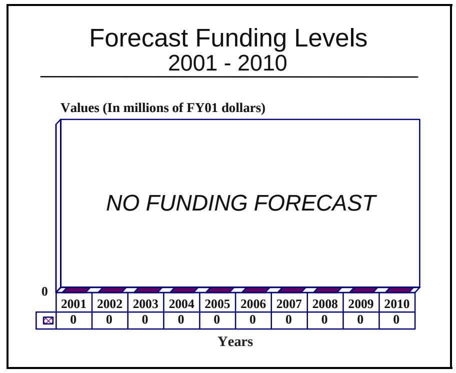
TRI-TAC – Archived 12/2002

Outlook

- On the first day of FY02, the Joint Network Management System (JNMS) program replaced the TRI-TAC program
- The JNMS program is funded under Program Element 0604783A, Project 363



Orientation

Description. TRI-TAC is a US tactical communications system used by the Air Force (USAF), the Army, and the Marine Corps (USMC). It is also known as the Joint Tactical Communications Program and has been called the Multi-Service Communications System (MSCS). On the first day of FY02, the Joint Network Management System program replaced the TRI-TAC program. The Joint Network Management System (JNMS) program is funded under Program Element 0604783A, Project 363. For details of the JNMS, see Forecast International's report entitled "Joint Network Management System."

Sponsor

Joint Tactical C^3 Agency (JTC^{3}A)
Ft. Monmouth, New Jersey (NJ) USA
(overall system architecture and joint coordination)

US Army – Communications Electronics Command
Ft. Monmouth, New Jersey (NJ) USA
(TRI-TAC tasks assigned to the Army)

US Air Force – Materiel Command
Hanscom AFB, Massachusetts (MA) USA
(USAF TRI-TAC work)

US Marine Corps – Systems Command
Quantico, Virginia (VA) USA
(USMC portion of TRI-TAC)

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Status. All TRI-TAC elements have been produced and delivered. On the first day of FY02, the Joint Network Management System program replaced the TRI-TAC program. The Joint Network Management System (JNMS) program is funded under Program Element 0604783A, Project 363. For details of the JNMS, see Forecast International's report entitled "Joint Network Management System."

Total Produced. TRI-TAC equipment produced through 1999 is approximately as follows: 134 TTC-39(V)s, 526 TRC-170(V)s, 70 TTC-42s, 740 SB-3865s, 43 TYC-39s, 50,000 DNVTs, 5 TTC-46s, 200 TTC-48s, 44 TYQ-30s, and 70 TYQ-31s.

Application. TRI-TAC enhances the interoperability between US Army and other US Department of Defense (DoD) telecommunications systems. The system provides new equipment, which reflects the most recent technology, and eliminates duplication in development among the services and agencies.

Price Range. Unit prices for TRI-TAC equipment are as follows (in FY92 US dollars): TRC-170 about US$1 million; UXC-7 about US$14,117; Digital Nonsecure Voice Terminal about US$847; TTC-39(V) about US$3.5-5.5 million; Digital Voice Terminal (without Communications Security Module) about US$17,000; KG-84 about US$4,500; KG-93 about US$10,096; ANDVT (CV-3591) about US$33,333 (Army); and ANDVT about US$36,364 (Marine Corps).

Technical Data

TRI-TAC Major Components. The primary TRI-TAC components include the TTC-39/TYC-39 large circuit and message switches, Unit Level Circuit Switches or ULCS (TTC-42, SB-3865), the TRC-170 Digital Troposcatter radio, the TSQ-111 Communications Nodal Control Element (CNCE), the GYC-7 Small Unit Level Message Switch, the Digital Group Multiplexer (DGM) group of equipment, the TYQ-30/31 Communications System Control Element, the UXC-4 Tactical Digital Facsimile (TDF) terminal, and the Digital Nonsecure Voice Terminal.

Digital Group Multiplier (DGM). The DGM is a family of digital multiplexers, cable driver modems, pulse restorers, and order-wire control units for transmission applications in TRI-TAC. Almost every TRI-TAC subsystem includes some component of the DGM family. Family members include: an array of digital multiplexers that range from a low-capacity field-portable unit to a shelter-mounted unit; an assemblage of coaxial cable and fiber-optic modems for between-shelter connection of digital channel groups; order-wire control modules for data and voice order-wires; a radio modem that allows use of the GRC-103 radio in TR-TAC; display modules for alarms and crypto unit power supply; and cable repeaters for long-length cable systems. All DGM units are fully ruggedized. The DGMs are sub-elements of the TRC-173/174/175 family.

