite being addressed.

AN/FYQ-134 Digital Computer System: Also known as the Operational Software Maintenance Complex (OSMC), the OSMC is independent and has MCC-like equipment which enables it to provide back-up support for MCC space vehicle operations. The OSMC provides support to the MCCs in software development and changes in training and operations functions. They also provide software modification, debugging, data management services, and conduct exercises and rehearsals.

AN/FSQ-T24 Satellite Configuration Control System Trainer: Also known as Mission Control Complex-Kernal (MCC-K), is used to train Mission Control Team personnel in the various aspects of satellite contact planning, support, and evaluation. Realistic contact scenarios are developed which simulate the use of contact support equipment, associated interface units, and range resources.

AN/FSQ-192 Defense Satellite Communication System Operational Support System: Also known as the Resource Control Complex-Falcon (RCC-F). RCC-F provides the capability to accomplish scheduling and control interrange operations of the Air Force Satellite Control Network (AFSCN) and National Aeronautics and Space Administration (NASA) resources necessary to support satellite operations; scheduling functions to include processing of user resources; and identification of required resources, conflict resolution, and the generation of resource schedules. Control functions include configuring the range

resources, verification and testing of the resources prior to mission operations, and monitoring of the resources during mission operations.

AN/FSQ-151 Automated Remote Tracking Station - ARTS: Located at nine sites around the world, ARTS provides satellite support capabilities from fixed ground tracking stations that are remotely controlled by MCCs through a communications network. Consists of antenna subsystem, core subsystems, enhancement subsystems, and a communications subsystem. Is equipped with built-in monitoring and fault isolation capability to the extent necessary to allow complete remote control and statusing of the station from a Resource Control System (RCS) or MCC. The AN/FSQ-151 consists of a core configuration which has common Telemetry, Tracking, and Commanding (TT&C) and Command and Status (C&S) equipment. TT&C performs acquisition, tracking, and range determination of satellites, reception, and recording of telemetry data, and transmission of commands to the satellite. Antennas are either 33, 46, or 60 feet. The AN/FSQ-151 provides ground-based TT&C support, payload data reception, and data relay support for satellite operations. Also provides S-band telemetry and tracking support for launch, flight testing, and evaluation of orbital satellites.

MISSILE WARNING

AN/FPS-108 - COBRA DANE: COBRA DANE, an intelligence collection phased array radar, is designed to collect data at L-band frequencies during foreign strategic ballistic missile tests. The primary COBRA DANE mission is tracking and collecting data on foreign submarine launched ballistic missile (SLBM) and intercontinental ballistic missile (ICBM) test launches to the Kamchatka Peninsula and Broad Ocean Area. The corollary mission is early warning and the secondary mission is SPACETRACK.

AN/FPS-123(V) Radar Set - PAVE PAWS: The PAVE Phased Array Warning System (PAWS) has sites at Cape Cod AFS, MA; Beale AFB, CA; Robins AFB, GA; and Eldorado AFS, TX. The primary mission of PAVE PAWS is to provide the CMC with Tactical Warning/Attack Assessment (TW/AA) data on all SLBMs penetrating the coverage area. The secondary mission is to provide the CMC and other users with TW/AA data on ICBMs penetrating PAVE PAWS coverage. The PAVE PAWS mission also provides ESV surveillance, tracking, and SOI data as required. All PAVE PAWS sites are dual faced, computer controlled phased array radars with built-in self-diagnostic capabilities. The radars can track multiple objects and, by allocating time, can perform self-diagnostic tests in between tracks. All sub-systems have redundant channels or complete systems, i.e., Dual Cyber 865 computers, beam steering units, and radar controllers. This UHF dual faced phased array radar contains over 2,500 antenna elements on each face, of which 1,792 transmit and receive RF energy. This array provides 602KW of power. The array receives target returns that are processed by four general purpose signal processors. This target data is then processed by the prime mission computer and sent to forward users.

Ballistic Missile Early Warning System - BMEWS: The BMEWS sensors consist of an AN/FPS-120, two-faced phased array radar located at Thule AB, Greenland; three AN/FPS-50V detection radars and an AN/FPS-92 tracking radar at Clear AFS, AK; and three AN/FPS-49A tracking radars at Royal Air Force (RAF) Fylingdales, United Kingdom. The primary mission of BMEWS is to provide CMC with TW/AA data on all ICBMs and SLBMs penetrating the site's coverage. Secondary mission is to provide Launch and Impact (L&I) predictions for attack assessment by the CMC. Thule (Site I) was the first UHF phased array radar designed for BMEWS ICBM warning. This dual-faced phased array radar contains 3,169 antenna elements per face of which 2,560 per face transmit and receive RF energy. Each array provides 870KW of RF power.

The arrays receive target returns which are processed by the signal processors and forwarded to the prime mission computers for final processing and transmission to forward users. Clear (Site II) composition of three detector radars (DRs) is transmitters, reflectors, receivers, and the DR data take off (DRTO). The transmitters (multiple/redundant, 13 ea) supply two 4MW beams (upper and lower) of RF energy to each of the DR reflectors. The reflectors, truncated parabolic toroid sections 165 ft high and 400 ft long are positioned to reflect the lower beams at 3.5 degrees elevation and the upper beams at 7 degrees elevation. Each DR covers a 40 degree azimuth sector. The reflectors receive target returns which are routed to the dual channel dual conversion superheterodyne receiver. Receive signals are routed to the DRDTO which performs analog to digital conversion. These digital signals then are processed through the main mission computers (CDC Model 170-720) for final processing and transmission to forward users. The Clear AN/FPS-92 Tracking Radar (TR) consists of transmitters, antenna assembly, receiver, and TR data take off (TRDTO). The transmitters (multiple/redundant, 3 ea) supply 8MW of RF energy to the antenna assembly (4MW in azimuth and 4MW in elevation). The antenna is an 84 ft diameter parabolic dish. The movable portion weighs 210,000 lbs (105 tons) and is enclosed in a 140 ft diameter radome.

Target returns are routed to the receiver which consists of two sections, scan and track. Each section amplifies and processes the four monopulse signals through the TRDTO for analog to digital conversion, then to the prime mission computer for final processing and transmission to forward users. Fylingdales (Site III) became operational as a mechanical tracking radar (3 ea) in Sep 64. Upgrade to a 3-faced phased array radar was accomplished for IOC in Jul 92. The operation of the AN/FPS-49 is identical to the AN/FPS-92 (Clear, Site II), except the AN/FPS-49 has a traditional azimuth bearing assembly (race and steel balls) while the AN/FPS-92 has a hydrostatic bearing (antenna floats on a high pressure film of hydraulic fluid).

AN/FPQ-16 Radar Set, Perimeter Acquisition Radar Attack Characterization System - PARCS: PARCS is a single faced phased array radar system consisting of AN/FPQ-16 radar and an AN/FSQ-100 computer system located at Cavalier AFS, ND. The primary mission of the PARCS

is to provide the CMC with TW/AA data on all SLBMs penetrating the coverage area. The secondary mission is to provide the CMC and other users with TW/AA data on ICBMs penetrating PARCS coverage area.

ATMOSPHERIC WARNING SYSTEM CONNECTIVITY
(CMAFB-CONUS ROCC-ROCC's-SOCC's)

CMAFB	
CONUS ROCC	
CONUS SOCC's	
ICELAND ROCC	
ALASKAN ROCC	
CANADIAN SOCC'S	
HAWAIIN ROCC	
FORWARD TELL	
LATERAL TELL	
FORWARD TELL/FMS	
FORWARD/TELL/FMS	
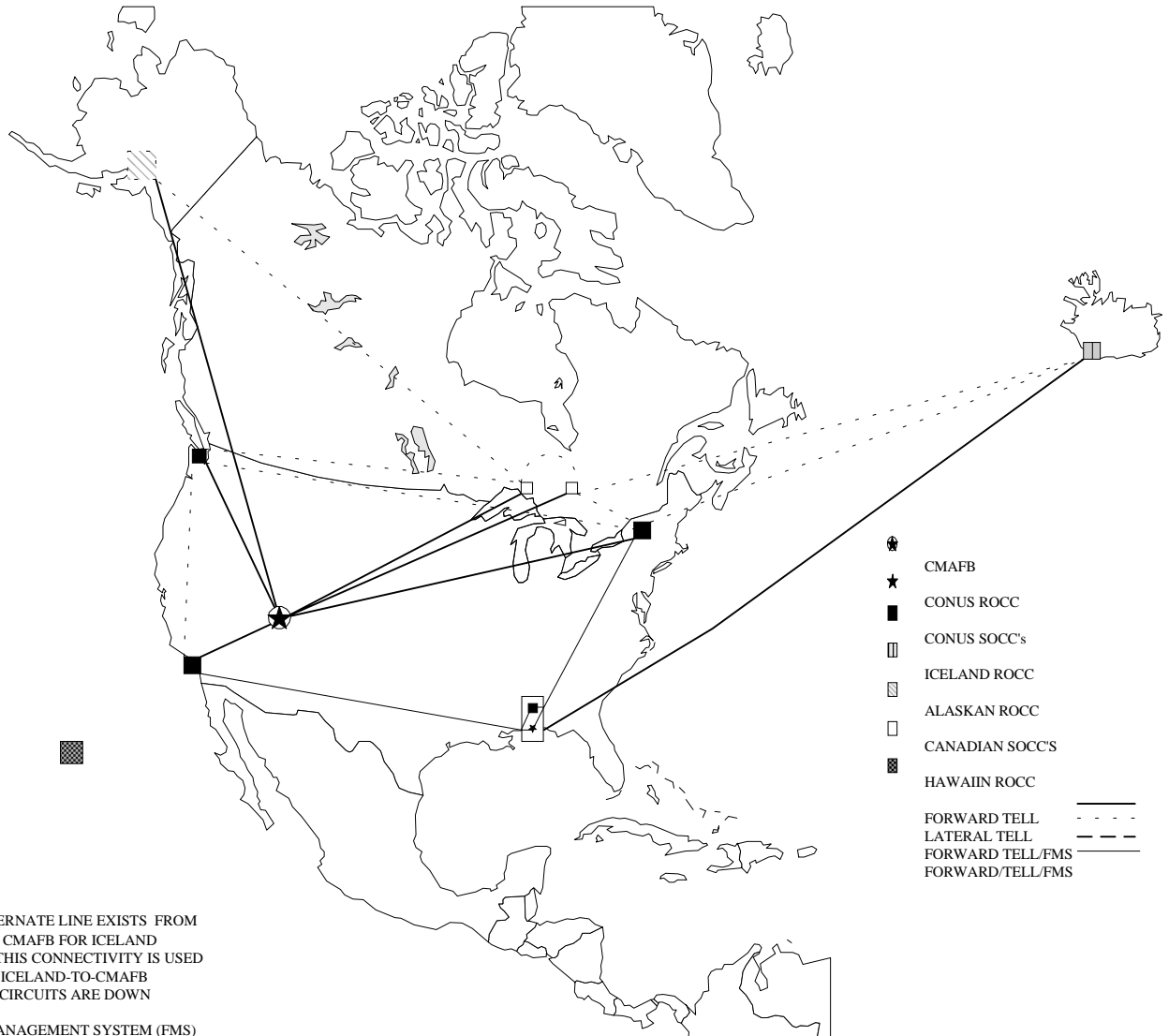
Note : AN ALTERNATE LINE EXISTS FROM CONUS ROCC TO CMAFB FOR ICELAND FORWARD TEL. THIS CONNECTIVITY IS USED WHEN PRIMARY ICELAND-TO-CMAFB FORWARD TELL CIRCUITS ARE DOWN

Note: FORCE MANAGEMENT SYSTEM (FMS) PROVIDES THE CONUS NORAD REGION COMMANDER WITH TIME SENSITIVE INFORMATION NEEDED IN DEFENSE OF THE NORTH AMERICN CONTINENT.

AIR DEFENSE SYSTEMS

The Air Combat Command (ACC) portion of the Air Defense System (ADS) is composed of the CONUS Region Operations Control Center (CONUS ROCC), the Iceland ROCC (ICEROCC), and four Sector Operations Control Centers (SOCC) that provide NORAD with the means to detect, identify, intercept, report and, if necessary, destroy an airborne object which may pose a threat to North America in fulfillment of the tactical threat warning attack assessment. The CONUS ROCC is responsible for force employment, deployment, and execution in support of the ACC portion of air defense operations during peacetime, transition, and wartime. The SOCC is the focal point for the conduct of weapons, surveillance, interface, and identification functions. ROCCs/SOCCs play a vital role in anti-drug detection, monitoring, and interdiction.

Connectivity: Radar land lines to long range radars, Tethered Aerostat Radar Systems (TARS), Over The Horizon-Backscatter (OTH-B), Lateral Tell Lines between all adjacent SOCCs; Lateral Tell lines from Air Forces Iceland (AFI) to Northeast SOCC and Canada East; Forward Tell from AFI to CONUS ROCC and NORAD Cheyenne Mountain AFB (CMAFB); Forward Tell from CONUS SOCCs to CONUS ROCC and NORAD CMAFB; UHF ground-air-ground to GATR sites; land line TADIL B and HF TADIL A/B through ROCC/AWACS Digital Information Link (RADIL); Meteor Burst VHF; land lines to FAA AMIA.

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                                              ┌ · · · ALSO FMS DATA ROCC ONLY · · · ┐
                              ┌─────────────┐
                              │  NW SOCC    │                  ┌─────────┬─────────┐
                              │ McCORD AFB  │                  │ CONUS   │         │
                              └─────────────┘                  │ ROCC    │  CMAFB  │
                              ┌─────────────┐                  └─────────┴─────────┘
                              │  SW SOCC    │
                              │ MARCH AFB   │
              ┌─────────┐     └─────────────┘
              │  OTHB   │     ┌─────────────┐
              │         │◄───►│  SE SOCC    │
              │         │     │ TYNDALL AFB │
              │  ECRS   │◄───►└─────────────┘
              └─────────┘     ┌─────────────┐
                              │  NE SOCC    │
                              │ GRIFFISS AFB│
                              └─────────────┘
                              ┌─────────────┐
                              │  ICEROCC    │
                              │ AIR FORCES  │
                              │  ICELAND    │
                              └─────────────┘
                              ┌─────────────┐
                              │  CESOCC     │
                              ├─────────────┤
                              │  CWSOCC     │
                              ├─────────────┤
                              │ NORTH BAY   │
                              └─────────────┘
                              ┌─────────────┐
                              │ ALASKA ROCC │
                              │ ELMENDORF   │
                              │    AFB      │
    LATERAL TELL DATA         └─────────────┘   FORWARD TELL DATA

                              ADS CONNECTIVITY
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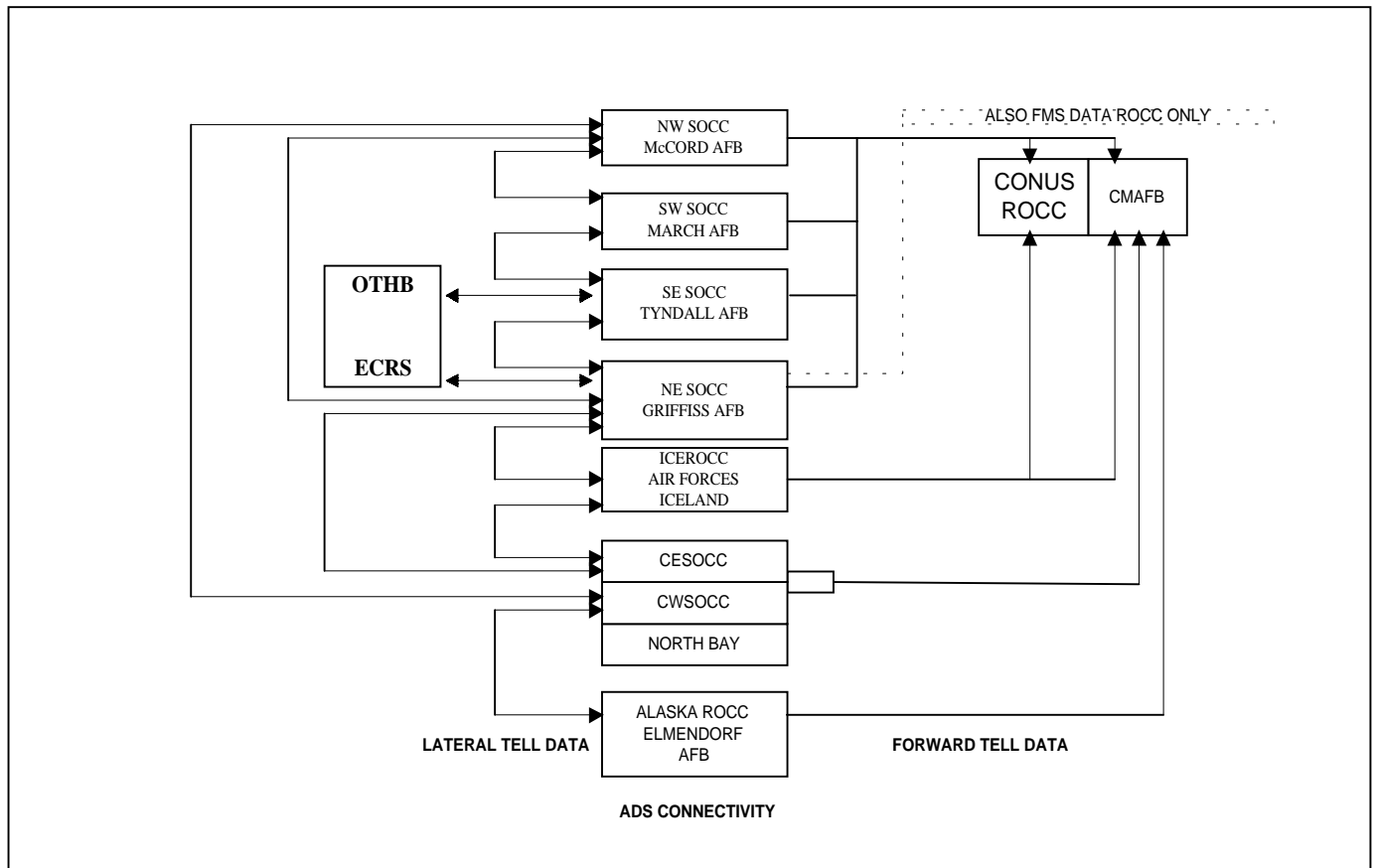
JOINT SURVEILLANCE SYSTEM - JSS

The JSS Program is a joint USAF/FAA radar use program. The ACC portion
of the JSS is composed of four CONUS SOCCs and 44 ground-based radars.
Each radar site has a delta-band radar. Collocated with the majority
of radar sites are ultra-high frequency (UHF) ground-air-ground (GATR)
transmitter/receiver facilities.   The GATR facility provides radio
access to fighters and AWACS aircraft from the SOCCs. The JSS radars
forward surveillance data to the SOCCs who in turn forward tracks of
interest to the CONUS ROCC and NORAD. CONUS SOCCs communicate with the
CONUS ROCC and NORAD by voice and data landline circuits.

Connectivity: Radar/track data provided via landlines. UHF radio for
ground-air-ground use. Two very high frequency (VHF) radios will be
installed at 14 sites.   More radios will be added as funds become
available. Land line TADIL-B and HF TADIL-A capability through the
ROCC/AWACS Digital Information Link (RADIL).

Equipment: FAA Air Route Surveillance Radar (ARSR) 1, 2, and 3.
AN/FPS-93 Search Radar. AN/FYQ-93(4) Computers.
Planned Improvements: FAA/AF Radar Replacement program is the CONUS
JSS upgrade program. Thirty six radars (ARSR-4 three dimensional long
range radars) will replace older JSS two dimensional surveillance and

height finder radars with modern, reliable systems. A replacement program is being planned for the antiquated AN/FYQ-93 SOCC computers.

JOINT SURVEILLANCE SYSTEM
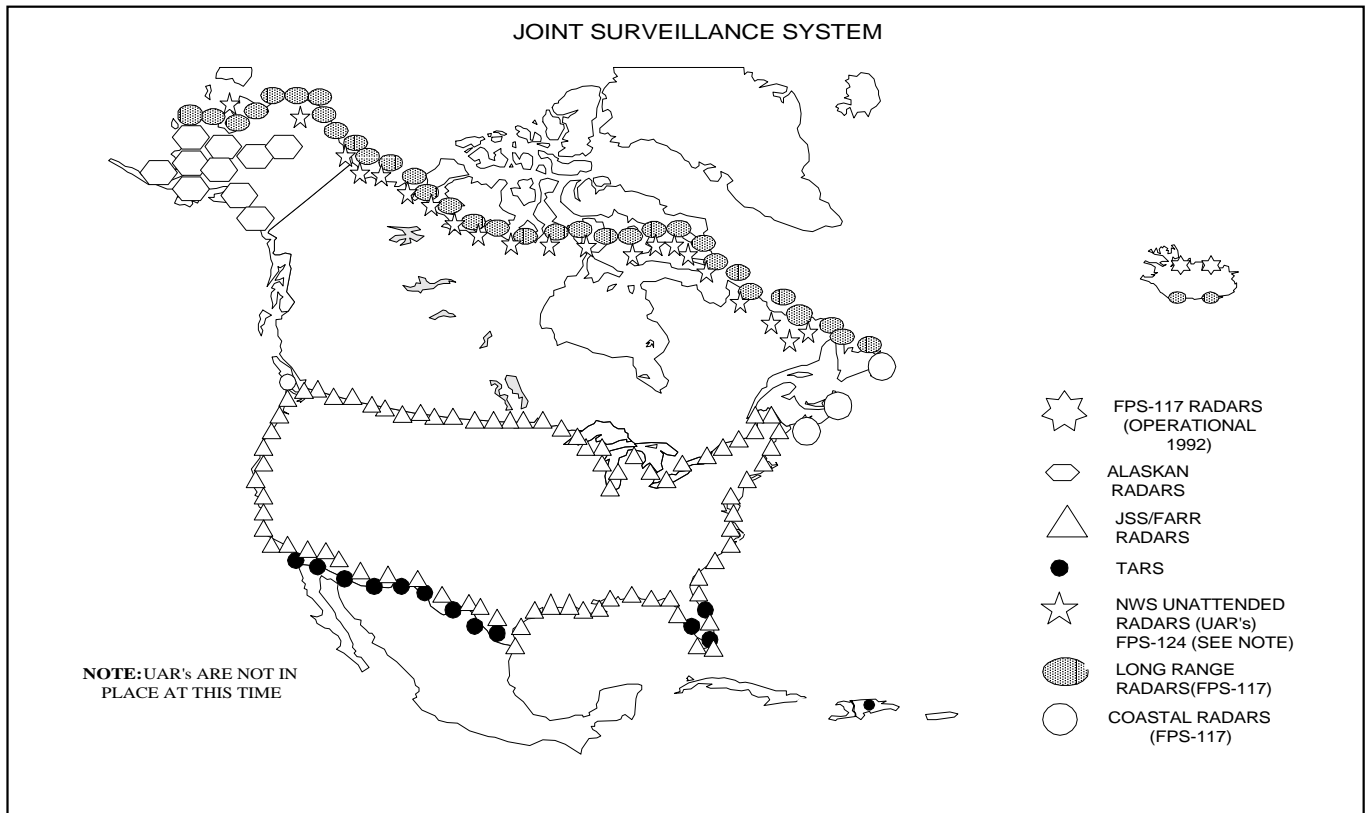
FULL COMMUNICATIONS SERVICE - FCS

The JSS Full Communications System (FCS) is a radio communications and information transfer system interconnecting the North American (Alaska, Canada, and CONUS) air defense regions and sectors with USAF/FAA sensor sites. FCS is a follow-on to the JSS Contingency Communications System. FCS encompasses the total communications equipment and network supporting the NORAD mission, i.e., peacetime air sovereignty and wartime air defense of the North American continent.

Connectivity: Under normal conditions, connectivity to the sensor sites is provided by two point-to-point circuits for radio voice and two switched circuits for radar data and radio voice. If the need for operational radios arises, two additional switched circuits can be taken from an augment pool. The capability for ground-to-air radio phone patch from the SOCC is also available.
Equipment: Leased communications equipment/consolers are provided and maintained by GTE Telecom incorporated.

Planned Improvements: FCS is a dynamic system where improvements are made as needed through the FCS contract.

NORTH WARNING SYSTEM - NWS

NWS is a joint US/Canadian program designed to replace 31 Distant Early Warning (DEW) Line radars located across northern Alaska and Canada. A mix of GE AN/FPS-117 long range radars (Delta Band) and UNISYS AN/FPS-124 (L Band) unattended radars (UAR) have been installed. Long range radars (LRR) are currently in place. Three other LRRs have been installed at new sites on the eastern Labrador coast. UARs were installed in FY92-FY94. Maintenance Control Facilities (MCF) will be collocated with the Alaskan ROCC and Canadian SOCCs to provide remote control of UAR sites. Connectivity between LRRs, LRRs, UARs, MCFs, and the ROCC/SOCC will be provided by a satellite communications network.

Connectivity: Satellite communications between control centers and radar sites. UHF ground-air-ground between LRRs and ROCC/SOCCs.

Equipment: 15 AN/FPS-117s and 39 AN/FPS-124s.

Planned Improvements: None.

NORTH WARNING SYSTEM - NWS
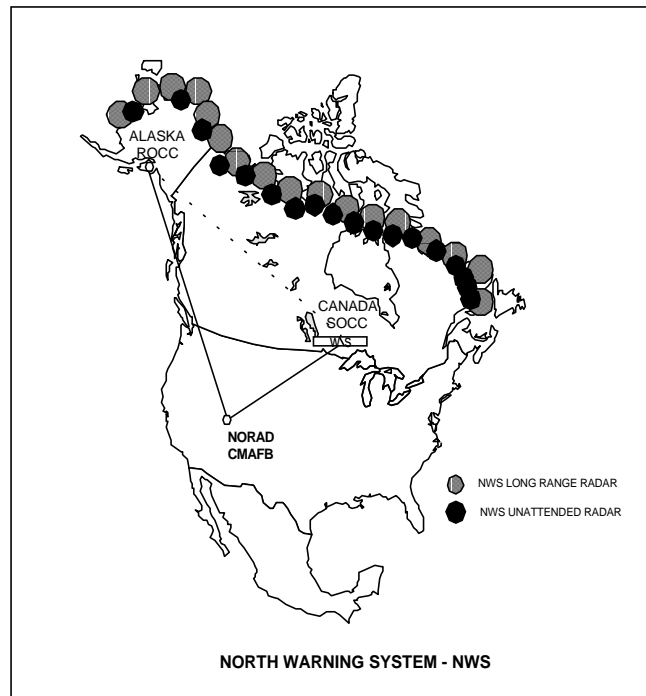
NORTH ATLANTIC DEFENSE SYSTEM - NADS

NADS is a modern surveillance command, control, and communications (C^3) system designed to enhance the ability of Air Forces Iceland to carry out the NATO mission of Icelandic Air Defense. NADS objectives are to ensure peacetime management of the Iceland Air Defense Region, to identify and counter threats to air and sea lines of communications in the North Atlantic, and to provide threat warning to the operations of US and allied forces in the North Atlantic region. NADS will provide a comprehensive surveillance, data handling, and communications system. The system will be capable of handling all aspects of land, sea, and air defense.

Connectivity: Radar sites tied to ICEROCC via fiber optic cables. UHF ground-air-ground between ICEROCC and sites. HF TADIL A and land line TADIL B through RADIL. The illustration below identifies the current configuration.

Equipment: AN/FPS-93A (H1&H3) and AN/FPS-117 (H2&H4).

Planned Improvements: The NADS program will provide an automated C^3 system, four new Delta Band ground based AN/FPS-117 radars and off island sensors. Currently, two new radars and two old radars are tied into an interim C^3 facility (ICEROCC). The two AN/FPS-93A two

NORTH ATLANTIC DEFENSE SYSTEM
(NADS)
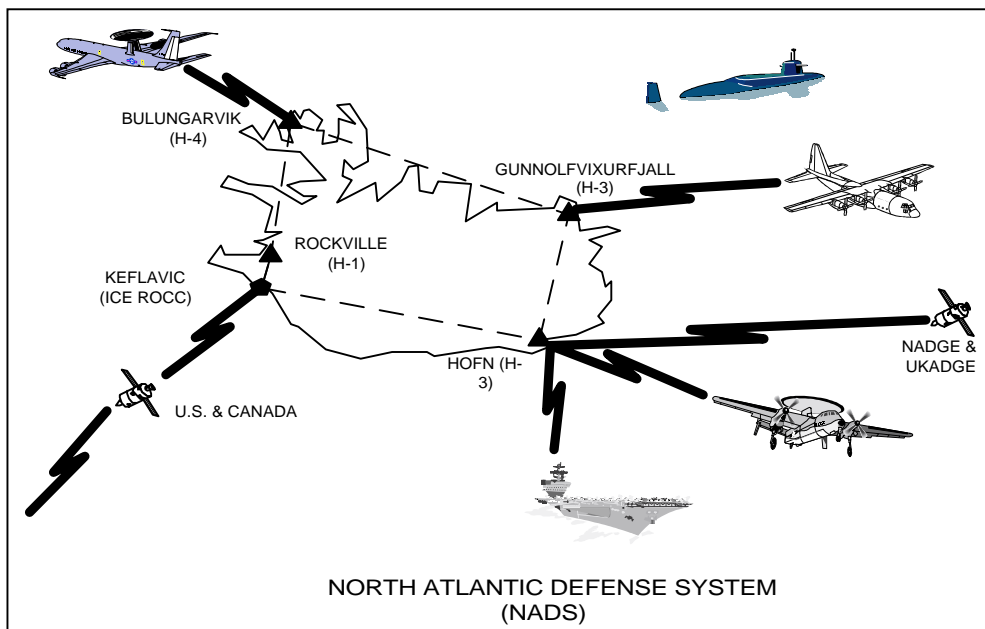
dimensional radars were replaced by two AN/FPS-117(V)5 three dimensional radars in FY92. The ICEROCC was replaced by the Control and Reporting Center in FY95.

OVER-THE-HORIZON BACKSCATTER - OTH-B
RADAR SYSTEM

The OTH-B radar system provides extended range surveillance and tactical early warning for the National Command Authorities through NORAD for decision making and to counter an attack on North America. An OTH-B is a bistatic radar that uses the high frequency spectrum to refract radar beams off the ionosphere to the surface/target. A small portion of this energy is reflected back (backscattered) to the receiver by the same process. This provides the radar with an area barrier of surveillance, from the ionosphere to ground level that may be placed from 800 to 1800 nautical miles. The program consists of two systems, East and West coast. Data is currently provided to the Northeast and Southeast SOCCs, Canada East, as well as CONUS ROCC and NORAD CMAFB. Each radar system consists of an operations center, transmitter site, and receiver site. The system is designed in multiple segments that individually provide 60 degrees of radar coverage. The East Coast and West Coast systems consist of three segments each.

Connectivity: Radar/track data is provided via land lines. Connectivity between system sites is via troposcatter on the east coast and via satellite on the west coast.

Equipment: AN/FPS-118.

Planned Improvements: The East Coast system is currently being used in a limited operations capacity (one segment, 40 hours-a-week). The West Coast has been placed in cold storage with a capability to become

BANGOR

MT HOME

● OPERATIONS CENTER
▲ TRANSMITTER
■ RECEIVER

**OVER-THE-HORIZON
BACKSCATTER (OTH-B) RADAR SYSTEM**
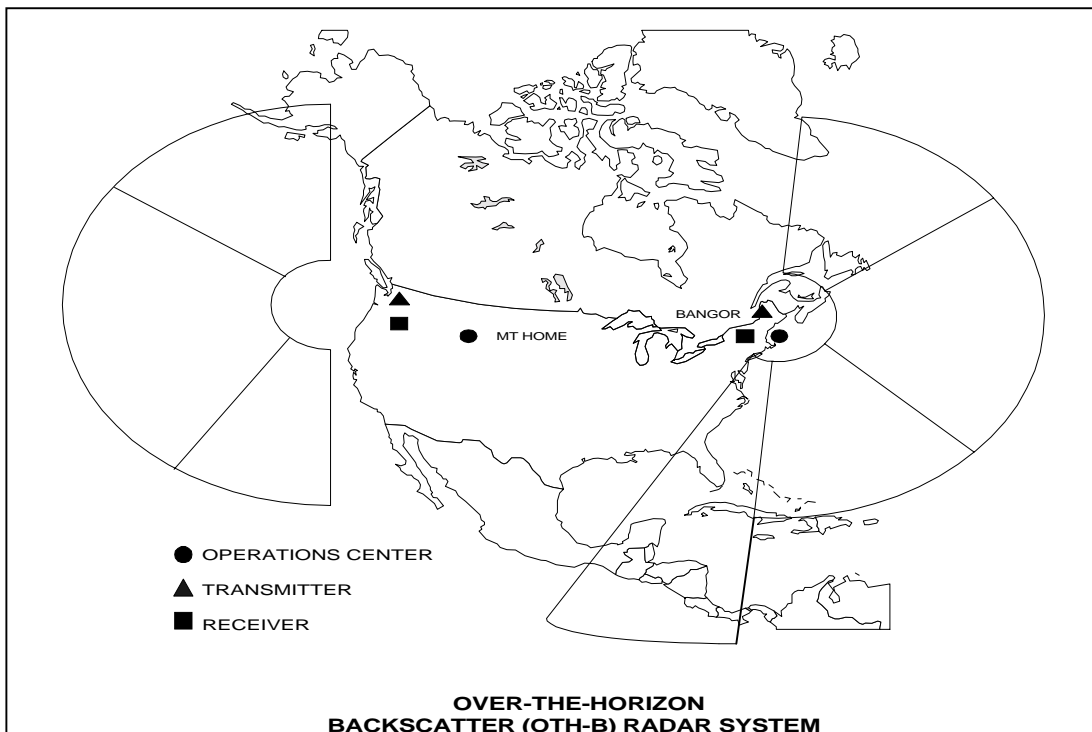
operational within 12 hours.

CARIBBEAN BASIN RADAR NETWORK - CBRN

CBRN is a USCINCSO and USCINCLANT requirement that establishes a radar
air surveillance capability throughout the Caribbean Basin area to
enhance drug and arms interdiction, air surveillance, regional
cooperation, and attack warning (refer to the illustration below). Ten
new and ten existing radars will be connected via satellite and
microwave to respective Northern Regional Operations Centers (NROC),
Naval Air Station Key West, or Southern Regional Operations Centers
(SROC), Howard AFB, Panama. Satellite connectivity will also be
provided between the SROC and Host Nation Command Centers. Ten sites
are operational, six new installations and four existing sites are
integrated into the network.

Connectivity: HF, UHF, VHF, SATCOM, and TADIL-A.

Equipment: AN/FPS-67, AN/FPS-70, AN/FPS-93, Data Terminal Set,

EXISTING RADARS INTERGATED INTO CBRN

NEWCBRN RADARS

1992-FUTURE CBRNS

NEW CBRN ISNTALLED RADARS

EXISTING RADARS INTERGRATED INTO CBRN

1. Key West, Florida
2. Guantanamo Bay, Cuba
3. El Manaclar, Dominican Republic
4. Punta Salinas, Puerto Rico
5. Punta Boringuen, Puerto Rico
6. Lajas, Puerto Rico
7. Pico Del Este, Puerto Rico
8. Yucatan Gap
9. Cayman Island
10. Trujillo, Honduras
11. San Andras, Columbia
12. Semaphore Hill, Panama
13. Barranquilla, Columbia
14. Rochacha, Columbia
15. Monte Cano, Venenzuela
16. Maracay, Venezuela
17. El Copey, Venezuela
18. Cerro La Mole, Honduras
19. Cerro Azul, Costa Rico
20. Mount Denham, Jamaica

CARIBBEAN BASIN RADAR NETWORK
(CBRN)

Tactical Display Console, Operator Display Console, Joint Visually
Integrated Display Systems, EDO box, satellite earth terminal,
microwave radio system, HF, UHF, and VHF radios, KG-40 and KG-84.

Planned Improvements: None.

TETHERED AEROSTAT RADAR SYSTEM - TARS

The aerostat network is a system of lighter-than-air platforms (balloons) called aerostats, with an associated look down capable radar anchored to the ground by a tether. These systems are located at fixed locations across the US from Arizona to Florida into the Caribbean. The purpose of TARS is to create an effective low-level radar detection capability along specified drug routes. The TARS is subdivided into three adjacent segments: Southwest Border (six systems from California to Texas); Gulf of Mexico (one system operational and five planned from Texas to Florida); and the Caribbean Basin (three operational and one planned from Florida to Puerto Rico). These systems forward surveillance data to two USCS Command, Control, Communications, and Intelligence (C^3I) Centers on the East and West coasts as well as NORADs Southwest and Southeast SOCCs and the CARIBROC located in the Florida Keys. The illustration below identifies a TARS typical deployment.

Connectivity: Radar/track data transmitted through land lines.

Equipment: DPS-5 (4 systems), L-88 (4 systems), and AN/TPS-63 (5 systems).

1. YUMA
2. FT HUACHUCA
3. DEMING
4. MARFA
5. EAGLE PASS
6. RIO GRANDE CITY
7. MATAGORDA
8. MORGAN CITY
9. ALABAMAPORT
10. HORSESHOE BEACH
11. VENICE
12. CUDJOE KEY
13. HIGH ROCK
14. GEORGETOWN
15. GREAT INAGUA
16. PUERTO RICO

**TETHERED AEROSTAT RADAR SYSTEM
(TARS)**
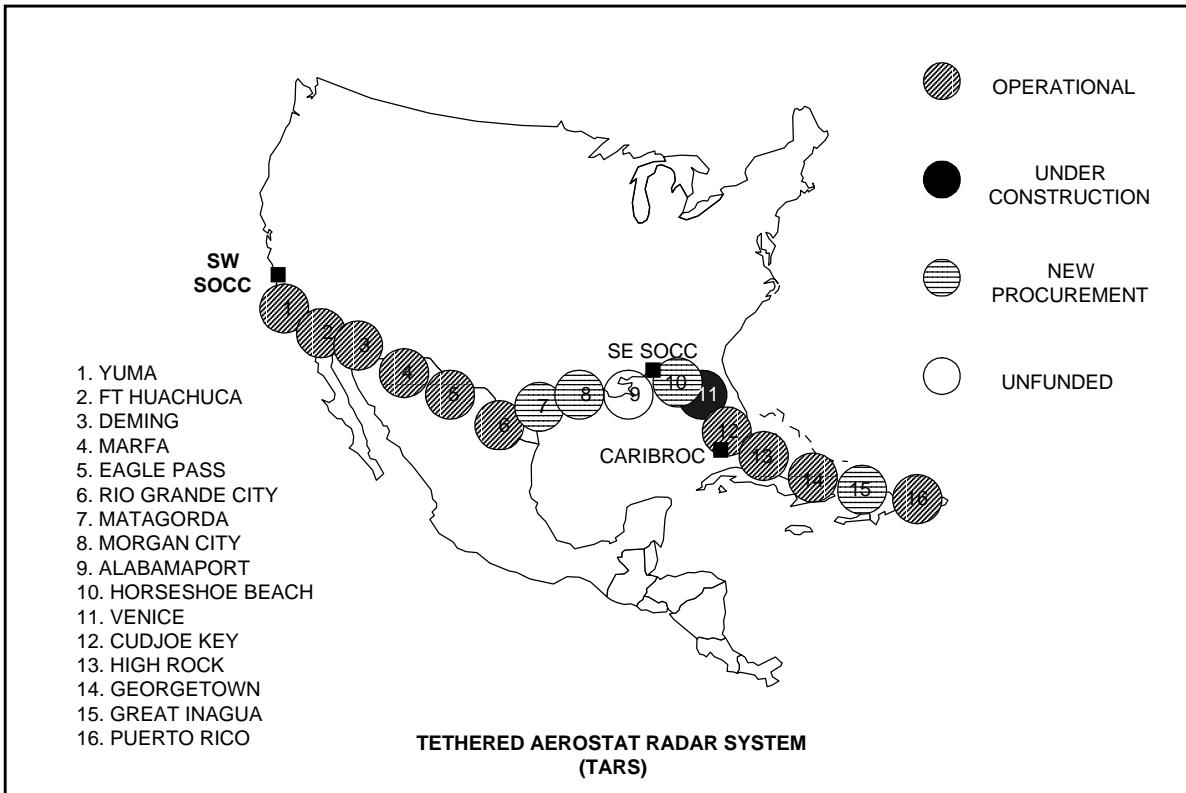
THE TACTICAL AIR CONTROL SYSTEM – TACS

The Tactical Air Control System (TACS), a major user of nine-level personnel, has both a ground and an airborne segment which together form a theater-level command and control system designed to be deployed anywhere in the world. It provides the command and control capability to direct all Air Force assets in a given theater or area of responsibility (AOR), and is under the command of the senior Air Force commander in the theater or AOR. The two main segments of the TACS are the ground and airborne TACS. The airborne TACS consists of Airborne Warning and Control System (AWACS) units flying E-3A surveillance and EC-130 COMPASS CALL and Airborne Command and Control Center (ABCCC) aircraft. AFSC 2E2X1 personnel are assigned to these units for maintenance of the computer control and display systems of the aircraft.

MISSION AND ORGANIZATION

The USAF TACS provides the Tactical Air Forces (TAF) Commander with a mobile command and control system and trained personnel which can be tailored for large or small scale operations in varying intensities of warfare. The TACS elements may be deployed to form a complete system or deployed incrementally to augment an existing theater fixed/mobile system. The TACS operates on the principle of centralized control and decentralized execution. A TACS is the organization, personnel, procedures, and equipment necessary to plan, direct, and control tactical air operations and to coordinate air operations with other services and allied forces. It is composed of control agencies and communications-electronics (C-E) facilities that provide the means for centralized control and decentralized execution of tactical air operations.

The TAF Commander serves as the commander of the Air Force component of the joint or combined force and controls Air Force operations through the Tactical Air Control Center (TACC). The TACC is the wartime operations center of the TAF Commander. The TACC provides the TAF Commander with the capability to supervise and manage the activities of assigned or attached forces, and to monitor the actions of both friendly and enemy forces. The TACC is the senior control element of a TACS and includes personnel and equipment of both a Tactical Air Control Center Squadron and a Tactical Intelligence Squadron.

ELEMENTS OF A TACTICAL AIR CONTROL SYSTEM – TACS

The elements of the TACS include the Tactical Air Control Center (TACC), Airlift Control Center (ALCC), Control and Reporting Center (CRC), Control and Reporting Post (CRP), Forward Air Control Post (FACP), Airborne Warning and Control System (AWACS), Airborne Battlefield Command and Control Center (ABCCC), Air Support Operations Center (ASOC), Tactical Air Control Party (TACP), and Airborne Forward Air Controller (AFAC).

The main purpose of the ground TACS is to provide the capability to implement the centralized control and decentralized execution doctrine of the TAF. It consists of two distinct legs that, together, implement this doctrine. The direct support leg provides offensive air support for the ground war, while the control and surveillance leg provides air defense, airspace control, and attack warning. The direct support units are the ASOC and the TACPs located at the Corps, Division, Brigade, and Battalion levels of associated Army combat units. The control and surveillance leg is comprised of the CRC, CRP, and the FACP. As the senior element of the TACS, the TACC brings both legs of the system together under the direct control of the theater command structure.

Tactical Air Control Center - TACC: The TACC provides centralized control of the entire air war through its two main functions - Combat Operations and Combat Plans. Combat Operations directs today's war while Combat Plans develops plans for tomorrow's. A Tactical Intelligence Squadron deploys as part of the TACC to provide all-source intelligence support to the entire effort. TACC is the main command center for control of the TACS. It prepares, issues, and monitors the execution of coordinated orders for the employment of all TAFs assigned, attached, or otherwise made available to the commander. The TAF Commander, through the TACC, issues planning guidance to command/control assigned forces. This is called the air directive and outlines the apportionment of the air effort. The TACC also develops and distributes the Air Tasking Order (ATO) which translates the apportionment guidance into allocation tasking.

TACC MAJOR EQUIPMENT / SYSTEMS

•AN/TRC-170(V) Troposcatter Radio Set(s)
 AN/TSC-60(V) HF Communications System
•AN/TTC-39A Telephone System
•AN/TSQ-111 Technical Control Facility
•AN/TRC-87B UHF Communications Central
•AN/TSQ-146(V) Multiplex System
•AN/TSC-100A(V)2 Satellite Communications System
•A/E24U-8 Transportable Power Plant
•Computer Assisted Force Management System/Contingency TACS Automated Planning System (CAFMS/CTAPS)
•AN/TSQ-165 Modular TACC

Air Support Operations Center - ASOC: The ASOC's main function is to coordinate, plan, and direct immediate tactical air support in support of ground forces. It is normally collocated with the Army Corps HQ, where it is in the best position to receive immediate air requests from TACPs at subordinate Army echelons. The ASOC coordinates these requests with the Army operations and fire control staff, and the TACC, and then provides initial direction to the aircraft as they enter the area. In addition, the ASOC staff works with their Army counterparts

to advise them on the best uses of different types of air assets and weapons.

ASOC MAJOR EQUIPMENT / SYSTEMS

•AN/TSQ-93 Operations central
•AN/MRC-108/-107, and AN/GRC-206 Communications Central (the AN/GRC-206 is replacing older models)
•AN/TSC-94A(V)2 Satellite Communications System
•AN/TRC-170(V) Troposcatter Radio Set
•Various small TRI-TAC Systems
•A/E24U-8 Transportable Power Plant

Tactical Air Control Party - TACP: TACPs, subordinate to ASOCs, are located at Army units down to battalion level. Equipped with AN/MRC-107/-108 or AN/GRC-206 Communications Central, their function is to advise the Army commanders on the use of tactical air and to request air support for immediate needs on the battlefield.

CRC MAJOR EQUIPMENT / SYSTEMS

•AN/TPS-43E Radar Set (being upgraded to AN/TPS-75)
•AN/TSQ-91 Operations Central (to be replaced with AN/TYQ-23 Modular
  Control Equipment)
•AN/TTC-30 Telephone Switch (being replaced with AN/TTC-42 TRI-TAC Switch)
•A/E24U-8 Transportable Power Plant
•Other communications systems are identical to TACC but in larger numbers.

Control and Reporting Center - CRC: The CRC is the senior element of the control and surveillance leg of the TACS. It is directly subordinate to the TACC in executing the war effort and is responsible for overall airspace control and warning. It collects and collates data from other sensor elements and distributes a consolidated air picture to the TACC, AWACS, Army Air Defense units, and other command and control centers. In a "classical" employment scenario, the CRC would be responsible for overall airspace management of approximately a Corps area, with subordinate units to provide close-in control and "gap-filler" coverage of selected areas.

Control and Reporting Post - CRP: The CRP is identical to the CRC except for slightly smaller numbers of operations personnel and some communications equipment. It focuses the control functions of the CRC in a smaller geographical area and reports to the CRC. The CRP is likely to disappear as a distinct element of the TACS when the AN/TYQ-23 Modular Control Equipment is fully fielded. In all other areas, the CRP is identical to the CRC.

Forward Air Control Post - FACP: The FACP is the smallest, most mobile of the radar units in the TACS. It is normally employed within 50 miles of the actual or expected fighting, and can redeploy and be operational in a very short time in response to changing situations. The FACP completes the decentralized execution loop of the combat doctrine, by providing close control

of air assets immediately prior to engagement. They also provide

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FACP MAJOR EQUIPMENT/SYSTEMS

•AN/TSC-53 Communications System
•AN/TPS-43E Radar Set (being upgraded to the AN/TPS-75)
•AN/TSQ-61 Operations Center (will be replaced by AN/TYQ-23 Modular Control Equipment)
•A/E24U-8 Transportable Power Plant

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detailed radar coverage of their assigned area.

Other uses of 2EX9X personnel within the TACS are in the reconnaissance business and in the TAC component of NORAD - the First Air Force. Imagery obtained by various photographic reconnaissance platforms are processed and interpreted by the WS-428A Tactical Information Processing and Interpretation (TIPI) ground segment, maintained to a large degree by 2E2X1 personnel. 2E2X1s are also used extensively in the 1 AF Region and Sector Operations Centers for maintenance of the AN/FYQ-93 Computer System. 2E2X1, and several other C-E maintenance AFSCs, are also used extensively as Quality Assurance Evaluators (QAEs) for several NORAD systems maintained by contractor personnel. These include the AN/FPS-117 North Warning and the AN/FPS-118 Over-the-Horizon Backscatter radar systems.

COMMUNICATIONS LINKS

The TACS uses land-line cable for voice and data transfer within a site. Long haul communications are done by radio wave transmission. The following is a short description of the types of communications available to the TACS:

HF Radios: HF is beyond-line-of-site communications. Therefore, HF transmission quality is affected by changes in the ionosphere. The major influence on the ionosphere is radiation from the sun; therefore, time of day, time of year, and sun spot activity affect HF radio transmissions.

UHF Radios: UHF is normally a ground-to-air link. UHF is line-of-site communications. Its limiting factors for quality transmission are the local terrain and the curvature of the earth.

VHF Radios: VHF is primarily used in frequency modulated (FM) radios. It is line-of-site and similar to UHF in transmission.

Wideband (multi-channel) Radios: Primary communications in the TACS. Wideband is a technique for minimizing the use of radio frequencies by putting more than one signal (channel) on each frequency. Consists of troposcatter and satellite radios.

Troposcatter: A very high power UHF transmitter that uses a high gain directional antenna to transmit energy at the horizon. These waves are then scattered off the troposphere and sent back to earth. A typical path is 300-1000 Nms. Troposcatter shots need high power transmitter, elaborate antennas, and link engineering to get the signal to the receiver.

Communications Satellites: Basically, a microwave repeater station. It receives an "uplink" signal from earth, amplifies it, and re-transmits it on a separate "downlink" frequency. There can be several separate communications channels in one satellite. The vast majority of communications satellites are "parked" in a synchronous, orbit--that is, they appear to hover over a certain spot on the earth. With this type of orbit, it's relatively simple to aim the ground station antennas. Satellites are the only medium that must be controlled by man. Each system has a limited number of channels and the network is controlled by an agent.

Tactical Digital Information Link - TADIL: Approved standard communications link suitable for transmission of digital information. This system is intended to improve on existing analog data transmission capabilities.

TADIL A: HF (Primary), UHF (Backup) send or receive. Purpose is to pass aircraft track information from C^2 airborne elements to C^2 ground.

TADIL B: Multichannel send and receive. Purpose is to pass aircraft track information between ground C^2 elements. It is a ground-to-ground link.

TADIL C: UHF send or receive. Purpose is to control aircraft from C^2 elements to fighters. Normally air-to-air system.

TADIL J: UHF (TACAN Band) Purpose is to pass aircraft track information and other messages from C^2 airborne to ground and fighter units. It's used in the Joint Tactical Information Distribution System (JTIDS) and will replace TADIL A in most cases. It's an air-to-air and air-to-ground link.

TACS OPERATIONS SYSTEM SHELTERS

AN/TSQ-61: A Forward Air Control Post (FACP) is an operations central which provides radar surveillance data by means of two AN/UPA-62C PPI (Plan Position Indicator) scopes and aircraft control communications through the use of the AN/TSC-53 van for the FACP. The operations central also coordinates the FACP operation by communicating with other elements of the TACS.

AN/TSQ-91: A Control Reporting Center/Post (CRC/CRP) operations central which when integrated with the AN/TPS-43E radar functions as the major weapons control agency of the TACS. Facilities are provided to perform all functions of surveillance and weapons control within its assigned area of responsibility.

AN/TSQ-92: A Tactical Air Control Center (TACC) operations central which is the command action arm of the TACS. The TACC is essentially a manual operation; it consists of desk positions, manually posted plotting displays, and communications equipment necessary to support personnel. Facilities are provided to perform the current operations and current plans functions of the Air Force Component Command Post (AFCCP).

AN/TSQ-93: An Air Support Operations Center (ASOC) is an operations central which provides fast reaction to ground force requirements for immediate close air support, tactical reconnaissance, and aircraft needs. Working in close coordination with Army personnel, ASOC personnel provide the focal point for information exchange, coordination, and allocation of sorties provided by the TACC to fulfill Army requirements. Like the TACC, the ASOC is essentially a manual operation; it consists of desk positions, manually posted map displays, and communications equipment necessary to support personnel in their performance of the assigned mission.

COMMUNICATION EQUIPMENT

The following paragraphs describe the types of communication equipment in the TACS. The majority of the TACS communications is brought with the units. The TACS builds its own networks and transmission systems. The current system, fielded in the 1950s, is called the 407L system after the type of copper cable it uses. Most of the equipment is being replaced by the new communications programs such as the Joint Tactical Communications Program (TRI-TAC). The TRI-TAC program provides digital secure/nonsecure transmission, switching, terminals, and equipment for use in the tactical environment. The equipment is located throughout the TACS. In addition, the Army and Navy will use TRI-TAC (or TRI-TAC compatible) equipment.

Message (record) Traffic

AN/TYC-39: The tactical equivalent of a DDN switching center. It provides DDN access to the Modular Tactical Communications Center (MTCC). Intelligence information systems requiring direct DDN access would also interface via the AN/TYC-39. The AN/TYC-39 is a 50-line, mobile, automatic, electronic store and forward switch under processor control with integral COMSEC and multiplex equipment. The AN/TYC-39 message switch provides a secure, automatic, processor controlled, store, and forward message switching capability by receiving and storing a full message from another AN/TYC-39, and AUTODIN Automatic Switching Center (ASC), or a dedicated subscriber, such as an AN/TGC-27 (Modified), and then forwarding the message to the intended recipient. It isn't a "switch" in the normally accepted meaning of the word because a direct connection between subscribers is never achieved. In this sense, it operates like an ASC message processor. The AN/TYC-39 does not have the capability to function in a half-duplex, query-response mode of operation. It will maintain security integrity, message precedence, and message accountability as well as control message routing. It performs mode, code, and rate conversions to allow dissimilar terminals to communicate with one another. Units which have an Air Force Component Headquarters (AFCH) mission will receive the AN/TYC-39. It's capable of transmitting and receiving messages up to and including SECRET.

AN/UGC-129(V)1: A multi-environment ruggedized information terminal and printer. It is a general purpose tactical message device to compose, record, transmit, receive, edit, display, and monitor record message traffic. Its data adapter permits automatic transmission control which sets up the device to assume the characteristics of the communications network and switch. The display uses electroluminescent technology, resulting in a high-contrast, high-resolution display. The CT has a built-in test capability and requires no special support equipment. The terminal is capable of being transported as loose cargo and is designed to survive field installation environments. It complies with TEMPEST, electromagnetic pulse, and environmental requirements. The SST will eventually replace the AN/UGC-129 Teletype Terminal.

AN/UGC-144: Consists of three user operated single subscriber terminals (SST) providing a high speed data system capable of composing, editing, storing, displaying, receiving, and transmitting messages for direct entry into AUTODIN. Telephone (Voice/Data) Traffic - these circuit switches perform essentially the same functions as an AT&T dial central office. That is, each switch is programmable and maintains a data base of all its subscribers. The data base contains subscriber information such as: telephone number, security required/desired, and maximum precedence. The circuit switches provide switching for local site "area communications" as well as external communications to other fixed and tactical locations. For example, in a nonsecure mode, it's possible to place a DSN call from a bare base in

the middle of nowhere to Langley AFB. The circuit switches come in a variety of types:

AN/TTC-39A: The AN/TTC-39A is a hybrid, mobile, automatic, modular circuit switch that provides both circuit switching service and some nodal control functions for analog and digital traffic. It operates under processor control with integral COMSEC and multiplexer equipment. By module replacement, the 744-line switch has the capability to accommodate analog, digital, or analog/digital users. The AN/TTC-39A provides subscribers with a variety of features such as precedence, preemption, conference capability, abbreviated dialing, call transfer, and "Hot Line" services. The AN/TTC-39A is compatible with the Inter-Service tactical communications system, NATO Integrated Communications System, and allied organic tactical communications systems. It incorporates limited, essential nodal technical control capabilities needed in tactical switched systems. These features allow limited nodal control when a AN/TSQ-111 Communications Nodal Control Element (CNCE) is not available or disabled. The follow-on deliveries of the large circuit switch will be the AN/TTC-39E instead of the AN/TTC-39A. The AN/TTC-39E has similar capabilities; however, it's limited to 708 lines and does not have a space division matrix. It will primarily be used as a telephone switch, but as increasingly more user-provided computers/local area networks are fielded, it's to be expected that more and more purely digital devices will need to be accommodated.

AN/TTC-41: Similar to the TTC-39A supporting 160 subscribers.

SB-3865: A transportable automatic digital/analog telephone switch package. Units may be used individually or stacked up to three units with a total capacity of 90 lines, 30 lines per unit. Receives, processes, routes, and transmits voice data and facsimile loops, analog loops, or trunks (per SB-3865) when equipped with line termination unit (LTU).

Transmission - Wideband (multi-channel) Radios

AN/TRC-170: A tropospheric radio system which provides point-to-point communications at ranges from 50 to 200 miles. Both range and throughput are dependent upon terrain and distance; however, relays can be established if needed. The AN/TRC-170 can be thought of as the "communications backbone" within the tactical environment for short to medium range connectivity. It has 60 channels. Most of the information on the radio is multiplexed together and comes from the network switches. Dedicated lines can be used.