DNVT (Digital Non-secure Voice Terminal). The DNVT was developed as a low-cost subscriber terminal for use with the TTC-39, TTC-42, and SB-3865 switches in situations where communications security is not necessary. Essentially, DNVT is a low-power, digital voice telephone set and is available in both ruggedized (field use) and desktop variants.

GYC-7. This is a two-man, transportable, 12-line, microprocessor-controlled automatic data switch. Its main missions are message routing and delivery verification, providing message throttling, and carrying out network management and control functions. The GYC-7 can also be used to set up a forward-area tactical packet switching network that is able to support the data communications needs of the corps and division command posts.

TRC-138A/B. This provides facilities terminating multi-channel radio and cable groups, plus a GRC-222 for transmitting multiplexed groups from the radio park top-of-the-hill to the switching node bottom-of-the-hill. It has the capability to terminate up to three systems and may be used for radio repeater, short-range wide-band radio, or terminal applications.

TRC-170(V)2/3. This system is an air and ground transportable troposcatter microwave radio terminal. The terminals provide secure transmission and reception of tactical multi-channel digital voice and data by means of the troposcatter mode of propagation in the 4.4-5.0 GHz frequency band. The terminals supply secure, digital, long-haul radio trunking between major nodes of TRI-TAC communications networks and interface with other TRI-TAC systems.

TRC-173/A. An extension terminal deployed at major nodes to provide up to 36 channels of digital trunk communications. It contains two communications sets, based on the GRC-103(V)4, capable of send/receive and line-of-sight operations.

TRC-174/A. An extension repeater deployed at major nodes to provide up to 36 channels of digital trunk communications. It has three communications sets, based on the GRC-103(V)4, capable of send/receive and line-of-sight operations.

TRC-175/A. A major switching node used to transmit/receive trunk groups with the associated radio park. This bottom-of-the-hill radio terminal contains two communications systems, based on GRC-222 and DGM equipment, capable of send/receive operations.

TSQ-111 Communications Nodal Control Element (CNCE). The element functions as the centralized automated technical control system for a communications node. Circuits from both analog and digital equipment enter the CNCE, where voice and message traffic is routed to other switching facilities. The CNCE executes automatic testing of both analog and digital circuits. For analog circuits it handles manual patching and line conditioning, and for digital circuits it handles multiplexing, automated electronic patching, and testing. The CNCE also processes switch status report data from the TTC-39, TYC-39, and TTC-42; the telemetry fault and performance information from the transmission facilities; and the automated channel assignment status. The CNCE functions as the master clock for all digital circuits and contains a cesium timing standard for this purpose.

TTC-39(V). A mobile, automatic, modular electronic circuit switch under processor control, with integral COMSEC and multiplex equipment. It handles secure and non-secure voice and data traffic and provides precedence, preemption, conference, and a variety of other features.

TTC-42 Automatic Telephone Central Office. A shelter-housed, central office capable of supplying 1,509 terminations (a combination of subscribers and trunks). The SB-3865 Automatic Telephone Switchboard is a small team-transportable telephone switching unit with a capacity of up to 30 terminations.

TTC-49. Previously called the Tactical Hybrid Switch (THS), it is an non-development item (NDI) that draws upon the SB-3614(V)/TT and MSE TTC-48 Small Extension Node programs. The TTC-49 provides a 60-line analog switch assembly.

TYC-16. An interim secure, mobile, record traffic processing center. It provides message preparation, transmission, reception, distribution, automatic transmission by precedence, and automatic assignment of incoming messages.

TYC-39. A mobile, automatic, modular, electronic store-and-forward message switch under processor control with integral COMSEC and multiplex equipment. The TYC-39 operates independently or jointly with the TTC-39(V). The TYC-39 accepts, processes, stores, delivers, and accounts for message traffic by utilizing the store-and-forward central processor, appropriate software programs, and memory storage. The three primary functions of the TYC-39 are the maintenance of security, message accountability, and verification of character/bit integrity of all message traffic.

TYQ-30/31 Communications System Control Element (CSCE). The CSCE is the most significant component of the system management and control hierarchy of the TRI-TAC network. It provides near-real-time supervision of the allocation and use of resources available inside its assigned share of the deployed tactical communications network. The CSCE also sets up and maintains a network information base. The CSCE is designed to help network managers and controllers plan, engineer, and control tactical communications systems at echelons above corps. There are actually three versions of the CSCE: the TYQ-30(V)1, deployed at Theater Communications Commands and Area Signal Brigades; the TYQ-30(V)2 Network Management Facility, deployed at Area Signal Battalions; and the TYQ-31 Nodal Management Facility, deployed at the area signal node/company.