Troposcatter Satellite Support Radio - TSSR: A remoting option for the AN/TRC-170 and GMF SATCOM terminals. It consists of a small microwave transmitter that allows the terminals to be 6km away from the operators.

Transmission Terminals

Digital Subscriber Voice Terminal (DSVT)/Digital NonSecure Voice Terminal (DNVT): These are the TRI-TAC telephones. The DSVT (KY-88) is comparable to a tactical STU-II/III. It provides digital secure voice over switched or point-to-point communications. In addition, the DSVT has a data port, which, with an appropriate interface, can provide secure data communications. The DSVT can operate in both a secure and nonsecure mode. In the secure mode, the DSVT receives its crypto key from the circuit switch up to the secret level. It should be noted, at levels above secret, the DSVT must be manually keyed by the operator.

Single Subscriber Terminal (SST): The SST is a microcomputer that connects to the TYC-39 and MTCC. This workstation is designed to format and automatically transmit messages into the AUTODIN system.

Advanced Narrowband Digital Voice Terminal (ANDVT): The ANDVT is designed to digitize voice communications over an HF radio. It is a point-to-point connection.

Secure Net Radio Interface Device (KY-90): The KY-90 allows any phone on the TRI-TAC network to go digital over an HF radio.

Technical Control

TRI-TAC is controlled by the Communications Nodal Control Element (CNCE). CNCE provides an automated digital technical control. CNCE's mission is to provide the interface between transmission facilities and users and to provide the means by which communications resources at a node will be assigned, monitored, controlled, and managed. CNCE performs these functions in an environment consisting of a hybrid mixture of analog and digital transmission, circuit switching, and store and forward equipment. The AN/TSQ-111 functions as the hub of the communications node at tactical main operating bases and any other main tactical communications locations. It acts as an interface and fault isolation facility between terminal and transmission equipment. Digital and analog circuits as well as TRI-TAC transmission groups from the AN/TTC-39/39A, AN/TSQ-146, AN/TRC-170, AN/TSC-94A/100A, TSSR, TAC-1 and loose DGM equipment are routed, channelized, tested, and monitored. Digital groups can be encrypted or decrypted. Telemetry from digital equipment terminates in the CNCE and is used to fault isolate the communications network for which it acts as net control.

AN/TSQ-111: Provides a central point for equipment interface and quality control of the communications circuits. This transportable shelter is equipped with circuit patch and test facilities, test equipment and a 12-line manual switchboard to provide rapid implementation of intra-site and inter-site communication within the TACS. The control center is also equipped with a telephone and teletype order wire facility to quickly respond to changing tactical communications requirements.

Communications Security (COMSEC)

Encryption: TRI-TAC has many COMSEC encryption devices. The primary ones are: the KG-81, a Dedicated Loop Encryption Device; the KG-84, and the KG-94/104, which are Dedicated Trunk Encryption Devices. Normally, encryption devices have a 10-20 year life cycle and an additional 5 year phase out/replacement cycle. There is at least 10 years left on the encryption devices listed above. The KG-84 has already started an evolution to an embedded COMSEC module (KIV-7). This device is the same size as a computer disc drive and will fit most PCs.

Encryption devices will continue to evolve to an embedded IC chip. The Multilevel Information System Security Initiative (MISSI) is an example of this evolution. It is an anticipatory development with the goal to provide affordable, adequate, and timely Multilevel Security (MLS) for the DMS. There are four basic types of MISSI products: in-line network encryptors; workstation security; security servers; and security management devices. MISSI is scheduled to employ an end user and contract maintenance logistic support concept.

Secure Voice (KY-57/58, KY-65/75, KY-99/100). This equipment is used to secure radio systems transmitting classified and sensitive unclassified information. They operate in the HF, VHF, and UHF SATCOM modes. The Advanced Narrowband Digital Voice Terminal (ANDVT), KY-99/100, will replace all KY-57/58 and KY-65/75 assets.

Research and Development (R&D) of Integrated Services Digital Network (ISDN) compatible Secure Telephone Equipment (STE) is on-going to find an evolutionary upgradeable digital replacement for the analog STU-III. The Defense Red Switch Network (DRSN) is in place and providing secure telephone communications for the foreseeable future.

Terminal Equipment (Teletypewriters, Standard Remote Terminal, etc.) will eventually be phased out of the Secure Communications Career Field. Desktop PCs are replacing secure communications terminal equipment.

Ancillary Equipment (Modems, Synchronizers, Multiplexers, Peripheries, etc.) will always be required for this type equipment, either internal or external to the terminal equipment. Technology will improve the capabilities of these devices concerning size, speed, capacity, etc. Multiple AFSCs currently maintain this equipment.

New technologies and increased equipment reliability require changes in the Secure Communication System Maintenance career field as we know it today. Embedded systems may eventually be maintained by the terminal equipment (end item) maintainers. These systems are anticipated to be maintained at the black box level of maintenance. As stated above, PCs with embedded crypto will have a significant impact on secure communications terminal equipment in the future.

Tactical Secure Voice Program - TSVP: TSVP's main goal is to implement Tactical Secure Voice (TSV) COMSEC equipment to secure all Air Force combat and combat support voice communications. This effort includes securing all airborne voice nets, ground-air-ground voice nets, point-to-point ground based command and control links, switched systems voice, and all required interfaces to the fixed strategic systems from which high level direction is received. Radios to be secured include all UHF/VHF single and multichannel radios and all HF radios tied into these nets/links.

Ground Mobile Forces (GMF) Satellite Terminals

GMF Terminals, an Army, AF, and Marine program, provides tactical SATCOM in situations where C^3 requirements cannot be satisfied by conventional terrestrial systems. GMF terminals link tactical AF headquarters, tactical air bases, and elements of the TACS, and provide entry into the DCS. GMF SATCOM provides high speed communications links within the tactical environment where ranges exceed the capability of the AN/TRC-170. As such, GMF SATCOM will be used for intertheater communications and DCS entry. The GMF SATCOM equipment is compatible with the TRI-TAC switching and terminal equipment. GMF SATCOM uses the Defense Satellite Communications System (DSCS) The AN/TSC-100A is the nodal terminal allowing for four links at once. The AN/TSC-94A is the point-to-point terminal allowing only one link at a time. The GMF terminal program has four phases. Phase I was the low rate initial production of AN/TSC-94 and AN/TSC-100 terminals. Phase II provided AN/TSC-94A and AN/TSC-100A terminals which provide TRI-TAC interoperability. Phase II also includes the incorporation of anti-jam control modems.

OE-361(V)/G Quick Reaction Satellite Antenna (QRSA): A transportable, center-feed, single-carrier ((V)1) or multi-carrier ((V)2), 20ft diameter, SHF antenna used in support of the AN/TSC-94A/100A Satellite Terminals.

Defense Communications System (DCS) Entry

The tactical system can be set up anywhere in the world; however, the system must connect to the fixed DCS system. DCS has developed entry points around the world. At these entry points, the computer takes the signal and routes it to the appropriate systems.

HF/VHF/UHF Equipment

Most of the radio networks are nonsecure/voice networks. Many programs are designed to secure these links and allow data to be transferred. HF radios are used as the primary communications means during the first days of employment. Point-to-point radios like the AN/TSC-60, MRC-107/108, etc., are used to connect points in the TACS. Networks are set up during a deployment. Some of the networks may be a wing operations network, flying formation network, airspace control network,

etc.   The Close Air Request Network is an HF network between the TACPs and ASOC.   Airborne Communications: Most airborne communications are UHF from aircraft to aircraft/ground. Most airborne platforms like the AWACS, ABCCC communicate HF to the ground units.

AN/MRC-107/108:   A transportable communications central used primarily for coordination and control of all types of tactical aircraft in a battlefield environment.   The units are self-contained radio sets with UHF-AM, VHF-AM, VHF-FM, and HF-SSB radios.   The system is being replaced by the AN/GRC-206.

AN/GRC-206:   A mobile communications central used primarily for coordination and control of all types of tactical aircraft in a battlefield environment.   The unit consists of self-contained radio sets with UHF-AM, VHF-AM, VHF-FM, and HF-SSB radios.

AN/GRC-206(V3):   A mobile HF/VHF/UHF communications facility mounted on an M-998 HMMWV.   Provides single channel HF single sideband (2-29.9999MHz, 150W), VHF/FM (30-75.975MHz, 2W or 10W), VHF/AM (116-149.975MHz, 2W or 10W), and UHF (225-399.975MHz, 2W or 10W) communications.   System is fully remotable up to 2 km.   Includes encryption devices.

AN/TSC-53:   A transportable communications set which provides HF voice, teletype, and VHF/UHF air-to-ground communications facilities for a (FACP).   It also serves as an intrasite communications net between the radar set, operations central, troposcatter set, on-base subscribers, and intersite communications with aircraft.

AN/TSC-60(V):   An HF/SSB radio communications central that can be used for ground-to-ground or ground-to-air communications.   Two 1 KW transmitters, receivers, and associated equipment provide voice, CW, teletype or high speed data, multiplexed teletype, and speech-plus-teletype signals.   Provides up to four simultaneous voice frequency channels, combination of 4, 8, or 16 teletype channels, and 8 channels of speech-plus teletype.

AN/URC-119:   This Pacer Bounce project is an HF/SSB radio used for voice communications.

AN/URC-119(V2):   An HF/SSB, 500W voice or CW radio system tunable from 1.6 to 29.99999 Khz(10Hz steps).   It can be operated as a mobile or fixed unit and is primarily used for command and control, engineering, and unit nets.   The unit can be fully controlled from up to one mile with a remote control cable and remote control unit, or even telephone lines.

AN/VRC-46:   Provides short-range, two-way, FM radiotelephone communications between vehicles.   The receiver-transmitter is manually tuned; no preset channels or remote control are available.   It is a

rugged, lightweight, compact receiver-transmitter housed in a watertight case. All controls are located on the front panel.

HAVE QUICK

HAVE QUICK consists of an ECCM modification to selected airborne and ground-based radios giving them a frequency hopping capability. Frequency hopping is a technique where the channel or frequency being used for communication on any given link is rapidly changed. Part of HAVE QUICK's strength comes from the use of channels in an apparently random manner, so that no pattern is evident to an external observer. Ground based radios that are HAVE QUICK capable are AN/GRC-171(V)4, AN/PRC-113, AN/TRC-176, and the GRC-206. HAVE QUICK is the only system with which the US military services and NATO can achieve jam-resistant voice interoperability in the near term. HAVE QUICK has worked well against threats used in exercises; however, more capable threats are expected in the near future. The upgrade to HAVE QUICK and HAVE QUICK II provides an expanded memory capability and a new control head. HAVE QUICK IIA is a further improvement which includes a faster hop rate and more power (while still retaining the HAVE QUICK and HAVE QUICK II modes for interoperability). All combat aircraft were to be equipped with HAVE QUICK radios by the end of 1986. HAVE QUICK II fielding was to begin in 1988. The fielding of the HAVE QUICK II radios for ground use was scheduled to begin by mid-year 1990. Ground forces should have received the HAVE QUICK IIA radios in 1991.

SCOPE SHIELD

SCOPE SHIELD is a tactical voice radio communication system which supports the command and control function of the USAF Security Police forces engaged in Air Base Ground Defense (ABGD) and Weapon System Security (WSS). This system operates wherever USAF Security Police forces now operate or may be deployed in the future. In addition, SCOPE SHIELD will be used for other land mobile radio (LMR) communication needs.

SCOPE SHIELD Phase I: The SCOPE SHIELD Phase I Communications System was a limited procurement of state-of-the-art equipment comprised of hand-held radios, base stations, vehicle adapters, and tactical repeaters with control center capability, extended range, and host nation frequency compatibility. The Phase II radios operate on frequency bands of 30-88MHz and 403-470MHz.

SCOPE SHIELD Phase II: The system consists of a standardized modular family of receiver/transmitter sets and ancillary equipment. The radios have the capability of providing mobile-to-mobile, mobile-to-fixed, and fixed-to-fixed radio communications links over multi-channel and multi-frequency bands. The communication links are to support multi-mission requirements of the Air Force Security Police (AFSP) and to provide secure and clear text two-way communications service. The SCOPE SHIELD Phase II equipment consists primarily of base station and hand-held radios, and tactical repeaters plus vehicle adapter kits.

Transmit/receive frequency capability of both the base station and hand-held radios permit worldwide operation of the system. The SCOPE SHIELD Phase II equipment also includes a limited number of tactical repeaters which will be used to expand the communications range. The Phase II equipment consists of:

AN/PRC-139 Hand-Held Radio: The hand-held radio is a small, militarized portable radio which provides an individual with local area two-way communication in the 30-88, 136-174, or 403-470 MHz frequency bands. Communication can be in either secure or non-secure modes. The hand-held radio is interoperable with the AN/PRC-77, AN/PRC-128, and the VHF FM single channel mode of SINCGARS-V VINSON (KY-57) compatible at 16 kilobits per second (kbps), and FED-STD-1023 compatible 12 kbps receiver/transmitters. It is also interoperable with commercial 25 kHz analog (clear) FM equipment. The hand-held radio is suitable for use as a personal portable or for vehicular use with vehicle mounting assemblies.

AN/GRC-238 Tactical Base Station: Base station radios provide the SFSP forces with radio communications capabilities appropriate to a control center. These radios provide communication with elements of the local networks and will permit information interchange with external forces needed for protection and defense of the resources which are the responsibility of the AFSP forces. The base station radios provide the capability to establish communication with the forward air controller, external ground forces (Army, Marines, and allied forces) including those equipped with SINCGARS radios. The base station radios are suitable for configuration in both fixed and vehicular installations.

AN/TRC-199 Tactical Repeater: The tactical repeater allows for expansion of the communication range of the base station, hand-held, or vehicle adapted radios by providing a receive/retransmit capability. The repeater is capable of operating as a self-contained/stand-alone unit in an unprotected environment.

OF-228/U Adapter Group, Radio: The Adapter Group, Radio (referred to as the vehicle adapter) performs two main functions. The primary function is to allow the user to operate and control the hand-held radio from a vehicle. The secondary function allows recharging the nickel-cadmium battery in the radio.

TACTICAL RADARS

AN/TPS-43E Radar Set: A transportable ground radar set designed for simultaneous long-range search and height finding in a severe weather and/or jamming environment. The radar set is a self-contained data gathering system requiring 59 KVA, 120/208V 3 Phase, 400 Hz power. The AN/TPS-43E utilizes a stacked beam antenna configuration as a means of providing range, height, and azimuth information. The radar set is equipped with self-contained air-to-ground and ground-to-ground communication capability.

AN/TPN-24 Airport Surveillance Radar: A solid-state, tactically mobile, dual-channel, dual-frequency, search radar operation between 2.7 and 2.9 GHz. Provides all-weather coverage to 60 NM range and 40K foot altitude.

AN/TPX-42(V) Interrogator Set: Used for identification of airborne targets. The equipment can be mounted within a GCA, mobile, or fixed RAPCON to augment the radar set with an IFF Mark X SIF/ATCRBS capability.

AN/UPX-23: A lightweight transportable radar recognition set, for use in connection with one or more decoder groups, radar indicators, and radar sets. This interrogator set is used with a AN/GPS-13A interference blanker, and is used in the AN/TPS-43E to process AN/HPX-23 IFF/SIF aircraft replies.

AN/GSQ-120: The AN/GSQ-120 provides for the transmission of radar data signals between central operating sites and remote radar sites. This system provides greater flexibility to the Control Reporting Center (CRC) and Forward Air Control Post (FACP) by remoting existing data terminals through microwave links. Each transfer system permits separation of the local radar site and the operations center by 10 miles.

TACTICAL COMPUTERS

The availability of microcomputers combined with the increased dependency of these computers has resulted in a proliferation of deployed computer systems. If these systems are operated in a stand-alone configuration, they present no problem in the TACS. However, interfaces necessary for efficient transmission of digital data between micro and mini-computers has not been developed. Many aspects such as ruggedized equipment to withstand the elements, TEMPEST certification classified processing, and maintenance and logistics supportability must be considered when computers are put into the tactical environment. Most tactical computers are embedded into communications and intelligence systems. The following is a list of some of the TACS automated processing capabilities:

Stand-Alone Computer Systems

Computer Assisted Force Management System - CAFMS: CAFMS is a computer system located at the TACC. The purpose of CAFMS is to automate the generation, distribution, and execution of the Air Tasking Order (ATO). It consists of one mainframe Central Processing Unit (CPU) at the TACC along with local terminals in the Combat Ops and Plans sections. It also can have up to 11 remote terminals (connected by TRC-97s) located at the WOCs. The terminals are used to type in the ATO data. CAFMS CPU provides data base management and message formatting for the ATO.

CROMEMCO 2H SYSTEMS: These stand-alone microcomputers are used as administrative and data base management tools. Off-the-shelf and local software is used.   Zenith Microcomputer Systems [Z-120s and Z-151 (TEMPEST)] are replacing the Cromemco systems.

Interconnected Computer Systems

Modular Control Equipment - MCE: MCE will replace elements of the aging 407L system at the CRC, CRP, and FACP. MCE is a dedicated system which receives and processes data input from the ground surveillance radars (AN/TPS-43E and AN/TPS-75) and displays enemy target and friendly aircraft tracks on four self-contained operator consoles. Each MCE operations module (OM) has four operator consoles and a communications suite with four UHF, three VHF, and two HF radios. Up to four OMs linked by fiber optic cables constitute the operations control element of the CRC, and two connected OMs make up the control central of a FACP. Other hardware within the MCE includes a complete set of communications (radio, telephone, and crypto), a voice communications access unit, and four dual-display operator consoles. As well as supporting   aircraft tracking/display, other functions will manage aircraft identification/classification, intercept/weapons calculations, simulation, communications, threat evaluation, weapons control, and built-in test monitoring/fault isolation.

Contingency Tactical Air Control System (TACS) Automated Planning System - CTAPS: CTAPS is a broad C2 system, centered at the TACC initially. CTAPS, as a program, incorporates the replacement efforts for the TACC, ASOC, and TAC and TAC-gained flying units of the Contingency TACS. Mission applications include the Computer Assisted Force Management System (CAFMS), Route Evaluation Module (REM), Airspace Deconfliction Software (ADS), Improved Many-On-Many (IMOM), Battlefield Correlation Element (BCE) Automated Support System (BASS), Tactical Decision Aids (TDA), Air Situation Display System (ASDS), plus other software packages to provide the man-machine interface, system administration, electronic mail, etc. The system will be hosted on a distributed network of minicomputers netted via a LAN with two host processors and up to 12 workstations in each. The overall purpose of CTAPS is to modernize a major portion of the TACS. The TACC develops, disseminates, and monitors the execution of the ATO, which contains the orders directing all tactical air operations. The TACC must be able to disseminate the ATO, as well as send and receive updates, throughout the theater. A lack of sufficient local and long-haul data communications would limit the effectiveness and responsiveness of the entire TACS. The ASOC controls the application of air power in support of Army immediate air support requests and coordinates its activities with the TACC.   Its mission is totally dependent on voice and data communications.   The CTAPS unit level efforts will be providing a capability for each wing and its squadrons to share data at the unit level, as well as the ASOC and TACC.

Mission Support System - MSS: MSS is a small computer-based combat mission planning tool.   The system is comprised of four software

programs designed to run as an integrated software package to load
aircraft data transfer cartridges/modules. The aircrew plans the
mission on the MSS, loads the cartridge, and uses the cartridge to
initialize on-board aircraft computers. MSS currently has implemented
three of the four functions: flight planning, using aircraft specific
performance data; penetration analysis, providing optimum routing
through the threat area; and TAFMAP, software to drive the map display.
A fourth capability, weapons delivery, which provides ordnance delivery
settings and pop-up attack calculations, will be integrated at a later
date. Aircraft supported will include the F-16, F-15, F-4, and F-111.
Information processed includes the electronic order of battle, digital
map/imagery, aircraft performance data, and various data bases (nav
points, tail numbers, and weapons configuration). As currently
envisioned, each tactical fighter wing will have three mission planning
systems per squadron and one per wing. MSS is planned to interoperate
with each TAF MAJCOM wing level system through the WCCS/SB Ethernet LAN
when that capability is available.

Air Force Mission Support System - AFMSS: AFMSS provides aircrews and
mission planners with computer planning system for peacetime and
wartime air mission. The AFMSS consists of three major configurations:
the Mission Planning Subsystem (MPS), the portable Mission Planning
Subsystem (PMPS), and the Data Preparation Subsystem (DPS). All
hardware will maximize the use of Non-Developmental Items (NDI)

AFMSS provides the core mission planning system with functions that are
common to all using commands. The system is based on an Open System
Architecture (OSA) and a modular software design to provide a common
interface for a variety of Aircraft/Weapon/Electronic (AWE)systems.
It automates the organization and display critical mission planning of
weapons delivery, and the selection of minimum risk routing through
hostile areas.

AFMSS also creates radar predictions, digitized maps and charts,
displays digitized satellite photos, and creates perspective views of
satellite photos using Digital Terrain Elevation Data (DTED). The
mission plan can then be printed as a Combat Mission Folder (CMF) (a
set of printed maps, images, radar predictions, scene perspectives, and
forms used by the aircrew for mission execution), and the transfer of
aircraft/weapon initialization data to a Data Transfer Device or to the
aircraft via a direct interface using a portable MPS. The DDT or PMPS
is hand-carried to the aircraft and used to initialize on-board
avionics and weapon systems. The MPS post-mission debriefing function
will support extraction of aircraft maintenance personnel and have the
capability to recall and print various data lists from the aircraft
avionics systems via the DTD, the MPS, and PMPS. Dedicated MPS systems
for maintenance data lists from the aircraft maintenance personnel
will be on a non-interference basis.

The standard MPS is a multi-user "high end" computer workstation. It's
used primarily at the unit level (wing/squadron) and will support in-
garrison and deployed operations. The MPS is built into rugged transit

cases for mobility and rapid setup and deployable worldwide using a single 463 L pallet. Each subsystem is 2 person portable, with set up time not to exceed 25 minutes, and requiring hand tools. The system is capable of operating within the steady state transient voltage and frequency characteristics of standard mobile power systems. A non-deployable version will typically consist of one color printer for every two planning workstations, removable secondary memory device, 3-1/2 inch floppy disc drives, and four loader /reader devices for DTD media.

The MPS interfaces with systems such as the Air Force Weather Distribution System, Sentinel Byte, Constant Source, and Air Force Wing Command and Control systems. COMSEC equipment may be needed for network interfaces.

The PMPS is a single user system that provides limited mission planning capabilities. It is used primarily by AMC and SOF aircrews to plan missions and input\update mission data to the aircraft directly through a MIL-STD-1553B data bus. Other commands will use the portable system for deployment operations or when minimum planning tasks are all that is required. Mission data will be transferred to the aircraft through the appropriate data transfer device.

The DPS digitizes various types of Mapping, Charting, Geodesy, and Imagery (MCG&I) data into the CMS format for input into MPS. The DPS is expected to use the same computer systems as the MPS with different software and peripherals such as scanners, various types of tape drives, and compact disc readers, to process MCG&I data. The DPS is not ruggedized and is intended for use in an office type environment.

Wing Command and Control System - WCCS: WCCS is an evolutionary effort to implement an automated, secure wing C2 system that provides support and communications tools needed for effective employment of combat forces through efficient allocation of wing resources. WCCS will provide an integrated, all encompassing view of the wing that consolidates weather, intelligence, maintenance, operations, and combat support information on a single system. A goal of WCCS is to provide the consolidated view, with no duplication of information input, requiring automated interfaces with other wing and force level systems. The system will receive and process force-level tasking, assist in allocating resources to assigned missions, monitor the status of all wing resources and activities, and electronically interface to AF standard systems, force-level systems, and tactical battle management systems to minimize dual entry/manual entry of data into/between systems at the wing. The hardware for the WCCS will be the same as the hardware used for CTAPS.

Airborne Battlefield Command and Control Center Capsule - ABCCC: The ABCCC III Capsules are replacements for the current C2 capsules on board the EC-130E. These capsules serve as airborne extensions of the TACS for air operations beyond the radio range of ground elements. An automated communications and intercom distribution system will replace

the manual systems used in the present capsules. As an extension of the TACS for air operations beyond the radio range of ground elements, it will sometimes perform limited ASOC functions. As such, the ABCCC would need to interface with the TACP to receive the CAS requests and disseminate this information. The capsule upgrade will completely automate the planning functions of the ABCCC system, but no new data links will be associated with the upgrade.

Digital Communications Terminal - DCT: DCT is a lightweight, hand-held communications message processor providing the user with point-to-point netted communications over a variety of military radios and secure equipment. The DCT is operator interactive with an LED display and key entry for composition and readout of messages. The ability to compose, edit, display, and process communications messages is provided through a stored program and a microprocessor. The DCT will be used to assist the Army for CAS support. Each Army battalion will have a DCT to send up the request for CAS. These battalions will be supported by a TACP with a GRC-206 communications pallet. Each level above the battalion (brigade, division, corp) will have the BCT, a portable, intelligent communications, computation and display terminal that provides simultaneous communication over as many as six separate radio or wire nets and presents commanders with an interactive alphanumeric and graphic display. The CAS request at the battalion is sent up the channel to the ASOC, and each level of command receives the information without human intervention. After the decision is made as to what type of CAS support will be initiated, an acknowledgment is sent back to the battalion through the TACP. In addition, the ASOC will send out the necessary message to provide the air support.

Joint Surveillance Target Attack Radar System - JSTARS: JSTARS is an Army/Air Force airborne radar platform/system. It provides a radar picture of the battlefield, similar to what AWACS provides for the air war. The system has both airborne and ground elements to provide the "electronic high ground" from which to detect and track enemy ground forces. The airborne element consists of E-8 aircraft carrying radar, operations and control consoles, and communications. The ground element consists of Ground Station Modules (GSM) that perform targeting, communications, command and control, and intelligence (C3I) functions. JSTARS supports the end-to-end engagement process from initial detection of moving ground vehicles to the precise attack with conventional weapons. Radar data will be passed to the ARMY GSMs via a data link designated the Surveillance and Control Data Link (SCDL). Data exchange with Air Force C^3I nodes (MCE) will be via JTIDS.

INTELLIGENCE SYSTEMS

The Combat Intelligence System (CIS) program absorbed both the Constant Source and the Sentinel Byte programs. Constant Source and Sentinel Byte no longer exist. Constant Source software was renamed as the CIS Automatic Associator (CIS/AA) Module. Sentinel Byte is now known as CIS/Data Manipulation (DM)/ Message Analysis (MA). Joint Deployable Intelligence Support System (JDISS) is another CIS program.

CIS Automatic Associator (CIS/AA) formerly Constant Source - CS: CIS/AA resides at the squadron, wing, and force levels. The AA provides ELINT updates to the force and unit levels for threat awareness and mission planning. The AA is built into rugged transit cases for mobility, rapid setup, and making it deployable worldwide.

The AA is a wide area surveillance processing and display system. The system may receive signals from TADIXS broadcast, the trap service, and the TIBS program; it processes these signals and presents the output as a graphic display on a computer color monitor. The system is processor controlled and can accept, process, correlate, and graphically display multiple sensor reports. The outputs can also be provided, either filtered or non-filtered, in graphic format to other tactical data processors (CIS/MA or AFMSS) or in teletype written format to communications terminals, high-speed printers, or keyboard printers.

The basic AA is comprised of three groups of equipment: the antenna group; the TAXDIXS B/TRAP Radio Terminal Set (RTS) consisting of the receiver, crypto, and processor groups; and the Operator's Terminal, consisting of the display and storage groups. The AA also uses the TIBS Receiving and Processing Channel equipment, which consists of its antenna, receiver, and processor that has an embedded COMSEC/TRANSEC module which performs the decryption function. The TIBS Receiving and Processing Channel is integrated into the TAXDIS B/TRAP RTS and interfaced with the same Operator's Terminal in the Multiple Channel configuration.

Contingency Support System - CSS: The CSS is a prototype communications and intelligence system designed for worldwide contingency operations. It provides a means for the AFFOR commander and his staff to receive and effectively use multisource intelligence - including imagery - while deployed at remote locations. There are two phases of CSS. Phase I is a lightweight, suitcase sized, man portable, UHF SATCOM system to provide secure voice and data. Two systems are required - one to deploy with the AFFOR, and the other to remain at the CONUS headquarters or to deploy as needed. Imagery transmission capability is desirable but must be lightweight. Phase II is vehicle mounted and air/ground transportable. It includes a multichannel SHF SATCOM system to provide DSCS entry for DSN and DDN service and a dedicated imagery transmission channel to Langley AFB, VA.