UGC-144. This is a formal traffic communications terminal capable of storing, editing, displaying, transmitting, receiving, and printing record traffic in the general service and intelligence communities at all echelons of a tactical communications system. It replaces the UGC-137A(V)2 SST system, which was canceled in 1986.

USC-43(V)2 Advanced Narrow-band Digital Voice Terminal (ANDVT). Provides a narrow-band, secure voice capability for tactical and strategic echelons. The ANDVT Tactical Terminal provides fixed and mobile forces with the capability of securing voice or data transmission via HF, VHF, UHF radio satellite systems, wireline, or net radio interfaces.

UXC-4 Tactical Digital Facsimile. Functions as a means of rapidly sending and receiving maps, photos, and other visual material over tactical communications channels. It can be both a full- or half-duplex transceiver. When in the full-duplex mode, the unit can simultaneously transmit and receive independent facsimile information. The UXC-4 can also function as a receive-only printer (180 lines per minute) and thus can be used as a computer peripheral or a teletype machine.

UXC-7 Lightweight Digital Facsimile. A non-developmental terminal that provides transmission/reception of facsimile graphic/narrative traffic over digital switched voice and data networks and combat net radios. It also supplements SSTs and/or communications centers.

Other significant elements include the TSC-85A/ TSC-93A and TSC-100/TSC-94 SHF satellite terminals.

Unit Level Digital Switch (ULDS). The ULDS provides the TRI-TAC interface with the Mobile Subscriber Equipment (MSE) system. The ULDS consists of an MSE TTC-48 Small Extension Node and an MSE TTC-46 Large Extension Node. The TTC-48 provides the primary means of telephone subscriber entry into the echelon above the corps area system via a 41-line automatic switchboard. It also provides a direct link between local subscribers as well as a manual interface to commercial telephone systems. The TTC-46 provides access for up to 176 subscribers into the echelon above the corps area system, including flood search and automatic affiliation/disaffiliation capabilities.

Fiber-Optic Links. Coaxial cable links used for transmissions between TRI-TAC elements have been replaced by the US Air Force-sponsored TAC-1 fiber-optic system. A typical TAC-1 configuration is composed of an assemblage of six cables which, when joined together, form an unrepeated link between two terminal units which are then connected to the appropriate TRI-TAC elements. The TAC-1 system is one of the first tactical fiber-optic coaxial replacement initiatives sponsored by the DoD. When qualified, TAC-1 was fielded in US equipment throughout the world. Siecor was awarded a US$2 million contract for the program in early 1988.

US Army's Fiber Optics Transmission System (FOTS). Also a part of the TRI-TAC program, FOTS consists of discrete electrical and fiber-optic interconnecting equipment now in use by tactical signal units. The FOTS is designed for use at various echelons with TRI-TAC equipment, with a potential for being used in the MSE system. No modifications have been made to the electronic equipment or their shelters in those systems that have already been fielded. Exceptions include the TRC-138A, the TRC-173/174/175, the TTC-39D, and the TYQ-30/31, all of which have been designed to accept FOTS components. Current FOTS program applications are limited to echelons above corps, the DGM family, switches, and control facilities. The Army's FOTS-LH (Long Haul) is a replacement for CX-11230 twin coaxial cable and offers increased bandwidth, flexibility, and EMP/RFI immunity, and decreased diameter, weight, and cost.

Fiber-Optic Cable System (FOCS). The Marine Corps has a program called the Fiber-Optic Cable System (FOCS), which is said to be worth about US$50 million. The FOCS cables connect TRI-TAC digital switches and radio equipment including the ULCS, the MRC-139 Digital Wide-Band Transmission System, and the TRC-170, as well as interface with other service digital equipment. ITT is prime contractor for FOCS.

TRI-TAC COMSEC Equipment. TRI-TAC communications security equipment is based on the TENLEY and SEELEY families of cryptographic equipment, with both families using the SAVILLE crypto system. Previously, most variables have come in the form of a computer card called a key card or key list, which was used to plug a plug-board. TRI-TAC's COMSEC equipment uses electronic keys, which means that the operators cannot see what the variables look like. Fill devices are used to carry around the electronic variables. The fill devices have several memory slots (locations), with each slot holding a different variable. A new feature of TRI-TAC equipment is the remote keying that some elements use.

The following TRI-TAC equipment is equipped with COMSEC: TTC-39, TYC-39, TTC-42, SB-3865, TSQ-111(V), TYC-16(V), TRC-170, UXC-4(V), UGC-137(V), and the MRTT (Modular Record Traffic Terminal).