Joint Service Imagery Processing System - JSIPS: JSIPS is a combined Air Force, Marine, Army, and Navy program. Within the Air Force, JSIPS is a TAF system. It provides tactical imagery from national, tactical, and strategic sources. Based upon information derived from imagery, reports will be generated for transmission via message or voice circuits. JSIPS will be fielded at the TACC. Future concepts may negate the requirement to have JSIPS in any form at the unit level. It will replace TIPI-IIS starting in the 1990s and will serve as a common ground station for programmed strategic and tactical reconnaissance systems. JSIPS consists of the: National Input Segment (NIS),

Tactical Input Segment (TIS), Softcopy Exploitation Segment (SES), Communications Support Segment (CSS), Exploitation Support Segment (ECS), and System Support Segment (SSS). The system is configured depending on individual user requirements. In each configuration, the system is a node in an intelligence network and must adapt to the C^{3}I environment for each user in each deployment scenario.

NIS: Receives and routes national imagery and low rate data, transmits requests for selective image distribution, and formats and compresses imagery.

TIS: Interfaces with airborne sensor platforms, processes raw digital data/imagery, and provides processed imagery for softcopy or hardcopy exploitation. Receives sensor data via data link or tape and processes it into imagery, archives and formats data into common format, and connects with data/image LANs and aircraft communications via UHF/VHF and HF radio.

SES: Provides the capability for real-time softcopy screening, softcopy detail exploitation of imagery, report generation and output, and on-/off-line storage/retrieval of imagery.

ESS: Supports both national and tactical imagery exploitation, softcopy/hardcopy exploitation management, imagery interpretation report (IIR) creation, incoming report processing, and data base management. Located in the CSS.

CSS: Provides the patching, switching, and interface functions necessary to establish connectivity with host base facilities and/or mobile communications systems. Provides secure/clear voice and data communications, supports secondary imagery release and receipt.

SSS: Provides power, environmental control, and maintenance for all segments of JSIPS. It will also interface with IITS users via TRI-TAC. It also provides data to LENSCE.

Limited Enemy Situation Correlation Element - LENSCE: LENSCE resides at the TACC and has the capability to automatically process, compare, combine, and distribute multisource intelligence data. Significant is the automated support of OB maintenance, analysis, targeting, threat assessment, and briefing. LENSCE support can be extended to other command and control nodes through the remoting of system terminals to provide threat and situation information. Intelligence analysts and targeteers use the system data base to support TACC functions and to provide updated threat and situation information to subordinate units. Each LENSCE system consists of the following key components: a LENSCE correlation center, LENSCE intelligence work stations (IWS), a stand-alone communications subsystem (SACSS), and a remote server.

Tactical Elint Processor - TEP: The TEP provides processed and correlated multisource TACELINT reports to the TACC via a communications processor and the TYC-39. Intelligence reports, direct

from collectors or processed DDN reports received from national, theater, and tactical worldwide sources, are processed, correlated, and sent to operational users (in the TACC) via DDN. LENSCE utilizes TEP data as well as the Tactical Intelligence Squadron (TIS) component within the TACC. The TIS uses TEP reports to "fine tune" the EOB which provides the aircrew, among other things, the electronic combat tactics and parameters necessary to operate in the dense hostile electronic environment. The TEP processes the information and sends reports via DDN. Primary users of TEP data are LENSCE and the TIS in the TACC.

Imagery Interpretation and Edit Station - IIRES: Resides at the Wing Operations Centers and Squadron Operations Centers. IIRES provides Air National Guard (ANG) imagery interpreters an automated capability to generate, edit, and disseminate imagery exploitation reports. Hardware consists of six Z-150 computers and peripherals in a stand-alone environment. However, information is passed via DDN to users at the TACC. Direct DDN connectivity to TRI-TAC may be requested sometime in the future.

Intratheater Imagery Transmission System - IITS: IITS will reside at the squadron, wing, intelligence units, and higher echelons including the TACC. IITS transmits near-real-time (NRT) imagery from the intelligence processing facility to tactical users for mission planning and targeting support. It is intended to put a picture of the ground target in the pilots' hands in an NRT manner. Target acquisition by the pilot is greatly enhanced reflecting in fewer required sorties against a target. Hardware is in two configurations, the tactical digital facsimile (TDF - AN/UXC-4) and the Interface Processor for Imagery Exchange (IPIX). The IITS consists of the IPIX and TDF, plus a MicroVAX II processor and crypto equipment (KY-68 or KG-84A).

Intelligence Support System - ISS: ISS aids intelligence personnel in managing data for the operations mission data generator (MDG). The ISS consists of three Z-150/200s and monitors, external hard disk drives, a printer, and a file server. ISS software allows receipt of TACELINT DDN messages at the squadron for subsequent passing and updating of data bases. Messages are received, processed, and passed to the Intelligence Message Processing System (IMPS), which processes the data and produces a tape which is used to load the aircraft jamming system. The system has DCA Category III certification (DDN connectivity approval).

Tactical Imagery Processing and Interpretation Imagery Interpretation Segment - TIP-IIS: Resides in the reconnaissance wing and squadron. Provides automated imagery exploitation and report generation and transmission support. Currently uses DDN and teletype (TTY) for communications. Hardware consists of three shelters. The interpretation "I" shelter consists of two imagery interpretation consoles with code matrix readers, automated light tables, monitor, keyboard, and map table on each work station. The auxiliary "A" shelter, containing two monitors and keyboards per each shelter used

for editing, provides the interface between the interpretation shelter and the communications center. The interpretation augmented "IA" shelter combines the functions of the other two shelters and consists of two workstations plus communications. Will be replaced by JSIPS.

LOGISTICS SYSTEMS

Enhanced Data Transfer Terminal - EDTT: EDTT belongs to the mission support system family of equipment designed to support the F-16 series aircraft. It's an organizational level (flying squadron) maintenance system used by the AMU for post mission maintenance debrief, to upload OFP software changes, and to retrieve crash survivable flight recorder data. The EDTT downloads and processes the pilot fault list/maintenance fault list from the data transfer cartridge carried on board the aircraft. This data is then used by maintenance personnel to initiate repair. EDTT is physically very similar to MSS. Although EDTT does not presently do so, in the future it will likely feed data to the Core Automated Maintenance System (CAMS) or the Tactical Interim CAMS and REMIS Reporting System (TICARRS) as an interim.

Deployable Combat Ammunition System - Base - DCAS-B: The capabilities of the Combat Ammunition System, in a deployed environment, are key to TAC meeting its wartime and contingency commitments, DCAS is required to support effective unit level and intermediate ACP operations. These operations include the receipt, identification, and positioning of combat ammunition stocks. Connectivity requirements for DCAS-B fall into two general areas: connectivity for the purpose of ordering or tracking munitions, and command and control connectivity to report consumption and status to mission planners. The flow of information from the depot to the theater ACP, to the local munitions unit, is required for basic logistics tracking, shipment ordering, and shipment redirection. The selection of tactics and munitions can be greatly impacted by availability. Up-to-date information on munitions availability can prevent the re-accomplishment of portions of an ATO by TACC mission planners due to non-availability of a specific munitions.

Combat Supply System - CSS: CSS functions as an extension of the SBSS providing WRSK inventory loss/gain transactions accounting in the deployed environment. Data in the SBSS is updated from the CSS upon recovery from deployment. The CSS performs the basic inventory accounting functions of supply such as issues, receipts, turn-ins, due-out releases, and shipments. Data base queries and essential management reports are also provided. The hardware consists of about six workstations hung-off a Boroughs B26 microcomputer. Data links between CSS and the supply system don't currently exist, but are required. CSS will require connectivity into a standard base supply computer, either home base for small deployments, or in-theater during a major action.

Deployable Core Automated Maintenance System - DCAMS: DCAMS, as the name implies, will be the deployable version of CAMS. The system can

be especially useful in deconflicting periodic maintenance, mission requirements, and unplanned maintenance. The AT&T 3B2 is being considered for the hardware; however, the functions performed would have to be limited to essential only functions. The in-garrison version of CAMS consists of the same equipment being used in SBLC system (S1100/60) except at two bases where S1100/90s are used.

MOBILIZERS

The various vans and shelters that comprise this equipment must be transportable over various road surfaces. The A/M32U-17, M-832, M-720 transportable trailer dolly sets are used to accomplish this. These "mobilizers" are designed to be towed over prepared roads, rough terrain, and hard bottom water crossings. Each dolly set consists of a front and rear dolly which are coupled together during transport or storage. They are equipped with a towing bar and steering mechanism for the front dolly. When in use, the dollies are uncoupled and attached to opposite ends of a shelter which is then easily transportable. Maximum Loads: U-17 - 8.5 tons, M-832 - 5 tons, M-720 - 3 tons.

TACS POWER GENERATION AND
ENVIRONMENTAL CONTROL EQUIPMENT

Because of the tactical nature of the TACS, portable power generating and environmental equipment must be available to power and cool/heat the various shelters where this equipment is housed and possibly power the entire ASOC complex.

A/E24U-8: The -8 is a transportable 60/120kw, 400Hz power plant consisting of two fully equipped EMU-3O/E gas turbine generators and associated distribution equipment mounted on a pallet. The power plant will operate in all weather, global environmental conditions for extended periods.

EMU-12: This generator provides 20kw at 400Hz, 3ph, 120/208VAC power and the set is a compact skid mounted, portable, self-contained source of electrical power. The generator is driven by a gas turbine engine which is enclosed in a lightweight aluminum enclosure. The set may be operated on JP4, JP5, kerosene, or diesel fuel.

MB-15: A 150kw, 120VAC, 60Hz generator used as primary power for the Limited Enemy Situation Correlation Element (LENSCE) system while deployed with the TACC. It's also used for emergency standby power while in-garrison.

A/E32C-18/23, F9000H-3: These environmental control units (ECUs) are self-contained units that provide ventilation, cooling, heating, pressurization, filtering, and dehumidification to meet electronics and personnel environmental control requirements.

A/E32C-24/25/27: These ECUs are pallet mounted units that provide ventilation, cooling, heating, pressurization, filtering, and dehumidification to meet electronics and personnel environmental control requirements.

COMBAT COMMUNICATIONS

The mission of the combat communications units is to provide equipment and services to support worldwide communications and air traffic control requirements. The combat communications units are organized, trained, and equipped to support wartime and contingency operation requirements for certain mobile or transportable communications equipment. To achieve this end, all units maintain a readiness posture to assemble and deploy personnel and equipment within 72 hours. A request or requirement for combat communications equipment may be a single radio, include an entire base communication facility or air traffic control facilities, and operations. The larger scale deployments such as "bare base" deployments are accomplished in three phases: the site verification team (SVT), the initial communication element, and the sustaining communication element.

Quick Reaction Package - QRP: The QRP is designed to provide initial communications at deployed tactical air bases in support of crisis/contingency and associated operations. In most operational scenarios, the QRP will provide initial communications until larger follow-on facilities arrive and become operational. The terminal is road and air mobile; self-contained and can provide automatic dial switchboard service; secure data and teletype circuits; secure voice; weather teletype; HF independent sideband, HF single sideband; and VHF/AM/FM and UHF/AM equipment.

AN/TSW-7 Air Traffic Control Central: The AN/TSW-7 provides visual control for landings and departures. Includes shelter with extensive window area allowing observation by three controllers around a 360 degree perimeter. Major equipment includes UHF/VHF/HF air to ground to air communications. A 20kw generator, a TACAN monitor panel, control aids, light gun, etc., are also included. The TSW-7 can be elevated to a height of 25 feet for better observation of the airfield through the use of the mobile control tower supporting structure, A/E 32G-1.

EQUIPMENT TYPICALLY FOUND IN A COMBAT COMMUNICATION UNIT IS QUITE VARIED. EXAMPLES ARE:	
AIR TRAFFIC CONTROL TOWERS AN/TSW-7 MOBILE CONTROL TOWER	TROPOSPHERIC SCATTER SYSTEMS AN/TRC-170 (V-2 & V-3) TROPOSCATTER RADIO
AIR TRAFFIC CONTROL RADARS AN/MPN-14 MOBILE ATC RADAR AN/TPN-19 MOBILE ATC RADAR	SATELLITE SYSTEMS AN/WSC-3 UHF SATELLITE TRANSCEIVER AN/TSC-102 SATELLITE COMMUNICATIONS SYSTEM AN/TSC-100A (V-1 & V-2) SATELLITE COMMUNICATION TERMINAL AN/TSC-94A (V-1 & V-2) SATELLITE COMMUNICATION TERMINAL
WEATHER SYSTEMS TABWS - TACTICAL AIR BASE WEATHER SYSTEM AN/TPS-68 TACTICAL WEATHER ANALYSIS CENTER	TELEPHONE CENTRAL OFFICES AN/TTC-22 TELEPHONE COMMUNICATIONS CENTRAL AN/TTC-30 ELECTRONIC TELEPHONE CENTRAL AN/TTC-32 ELECTRONIC TELEPHONE CENTRAL AN/TTC-39 TRI-TAC AUTO TELEPHONE CIRCUIT SWITCH AN/TTC-39A TRI-TAC AUTO TELEPHONE CIRCUIT SWITCH AN/TGC-27 COMMUNICATION CENTRAL AN/TYC-39 TRI-TAC AUTO SWITCHING CENTRAL AN/TYC-39A TRI-TAC AUTO SWITCHING CENTRAL
NAVAIDS AN/TRN-26B MOBILE TACAN AN/TRN-41 MOBILE TACAN	SWITCHBOARDS INSTRUMENTS SB-3614 TA-236 SB-3865 TA-312 SB-86 TA-720 SB-82 TA-838 TA-954
SELF PROPELLED COMMUNICATION CENTRAL AN/GRC-206 MOBILE COMMUNICATIONS CENTRAL AN/MRC-107 MOBILE COMMUNICATIONS CENTRAL AN/MRC-108 MOBILE COMMUNICATIONS CENTRAL AN/TSC-107 QRP COMMUNICATIONS CENTRAL	TELETYPE AN/UGC-144 TELETYPE SET AN/UGC-129(V-1) TELETYPE SET
SPECIAL PURPOSE COMMUNICATIONS HAMMER RICK HF SYSTEMS AN/PRC-104 HF/SSB PORTABLE RADIO SET AN/TSC-60 (V) COMMUNICATION CENTRAL AN/URC-92 HF/SSB TRANSCEIVER AN/URC-119 SINGARS RADIO SET	TECHNICAL CONTROL FACILITIES AN/TSC-62 TECHNICAL CONTROL FACILITY AN/TSQ-111 TECHNICAL CONTROL FACILITY
UHF/VHF SYSTEMS AN/GRC-171 UHF MULTI-CHANNEL RADIO AN/TRC-176 VHF/UHF AM RADIO SET AN/TRC-177/187 HAVE QUICK TIME SIGNAL SET AN/PRC-77 PORTABLE VHF/FM RADIO AN/PRC-113 PORTABLE VHF/UHF AM RADIO AN/VRC-46 VEHICLE FM RADIO	

STRATEGIC COMMUNICATIONS SYSTEMS

Survivable Low Frequency Communications System - SLFCS: The primary purpose of the SLFCS is to provide a reliable and secure communications system in the event of nuclear attack. There are two main receive systems, the AN/FRR-97, used at the Minute Man Launch Control Centers, and the AN/FRR-98, used at Wing Command Posts. The major difference between the 97 and 98 is that the 97 is set up for single channel receive, while the 98 has three separate receivers and page printers in one rack, so it could be set up to receive three frequencies at once, though this is seldom done. Certain planes and other branches of the US military have transmit capability. At present, we don't have any control or interface with them.

Emergency War Orders Systems - EWO: The Emergency War Order system is composed of two separate networks. One network, EWO-1, is a telephone system which uses commercial telephone (TELCO) lines to provide direct line communications between the WCP, the ACP, and the SCPs. The network also provides the WCP the capability to conference or bridge the ACP and the SCPs. The second network, EWO-2, is a party-line telephone system that allows the ACP to communicate with any or all of the SCPs via the HICS. Each ACP and SCP has the capability to receive, transmit, and generate EWO-2 ring tones and voice.

Hardened Voice Channel System - HVC: The HVC is a telephone network that provides voice communications between the LCFs in a squadron. The HVC system is used for verification of launch commands and for notification of gross faults. The HVC system can also be used as a backup for the Support Information Network (SIN). If the SIN system fails at the LCF, the affected LCF can contact another LCF using the HVC system and have any required information relayed to the Strategic Missile Support Area.

Rapid Execution and Combat Targeting — REACT: REACT consoles are ICBM operation consoles designed to integrate the reception of redundant Higher Authority Communications messages into one physical input/output. REACT acknowledges and suppresses duplication of identical messages received via AFSATCOM, SACCS, and SLFCS. The REACT console also houses the Weapon System Control Element.

Hardened Intersite Cable System - HICS: The HICS is a network of hardened, buried, pressurized cables which provide direct interconnect between the Alternate Command Post (ACP), Squadron Command Post (SCPs), Launch Control Center (LCCs), and Launch Facilities (LFs) of the Minuteman missile wings. There's no HICS connectivity between the missile sites and the WCP located on the support base. The HICS is designed and installed to ensure system survivability through redundant propagation of launch commands.

GROUND WAVE EMERGENCY NETWORK
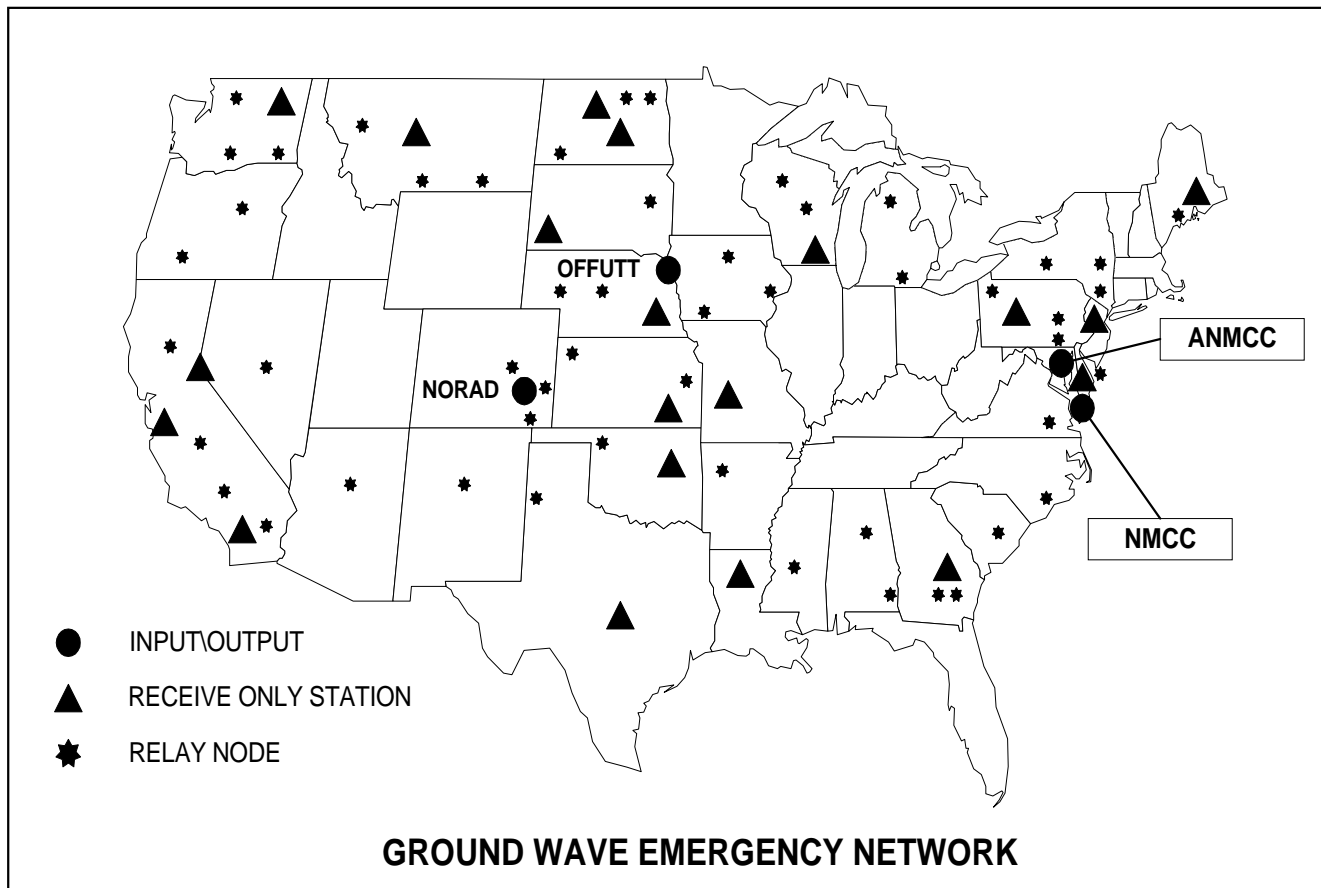
Ground Wave Emergency Network - GWEN: The mission of the GWEN system is to provide Command and Control Communications for the USSTRATCOM commander during the period of time between a high altitude blast and the ground level blasts. Current expectations are it will last roughly 15-30 minutes.

Connectivity: The I/O stations are linked to nearby R/Ns via UHF link at a frequency range of 225-399.975MHz. ROs and RNs are linked via LF within the frequency range of 150-175kHz.

Equipment: AN/GRC-217 Relay Node Radio System
                  AN/GRC-218 Input/Output Radio System
                  AN/GRC-219 Receive Only Radio System

Planned Improvements: None

Giant Talk: The mission of the Giant Talk system is to provide COMUSSTRAT a means of positive control of USSTRATCOM forces. It also provides the National Command Authorities (NCA), through COMUSSTRAT, the means to exercise command and control of tactical/strategic aircraft, and a means for all echelons of command to control their forces. Giant Talk also provides long range command and control of reconnaissance and special platforms. An additional peacetime role is to provide the necessary communications training for aircrews, missile crews, and ground radio operators so that all will be proficient in the event of a declaration of war. Each station requires five "green" and four "amber" transmitters.

GIANT TALK NETWORK
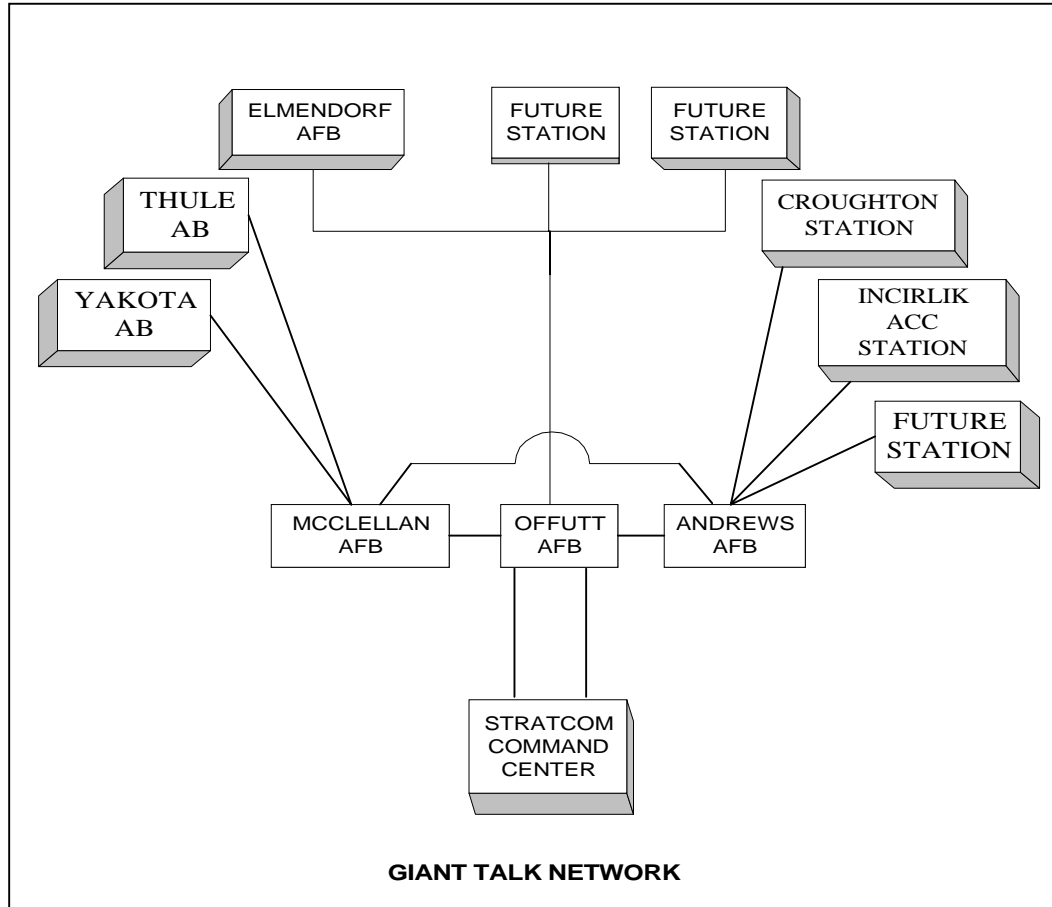
Missile Radio Communications Systems: Missile radio provides command and control capability between Wing Launch Control Facilities and higher authority. Made up of two systems, UHF and HF. The UHF radio system provides voice communications between the LCF and the TACAMO aircraft. The HF radio system provides voice communications between the LCF and the Wing Command Post (at Whiteman AFB only).

Missile Radio Communications System - UHF
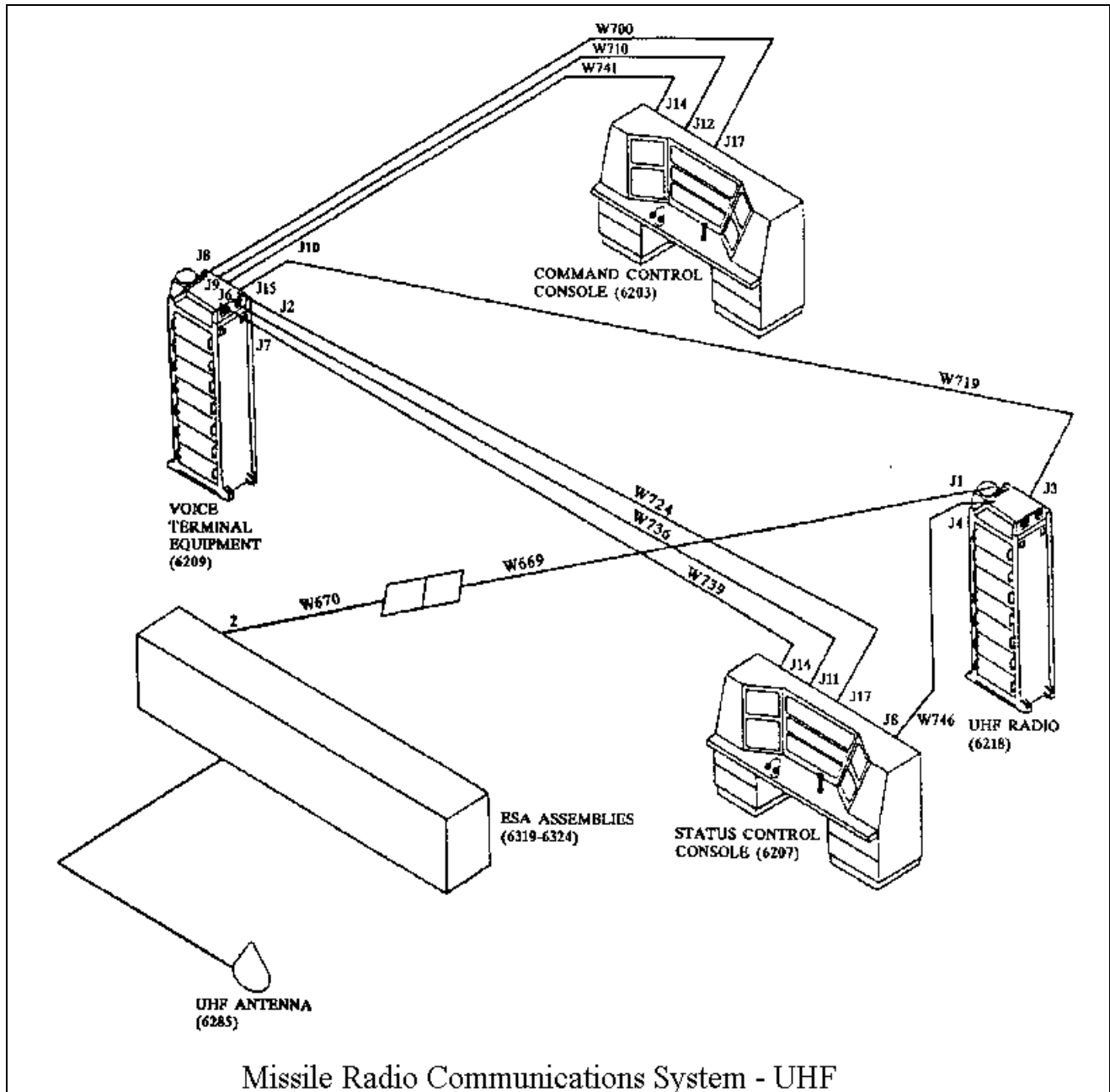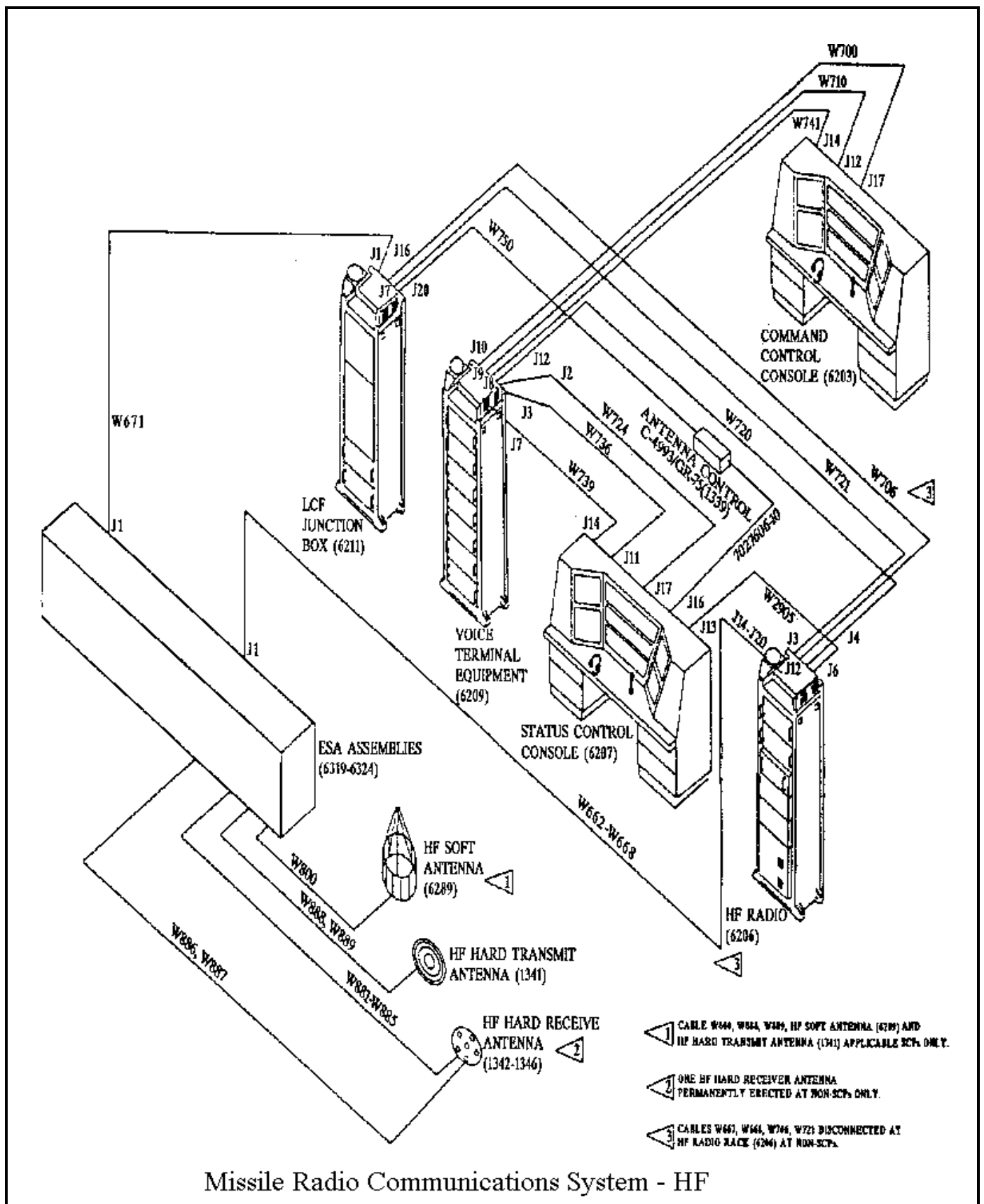
Missile Radio Communications System - HF

Support Information Network - SIN: The SIN and MCN systems are divided into several separate smaller systems:

LCF - LF Telephone: Each Launch Control Center (LCC) has direct line communications with its ten launch facilities by using this circuit. The LCC crew member properly depresses the appropriate button on the communications panel that selects and rings the desired LF; the telephone at the called LF rings until answered or the crew releases the circuit. The LF can call the LCC by simply picking up the headset (Wing I-V LFs), or by picking up the handset and momentarily placing the IN-OUT-Ring switch to the RING position (Wing VI LFs).

LCF Interphone: This system is comprised of several jackboxes, connected in parallel, throughout the LCC, LCF, and Launch Control Equipment building. Personnel connect headsets or handsets to the jackboxes and can communicate with another jackbox or the capsule crew.

LF Interphone: This system also contains several jackboxes. These jackboxes allow communications within the Launch Equipment Room (LER) and between the LER and support building. In addition, the jackboxes can be connected to the LCC by using the LCF - LF telephone circuit.

Dial Lines 1 and 2: These two telephone circuits provide the LCC crew members the capability to dial on-base or off-base telephone numbers. The communications control panel allows the crew to select either of the two circuits. Dial line 2 also has an extension in the Security Control Center (SCC) for security guard to use and monitor if requested by the LCC crew.

LCC - SCC Telephone System: This direct line system allows the security guard immediate communications contact with the crew in the LCC. The guard removes the handset from the SCC telephone and the crew immediately receives an incoming call indication. The crew answers the call by accessing the circuit on the communications panel. The crew can also initiate a call by simply depressing the SCC push-button on their panel.

VHF Radio: VHF Radio equipment is installed and allows communications to each LCF, maintenance vehicles, and certain locations on the support base. At the LCF, the crew in the LCC and the security guard have transmit and receive capability.

Strategic Automated Command Control System - SACCS: SACCS is a high-speed, secure, data transmission, processing and display system which links together all the selected wing command posts (CPs) in the CONUS. It is the primary system for providing the USSTRATCOM commander with an automated capability for the assessment of force readiness and a broadcast capability for transmitting alert and execution messages to strategic forces. The SACCS is also used in developing plans and conducting worldwide exercises. The SACCS has three basic subsystems: SACCS Digital Transmission Subsystem (DTS), Data Processing, and Data Display.   SACCS DTS is the means for entry, transmission, and

distribution of SACCS messages between HQ USSTRATCOM, NAF Headquarters, and unit CPs. There are five types of SACCS DTS terminals: AN/FSC-84 Subnet Communications Processor, AN/FSC-85 Base Communications Processor, AN/FSC-86 Aircraft Wing Command Post, AN/FSC-87 Missile Base Command Post, and AN/FSC-100 Hardened User Terminal Equipment.

Command Center Processing and Display System - CCPDS: The CCPDS is dedicated to the near real-time receipt, processing, and command display of ballistic missile AW/AA information in the National Military Command Center (NMCC), the Alternate National Military Command Center (ANMCC), the NORAD Cheyenne Mountain Complex (NCMC), the HQ USSTRATCOM Command Center, and the Worldwide Airborne National Command Post (WWABNCP). Information derived from CCPDS is required by the NCA, USSTRATCOM Commander, and CINCNORAD for use in making decisions related to retaliatory execution of the SIOP, force survival, and the use of strategic reserve during the trans/post-attack phases of engagement.

Air Force Satellite Communications System - AFSATCOM: The AFSATCOM was designed to provide Single Integrated Operation Plan (SIOP) forces and other high priority users with secure, reliable, and survivable satellite command and control communications capability. AFSATCOM is specifically designed for Emergency Action Message (EAM) dissemination, force direction, force

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THERE ARE SEVEN BASIC GROUND TERMINALS

•Launch Control Centers (LCC), AN/FRC-175
•Combined Ground Command Post (CGCP),
 AN/GSC-40
•SAC Wing Command Post (SWCP), AN/GSC-42
(V)1-4
•Consolidated Ground Terminal (CGT), AN/GSC-
 43 (V)1-3
•Consolidated Ground Terminal (CGT), AN/GSC-
 44 (V)1-11
•Ground Command Post Type 12 (T-12), AN/TSC-
 88
•Strategic Transportable Satellite Terminal,
 AN/GSC-39 (ST)

AND, TWO BASIC AIRBORNE PLATFORMS.

•Airborne Command Post Terminal, AN/ASC-21
•Airborne Terminal, AN/ASC-19
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report back, and Commander-in-Chief (CINC) internetting. AFSATCOM is tailored for each individual base and mission requirements.

Single Channel Transponder Injection Subsystem - SCTIS: The Single Channel Transponder Injection Subsystem (SCTIS) is a part of the overall transition from AFSATCOM to MILSTAR. It provides jamming protection and nuclear effects induced propagation disruption protection. The SCTIS provided a National Command Authorities directed Emergency Action Message (EAM) and Force Direction Message dissemination capability to selected command centers and force elements.

Injection Segment Single Channel Transponder Injection Subsystem (SCTS) provides the ground SHF injection capability for the command centers. SCTIS is one of three segments of the Single Channel Transponder system (SCTS). SCTIS is the injection segment and provides connectivity between a Super High Frequency (SHF) satellite earth terminal and Ultra High Frequency (UHF) AFSATCOM earth terminal. It provides selected command centers a means to access the Single Channel Transponder (SCT) on board the Defense Satellite Communications System (DSCS) satellite. The SCTIS is Electromagnetic Pulse (EMP) protected and will provide another route for Emergency Action Message (EAM) dissemination for selected command centers and force elements.

ICBM SHF Satellite Terminal - ISST: A communication system used to relay the SHF AFSAT II single channel transponder downlink to the hardened Launch Control Center (LCC) AFSAT system. ISST provides a high altitude burst survivable communication system with special scintillation processing to support strategic connectivity for delivery of high priority Emergency Action Messages (EAMs) to the LCCs. The ISST is an automatic signal acquisition and processing system that requires no operator for normal operation.
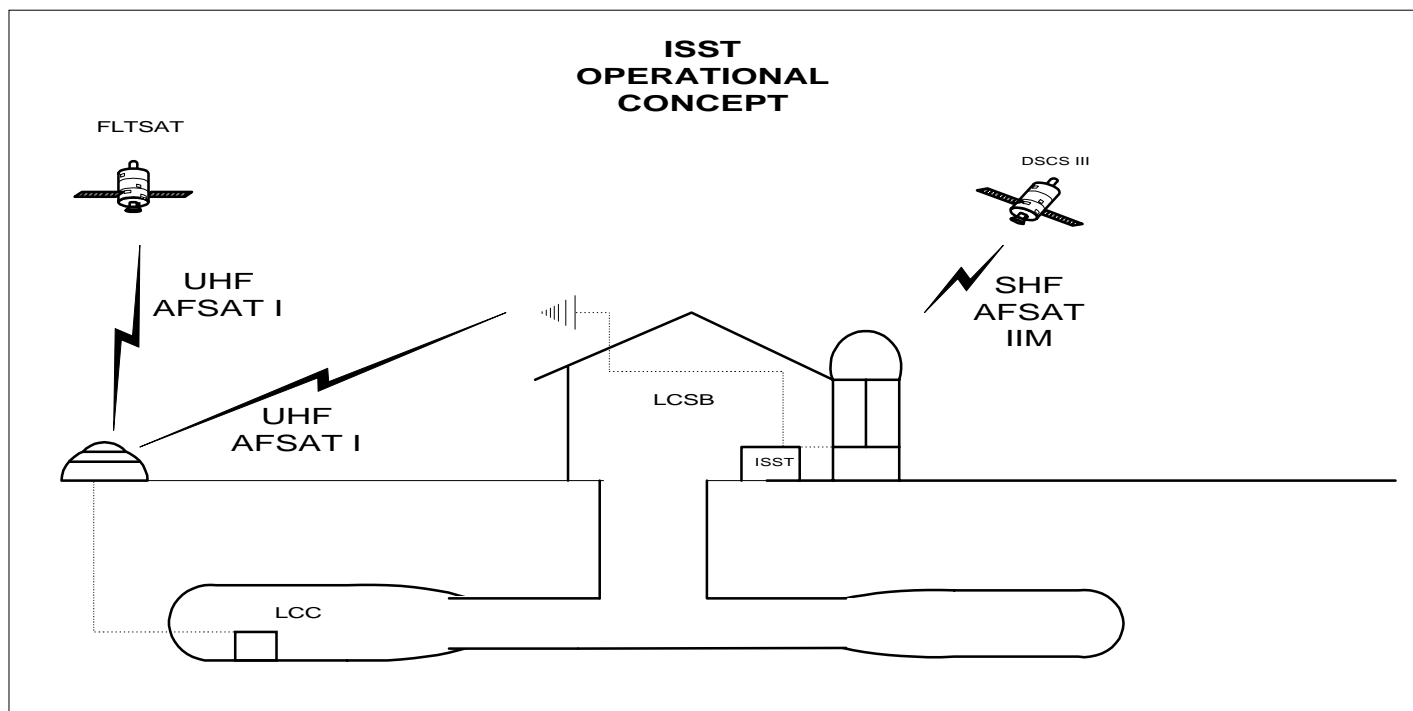
BASE AND INSTALLATION SECURITY SYSTEMS – BISS

There are four major types of BISS equipment: exterior sensors (i.e., AN/GSS-26A, AN/GSS-34, etc.), interior sensors (i.e., AN/GSS-20, AN/GSS-39, etc.), annunciators (i.e., AN/GSS-29, AN/GSS-41, etc.), and surveillance equipment (i.e., AN/GXS-2, AN/GXH-8, etc.).

EXTERIOR INTRUSION DETECTION SENSORS

Exterior (or perimeter) intrusion detection sensors are used as first line detection sensors. These sensors are deployed around large areas with entry controlled into an area (i.e., Weapons Storage Area, Alert Aircraft Parking Area, etc.). These can be either buried or fence line sensors. Any detected intrusion attempt is transmitted to an annunciator.

Fence Disturbance Sensor - FDS: The FDS is designed to mount on chain link fences. It contains a mercury switch which is adjusted to remain open until the fence is vibrated. Vibration of the fence will cause the mercury switch to momentarily close, creating an alarm condition that is recognized and displayed by the annunciator. The FDS units are wired in parallel and can be used either singularly or in groups, called zones. The average number of FDSs per zone is 15.

AN/GSS-26A Magnetic Anti-Intrusion Detector/Magnetic Intrusion Line Sensor - MAID/MILES: The AN/GSS-26A consists of one pickup assembly, one shorting plug assembly, and one motional pickup transducer (line sensor). The line sensor reacts electrically to ferromagnetic material in a vehicle, weapon, or item of apparel which may be driven, transported, carried, or worn by an intruder. The line sensor also reacts electronically to ground pressure changes and vibrations. The electrical output of the line sensor is the input to the pickup assembly. The pickup assembly electronically amplifies and analyzes the line sensor input signal. If the inputs have the required characteristics, they cause a switch in the pickup assembly to close. This switch closure completes a circuit causing the annunciator to indicate an alarm condition. The shorting plug assembly completes the power circuits between the battery assembly and the pickup assembly's electronic circuits.

AN/GSS-32 Filter Set, Band Pass - Band Suppression System: The AN/GSS-32 is a supplemental unit for the FDS and is designed to electronically reduce the number of wind caused nuisance alarms, or other random fence excitations. The AN/GSS-32 electronic assembly consists of a 20 channel filter module contained in a standard enclosure. The unit is basically an adjustable bandpass filter for the FDS system. The power supply is in a separate container and is capable of powering up to five 20 channel AN/GSS-32 units.

AN/GSS-34 Ported Coaxial Cable Sensor - PCCS: The AN/GSS-34 is a perimeter sensor system, intended to detect and locate intrusions on

outdoor perimeters of up to 3.2kM. Intrusion detection is accomplished by utilizing the RF transmission properties between a pair of parallel buried transducer cables deployed around the perimeter. Interruption of this RF field is seen as an alarm and is transmitted to the annunciator.

AN/GSS-37 Racon Microwave Fence Sensor: The AN/GSS-37 is an RF sensor system. It's a bistatic microwave sensor employing a modulated transmitter and receiver separated by a limited line-of-sight distance (maximum of 1200 ft). Moving objects cause a change in the net vector summation of the received signal level. Resulting signal strength variations at the receiver causes it to generate an alarm signal. This alarm signal is transmitted to the annunciator. The AN/GSS-37 systems consists of a transmitter, receiver, and multiple sensor interface and distribution units.

AN/GSS-40 Short Ported Coaxial Cable Sensor - SPCS: The AN/GSS-40 works on the same principle as the AN/GSS-34. The only difference between the two systems is the length of the perimeter that can be monitored. The AN/GSS-40 can only monitor 600 feet of cable, while the AN/GSS-34 can monitor 1200 feet.

AN/GSS-42 Exterior Intrusion Detection System - EIDS: The AN/GSS-42 system is comprised of several different sensor systems that are used in conjunction with each other.

DTR-90 Taut Wire System: This system consists of stretched barbed wire across the top of a fence line. This wire is stretched across microswitches which change condition if the wire is moved by more than 1/4 of an inch at the switch. Cutting the wire causes the switch to activate due to a lack of tension. This system only detects attempts to enter the area by going over or through the barbed wire array atop the fence. This system in no way detects fence cutting or climbing. The DTR-90 should always be used in conjunction with systems capable of detecting these other means of intrusion.

Inertiaguard: This system is based on contact/no contact of shock sensitive switches across a pair of monitored wires. It is installed directly on the fence fabric. The electronic processor reads the sensor output looking for a particular time-frequency pattern which meets preset alarm criteria. The inertiaguard system is always used in conjunction with other fence detection systems capable of detecting other kinds of intrusion attempts.

E-Flex: The E-Flex system works by monitoring a set capacitance level. The coaxial cable, which is mounted on the fence, has a center conductor that is "floating" in the insulator. Fence vibrations cause this conductor to move within the cable, changing the capacitance between the center conductor and the cable shield. This is seen as a change of state by the processor and is compared against preset alarm

criteria. E-Flex is used in conjunction with other fence disturbance sensors.

FPS 2-2R: The FPS 2-2R is designed to detect intruders attempting to cut through, jack up, or climb over a chain link security fence. It employs a transducer coaxial cable attached to the fence and a signal processor. Each processor monitors either a single 1000 foot length of cable with a single alarm output (single zone), or two 1000 foot lengths of cable each with its own alarm output (dual zone). Flexing, vibration, or stressing the fence results in small deformations of the cable which in turn causes a transfer of charges between the inner and outer conductors. These electrical signals are applied to the processor which determines whether the signals represent an intrusion attempt or are the result of natural phenomena such as rain or hail. The FPS 2-2R is used in conjunction with other fence disturbance sensors.

Infrared Perimeter Detection System - IPDS: The IPDS employs an array of active infrared transmitters and receivers operating a positive beam interrupt mode. This array provides an invisible intrusion detection wall, which when penetrated, initiates an intrusion alarm. It's used to protect entry control points and taxiway gaps on the perimeter. Detection distances are limited to 200 feet between transmitters and receivers. The transmitter pole holds six transmitters and three receivers, while the receiver pole holds six receivers and three transmitters. Failure of any component that comprises the receiver outputs initiates an alarm. Each system has tamper protection and has a minimum of four hours battery backup. The infrared output is not continuous, but operates in time monitored micro-second bursts which provides detection of intrusion attempts by outside infrared sources.

INTERIOR INTRUSION DETECTION SENSORS

These sensors are used for structure security. They can be mounted on doors and windows for intrusion, as well as on ceilings and walls for movement detection. These sensors are used in structures such as Intermediate Maintenance Facilities and Storage Igloos in a Weapons Storage Area. The detected intrusion is transmitted to an annunciator.

AN/FPS-9 Balanced Magnetic Switch - BMS: The AN/FPS-9 sensor is used to detect intrusions into secured areas. It detects an intrusion whenever a window or door is opened into an area which is secured. The BMS consists of two major components, a magnetic switch assembly and an actuating magnet assembly. The actuating magnet is installed on the moving surface and the switch assembly on the non-moving surface. The magnet and switch assemblies are installed to provide concealment of the mounting hardware to prevent unauthorized removal.

AN/GPS-16: The AN/GPS-16 provides warning of intrusion into a closed indoor area. This is an upgraded version of the AN/GPS-15. It utilizes an electromagnetic device which establishes a field of RF

energy and detects motion within that field by monitoring for a doppler shift. An AN/GPS-16 unit normally consists of four radar sets and one control power supply. The number of units within an enclosed area is determined by the physical layout of the area.

AN/GSS-20: The AN/GSS-20 consists of one alarm set group (ASG) and one control power supply (CPS). The AN/GSS-20 provides internal building security by detecting intruders and transmitting alarm data. The group transmits energy of a fixed frequency into its zonal environment while simultaneously receiving energy reflected back from that environment. As long as no moving intruder is within range of the group, transmitted and received frequencies are identical and no alarm is given. However, a moving intruder produces a doppler shift between transmitted and received frequencies which is immediately detected and interpreted as an alarm. Each alarm set employs two separate doppler intrusion channels. An alarm is produced only when an intruder affects both channels simultaneously, thereby greatly reducing the probability of a false alarm. The two types of energy employed are microwave and ultrasonic. Other features of the alarm set include tamper, performance monitoring, and self-test circuits.

AN/GSS-36 Open Sheltered Aircraft Sensor - OSAS: The AN/GSS-36 is a monostatic, range gated pulsed doppler radar which detects movement of objects intruding its surveillance area. Signals produced by target movement are processed by the monostatic radar set (MRS) to determine if the target exhibits characteristics of intruder movement. If so, it signals the fixed control power supply (FCPS) to relay an intrusion alarm to the annunciator. The MRS relies on three basic techniques to process target signals; doppler signal detection, range gating, and quadrature signal processing. Range gating selects target signals based on the distance of the target from the MRS, and quadrature signal processing determines whether target movement is characteristic of an intruder.

AN/GSS-39 Interior Intrusion Detection System - IIDS: The AN/GSS-39 primarily consists of an AIRTECH Corp ADVISOR VIII High Security Intrusion Detection system tailored, augmented, and installed to meet the specific security requirements of standard Air Launched Cruise Missile Storage Igloos. The engineered configuration is made up of a control unit and a selected mix of up to 26 ultrasonic and passive infrared (PIR) intrusion detection sensors. Each sensor has independent signal processing. A single ultrasonic sensor protects an oval volume approximately 35 feet long by 25 feet wide. The PIR detects changes in temperature along selected path or geometrics. If a power loss occurs, the system automatically switches to its battery backup (four hour capability) without alarm.

ANNUNCIATORS

Annunciators are the heart of the system. They receive electronic signals announcing the intrusion attempt and display it on a map of the area. The announcement is not only visual, but a status change on the

display causes an audible alarm to sound which an operator must respond to.

AN/GSS-29 Small Permanent Communication and Display Segment - SPCDS: The AN/GSS-29 provides a flexible system for base security. When combined with sensor equipment, it detects and displays personnel and vehicle intrusions and pinpoints the geographic location of the intrusion on a map display. Alarm conditions are indicated by map display LEDs, audible alarms, a coded digital display, and control panel indicator lights. The coder multiplexer, sensor data (CMSD), located at the entry control point, routes the composite signal to both the remote and local displays via hardwired cables. The composite signal consists of four types of signals: sensor alarm messages, line fault messages, LMB signal, and data link monitor (DLM) messages. The sensor alarm message indicates an intrusion in the secured areas. The line fault message indicates a high resistance (cut) in the wiring between the sensors and the CMSD. The LMB signal is used to monitor the wiring between the display area and the CMSD. This signal is generated within the CMSD and periodically transmitted to the receiving equipment in the display areas. If a wiring fault occurs between the CMSD and the receiving equipment, the display area receiving equipment will generate a unique line fault (ULF) message. The DLM message is generated by the CMSD and is threaded through certain alarm set equipment units. A loss of the DLM signal and activation of the DLM indicator is an indication of alarm set malfunction, an open tamper switch at the entry control point, or noise jamming in the system which may prevent incoming signals from being displayed. Each CMSD has a maximum capacity of 79 channels, or alarm points. The maximum configuration of a GSS-29 is 474 channels.

AN/GSS-41 Standard Annunciator System - STAS: The AN/GSS-41 is a replacement for the AN/GSS-29 SPCDS. It displays alarms from individuals sensor systems. It works from a touch screen monitor and has its own uninterrupted power supply. Inputs from sensors are multiplexed into a single signal at remote locations and transmitted for demultiplexing to the AN/GSS-41. The inputs are assessed for alarm conditions and displayed as appropriate. The operator assesses the display and reacts according to alarm indications. The AN/GSS-44, Small Annunciator System - SMAS is similar to the AN/GSS-41; however, it does not have video alarm assessment capability.

SURVEILLANCE EQUIPMENT

Surveillance equipment is used to assess the alarm condition. This equipment is interfaced with the annunciator so that automatic call up to the detected intrusion is available. Whenever an alarm is processed by the annunciator, the cameras in the area of the intrusion attempt will automatically activate. This provides the security police (the operators) with an immediate assessment capability of the alarmed area.

AN/GSQ-199 Voice Communications Console System - VCCS: The AN/GSQ-199 is a communications system for use in selected aircraft parking areas and in the ESE programs weapons storage areas (WSA) worldwide. It provides designated area local and remote alarm monitors with direct and administrative telephone communications capability which allows direct communications with weapons storage/aircraft parking structures, selected maintenance facilities, offices, and fixed posts. This capability is available in both the master surveillance and control facility (MSCF) and central security control (CSC). Additionally, it provides the MSCF operator with a local area public address system. The system can be configured to accommodate a maximum of 200 telephone lines. The AN/GSQ-199 has an emergency battery backup capability of four hours.

AN/GXH-8 Video Storage System - VSS: This system is used to record alarm sequences displayed on the AN/GXS-2/3 monitors. This is a continual update process. The unit monitors up to 40 cameras and will call up six frames of the camera monitoring the intrusion area. These frames are stored in memory immediately upon receipt of an alarm. This can be extremely useful when multiple alarms are received. If the VSS is deployed with the AN/GXS-3 system, there must be one unit per 40 cameras deployed. This is not a sensor system, but simply a tool to assess received alarms.

AN/GXS-2 Perimeter Security Surveillance Closed Circuit Television System - PSSCCTV: The PSSCCTV system is used for surveillance of perimeters being monitored by sensor systems. Upon receipt of an alarm, the camera monitoring the area automatically is called up on the monitors in the MSCF. These can also be called up manually. This provides immediate assessment for any alarm area which is covered by these cameras. The camera's field of view can be changed by interchanging five different sizes of lenses, varying from wide angle (12mm) to long distance (75mm). This system is not a sensor, it's strictly for assessment of a suspected intrusion attempt. This system accepts up to 40 cameras.

AN/GXS-3 Perimeter Security Surveillance Closed Circuit Television System - PSSCCTV: This system is identical to the AN/GXS-2 system except camera capacity is up to 120 cameras.

LIMITED NUCLEAR SURETY INSPECTION - LNSI

Ongoing budget and personnel cuts are reducing the security field resulting in increased dependence upon electronic security equipment for expedient, accurate assessment of the security picture. Since these personnel and our equipment are used in guarding priority A, B, and C assets, the necessity also exists to evaluate their capability. The LNSI accomplishes exactly that. In theory, it is a test of the security police's capability to safeguard an asset. In actuality, it becomes a piece by piece inspection of all aspects of the security picture, to include all installed BISS equipment. The BISS equipment must be near 100% capability, or the security police must have taken approved compensatory measures to make up for the loss of any BISS capability.

ELECTRONIC WARFARE RANGE SYSTEMS

PACAF'S AIRCRAFT WEAPONS RANGE — PIL SUNG

Pil Sung, formerly known as KOTAR, is used and operated jointly by the United States and Republic of Korea Air Forces. Many types of electronic trainers are used to train combat aircrews of both nations in radar threat recognition, avoidance, and countermeasure tactics. The range is located in very rugged and mountainous terrain approximately 120 miles east of Osan AB. The Korean AF and 51st EWTS operate and maintain North Korean type "RED FORCES" radar defenses and anti-aircraft threat simulators. This equipment defends the range complex against target penetration using realistic target arrays situated in a live ordinance delivery area and a real time scoring system with video recording capability. Primary equipment located at Pil Sung is US provided and logistically supported. The equipment includes three computer/television based scoring systems (TOSS), several radio frequency and land line communications systems, and the EW threat equipment (IFF, AAA, SAM), which are maintained and operated by Korean and American "RED FORCES."