The following is the main COMSEC gear associated with TRI-TAC: KG-81 TENLEY Trunk Encryption Device (TED), KG-82 SEELEY Loop Key Generator (LKG), KG-83 TENLEY Key Variable Generator (KVG), KG-84 TENLEY Dedicated Loop Encryption Device (DLED), KG-93 SEELEY Trunk Encryption Device (STED), KG-94 SEELEY Trunk Encryption Device (STED), HGX-82 Loop Key Generator (LKG) Common Unit (CU), HGX-83 TENLEY Automatic Key Distribution Center (AKDC), HGX-84 Interface Control Unit (ICU), HGX-93 SEELEY Automatic Key Distribution Center (SAKDC), HGF Equipment Racks, KYK-13/FYX-15/KOI-18 fill devices, KY-68/78 SEELEY Digital Subscriber Voice Terminal (DSVT), KY-58 Vinson Digital Secure Voice Terminal (DSVT), and KY-90 Secure Digital Net Radio Interface Unit (SDNRIU).

Variants/Upgrades

TRI-TAC equipment is constantly being upgraded to ensure that the system remains capable of carrying out its mission and interacting with new equipment such as the Mobile Subscriber Equipment (MSE).

The following is a list of various upgrades:

GRC-222. The GRC-222 replaces the GRC-144(V)3s in the TRC-175 and TRC-138A. The GRC-222 operates in the 4.4-5.0 GHz frequency range and provides the Army with high-capacity LOS and SRWBR capabilities at echelons above corps.

TRC-138A/B, TRC-173, TRC-174. These radio systems have been downsized to a smaller package for transport. Laguna Industries was awarded the contracts in July and August 1989, and in January 1992.

TTC-39(V). Existing TTC-39(V)s have been upgraded to A and D configurations. The A configuration adds nodal control, and the D is an all-digital configuration providing service for 708 terminations. The A retrofit was completed in 1995. The D configuration is also important because, at present, the MSE and TRI-TAC switching systems operate with different call routing systems. The deployment of the TTC-39D results in increased theater survivability, the number of call paths between corps and the echelon above corps becoming unlimited with no single switch or system acting as a critical choke point. Users now have a permanently assigned telephone number regardless of which switch they are connected to anywhere on the battlefield.

TTC-42 (ULCS). In 1991, the USMC began a ULCS and software integration and support effort to incorporate improvements, which include increasing the line capacity form 150 to 280 lines and the addition of a packet data switching capability. Work continues on integration of packet switch and circuit switch software into a single package for the TTC-42 and SB-3865.

Architecture. The Block III architecture plan, currently the most important development plan involving the TRI-TAC system, came about largely as the result of fielding MSE at the division and corps level in the US Army, while leaving the echelon above corps (EAC) somewhat behind in capabilities. It has been found that MSE calls must be sent in a direct transmission path (i.e., line-of-sight) to other MSE nodes. If out of the line-of-sight, the message must be relayed, via TRI-TAC, back down the MSE network.

The US Army Signal Center began evaluations in 1985 on to how to provide MSE-type capabilities for the EAC in order to form a more homogeneous whole at the theater level. TRI-TAC Block III, otherwise known as the EAC tactical communications initiative, was the result. Block III architecture is an amalgam that is derived from the Integrated Army Communications Study (INTACS), MSE and TRI-TAC, and results in the overlay of mobile subscriber capabilities on the EAC common-user digital network. Included are an increase in circuit switching nodes, the streamlining of communications support to theater-army and theater-army functional command headquarters, and a general upgrade in communication support for Central Army Group (CENTAG), 32nd Army Air Defense Command (AADCOM), and the 56th Field Artillery Command.

The foundation phase of the three-phase TRI-TAC Block III effort was completed in 1987. The baseline architecture phase was completed in 1995. This second phase covers the overlay of minimum essential mobile subscriber capabilities on a TRI-TAC transmission and switching network at EAC levels. The third phase, objective architecture, began in 1996, and provided for full area communications with increased nodal switching and mobile subscriber capabilities.

Because MSE-equipped units that transit or operate in the echelon above corps area currently do not have access to the theater network through the echelon-above-corps-area nodes, the TRI-TAC Block III architecture has programmed employment of two TRC-191 radio access units (or similar equipment at all echelon-above-corps-area nodes). The utility of RAUs enables MSE users to gain access to the full theater network, and allows the expansion of the common user network using cell-phone-like remote terminals at echelon-above-corps units beyond the wire line service distance of the area node.