EQUIPMENT USED AT PACAF RANGES

- AN/MPS-T1 Acquisition Radar, Anti-Aircraft Artillery (AAA), Surface to Air Missile (SAM) Simulator
- AN/FPS-8 Acquisition Radar
- AN/TPT-5 Bombable Threat Emitter
- AN/MPQ-T3 AAA Simulator
- AN/SPS-64 Bombable Threat Emitter
- AN/SPS-66 Bombable Threat Emitter
- AN/MPX-7 Identification Friend or Foe (IFF) Tracker
- AN/MSQ-T3 Modular Threat Emitter
- AN/TPT-T1 Unmanned Modular Threat Emitter

PACAF UNIQUE UNITS AND PROGRAMS

81 TACTICAL CONTROL SQUADRON

The 81 TCS is a Forward Air Control Post (FACP) assigned to the 623 Tactical Control Squadron. Both units fall under the 5th Tactical Air Control Group, Suwon AB, Korea. The 81st is unique in that it is the only squadron in the Air Force to own and maintain two AN/TPS-43E radars. One radar is considered a fixed training asset that performs both operator training and day-to-day control of the tactical fighters assigned to the 18th TFW. The other TPS-43 is a highly mobile tactical wartime asset. This system is maintained in a constant state of readiness and is the radar that the 81st maintenance personnel take on deployments.

HAWAII AIR NATIONAL GUARD
HIANG/6010 AEDG AC & W

HAWAIIAN AC&W EQUIPMENT

- AN/FPS-93A Search Radar
- AN/GPA-122 Coder/Decoder
- AN/FPS-90 Height Indicator
- AN/GPA-124 Coder/Decoder
- AN/UPX-14 IFF Integrator
- AN/GPA-125 Coder/Decoder
- AN/UPX-21 IFF Integrator
- AN/GPA-131 Video Mapper
- AN/UPA-62C Indicator Group
- AN/FYQ-47 Common Digitalizer
- AN/GPA-127 Indicator Group
- AN/UPA-35 Indicator Group
- TM-1B Radar Display Simulator
- AN/TMQ-15 Wind Speed Indicator

The air defense of the Hawaiian Islands and Guam are the responsibility of the HIANG under the operation and control of the 6010 AEDG. The responsibility is divided between the 150 ACWS and the 169 ACWS which both report to the 154 Composite Group. The HIANG has been authorized a FACP (Forward Air Control Post) at Barking Sands, Kauai.

JAPAN RECONFIGURATION AND DIGITIZATION (JRD)
AND THE KOREAN SOUTHERN LOOP (KSL)

These initiatives provide reliable communications for the Defense Communication Agency-Pacific (DCA-PAC) and are commonly known as the Japan Reconfiguration and Digitization (JRD) and the Korean Southern Loop (KSL). These programs are the Defense Communication Systems (DCS) backbone of the Pacific. They are replacing analog equipment with state-of-the-art digital systems. Replacement of analog communication systems with digital communication systems was needed to support DCA-

PAC. Ongoing since 1985, these programs are now complete with only system testing left to be performed at a few locations within Japan. The equipment installed provides high reliability and greater communications capability than the old analog systems.

Japan Reconfiguration and Digitization - JRD: This is a three phased program to upgrade and digitize the Defense Communication System in Japan. The USAF was responsible for Phase I, a six increment plan to reconfigure U.S. forces in the Kanto Plain. Phase II was the responsibility of the U.S. Army to upgrade the DCS on Okinawa. Phase III implemented by USAF provides connectivity between the Kanto Plain, southern Japan, Okinawa, and Korea by incorporating digital microwave, tropospheric scatter (tropo), fiber optic, and leased circuits.

Korean Southern Loop - KSL: Upgrades the DCS link between Osan AB and Kunsan AB connecting with the DC portion of the Telecommunication Plan for Improvement of Communications in Korea (TPICK), a fiber optic communication system that runs the length of Korea to mainland Japan thru Changson-Tsushima-Seburiyama.

Systems/Maintenance: Equipment used for both programs are Rockwell-Collins MDR-8-5N radios, DMX 2003 digital multiplexers, and FCC-98 VF multiplexers. JRD and KSL are maintained by contractors. The Special Maintenance Team (SMT) and the Central Repair Activity (CRA) at Yokota are available for assistance.

AIR COMBAT CAMERA SERVICE — AIRCCS

AIRCCS Mission: The AIRCCS is a worldwide Air Force combat imaging organization that provides an enduring visual record of United States Air Force and DoD activities during peace and conflict.   Through innovation, training, and a personal commitment to quality, AIRCCS maintains the highest combat readiness, responsiveness, and world-class visual imaging capabilities to give our customers unprecedented documentation of actions vital to national defense.

Personnel Makeup: AIRCCS is comprised of visual communications professionals strategically located at 14 locations in the U.S., Europe, and the Pacific. Assigned are aerial qualified photojournalists (PJs), videographers, production specialists, electronic imaging technicians, and television/base installation security systems personnel.

Areas of Responsibility

• Aerial and ground, still, electronic, and video imagery.

• Mobile satellite broad and narrowband transmission to the Joint Combat Camera Center, Pentagon, with simultaneous downlinks to other so-equipped military installation — clear, scrambled, or digitally encrypted.

• Photojournalism: Mandatory supplemental training for a photographer to become a PJ is completion of one year at the nation's most prestigious photojournalism schools, Syracuse University and Rochester Institute of Technology.

• Transmission of imagery via satellite, microwave, and telephone to give operational commanders virtual real-time imagery of current operations.

• High-end video productions, linear or interactive, broadcast standard, for corporate communications, readiness training, and operational assessment.

• Collect, screen, collate, duplicate, and disseminate bomb damage assessment and strike imagery within a combat theater for operational evaluations by battlefield commanders, technicians, and weapons and intelligence analysts.

• Operate the Motion Media Archives for DoD and the military services.

• Operate the Air Force Central Visual Information Library - film, video, and sound-on-slide media.

- Central administrator of DoD motion picture, television, and multi-media contract productions.
- Investigate, prototype, field test, and interface emerging electronic imaging technology with existing capabilities.

AIR FORCE BROADCASTING SERVICE

The Air Force Broadcasting Service (AFBS) is an Air Force named unit and part of the Air Force News Center (AFNEWS). AFNEWS is a field operating agency with the headquarters located at Kelly AFB, Texas.

History: The Air Force Broadcasting Service was originally a division of the Internal Information Directorate when the Air Force News Center was formed in 1978. In 1980, DoD directed the military services to centralize management of their Armed Forces Radio and Television Service (AFRTS) activities. AFBS was then established as a separate directorate on 1 October 1980.

Mission: AFRTS is a worldwide organization that broadcasts information and entertainment to DoD personnel and their families overseas. AFRTS provides - without censorship - the same types of programming available in the United States. In performing this Public Affairs mission, AFRTS has been consistently credited with sustaining and improving the morale and readiness of U.S. forces. AFBS manages, controls, and supports AFRTS outlets in Alaska, Greenland, Europe, the Middle East, and the Pacific.

Organization: The Office of the Assistant Secretary of Defense for Public Affairs provides AFRTS policy guidance and direction to the military services through the American Forces Information Service. The AFBS commander's staff at Kelly AFB includes a deputy for logistics, a deputy for operations, and a chief of broadcasting.

AFBS manages its field activities through one broadcasting squadron and four direct reporting detachments. The Air Force Pacific Broadcasting Squadron, Yokota Air Base, Japan, is responsible for AFRTS outlets in Japan. OL-A AFBS, Ramstein Air Base, Germany, is responsible for AFRTS outlets in Germany, Italy, Turkey, the Azores, and Norway. AFBS also provides Air Force proportionate manning for Army-operated networks in Germany, Italy, and Korea, as well as a Navy broadcasting outlet in Iceland.

Meanwhile, Detachment 2 provides an Air Force Contingent for the network managed by the Army in Panama. Detachment 3 provides a small operations force at the AFRTS Broadcast Center at March AFB, CA. Detachment 4 maintenance work center supports the television production and maintenance training courses at Ft. Meade, MD.

Operations: The AFRTS Broadcast Center, an AFIS field activity at March AFB, buys all radio and television programming for AFRTS from U.S. commercial networks and other sources. Radio programming consists of news, sports, features, music, and pre-recorded "disc jockey shows" representing a variety of formats. While U.S. civilian radio stations are able to tailor their programming to fit a specific audience, AFRTS stations strive to serve an ethnically diverse and generally youthful audience.

AFRTS must purchase rights to air commercial television programs. Some shows that have been sold to foreign television stations may not be readily available. However, AFRTS features the most popular American television programs without "reruns." AFRTS takes stringent measures to protect the security and integrity of copyrighted radio and television programming. Satellite radio and television programming supplements weekly program packages mailed by AFRTS-BC. News, sports events, and time-sensitive programs are delivered via a full-time, dedicated satellite network known as SATNET. Also, each station produces local information and entertainment programming. The primary purpose of AFBS-managed operations is to provide overseas commanders with a valuable means to deliver important local news and internal information messages to military members and their families.

AFBS Functions: HQ AFBS provides standardized, centralized management of all Air Force AFRTS activities to ensure overseas military audiences have access to the same types of radio and television services available in the CONUS. The HQs budgets for, buys, and accounts for broadcast equipment. It develops and manages the AFBS operations and maintenance budget, centrally manages AFBS projects and systems, provides centralized management for engineering, maintenance and logistics support, and directs the AFBS training, quality assurance, and management evaluation programs. It coordinates, approves, and maintains AFBS manpower standards, the assignment of military and civilian personnel, and coordinates AFRTS matters with DoD, other military departments, and Air Force agencies. It gathers local news in coordination with Public Affairs offices, to support local commanders and meets the objectives of the Air Force Public Affairs internal information program. Lastly, it plans for and provides radio and television service for combat forces in contingencies and wartime.

What About Me? A 9-level manager coming into AFBS would be assigned as a Chief of Maintenance, either at command or squadron level, and be responsible for providing maintenance management policies and guidance to the subordinate units. Some areas under this nebulous "umbrella" are:

Serving as the technical advisor to the maintenance and engineering manager. The maintenance staff consists of a maintenance branch and an engineering branch. At the top is a manager to direct the efforts of both sides. You would be the technical expert to assist the manager in his/her responsibilities.

Keep a close working relationship with other staff functions. As a maintainer, you must work with the operations staff to make sure their requirements can be met. A close working relationship with the operations staff is a must!

Visit each work center annually. Our organization is spread out all over the world. As Chief of Maintenance, it's your responsibility to

personally know each work center. The Chief of Maintenance has a high TDY job.

Make sure the budget includes cost for spares, test equipment, TDY, and training. The operation division establishes the requirements for new equipment and systems. It is up to you to make sure your work centers have the necessary support to keep everything up and running. It is your responsibility to budget for new or replacement test equipment for the work centers. Spares come into play due to the nature of the beast. Broadcast stations are made up entirely of commercial off-the-shelf equipment. Replacement parts, boards, training, etc., have very long lead times when going through the supply system.

Make inputs to and monitor Program Action Directives that affect maintenance. If something major is happening at a station, make sure your work center's actions are established.

The Command 2E1XX functional manager must be kept aware of proposed or projected changes to personnel or manpower. For technicians, assignment to an AFRTS work center is a special duty assignment. You need to track the manning levels, possible shortages, and other manpower issues. The 2E1XX career field and the work centers are not very big. To cover a 24 hours a day, 7 days a week operation, you need the manpower to make sure the mission is accomplished.

But Anyone Can Fix a TV. This is a common misconception about the 2E1XX career field. TVs are a very small part of a station's operation. As you read earlier, we have a worldwide satellite operation called SATNET. This is how the G.I. gets "real time" programming all over the world. Our satellite distribution system starts at the Broadcast Center (BC) at March AFB. From there it is transmitted via microwave and satellites to downlinks in over 128 countries. Not only does the broadcast center supply programming to AFBS, but the Army and Navy AFRTS outlets as well.

To maintain the security of the copyrighted material, an encryption system called BMAC is used. The broadcast center encrypts the signal and transmits it. In order to receive it, a decoder must be "authorized" as a receiving unit. Again, this is performed at the broadcast center. When a new or replacement decoder is received, the station provides the serial number to BC. Using this serial number, BC obtains the authorization code from the manufacturer to turn on the decoding circuits. When the decoder is connected to the system, BC transmits the proper code over the network. When the proper code is received for the proper decoder, the decoding circuits are turned on and you then receive the broadcasted signal.

I've Worked With Transmitters Before. This might be true to some extent. In AFBS we have AM, FM, and TV transmission systems. Both over the air and cable transmission. AM and FM transmission is fairly standard except you are working with a complex waveform in the modulation process. TV transmission is a combination of AM (for the

picture) and FM (for the sound) with the television signal considered the most complex of all waveforms generated.

Standards for transmission are established by the Federal Communications Commission (FCC), National Association of Broadcasters (NAB), and other associated technical groups. Something broadcasters in the states do not have to contend with is Host Nation regulations. When broadcasting in a foreign country, we also fall under their rules for frequency allocation and transmission power.

Lights, Camera, Action! One of the hardest concepts to understand in a broadcasting station is how it all fits together. When you first walk into a station, you can be overwhelmed by the amount of different types of equipment. An average station has approximately 150 different end items with most of them tied together somehow! Most stations can be considered two different sections. First, a TV station with all its support equipment. Next, a radio station with all its support equipment.

Your basic TV station is made up of video tape recorders, cameras, a mixer/special effect unit, and a signal distribution system. The video tape recorders (VTRs) in a broadcast situation are completely different from what you use at home. Most are microprocessor controlled, contain self-diagnostics, and contain signal correction systems. They can control the signal in the analog domain, or digitize it. In either case, the circuitry is extremely complex since you are not working with a simple sine wave. A major facet in maintaining VTRs is the mechanics and system controlling circuits. The tape must be precisely handled, threaded, and speed controlled in order for the machine to record and playback the program.

Cameras are similar in complexity. Camera systems are moving to completely solid-state pick up devices. You commonly hear them referred to as CCD cameras. With the introduction of the CCD camera, the physical size of the device has shrunk immensely. While this is great for handling and setting up, it becomes a technician's nightmare working with the extremely small circuit boards filled with surface mounted components.

The signal distribution system consists of three basic types. First is the video distribution. It must be able to split the signal to feed different systems or equipment items without introducing any type of signal, frequency, or level distortion. Next is the timing distribution system. In order for all this equipment to work together, it must be "timed." If it wasn't, when you changed signal sources the picture would roll or tear. Last is the color phasing system. This is a sine wave signal which all the color circuits are locked to. If the phase of a machine is off, your picture would change colors when you changed sources. The last trick in the whole distribution system is all the above systems must be timed and phased to each other!

Lastly, you have your mixer or special effects unit. This is the key in operating a TV station. All signal sources feed this one unit from which your board operator selects which source to feed to the transmitter. These units can switch between signal sources, combine two sources into a third signal, add another signal to it and finish with graphics or special effects! At the same time, making sure there is no type of distortion, timing, or phasing errors introduced. If you are wondering about the audio you hear on the TV, this is the unit which also selects the correct audio for the video you are showing. Along with the major items covered above, there are numerous support items for signal processing and special effects. The amount and type is determined by the mission of the station.

Let's Play Records. The other side of the "house" is the radio station. Here is where you have your DJs spinning the discs and reading the news. Audio systems basically consist of record players, cassette decks, reel-to-reel units, and lately the introduction of CD units. Tying this all together is an audio mixer. As in the video studio, the mixer can select between sources for airing, or "mix" two or more sources together. This is how you can hear the DJ and a song at the same time.

Main considerations in an audio situation are signal levels, phasing, and minimizing the distortion being introduced. All sources must have a common reference point. If not, when changing sources, the person listening has to get up and adjust their volume control. Sound familiar? Signal phasing is important when working with stereo sources and systems. This is because the signal has to be compatible with both mono and stereo receivers. If the phasing is incorrect, the two signals will cancel each other out. To the average listener with a stereo system, they might not notice. To a person listening on a FM mono pocket radio the audio will seem to disappear! Not good when you are trying to pass on important information.

What's a TASA? TASA is the Television-Audio Support Activity. It is a DoD agency which is responsible for supporting all AFRTS units by buying equipment and repair parts. If you caught the key word, it is a DoD agency. This means your supply support runs outside normal AF supply. Since equipment in AFRTS is commercial off-the-shelf items, there are very few repair parts which the normal base supply handles. TASA is geared up to support virtually all types of broadcasting equipment in the field. If they don't have it in stock, they act as the purchasing agent to get it for you. TASA is also the agency which buys all broadcast, support, and test equipment.

Do I Want to Work Here? You betcha! Broadcasting is a dynamic field to experience. Technology is advancing at a breathtaking rate. The challenges never stop and are always different.

Television and Intrusion Detection System (TIDS)

Through the use of digital compression technologies, Armed Forces Radio and Television Services (AFRTS)is developing a multi-channel television service to be provided throughout the DoD via their worldwide satellite network (SATNET).   Current plans are to provide four separate television channels with stereo audio.   These channels will include a full time sport, news, and movie channel.   The fourth channel containing traditional serial programming such as sit-coms, soap operas, and documentaries will be time-shifted to match the European and Pacific "prime-time" segments.   This new service is tentatively scheduled to be available in late 1997.

AFRTS, by utilizing state-of-the-art digital audio production equipment, is developing a "paperless and tapeless" Broadcast Radio Studio. Digital satellite programming, hard disk storage, computerized scheduling, cataloguing and play list generation, plus CPU based automated record/playback systems will be employed. These systems will replace the traditional analog environment of tape-based machines currently in use. Digital conversion is expected to be completed in FY 97.

Multi-point Microwave Distribution System (MMDS):   This system is being developed as an alternative to traditional broadcast television techniques. Able to deliver several encrypted channels on one carrier, AFRTS is utilizing this new technology to expand their television service via wireless means.   These systems are currently in use in Saudi Arabia and are being developed for use in Italy, Japan, and Turkey.

Several different types of Intrusion Detection Systems are used to protect Air Force priority A, B, and C resources. The following system descriptions are for those currently being developed, tested, or in-use.

Advanced Entry Control System (AECS):   The AECS provides the capability to control personnel entry into and exit from restricted areas and controls access to individual resources at specified locations.   AECS uses a card reader, personal identification number, and personal identity verifier correctly matching a biometrics characteristics (hand geometry or retinal eye scan).   Though AECS is being developed against an Air Force requirement, it is a program objective for AECS to become the standard control system for DoD.   It was initially acceptance tested at Eglin AFB with the first field installation scheduled at Malstrom AFB in FY 96.   Maintenance will initially be provided by the contractor under a 7-year Contractor Logistic Support (CLS) agreement.

Integrated Commercial Intrusion Detection system (ICIDS):   The ICIDS, a U.S. Army commercially procured physical security system, includes an annunciator system, entry control equipment, and interior/exterior sensors.   The USAF is procuring the annunciator system as a possible replacement for the Small Permanent Communications Display Segment (SPCDS) to meet USAF Priority A, B, and C requirements.

Tactical Automated Security System (TASS):   The TASS is a rapidly deployable easily relocatable, stand-alone security system adaptable to numerous applications including flightline and fixed site security support to the Air Base Ground Defense Force.   This system detects intruders, annunciates alarms, displays alarm information and alarm locations on a graphical scale, provides alarm assessment, and also provides power and/or power interfaces to all components.   Major TASS components include: relocatable sensors, tactical sensors, an RF communications link, desktop, laptop, thermal image, hand-held display units, and power modules.   These systems will be deployed in kit configurations and are programmed to be fully fielded and functional in late FY97.

AIR FORCE SPECIAL OPERATIONS COMMAND

All U.S. Air Force special operations forces are under the command of the Air Force Special Operations Command (AFSOC). AFSOC, established 22 May 1990, at Hurlburt Field, FL, is the Air Force component of the unified U.S. Special Operations Command (USSOCCOM).

MISSION

As a major air command, AFSOC organizes, trains, equips, administers, and maintains Air Force special operations forces for worldwide deployment and assignment to unified commands for conducting unconventional warfare, direct action operations, special reconnaissance operations, counterterrorist operations, and foreign internal defense. As the Air Force component of USSOCCOM, AFSOC exercises operational control over all U.S. based active duty and Air Force Reserve component special operations forces and Air National Guard psychological operations forces. We now own Hurlburt Field, FL, and its fixed assets.

ORGANIZATION

AFSOC has 40 units, composed of more than 5,600 people, approximately 25 percent of which are stationed overseas. The command's three special operations wings epitomize the composite wing concept. They are composed of 117 fixed and rotary wing aircraft, of five different types and 12 different models.

16th Special Operations Wing - SOW: The 16th SOW at Hurlburt Field is the oldest and most seasoned unit in AFSOC. Its units include the 8th Special Operations Squadron (SOS) which flies the MC-130E Combat Talon; the 16th SOS which flies the AC-130H Spectre gunship; the 20th SOS which flies the MH-53J Pave Low helicopter; and the 1st Special Operations Communications Squadron (SOCS) which provides ground communications with the aircraft and home station while the wing is deployed. Two squadrons are the 9th at Hurlburt Field and the 55th SOSs at nearby Eglin AFB, FL. The 9th flies the HC-130N/P Combat Shadow and the 55th flies the MH-60G Pave Hawk helicopter.

352nd Special Operations Group: The 352nd at RAF Alconbury UK, is the designated air component for Special Operations Command Europe. The 7th SOS flies the MC-130E Combat Talon and the 39th SOCS provides ground-to-ground and ground-to-air communications. Two squadrons are stationed at RAF Woodbridge, UK: the 21st SOS, equipped with the MH-53J Pave Low; and the 67th SOS, with the HC-130P/N Combat Shadow.

353rd Special Operations Group: The 353rd at Kadena AB, Japan, is the air component for Special Operations Command Pacific. The squadrons assigned to Kadena are the 1st SOS flying the MC-130E Combat Talon, the 17th SOS flying the HC-130P/N Combat Shadow aircraft, and the 353rd SOCF providing the ground communications for the deployed units and for

ground-to-air support. The 31st SOS, at Osan AB, Korea, flys the MH-53J Pave Low Helicopters.

720th Special Tactics Group - STG: The 720th STG, headquartered at Hurlburt, has units strategically located in the United States, Europe, and the Pacific. The group is comprised of special operations combat control teams and pararescue forces. Their missions include: air traffic control, air assault landing zone establishment, and close air support for strike aircraft and Spectre gunship missions.

WORKING FOR AFSOC

Air Force special operations has a wide variety of radio systems for command and control, logistic, intelligence, and administrative traffic. A working knowledge of these systems and their capabilities is required in order to plan and construct reliable communications nets. Managers coming into AFSOC would be assigned to one of the SOCS mentioned above. You would be responsible for providing maintenance management policies and guidance to the Chief of Maintenance. The following is a brief description of some of the major components used by the SOCS to perform their mission.

LONG RANGE RADIO SYSTEMS

Ultra-High Frequency (UHF) Satellite radio transmission is the primary method for long range command and control of AFSOC forces. In the event of full scale war, our satellite systems will be highly vulnerable, thus HF might be the only long range communications media available to our forces. AFSOC communications are dependent on a wide variety of HF and satellite radio systems in order to allow flexibility for long range command and control of its forces. The following HF and satellite radio systems are used by AFSOC for long range air-to-ground/point-to-point communications.

UHF Satellite Radio Systems

The following UHF radios are used by AFSOC for satellite communications. Many of these radios are also used for line-of-sight (LOS) transmissions in either FM or AM mode.

AN/URC-110: The AN/URC-110 is a portable UHF/VHF AM/FM satellite and LOS transceiver. It is suitable for vehicle, aircraft, fixed station, or manpack operations. It has secure voice capability and can be made compatible with current teletype and Digital Message Devices (DMDs). It can be powered off a battery pack making it portable and tactical for use in the field or it can be powered off a 110 VAC commercial power supply for fixed communications.

LST-5B: The LST-5B, Lightweight Satellite Terminal is a tactical LOS/Satellite AM/FM multi-function radio suitable for aircraft, vehicles, fixed station, and manpack applications. Being the smallest and lightest SATCOM transceiver currently produced, the LST-5B is the

most portable SATCOM transceiver used in a tactical environment. It can operate in the 5 kHz narrowband mode and in the wideband mode in voice, data, and cipher text. It is compatible with all tactical UHF satcom terminals. Power output in FM mode is adjustable in 2 watt steps from 2 to 18 watts. In AM mode, power output is 2 or 5 watts.

HST-4A: The HST-4A is a lightweight, portable UHF satellite, LOS, voice and data transceiver. This radio is used extensively by AFSOC special tactics teams (STT) and the SOCS. The HST-4A is microprocessor controlled with a built-in internal modem providing 1200 or 2400 BPS data capability using either FSK or BPSK modulation. It is compatible with other TACSAT radios to include the AN/URC-101, 110, AN/PSC-3, WSC-3, and LST-5A/B.

AN/PSC-3: The AN/PSC-3 is a portable SATCOM/LOS transceiver. It has a maximum power output of 35 watts in satellite mode and 2 watts in LOS mode. This system is capable of operating in either a wideband (25 kHz) or a narrowband (5kHz) mode. The AN/PSC-3 comes in two configurations; as a manpack radio (which is what the SOCS have), and as the AN/VSC-7 vehicle version. This radio provides plain voice text or secure voice text via the TSEC/KY-57. The AN/PSC-3 is ruggedly encased and incorporates a microprocessor to provide electronic control and has a built-in internal modem for data operation. The built-in modem provides BPSK or DBPSK modulation at 300, 1200, or 2400 bps. This system may also be used with the AN/PRC-77 or AN/PRC-70 VHF/FM radio systems for retransmission (relay) of secure traffic.

HF Radio Systems

AN/URC-119 (Pacer Bounce): The AN/URC-119 is currently used by each SOCS. AN/URC-119s are normally set up at different forward operating bases to provide a high power 1000 watt HF base station for long range command and control. The central component in the AN/URC-119 system is the RT-1446/URC which operates as the transceiver. The RT unit is rated at 100 watts Peak Envelope Power (PEP), can be fully remote controlled over two or four wire phone lines, has a built in phone patch capability, can provide internally generated FSK for teletype/data operations, and is equipped with an RS-232/422 computer control interface. It also comes with either a 500 watt (AM-7223) or 1000 watt (AM-7224) power amplifier.

AN/URC-92 (GSB-900 DX): The 1st SOCS is the only AFSOC unit that maintains this radio system. The AN/URC-92 is a 100 watt, digitally tuned, HF transceiver. It has the ability to operate in a two-frequency simplex mode which allows transmission on one frequency and reception on a different frequency. An additional operating mode permits the operator to select two simplex operating frequencies and rapidly change from one to the other with one selector switch.

AN/PRC-104: The AN/PRC-104 is the standard manpack HF radio system used by all branches of the U.S. military. It is a 20 watt HF

transceiver which has been ruggedized for battlefield conditions. As a basic manpack, the AN/PRC-104 is comprised of three compact subsystems: The RT-1209 receiver/exciter, the AM-6874 amplifier/antenna coupler, and battery pack. These units latch together to form a lightweight, rugged manpack system, easily carried in a standard rucksack or packframe. Each SOCS uses these systems to provide HF capability to their smaller communications locations, and AFSOC tactical teams use these systems in the field (LZ/DZ).

SHF Satellite Radio Systems

SHF satellite terminals will be used by AFSOC for DCS, higher headquarters, and internal connectivity where large data rate services are required.

LST-8000(V)4-6 Portable SHF Terminal: The LST-8000 can be configured for multiple digital data and secure voice channels at aggregate data rates of 64 kbps in the Single Channel Per Carrier (SCPC) mode or operate at 56 kbps with multiple users in the Demand Assigned Multiple Access (DAMA) mode. This system requires another terminal at the distant end with identical capability; at present, the LST-8000(V)4-6 is the only terminal with the C2 DAMA modem. The LST-8000 has a single computer interface for modem and terminal control functions, a fully automatic antenna tracking system, and a 400 watt TWTA power amplifier. The antenna assembly is mounted directly on the LST-8000 transit cases and can handle winds up to 40 mph without tie-downs or guys. This system is extremely portable and can be assembled/activated in less than two hours by two people; during transit it is contained in seven aluminum cases.

SHORT RANGE RADIO SYSTEMS

UHF/VHF AM Radio Systems

Short range radio systems are used primarily for air-to-ground and local area command and control communications. UHF/VHF AM transmission is the primary media for air-to-ground communications by AFSOC.

AN/PRC-113: The AN/PRC-113 is a manpack VHF/UHF radio. It is a dual band frequency hopping radio using Have Quick II technology. The radio can operate at power levels of 2 or 10 watts in either single channel or frequency hopping mode. It is fully compatible with the KY-57.

AN/TRC-176: The AN/TRC-176 is a tactical radio transceiver. It uses the AN/PRC-113 manpack radio as the basic building block in an expanded system. The AN/PRC-113 is inserted into a hardened case which provides both AC and DC power supply and a space to install a KY-57.

VHF FM Radio Systems

AFSOC ground forces use VHF FM radios for local area command and control, to communicate with their Army counterparts, ground-to-air communications, and to perform radio maintenance checks with AFSOC aircraft.

AN/PRC-117: The AN/PRC-117 is an advanced manpack radio that meets all electronic warfare requirements, yet is small, simple to operate, and easy to maintain. It incorporates full band frequency hopping, electronic counter-countermeasure (ECCM) technology. In the frequency hopping mode, the signal changes frequencies hundreds of times per second according to a pseudorandom pattern. The AN/PRC-117 operates in the 30 to 90 MHz range and has 2400 available frequency channels as well as 8 preprogrammed channels that are user selectable. A built-in channel scanning function allows monitoring of all eight preset channels, thus enabling one radio to monitor up to eight separate communication nets. The radio has three selectable power output levels of 10, 1, or 0.1 watts. The AN/PRC-117 operates in the FM mode and can transmit data at 16 kbps as well as voice. Both voice and data modes can be secured with KY-57s.

AN/PRC-77: The AN/PRC-77 is a short-range (5 to 15 miles depending on terrain), manpack radio. The RT-841/PRC-77 is the basic unit of this radio system. It can operate at power levels of 1.3 to 2 watts. There are a total of 920 channels available, of which 2 can be preset. The radio can be remotely controlled from up to 3.2 km, using a radio set control group (AN/GRA-39) or set up for relay using two AN/PRC-77s with an MK-456 relay cable kit. It can be secured with KY-57 crypto.

In addition to the many radios mentioned above, the SOCS also utilizes a wide array of cryptographic, termination, and communications interface equipment: narrowband encryption devices consist of the KY-65/75 (Parkhill), AN/CSZ-1 (Sunburst Processor), and the KG-84; wideband encryption devices include the KY-57/58 (Vinson) and KY-28/38 (Secure Speech System); the KY-68 Digital Secure Voice Terminal (DSVT) and STU-IIIs are the secure phones used.

The termination-communications interface equipment consists of many different items. The AN/UGC-129 teletype, GRID computers, Zenith 184, GXC-8A and UXC-7 facsimile, CRYPTEK facsimile, and Fredericks 1280AM modem are just a few of them.

AIR FORCE RESERVE / AIR NATIONAL GUARD
ADVISOR PROGRAM

Purpose of Reserve Forces Section 262, TITLE 10, U.S.C.: The purpose of each reserve component is to provide trained units and qualified persons to be available for active duty in the armed forces in time of war or national emergency, and when required by the national security to fill the needs of the armed forces during and after the period needed to procure and train additional units and qualified persons to achieve the planned mobilization. Within the Department of the Air Force, the Air Reserve Force consists of units and individuals from the

Air National Guard (ANG) and the United States Air Force Reserve (USAFR). Consistent with existing policies they are to be included in all phases of planning, programming, manning, equipping, and employing the "air arm" of the United States. The structure of these units will be as similar as possible to comparable active force units, and their training and evaluation will be conducted under the same standards.

ANG units enjoy a dual status. They are organized, commanded, and administered as "federally recognized" units in all 50 states, the Commonwealth of Puerto Rico, District of Columbia, and Guam. During peacetime they are commanded by their respective governor, and supported by the National Guard Bureau (NGB) through the Adjutant General (TAG) of the various states. When mobilization is ordered, they become part of the predesignated Air Force Major Command (MAJCOM).

USAFR units are assigned to HQ Air Force Reserve (AFRES) for command, administration, operational control, personnel, logistics, and comptroller functions. They also become part of predesignated Air Force Major Air Command upon mobilization.

Gaining commands are ultimately responsible for establishing training standards and objectives, inspection, safety, programming, equipment, and ensuring operational readiness for gained units.

Advisory Unit Responsibilities: The purpose of the advisory unit is to provide Air Reserve Force units with the advice and assistance necessary to establish an organization that is operationally ready to function effectively when mobilized. Assigned Air Force Technical Advisors (AFTAs) are the primary liaison representing the advisory unit. Units fund to support transportation and per diem for each AFTA visit, as applicable, to ensure attendance at UTAs and annual tours when an AFTA is assigned advisory responsibility. Consideration should be given to additional requirements, i.e., AFTA visits to AF medical facilities, annual WAPs testing, records review at supporting MPF, etc.

Provide training assistance to assigned ARF units, as requested by the AFTA. (Due to budgetary consideration, all on-base resources must FIRST be considered. If the training requirement is considered mission essential and beyond the capability of the AFTA to obtain on-base assistance, the AFTA will submit a written request to the advisory unit for assistance.)

Air Force Technical Advisor - AFTA: The purpose of the assigned AFTA is to provide the necessary advice, guidance, and assistance to the ARF unit that will ensure operational readiness upon mobilization. Full time AFTAs, with appropriate career fields and rank, are selected for these special duty assignments. Selection is coordinated with MAJCOMs and HQ AFMPC. Additional Duty AFTAs provide limited advisory support to ARF units in the absence of the full time assigned AFTA. AFTAs receive orientation training that covers unique characteristics of ARF training, including manning, mobilization, and mission.

Duties and Responsibilities of the Primary AFTA: AFTAs are on duty during normal hours and attend all UTAs and Annual Training of the unit (the latter is accomplished within budgetary constraints). They advise, guide, and assist Air Reserve Force (ARF) units in development and conduct of training to attain optimum mission readiness. They identify potential problem areas, and assist in prioritizing corrective actions, as needed. They advise the ANG/USAFR unit in the preparation of directives and regulation pertaining to unit mission, including unit plans and operational orders for mobilization, mobility, annual training, exercises, and contingency operations. They are familiar with all unit functions in order to monitor them and provide necessary guidance and requests for assistance. AFTAs assist the ANG/USAFR unit in determining and reporting the state of operational readiness of the unit. Advise and assist the unit on Air Force matters, including interpreting directives, evaluating trend analyses, and customs and courtesies. AFTAs also evaluate technical, administrative, safety, security, and general military training programs, and evaluate unit activities and provide assistance to the unit in all areas, but particularly the area of his/her specialty.

AFTAs forward requests for assistance beyond his/her capability to the advisory unit (on-base resources must FIRST be considered). Assist and advise in the development and conduct of the OJT program. Provide guidance to units in maintaining central files of all required publications. Advise the advisory unit commander of any problem areas encountered or anticipated in the training program and of any factors affecting the operational readiness of the unit. They advise the unit commander in conducting a self-inspection program IAW applicable directives. Advisors should emphasize the correlation between a good program and inspection results. Prepare and submit required Quarterly Activity Reports, Pre-UTA Advisories, Post UTA Summary Reports, etc., and forward to appropriate agencies. They also forward requests for assistance beyond his/her capability to the appropriate agency. On-base resources should FIRST be considered.

Duties and Responsibilities of the Additional Duty AFTA: Each of the 12 advisory units appoints an additional duty AFTA to provide limited advisory support to the unit in the absence of the primary AFTA. Additional Duty AFTAs establish a close working relationship with the assigned ANG unit, use available resources within the advisory unit's capability to provide support to the ANG unit, and are familiar with the unit's operational status. This includes reviewing the unit's Quarterly Activity Report and establishing close coordination with the primary AFTA. Perform all AFTA duties in the absence of the primary AFTA.

AFTA Limitations: AFTAs will not accompany ANG units when they are ordered to state duty by state authorities. They will not perform state-related duties. AFTAs will not be used for other than advisory duty unless specifically authorized by the advisory unit. (Note: During temporary critical manning shortages resulting from exercises or real world contingencies, the AFTA may be used to assist the unit in

other than advisory duties providing coordination and approval is FIRST obtained from the AFTA's Commander). AFTAs will not be appointed as custodians or alternate custodians of a unit's cryptographic or supply accounts. On mobilization of ANG units, advisory personnel will be reassigned IAW current directives. Reassignment instructions will depend on the prevailing situation.

ANG Unit Training Program: Advise and assist in preparing training plans, directives, and schedules for unit training assemblies and annual training periods. Validate, coordinate, and request advisory unit assistance, as needed. Analyze training documentation and actual job performance to determine unit's effectiveness. Analyze results of staff assistance visits to determine adequacy/availability of training resources. Submit to unit personnel suggested solution to deficiencies and/or suggestions to improve training programs.

Operational Readiness: Evaluate operations, maintenance, customer support, visual info, and support functions progress toward attaining mission readiness. Review unit and individual records to determine if standards are being met. Submit to unit commander a pre-UTA advisory report. Identify any problem areas noted which could impact unit readiness and require corrective action before or during the UTA and provide recommended solutions. Submit to unit commander a post-UTA advisory report. Outline corrective actions/activities of the UTA. Identify deficiencies still open and provide recommended solutions. Review management and completion of the self-inspection guide program and submit assessment to the unit commander.

Report each section/work center's capability to meet mission requirements. Prepare and submit Quarterly Activity Report to the ANG unit command and provide information copies to the advisory unit commander and MAJCOMs. Is able to summarize quarterly training and activities of the unit. Can provide a clear assessment of the unit's operational readiness. Is able to upchannel issues to higher headquarters for resolution, as needed.

AIR INTELLIGENCE AGENCY — AIA

The AIA is an Air Force Agency with its Headquarters at Kelly AFB, Texas. HQ AIA is an all-source intelligence function which also provides multi-source intelligent products, applications, services, and resources in the areas of information warfare/command and control warfare (IW/C2W), security, acquisition, foreign weapons systems and technology, and treaty monitoring. It's the executive agent for the U.S. Air Force-wide intelligent roles and functions. AIA units provide rapid radio relay; command, control, and communications countermeasures; computer security and communications security to U.S. and Allied Forces worldwide.

To provide training to aircrews in hostile electronic environments, AIA people deploy around the world to perform as adversaries in military

exercises.   In this role, AIA people jam transmissions to degrade communications, they also monitor U.S. military radio and telephone communications to determine if information is being exposed.

HQ AFI is also responsible for the Air Force cryptologic depot which manages and accounts for AF cryptologic devices, codes, call signs, and documents.   The Air Force Cryptologic Support Center (AFCSC) is also located at Kelly AFB and is responsible for life-cycle support for cryptologic equipment and systems along with TEMPEST testing and COMSEC programs.   AIA major equipment items include:

AN/FLR-9 - HF Intercept and Direction Finding (DF) System: This system consists of the antenna system (Elephant Cage), R-2174 receivers, PDP-1123/4 Computers, AN/FRQ-25 Radio Frequency Switch Matrix (Enlarger), Meager DF monitor position, and other associated consoles and equipment.

AN/FSQ-134 - General Purpose Collection Position (GPCP): This is a computer controlled, state-of-the-art, intergrated assembly of equipment for the reception, processing, and forwarding of information under the control of the operator.   The GPCP applies automated data handling techniques of the site mission for the purpose of enhancing the quality, timeliness, and efficiency of operations.   GPCP consists of a General Purpose Console, R-2174 and WJ-8600 series receivers, Audio Switch Matrix, Demodulator, Tuning Display Unit, Demultiplexers, Sound Recorder/Reproducer Set, and Disk Memory Unit.

AN/GSQ-216 - Wolfers/Rocketteer: The Wolfers/Rocketteer system is comprised of a Clock Pulse Distribution Unit (AN/GSQ-237 Chainwork), Secure Intercom/PBX consisting of a Mitel SX-200, AN/FTQ-1 Intercom, and AN/FTC-54 Telephone Connecting Switch.   This system is used for intersite communications and to distribute timing signals.

CRITICOM: A generalized message handling system consisting of a TD 1303 and 1398 multiplexer. Intelligent Data Network Exchange (IDNX) bandwidth managers, and CYSCO 4000/7000 Routers which make up the framework for global connectivity.

NEWSDEALER: Newsdealer is a message retrieval send and receive system designed to replace the Streamliner equipment.   The equipment is composed of 3B2/600g computers and Scope 2000 peripheral terminals for the man-machine interface.

Contingency Airborne Reconnaissance System (CARS):   A deployable intelligent gathering/dissemination system to support theater commanders for table management.   The system consists of approximately 27 deployable SCI vans and associated support equipment, it's also referred to as DDS-1 and DDS-2.

AIR FORCE COMMUNICATIONS AGENCY - AFCA

Air Force Communications Command (AFCC) became Air Force Command, Control, Communications, and Computer Agency (AFC4A), 28 May 1993,

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AACS
AFCS
AFCC
AFC4A
AFCA
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renamed Air Force Communication Agency (AFCA), 13 June 1996. This change reflects the evolutionary movement of Air Force communications responsibility which began with the birth of the Army Airways Communication System in 1938.

The basic mission of AFCA is to serve as a field operating agency (FOA) subordinate to the Deputy Chief of Staff, Command, Control, Communications, and Computers. The FOA carries out policies directed by the DCS and ensures integration and interoperability among C4 systems across the Air Force. This will be done by developing and validating C4 architectures, technical standards, requirements, policies, procedures, and technical solutions. The agency has four areas of responsibility: systems and procedures, interoperability and technology, plans and analysis, and resources. Specific functions to be performed include:

Systems and Procedures looks at current and future systems to develop and standardize policy and procedural guidance in accordance with architectures and technical standards; analyzes, validates, and recommends systems operations and maintenance support concepts and policies for Air Force-wide application; serves as the focal point for functional management issues and provides professional and specialty development in selected C4 areas; develops C4 security guidance; and provides operational oversight to Hammer Ace and Secret Service communications support.

Interoperability and Technology provides technical support to C4 systems evaluations, resource allocation decisions, feasibility studies, and interoperability validations; performs initial applications engineering studies; develops tactical standards and participates as the Air Force representative in standards forums; develops technical systems templates; performs engineering analysis, modeling, and simulation efforts for C4 architectures and proposed technical solutions; performs architectural prototyping and operational integration validation of C4 systems; and develops civil engineering standards for C4 facilities.

Plans and Analysis develops C4 architecture and master planning documents to support migration of systems toward target architectures; develops software concepts and procedures and performs software process assessments; develops strategic plans, policies, and procedures for data administration and data dictionaries; validates technical solutions and requirements for compatibility, interoperability, and integration; performs modeling and forecasting for C4 systems; develops C4 policy and procedural documents to provide centralized guidance on

C4 systems; resolves current roles and missions issues; and reviews C4 wartime operational requirements.

Resources performs internal manpower, personnel, financial management, information management, public affairs, and historical functions; develops and assists in implementing Fee-for-Service, Unit Cost Resourcing, and Defense Business Operations Fund financial policies, processes, and procedures; and prepares inputs for long-haul communications.

38th Engineering Installation Wing (EIW)

Mission Oriented-Customer Driven

The 38th EIW is an organization capable of meeting user demands for intergrated communication systems now and in the future. It's comprised of 4 geographically separated active duty Air Force units and augmented by 19 Air National Guard units. 38th EIW personnel have the experience to understand the fine points of mission requirements and are able to provide full complement of value-added products and services.

Engineering and Installation: The 38th EIW provides rapid response to customer requests for quality standard and non-standard engineering and installation (E&I) of a variety of communications-computer applications. Installation units provide emergency maintenance and repair of CS on a worldwide basis. Supporting a wide spectrum of state of the art technical solutions for air traffic control, meteorological, command and control, and telecommunications systems. Having an engineering services contract to augment their engineering functions gives them added flexibility to further meet customer needs. Installation forces are recognized experts in the fielding of communications-computer systems (C-CS). Superior quality installation coupled with a flexible response and professional training serves as the foundation for this reputation. It also offers Test Measurement and Evaluation services, such as Geodetic Surveys, Electromagnetic Compatibility, and High Altitude Electromagnetic Pulse (HEMP) testing. These services are available to all Air Force elements, DoD organizations, and government agencies. The 738 Engineering Installation Squadron (EIS), at Keesler AFB MS, serves as the focal point for these services. In 1991, the 738 EIS completed over 140 taskings such as Geodetic Surveys, Electromagnetic Compatibility, and High Altitude Electromagnetic Pulse (HEMP) Testing.

SPECIAL SEMINARS ON COMMUNICATIONS SYSTEMS / EQUIPMENT

Special communications-computer seminars are available which provide managers with training on a variety of management subjects unique to a communications-computer environment. The following is a list and description of some of these courses.

SAFCA3802 000 - Communications-Computer Systems Planning and Implementation Management Seminar: This course provides an avenue for base level program managers to obtain the appropriate knowledge to more efficiently and effectively accomplish daily responsibilities. Enhances training on current policies, procedures, and managerial techniques. OPR and quota control: HQ AFCA/XPC, Scott AFB IL 62225-5219.

SAFCA3802C - AFCA Commercial Communications Seminar: This course provides familiarization training in AFCA leased long-lines and base leased services management, methods, and procedures.   Contains instruction on preparation and processing requests for service, telecommunications service requests, annual review of leased long-line services, local telephone billing issues, contracting issues, and scope initiatives through staff briefings and practical applications.   All under the guidance of the Air Force Telecommunications Certification Office (AFTCO) accounts managers. Submit applications through MAJCOMs to AFTCO at Scott AFB, IL 62225-5219.

SAFCA49XX 000 - Communications and Computer Systems Management Seminar: This course provides advanced management training to communications and computer systems logistics and operations officers and senior NCOs on Air Force policies and procedures used to manage communications and computer systems.   The course prepares unit managers for the integration of new systems technologies, while focusing on today's management issues. Emphasis is placed on working today's management problems while blending in discussions on future technologies and systems management issues. The course includes: chief of maintenance and operations responsibilities, network management, integration, logistics management, logistics support, technical support, defense data network, communications and computer systems management, resource management, and other subjects of special interest. Requires SECRET security clearance. Submit quota requests to appropriate MAJCOM. Quota control and OPR: HQ AFCA/XPC, Scott AFB IL 62225-5219.

SAFCA3000 08A - Computer Networks Seminar: This course provides a one-week survey of computer network topics which includes: types of networks, network architectures, types of network topology, network testing concepts, principles of digital transmissions, network standards, congestion control, and internetworking. Course supports a wide range of student knowledge and is open to technicians, engineers, and managers. Quota control and OPR: HQ AFCA/XPC, Scott AFB IL 62225-5219.

MTECCS0025700SU - Engineering Installation Project Engineering Course: Provides formal training on proper preparation of communications-computer systems projects in support of worldwide Air Force, MAJCOM, and other communications agencies. Includes origin, development and management of engineering-installation workload, publications familiarization, support engineering, communications-computer systems planning and pre-project engineering, project package composition and preparation, special actions, project review, changes to project packages, engineering assistance, and quality assurance and control. Quota Control and OPR: CSC/TE, Tinker AFB OK.

MTECCS0026100SU - Electronics Installation Team Chief Course: Provides formal academic instruction to prepare electronics installation (EI) technicians in team management as EI team chiefs. Includes origin and management of EI workload, communications-computer systems project package composition, project package review and documentation, supply procedures, predeployment and post-deployment procedures, preimplementation surveys, project actions, project completion documentation, EI deficiency reporting, and management. Provides familiarization training for selected officers and NCOs in supervisory or managerial positions within the EI environment. Quota Control and OPR: CSC/TE, Tinker AFB OK.

MTECCS0026300SU - Engineering Installation Program Managers Course: Provides formal training in the policies and procedures for managing communications-computer systems programs and projects in support of the worldwide Air Force, MAJCOM, and other communications agencies and branches of service. Introduces the student to the functions of program management and the roles and responsibilities of the program manager. Includes program management structure, communications-computer systems requirements processing, planning, programming, and budgeting system, contracting, acquisition logistics, the Workload Management System, and the functions of the engineering and installation workforce. Quota Control, Waiver Authority, and OPR: CSC/TE, Tinker AFB OK.

ACRONYM LIST

ABCCC - Airborne Battlefield Command and Control Center Capsule
ACC - Air Combat Command
AC&W - Aircraft Control and Warning
ADOC - Air Defense Operations Center
ADPCM - Adaptive Distributed Pulse Code Modulation
AECS - Advanced Entry Control System
AETC - Air Education and Training Command
AFAC - Airborne Forward Air Controller
AFCA - Air Force Communications, Agency
AFCC - Air Force Communications Command
AFCH - Air Force Component Headquarters
AFFSA - Air Force Flight Standards Agency
AFI - Air Force Instruction
AFJQS - Air Force Job Qualification Standard
AFMC - Air Force Materiel Command
AFMEA - Air Force Manpower Evaluation Agency
AFMSS - Air Force Mission Support System
AFNET - Air Force Integrated Telecommunications Network
AFPC - Air Force Personnel Center
AFQTP - Air Force Qualification Training Package
AFRES - Air Force Reserves
AFRTS - Air Force Radio and Television Service
AFS - Air Force Specialty
AFSAT - Air Force Satellite
AFSATCOM - Air Force Satellite Communications
AFSC - Air Force Specialty Code
AFTCO - Air Force Telecommunications Certification Office
AIA - Air Intelligence Agency
AJCM - Anti Jam Control Modem
ALC - Air Logistics Center
ALE - Automatic Link Establishment
AMC - Air Mobility Command
AMHS - Automated Message Handling System
ANDVT - Advance Narrowband Digital Voice Terminal
ANG - Air National Guard

ANMCC - Alternate National Military Command Center
ASOC - Air Support Operations Center
ASR - Airport Surveillance Radar
ATC - Air Traffic Control
ATCALS - Air Traffic Control and Landing Systems
ATO - Air Tasking Order
ATM - Asynchronous Transfer Mode
AUTODIN - Automatic Digital Network
AUTOSEVOCOM - Automatic Secure Voice Network
AVR - Advanced VLF/LF Receiver
AWACS - Airborne Warning and Control System
AWDS - Automated Weather Distribution System
AWN - Automated Weather Network
AWS - Air Weather Service

BAN - Base Area Network
BCT - Battlefield Communications Terminal
BIDDS - Base Information Digital Distribution System
B-ISDN - Broadband Intergrated Services Digital Network
BISS - Base and Installation Security Systems
BITE - Built In Test Equipment
BMS - BIDDS Management System
BNCC - Base Network Control Center

C^3 - Command, Control, and Communications
C4I - Command, Control, Communications, Computer, and Intelligence
CAMS - Core Automated Maintenance System
CAS - Combat Ammunition System
CBRN - Caribbean Basin radar Network
CBT - CSP Backside Terminal
CCPDS-R - Command Center Processing and Display System - Replacement
CCSS - Command and Control Switching System
CCTV - Closed Circuit Television
CDC - Career Development Course
CDC - Control Data Corporation
C/DM - Communications/Data Management
CE - Communications-Electronics

CEM - Chief Enlisted Manager
CFETP - Career Field Education and Training Plan
CINC - Commander - in - Chief
CLS - Contractor Logistics Support
CMC - Cheyenne Mountain Complex
CMSD - Coder Multiplexer Sensor Data
CNCE - Communications Nodal Control Element
CODEC - COder-DECoder
COMSEC - Communications Security
COTS - Commercial Off The Shelf
CPU - Central Processing Unit
CRA - Central Repair Activity
CRC - Control and Reporting Center
CRC - Communications Relay Center
CRP - Control and Reporting Post
CS - Constant Source
CSC - Communications Systems Center
CSCI - Commercial Satellite Communications Initiative
CSP - Communications Support Processor
CTAPS - Contingency Theater Air control System Automated Planning System
CTG - Course Training Guide
CTS - Course Training Standard
CUT - Cross Utilization Standard

DASR - Digital Airport Surveillance Radar
DAWS - Distributed Automated Weather System
D-BRITE - Digital Bright Radar Tower Indicator Equipment
DCO - Dial Central Office
DCP - Distributive Communications Processor
DCS - Defense Communications System
DCT - Digital Communications Terminal
DCTN - Defense Commercial Telecommunications Network
DDDS(3DS) - Digital Decision Display System
DDN - Defense Data Network
DDN-MILNET - Defense Data Network-Military Network
DEB - Digital European Backbone
DECS - DSCS Electronic Counter-Counter Measure Control System
DFCS - DSCS Frequency Division Multiple Access Control System
DGS - Deployable Ground Station

DINS - District Information Networking System
DISA - Defense Information Systems Agency
DISN - Defense Information System Network
DISNET - DDN Intergrated Secure Network
DITS - Digital Imagery Transmission System
DLR - Depot Level Repairable
DME - Distant Measurement
DMIP - Defense Mediterranean Improvement Program
DMS - Defense Message System
DMSP - Defense Meteorological Satellite Program
DMU - Dual Modem Upgrade
DNVT - Digital Non-secure Voice Terminal
DOD - Department of Defense
DPC - Data Processing Center
DPN - Digital Pipeline Network
DPS - Data Preparation Subsystem
DRSN - Defense Red Switch Network
DSCS - Defense Satellite Communications System
DSN - Defense Switched Network
DSNET - Defense Secure Network
DSVT - Digital Subscriber Voice Terminal
DTD - Data Transport Devise
DTS - Data Terminal Set

EAM - Emergency Action Message
ECI - Extension Course Institute
E-DITS - Enhanced Digital Imagery Transmission System
EHF - Extremely High Frequency
EMS - Emergency Mission Support
EMUT - Enhanced Manpack UHF Terminal
ESD - Electronic System Division
EW - Electronic Warfare

FAA - Federal Aviation Administration
FARR - FAA Air Force Radar Replacement
FACP - Forward Air Control Post
FBMLS - Fixed Base Microwave Landing System
FCO - Facility Control Office
FCS - Full Communications System
FDB - Field Distribution Boxes
FDM - Frequency Division Multiplexing

FOC - Full Operational Capability
FM - Frequency Modulation
FTS 2000 - Federal Telephone System 2000

GATR - Ground-Air-Ground
GBS - Global Broadcast Service
GCA - Ground Control Approach
GCA/RFC - Ground Control Approach/Radar Final Control
GCCS - Global Command and Control System
GCI - Ground Control Intercept
GCN - Ground Communication Network
GDCTS - Ground Digital Communications Terminal System
GIS - Graphic Imaging System
GMF - Ground Mobile Forces
GPS - Global Positioning System
GWIP - Global Weather Intercept Program

HAMMER RICK - HAMMER Rapid Initial Communications Kit
HEMP - High -altitude Electro-Magnetic Pulse
HF - High Frequency
HFRB - High Frequency Regional Broadcast
HF/SSB - High Frequency/Simple Sideband
HICS - Hardened Intersite Cable System
HVC - Hardened Voice System

IC - Intergrated Circuit
ICIDS - Intergrated Commercial Intrusion Detection System
ICW - Interactive Courseware
IDE - Intrusion Detection Equipment
IDHS - Intelligence Data Handling System
IDM - Improved Data Modem
IDNX - Intergrated Digital Network Exchange
IDTS - Integrated Digital Telecommunications System
IFF - Identification Friend or Foe
IFR - Instrument Flight Rules
IIRES - Imagery Interpretation and Edit Station
ILS - Instrument Landing System
IMDS - Intergrated Maintenance Data System
IMIS - Intergrated Maintenance Information System

IMPS - Intelligence Message Processing System
I/O - Input/Output
IPIX - Interface Processor for Imagery Exchange
IR - Infrared
ISB - Independent Side Band
ISDN - Intergrated Services Digital Network
ISS - Intelligence Support System
ITOS - Interim Tactical Orderwire System
ITWAA - Intergrated Tactical Warning Attack Assessment

JCS - Joint Chiefs of Staff
JMINI - Joint (UHF) MILSATCOM Intergrated Network Controller
JRSC - Jam Resistant Secure Communications
JSIPS - Joint Service Imagery Processing System
JSS - Joint Surveillance System
JSTARS - Joint Surveillance Target Attack Radar System
JTIC - Joint Test and Interoperability Command
JTIDS - Joint Tactical Information Distribution System
JVIDS - Joint Visually Intergrated Display System
JWICS - Joint Worldwide Intelligence Communications System

Kbps - Kilobits per second
KHz - Kilo Hertz
KW - Kilowatt

LAN - Local Area Network
LANTRIN - Low Altitude Navigation & Targeting Infrared for Night
LASTE - Low Altitude Safety Targeting Enhancement
LDS - Lightning Detection System
LENSCE - Limited Enemy Situation Correlation Element
LMR - Land Mobile Radio
LMST - Lightweight Multiband Satellite Terminal
LNA - Low Noise Amplifier
LRM - Low Rate Multiplexer
LRR - Long Range Radar
LRU - Line Repairable Unit
LWDS - Local Weather Distribution System

MAJCOM - Major Command
MATAG - Maintenance Training Advisory Group
Mbps - Megabytes per second
MCCS - Missile Control Communications System
MCE - Modular Control Element
MCEB - Military Communications-Electronics Board
MCS - Master Control Station
METNAV - Meteorological and Navigation
MICK - Mobility Initial Communications Kit
MILNET - Military Network (DDN)
MILSATCOM - Military Satellite Communications
MILSTAR - Military Strategic-Tactical Relay
MIM - Master Interpretation Module
MLS - Microwave Landing System
MMDS - Multi-point Microwave Distribution System
MMLS - Mobile Microwave Landing System
MSPOC - Multiple Purpose Satellite Operations Center
MSEP - Maintenance Standardization and Evaluation Program
MSS - Mission Support System
MTI - Moving Target Indicator
MWDS - Missile Warning and Display System

NADS - North Atlantic Defense system
NAS - National Airspace System
NAVAID - Navigational Aid
NCS - Network Control Station
NCO - Network Control Office
NDB - Non-Directional Beacon
NEXRAD - Next Generation Weather radar
NFE - Noise Figure Enhancer
N-ISDN - Narrowband Integrated Services Digital Network
NMCC - National Military Command Center
NMR - Near Mobile Radar
NOTAM - Notice to Airman
NPOESS - National Polar-orbiting Operation Environmental Satellite System
NRT - Near Real Time
NRTS - Not Repairable This Station
NSC - Node Site Coordinator
NVIS - Night Vision Imaging System

NWS - North Warning System

ODD - Optical Disk Drive
O&M - Operations and Maintenance
OJT - On-the-Job-Training
OTH-B - Over-the-Horizon Backscatter
OTH-T - Over the Horizon-Targeting

PABX - Private Automatic Branch exchange
PAR - Precision Approach Radar
PBX - Private Branch Exchange
PC - Personal Computer
PCM - Pulse Code Modulation
PCU - Power Converter Unit
PIDP - Programmable Indicator Data Processor
PSN - Packet Switch Node
PSTN - Public Switched Telephone Network
PTF - Patch and Test Facility
PUP - Principal User Processing

QATS - Quality Assurance Test System
QRSA - Quick Reaction Satellite Antenna

RAILS - Relational Analysis of Internetting Linkages System
RAM - Random Access Memory
RAMMS - Remote Analysis Maintenance and Monitoring System
RAPCON - Radar Approach Control
RDIT - Rapid Deployment Imagery Terminal
RDL - Remote Data Link
REMIS - Reliability and Maintainability Information System
RLPs - Remote Line Printers
ROCC - Region Operations Control Center
ROMS - Remote On-Line Maintenance System
ROP - Receive Only Printers
RST - Remote Switched Terminal
RWR - Radar Warning Receivers
RVR - Runway Visual Range
RX Receive

SARAH - Standard Automated Remote to Autodin Host
SAT - Standard Automated Terminal
SATCOM - Satellite Communication
SATNET - Satellite Network
SB - Sentinel Byte
SBLC - Standard Base-Level Computer

SCAMP - Single Channel Anti-Jam Man Portable
SCIS - Survivable Communications Integration System
SCN - Satellite Communications Node
SCT - Single Channel Transponder
SCTR - Single Channel Transponder Receiver
SCU - Systems Communication Unit
SDHS - Satellite Data Handling System
SDS - Satellite Data System
SED - Signal Error Detector
SHF - Super High Frequency
SIDS - Secondary Imagery Dissemination System
SGNIT - Signals Intelligence
SINCGARS - Single Channel Ground and Airborne Radio System
SIN/MCN - Support Information Network/Maintenance Control Network
SLFCS - Survivable Low Frequency Communications System
SMART-T - Secure Mobile Antijam Reliable Tactical Terminal
SOC - Satellite Operations Center
SOCC - Sector Operations Control Center
SONET - Synchronous Optical Network
SRT - Standard Remote Terminal
SSB - Single Sideband
SSOC - Suitland Satellite Operations Center
STAMPS - Stand Alone Message Processing System
STE - Secure Telephone Equipment
STOPMS - Stand Alone Message Processing System
STS - Specialty Training Standard
SVTS - Secure Video Teleconferencing System

TAB - Tactical Air Base
TACAN - Tactical Air Navigation System
TACMET - Tactical Meteorological
TACMO - Take Charge And Move Out
TACP - Tactical Air Control Party
TACS - Tactical Air Control System
TADIL - Tactical Digital Information Link
TAF - Tactical Air Forces
TARS - Tethered Aerostat radar System
TAWDS - Transportable Automatic Weather Distribution System

TCF - Technical Control Facility
TDM - Time Division Multiplexing
TIBS - Tactical Information Broadcast Service
TMDE - Test, Measurement, and Diagnostic Equipment
TSS - Transportable Shelter System
TTC - Telephone Transmitter Control
TTY - Teletype
TX - Transmit

UAR - Unattended Radar
UDLC - Universal Data Link Control
UHF - Ultra High Frequency
UT - User Terminal
U&TW - Utilization and Training Workshop
UTE - Universal Terminal Emulator

VF - Voice Frequency
VHF - Very High Frequency
VORTAC - VHF Omnidirectional Range Tactical Air Navigation

WAN - Wide Area Network
WARDNET - Wide Area Robust Network
WBL - Wide Band Link
WCCS - Wing Command and Control System
WWMCCS - Worldwide Military Command and Control System
WX - Weather

GLOSSARY OF TELECOM TERMS

ACCESS CHARGE: Charge assessed to an IXC by a LEC, pursuant to FCC regulation, for use of the LEC's local network facilities to make or receive interstate calls.

ALTERNATE OPERATOR SERVICE (AOS) PROVIDER: Those entities, other than traditional operator service providers (OSPs) such as AT&T or the BOCs, which provide operator services to telephone customers. Some AOS participants object to use of the term "alternative" since it implies, they argue, that their companies are defined only in the context of being an alternative to AT&T. See "operator service provider."

ANALOG: A fundamental form of communications (voice, data or video) which utilizes a continuous electrical signal that represents information by means of variations in its amplitude or frequency. Although analog still is used for most voice communications, it is gradually being replaced by digital signals. For contrast, see "digital."

BELL OPERATING COMPANY (BOC): One of the 22 regional companies, divested from AT&T in 1984, and currently providing local telephone service, e.g., Illinois Bell and Pacific Bell.

BLACK CABLE: Black sheathed cable used to connect buildings, or floors of buildings. Although not deregulated by FCC as part of "Inside Wiring" decision, some phone companies maintain the Air Force should be responsible for its installation and maintenance on bases.

BYPASS: The process by which a potential customer circumvents the LEC's public switched network, the system traditionally used to place calls. Bypass may be accomplished by fiber or cable networks, microwave systems or satellite transmissions. LECs often complain that unregulated competitors target the most lucrative market segment (i.e. , high use business customers) for bypass, a process called "cream skimming." Unlike the LECs, these competitors are not required to service uneconomical market segments, such as low use, widely dispersed residential customers.

CALL BLOCKING: The practice of some OSPs to prevent a customer from accessing its preferred carrier through alternate dialing methods, such as dialing 800, 950 or 10XXX-0+ (an IXC access code). The practice often has occurred at phones available to the public or to transient users of a premises, e.g., in hotels or hospitals, or at pay phones. In October 1990, Congress amended the Communications Act (47 U.S.C. 226) to prohibit call blocking wherever equal access is technically feasible. It also requires

all equipment and software manufactured and installed by May 1992 to enable equal access to IXCs.

CALL BRANDING: The process by which an OSP audibly and distinctly identifies itself to every person who uses its operator services. In October 1990, Congress amended the Communications Act (47 U.S.C. 226) to require call branding before a customer incurs any charges.

CALL SPLASHING: The process by which an OSP transfers a call to another carrier at other than the most direct point, thereby causing the caller's bill to contain a charge that reflects the transfer of the call at the more distant location. In October 1990, Congress amended the Communications Act (47 U.S.C. 226) to prohibit most instances of call splashing.

CAMPUS: Contiguous property, all of which is treated as the responsibility of a single landowner for telecommunications purposes, e.g., an apartment building, industrial plant or commercial shopping mall. Some phone companies contend that military bases should be treated as a campus, and their tariffed responsibility should cease once service is provided to a single demarcation point within the base.

CENTRAL OFFICE (CO): The central switching unit of a telephone system, where customer lines and trunks terminate and are interconnected with the rest of the network. A CENTREX service normally is located in a central office.

CENTREX: A business service which utilizes telephone company switches (normally off base) that allow dialing within the system, direct inward dialing and direct outward dialing with extension users being automatically identified without an attendant's assistance. It is used as an alternative to "PBX."

COMMUNICATION SERVICE AUTHORIZATION (CSA): An ordering form (DD Form 428) used by the military services to obtain equipment or services which may be provided according to a basic agreement with a telecom company, or to modify, cancel, or terminate equipment or services already ordered under a CSA. HQ AFCC has announced that it will phase out the use of CSAs for unregulated services, eliminating the leasing of such services in CSAs by 1 Jan 94.

COMMUNICATIONS SERVICES INDUSTRIAL FUND (CSIF): A working-capital revolving fund established by the Secretary of Defense pursuant to DoD Directive 7410.4, as authorized by federal statute (10 U.S.C. 2208). The Defense Commercial Communications Office (DECCO) uses the CSIF to pay for the common long-haul services of its subscribers, including DoD components and a few other customers

(e.g., the FAA). The fund is replenished through reimbursements and surcharges paid by the subscribers from their appropriations. The CSIF simplifies financial accounting and contract administration, and enables cost savings by the bundling of common services for government customers. Unlike most appropriated accounts, the CSIF is available for obligation without fiscal year limitation.

COMPARABLY EFFICIENT INTERCONNECTION (CEI): An FCC requirement that RBOCs offer to enhanced service providers the same interconnection features on an unbundled basis and at the same price, as are enjoyed by the RBOCs companies for their own equivalent services.

COMPETITION IN CONTRACTING ACT (CICA): Federal legislation enacted in 1984 (10 U,S.C. 2301) which requires federal entities to compete the purchase of goods and services to the fullest extent possible. CICA applies to acquisition of telecom equipment and services which have been deregulated by the FCC and state PUCs.

CROSS-SUBSIDIZATION: The process by which a firm uses its regulated activities to subsidize its unregulated ones. The charge normally is raised in relation to the LECs and (to a diminishing extent) AT&T. These carriers engage both in regulated telecom services (for which there is no effective competition) and other competitive (unregulated) activities. Utility commissions normally allow common carriers to price their regulated services to guarantee a reasonable rate of return for investment in those services. Therefore, a LEC has an incentive to allocate costs from a competitive activity (e.g., cellular telephones) to a regulated one (local exchange service), and transfer revenue in the opposite direction. The process enables the carrier to cut the costs of its unregulated activity (enjoying an unfair advantage over its competition) and inflate the return on its regulated service.

CUSTOMER-OWNED COIN-OPERATED TELEPHONE (COCOT) SERVICE: Pay telephone station provided by other than the LEC. The COCOT service is connected to lines leased from the LECs and normally entails operator service from an AOS. IXCs increasingly offer public pay phone service for their networks on a credit card rather than a coin-operated basis.

CUSTOMER PREMISES EQUIPMENT (CPE): Communications equipment located on the customer's premises, including end instruments and switches, either owned or leased by the customer.

DEMARCATION POINT: The point of interconnection between a telco's communication facilities and the customer's premises. It marks the point at which the customer assumes responsibility for

installation and maintenance of communication facilities. The FCC requires local carriers to establish reasonable and nondiscriminatory practices of placing the customer 's demarcation point at the "minimum point of entry" for multiunit installations, such as a military installation (47 C.F.R. 68.3).

DEREGULATION: The legal process by which the FCC or a state Public Utility Commission removes an area of telecom service from its own regulation, and opens it to competition. For instance, as a result of the deregulation of inside wiring by the FCC, a telephone company no longer is required by law (tariff) to install and maintain such wire on a customer's property, including an Air Force base. Therefore, the Air Force may perform such services on its own, or contract with someone else (including the telephone company) for those services. However, the Air Force is not required to contract with the phone company, nor is the phone company required to perform such services, except pursuant to contract.

DIGITAL: A fundamental form of communications (voice, data or video) in which an electrical signal conveys information by means of noncontinuous electrical pulses. Although now used mostly for transmitting data, digital transmission is a growing technology which gradually is replacing analog for voice communication. Digital produces far better fidelity, is easier to monitor and encrypt, can accommodate multiple services (e.g., data, voice and facsimile) on the same network and is better suited to modern technology (e.g., multiplexing and fiber optic cable). However, it requires greater bandwidth than analog. For contrast, see "analog."

DIRECT INWARD DIALING (DID): A circuit that enables incoming calls to reach a called party without the intervention of a PBX switchboard and an operator.

DIVESTITURE: The negotiated settlement of an antitrust action by which AT&T agreed to divest itself of its operating companies (the BOCs), which survived as separate legal entities providing local exchange service. AT&T continues to provide long distance (interLATA) phone service, and may now compete in new fields, such as computers, which it previously was forbidden to enter due to its monopolistic status in the telecommunications industry. See also "MFJ."

DOMINANT CARRIER: A category established by the FCC for those telecom companies which have ability to exert "unnatural price control" on the markets they serve. The FCC requires such companies to file tariffs on prices and service. For long distance (interLATA) service, only AT&T is considered a dominant

carrier, releasing its competitors (e.g., MCI and Sprint) from tariff requirements.

END-TO-END SERVICE: The concept that one telecom vendor will be fully responsible for accomplishment of a particular service, e.g., a private line circuit. Before divestiture and deregulation, end-to-end service (mostly procured from AT&T) was routine. More recently, the Air Force has experienced difficulty in obtaining end-to-end service. For instance, an IXC might decline to provide for the final ("tail") portion of a service on base. In such cases, the Air Force either would maintain the tail itself, or subcontract with another firm (probably the LEC). Therefore, the Air Force may have multiple vendors (LECs at both ends of the service, and an IXC in the middle) providing service. Responsibility for repairing a service deficiency could be uncertain.

ENHANCED SERVICE: Legal term devised by FCC in its 1980 Computer Inquiry II decision to describe a class of telecom services which were not considered part of a phone company's basic service offerings, and therefore were detariffed and open to competition. The FCC defined an enhanced service as "any offering over the telecommunications network which is more than a basic transmission service." These services are characterized by the use of computer processing applications to restructure, repackage or "store and retrieve" the information, or some type of subscriber interaction, rather than mere transmission over a network. Typical examples of enhanced services include voice mail, advanced calling, call answering, credit card verifications, alarm services and "900" information services. See also "information services."

EXTENDED AREA SERVICE (EAS): A type of telephone service which permits subscribers of a given exchange to place calls to and receive calls from one or more other exchange areas without being assessed MTS charges for each call.

FEDERAL COMMUNICATIONS COMMISSION (FCC): Federal administrative body which regulates all interstate communications. DoD is represented before the FCC by the Defense Communications Agency (DCA).

FIBER-OPTIC CABLE: Transmission medium composed of hair-thin strands of glass that carry video images, conversations and computer data on beams of laser light. It has nearly unlimited capacity, and is virtually free of interference and delays. Despite its advantages, telephone companies have been reluctant to install fiber-optic cable over much of their network because the cost will not be justified to carry only voice communications. The BOCs claim that the advent of fiber-optic cable will make

their companies the most efficient provider of a broad range of communications services to the home, including video and data transmissions, if legal restrictions on their services are lifted.

FOREIGN EXCHANGE (FX): - - A service which permits a customer to make or receive local calls through a distant switching center by effectively providing a long extension cord in the form of a dedicated line between the customer's location and a telephone company switching system in the distant location (the foreign exchange).   Businesses which handle calls through a centralized national location, e.g., an airline reservation system, often use FX lines to give a caller the appearance that the call is received in the local area.

FTS 2000: A major contract (estimated at $25 billion) awarded in 1988 by the General Services Administration to AT&T and Sprint to provide the federal government with a broad range of telecommunications services, including voice and data transmission.   After a dispute arose as to whether federal law required DoD to participate in FTS 2000, or permitted it to award its own contracts, DoD agreed in May 1990 to use FTS 2000 for commercial long distance services (9-1, WATS, 1-800) and any non-command and control dedicated services which cannot be put on a common user system.   The agreement allows DoD to provide its common user systems (e .g.   , the Defense Switched Network, or DSN) separate from FTS 2000.

INFORMATION SERVICES: An umbrella description devised by the federal courts for a variety of services offered by phone companies beyond their basic transmission services.   They are defined by the MFJ as "the offering of a capability for generating, storing, transforming, processing, retrieving, utilizing or making available information which may be conveyed via telecommunications.   "Examples range from relatively simple public announcement services and alarm monitoring to classified advertisements (electronic yellow pages) to sophisticated financial or legal database access and retrieval systems. Services often are offered over phone lines in a videotext format. Although the MFJ forbids the RBOCs from offering their own information services ("content"), it allows them to "transmit" data (and provide gateways to information services developed by other entities).   The transmission exception excludes some services (e.g., voice mail) which are included under the concept of "enhanced services" devised by the FCC to detariff some telecom services.   Therefore, information services are a subset of the "enhanced services." For contrast, see "enhanced service."

INSIDE WIRING: The portion of a customer's telephone wiring which was deregulated by the FCC in November 1986, and therefore became

the responsibility of the building owner rather than they phone company. It generally consists of the wiring which extends horizontally across a building's floors. Also called "gray wire," since it usually is sheathed in gray insulation, or "Account 232 wire," in reference to how the FCC characterized the wiring in its standardized accounting system.

INTEGRATED SERVICES DIGITAL NETWORK (ISDN): A digital network designed to transport a wide range of telecommunications and information services (voice, video, data and facsimile). ISDN has become technically feasible due to advances in switching equipment, multiplexers and fiber optics. The RBOCs contend ISDN on a national scale would be economically feasible if legal restrictions on their activities were eased.

INTEREXCHANGE CARRIERS (IXCS): Telecom companies which provide service between two or more LATAs (interLATA). AT&T, MCI and Sprint are the three most prominent IXCs. AT&T is considered the only dominant IXC. Also called long-haul or long distance carriers. Although most LECs (the RBOCs) are prohibited from providing interLATA service, some states permit IXCs to provide intraLATA toll service in competition with the LECs.

LOCAL ACCESS AND TRANSPORT AREA (LATA): A telephone district served by one or more telephone operating companies on the basis of predominately local traffic patterns. The MEJ established 161 LATAs within the United States. Service within the LATA (intraLATA) normally is provided by LECs and regulated by a state commission. Service between LATAs (interLATA) is open to competition between various vendors, e.g., AT&T, MCI and Sprint.

LOCAL EXCHANGE CARRIER (LEC): Those telephone companies which provide regulated, local service. About 1,400 telcos, mostly small rural phone companies, function as LECs in the United States. However, several large LECs dominate the industry. The largest LECs are the 22 BOCs, and a few independent companies (e.g., GTE-Contel, Rochester Tel and Cincinnati Bell) which have purchased smaller telcos across the country.

LOWEST TOTAL OVERALL COST (LTOC): A contractual term which embodies the Air Force policy to purchase, rather than lease, CPE unless a lease represents LTOC pursuant to analysis described in AFR 700-4.

MAIN DISTRIBUTION FRAME (MDF): A frame where telephone lines coming from the outside appear inside a building near a switch. The LECs often claim the MDF on a base should be its sole demarcation point.

MAXIMUM POINT OF PRESENCE (MAXIPOP): The Air Force policy that a LEC should maintain multiple points of presence (or demarcation points) on a base, terminating service at the building interface for all unofficial customers, e.g., at each base residence and dormitory.

MESSAGE TELECOMMUNICATIONS SERVICE (MTS): The most frequently used long distance telephone service, in which each call is billed on the basis of calling distance, duration of call and time of day.

MINIMUM POINT OF PRESENCE (MINIPOP): The policy espoused by some LECE that they should have only one demarcation point, just inside the base boundary, and that the Air Force should be responsible for the installation and maintenance of all cable plant beyond that point. The policy is based upon the argument of those LECs that an Air Force base represents a "campus, " With only one customer, the Air Force.

MODIFICATION OF FINAL JUDGMENT (MFJ): A negotiated court settlement reached in 1982 which served as the basis for terminating the Justice Department's antitrust suit against AT&T. Among other things, the MFJ (1) required AT&T to divest itself of its operating companies (BOCs), (2) created the concept of LATAs to divide the telecom industry between regulated monopoly service (intraLATA) and relatively unregulated competitive service (interLATA) areas, (3) required that the BOCs provide equal access to their network to all IXCs and (4) prohibited the BOCs from providing interLATA service, manufacturing telecom equipment or providing "information services."

MULTIPLEXING: The process of dividing a transmission facility into two or more channels by combining and then separating individual messages. This reduces the cost of wiring by allowing one transmission facility to carry many different messages. For instance, a T-l circuit can carry twenty-four simultaneous voice communications on two pair of twisted wire.

NETWORK CHANNEL TERMINATING EQUIPMENT (NCTE): A generic term for interface devices located on customers' premises to perform functions necessary for using a transmission channel for digital communications. NCTE functions include circuit termination, signal conditioning and testing, multiplexing and surge protection. Although NCTE may be offered separated from terminal equipment under FCC regulations, its functions also may be built into such equipment.

OFFICIAL CUSTOMERS: Those entities on a base which use telecom services for official government purposes. In states which have deregulated premises cable, the Air Force agrees that it is

responsible for the installation and maintenance of the base cable plant which serves official customers. The Air Force considers government agencies, and those contractors working directly for the government, to be the only official customers on a base.

OPEN NETWORK ARCHITECTURE (ONA): Standards set by the FCC which require the BOCs to separately provide ("unbundle") each interconnection element or feature of their network. An alternative to previous structural separation requirements for regulated and unregulated services of the BOCs, ONA would provide enhanced service providers (ESPs) dependent on access to the local exchange with maximum flexibility in their interconnection arrangements for providing these enhanced services (e.g., data base services in which a customer dials a number to obtain access to stored information, such as Dow Jones News or computerized research facilities).

OPERATOR SERVICE PROVIDER (OSP): An entity that provides operator services, including AT&T as well as newer entrants in operator services industry. The service normally is provided in locations where consumers have limited access to other phones, e.g., hotels, hospitals, coin operated phones. In October 1990, Congress enacted legislation (P.L. 101-435) which seeks to protect consumers from price gouging by OSPs. It requires notification of OSP rates, curtails blocking of calls to the IXC of choice, forbids billing for unanswered calls and most instances of call splashing and mandates the installation of access capability into all future telephone switching equipment. See also, "alternate service providers," "call blocking," "call splashing" and "call branding."

OUTSIDE PLANT (OSP): The out-of-doors telephone equipment such as poles, conduit, cable and wire used in providing transmission facilities for subscribers, and between switching systems, when such transmission facilities are not within a central office building.

PERSONAL COMMUNICATIONS NETWORKS (PCNS): A wireless communications system which uses pocket-size, cordless handsets that function much like cellular telephones. The networks deploy low-power, high-frequency transceivers around a community to transmit and relay calls. Unlike cellular phone systems, which use powerful radio towers to cover relatively large areas, the new wireless technology will cover smaller areas using low-powered base stations at closer interval. PCNs are expected to be significantly less expensive than cellular phones. Several companies (including most RBOCs) have begun testing PCNs in select communities.

PRIVATE BRANCH EXCHANGE (PBX): A customer-provided exchange switch, usually located on base for Air Force customers, which can

receive calls, place outgoing calls and connect intraoffice extensions. It is used as an alternative to CENTREX. Unlike CENTREX, the PBX is not provided by the LEC and not subject to tariffed rates.

PRIVATE LINE: A telecom service involving leased lines (channels, switching and equipment) dedicated to the exclusive (private) use of the customer. Private lines normally connect two points. They may be used to fulfill highly specialized and vital requirements, e.g., the connection of mission critical personnel to operational units or higher command authority. Private lines provide immediate connections (no busy signal) and better security.

PUBLIC SWITCHED NETWORK (PSN): The nationwide network of trunks and switches maintained by the LECs and IXCs for the provision of switched services such as MTS and WATS. These services are distinguishable from private line services, which are not part of the PSN.

PUBLIC UTILITY COMMISSIONS (PUCS): The state administrative bodies which regulate prices and conditions of service for utility services, including telecommunications, within the state. HQ AFCC/JA and the Army's Regulatory Law Office represent DoD interests before such bodies.

PURCHASE OF TELEPHONES AND SERVICES (POTS) CONTRACTS: Any of 17 contracts awarded by the General Services Administration (GSA) to different vendors which provide for the purchase and maintenance of telephone equipment. The contracts are competitively awarded. The Air Force may satisfy the requirements of CICA by ordering such equipment and maintenance directly from GSA schedules based on the POTS contracts.

RECIPROCAL (OR INSTALLATION) LEASE: A legal document which establishes conditions and compensation rates for reciprocal use of cable by Air Force and LEC. Federal law requires the government to seek compensation for use of its property by nongovernment entities. Therefore, the Air Force must seek compensation for use of government cable by the LEC to serve unofficial customers. The Air Force normally receives the same compensation for such use as it pays the LEC for use of LEC cable to serve official customers.

REGIONAL HOLDING COMPANIES (RHCS): The seven corporate entities (e.g., Bell South and U.S. West) which control the 22 BOCs created by the divestiture of AT&T. Also called Regional Bell Operating Companies (RBOCs) or the "Baby Bells." As a result of the MEJ, the RHCs are prohibited from providing data information services (though they may transmit data information created by

others), furnishing interLATA services or manufacturing telecommunications equipment.

REVOCABLE LICENSE: A legal document, maintained at each Air Force base, which establishes the terms and conditions under which the LEC may enter the base to provide telecom services to its customers. It often provides that the Air Force be reimbursed for use of government property (cable pair, conduits, supporting structures) by the LEC to serve unofficial customers.

RISER CABLE: The telecom cable which extends vertically between the floors of a building. Although not considered "inside wire," and thus not deregulated by the FCC, some phone companies maintain the Air Force should be responsible for its installation and maintenance on base.

SEGREGATED PLANT: The policy advocated by the Air Force by which the military and LECs will have separate cable plants on a base wherever possible. One cable plant will be owned (or leased) and controlled by the military, and used to provide service to official customers. The other cable plant will be owned by the LEC to provide service to unofficial customers on an installation.

SLAMMING: Practice by which a telephone customer is switched from one IXC to another without the customer's consent. The practice normally results from overly aggressive telemarketers falsely reporting that a customer has verbally consented to a switch in service. Telemarketers are paid commissions based on the number of customers they can convince to agree to service with a particular IXC. In 1989, more than 100,000 phone customers complained to local phone companies that they had been slammed.

STRUCTURAL SEPARATION: A legal requirement initially imposed by the FCC on dominant telecom carriers (such as AT&T and the BOCs) whereby their regulated and unregulated businesses would have to be performed by separate corporate entities. The FCC abolished the requirement in 1986 as part of its deregulatory initiatives. However, in June 1990, the Ninth Circuit Court of Appeals reversed the FCC's abolition of the structural separation requirement pertaining to the BOCs.

SUBSCRIBER LINE CHARGE (SLC): A flat monthly charge, imposed pursuant to FCC regulations, assessed on each telephone line to compensate the LEC for use of its facilities by IXCs for interstate calls. The charge is assessed regardless of how many (or whether) interstate calls are made from that line. The LECs dislike SLCs since it is imposed directly on residential customers through the LECs' bills. They would prefer to recover for use of

their plant entirely by "access charges" imposed on the IXCs, and passed along to long distance customers through the IXCs ' bills.

TARIFF: A statement filed by a telecom company, and approved by the FCC or state PUC, which defines the regulated services it offers and the rates, charges and terms for use of such services. The company may not discriminate among its customers regarding such services. Therefore, all customers which order such service must accept it according to the terms of the tariff. In return, the company must provide service to any customer who desires it according to the tariffed terms. The tariff differs from a contractual arrangement (used for unregulated activities) where a company may negotiate separate and unique agreements with its customers, and may refuse service to potential customers.

TIE TRUNK (OR TIE LINE): A transmission path connecting between a customer's PBXs at two different locations and eliminating the need to call between through a central office.

TRUNK: A transmission path used to connect central offices and switching centers (including PBXs). Trunks do not terminate with an end user.

UNOFFICIAL CUSTOMERS: Those entities on a base which use telecom services for other than official government purposes. The Air Force contends that it is not responsible for installation and maintenance of the base cable plant which serves these unofficial customers. The Air Force considers the residents of base housing and dormitories, commercial enterprises on base (e.g., Burger King), AAFES and the Commissary to be unofficial customers.

VERY SMALL APERTURE TERMINALS (VSATS): A small dish, normally located on the roofs of buildings, used to receive and transmit satellite communications. The VSAT network "bypasses" the local telephone company. Businesses with a large number of geographically dispersed locations (e.g., automotive companies with many distributorships, hotel and supermarket chains) often find a VSAT system less expensive than conventional telephone-line costs. AT&T has offered VSAT network services under the name "Skynet" since 1986.

WIDE AREA TELECOMMUNICATIONS SERVICE (WATS): A bulk rate switched long distance service offering in which subscribers are billed on the basis of number of hours of usage, rather than on a per-call basis such as MTS. Outward WATS enables subscribers to place calls within selected service areas. Inward WATS ("800 service") enables subscribers to receive calls from selected service areas without charge to the calling party.