Common Carrier Interface. The USAF Rome Air Development Center, in conjunction with Raytheon, developed a communications interface used to link TRI-TAC through use of disaster teams with elements of any commercial telephone system that survives a disaster. Tests were run using Air National Guard TRI-TAC provisions to replace components of the FAA's communications link and the public switched network. The National Communications System procured a number of the interface units for emergency applications throughout the US.

SPEED. The USMC's System Planning, Engineering, and Evaluation Device (SPEED) is a microcomputer system which supports service tactical communications systems planning, engineering, and evaluation methods. SPEED acts to maximize the utility of tactical communications systems. A production decision for SPEED was approved in 1990 and four prototype

SPEEDs were deployed as part of Operation Desert Shield. Fielding to operational USMC forces was carried out during 1991.

Program Review

Background. In 1971, the US DoD created the Joint Tactical Communications Office (TRI-TAC) to design and execute a tri-service tactical communication system. A primary objective of TRI-TAC planners was to evolve a system which, through modern technology, would make available to tactical communicators the same variety of advanced telecommunication services already afforded to senior officials using strategic, fixed-plant equipment. TRI-TAC would enable field communicators to automatically interface with all existing and planned tactical terminals, technical control elements, and switching and transmissions equipment required for effective missions. TRI-TAC provided a significant increase in capability over existing US Army systems and equipment.

The Army's Integrated Tactical Communications System (INTACS), employing TRI-TAC equipment, was capable of voice, record and data security. TRI-TAC's digital systems and equipment took advantage of Large-Scale Integration (LSI) solid-state technology for increased reliability and reduced maintenance, size, weight and power consumption; provided increased efficiency of transmission systems without increasing the number of radio systems or radio spectra occupied; and lent themselves to the cost-effective application of COMSEC and jam-resistance techniques. Both voice and record traffic-switching functions are secure, automated, and processor controlled.

TRI-TAC Restructured. In the mid-1980s the US DoD restructured the TRI-TAC program to meet the changed requirements created by the Air/Land Battle 2000 concept. When TRI-TAC was originally conceived in the mid-1970s, it was seen as a tactical high-volume switching communications network where commanders at corps level were more the administrators, and those at division level and below represented the fighting forces. TRI-TAC's main emphasis was the development of transportable, shelterized, high-capacity digital message and circuit switches and ancillary multi-channel trunking gear for corps-level applications. Brigade and division-level users received the MSE, a common-user digital radio-telephone subscriber network being fielded.

However, with the adoption of the new concepts of Air/Land Battle 2000, the role of the corps commanders changed. It gave them a greater involvement in the actual combat area. The corps commanders required much more real-time intelligence and data on the close and deep battle areas, with an added emphasis on directing division commanders. This created a need for voice, data, and facsimile communications gear which was more mobile, secure and survivable than existing equipment at the corps level, and more compatible with lower-echelon equipment.

Since original TRI-TAC switches were too large for the mobility requirements of the new doctrine, the entire program was restructured. What was the original division-level equipment is now used at the corps level. The large switches and ancillary multi-channel trunking gear were used by the Echelons-Above Corps (EACs) to interface with theater forces and operations. Originally the US DoD planned its own development of MSE for brigade and division-level communications. In early 1983 it was decided that off-the-shelf items would be procured to save time. In November 1983, it was determined that the MSE application would be extended to corps level; therefore, significantly increasing the requirement for such equipment. Since the DoD wanted initial service entry by mid-1987, it chose to procure readily available, operationally fielded equipment.

MSE Competition. The MSE competition finally came down to elements of two systems: Plessey's Ptarmigan (used by the British Army) and Thomson-CSF's RITA (used by the French and Belgian armies). Although the Dutch Zodiac and Norwegian Deltamobile systems were also considered, they were rejected because they were not capable enough. After a long and heated competition, the MSE contract was finally awarded to Thomson-CSF and its main American partner, GTE, in November 1985.

The MSE program is a cellular area-communications system that supplies military commanders with a survivable, secure, mobile capability to transmit and receive voice, data and facsimile throughout the battlefield. It had an estimated worth of at least US$4.4 billion.

MSE provides multiple communication nodes with network features which automatically bypass and reroute communications around damaged or jammed nodes. Acquisition of MSE allowed the Army, for the first time, to fully implement the command and control (C^2) aspects of its Air/Land Battle Doctrine. The acquisition program provides MSE equipment to support the total Army force of five corps and 26 divisions including the Reserves and the National Guard. This was also the first time that all of the US

Army's units, both Active and Reserve, had fully interoperable, encrypted, jam-resistant, mobile tactical communications equipment.

The GTE MSE system incorporates major components of RITA and includes a number of major components that are standard US military equipment. Other components are produced in Canada, Italy and Sweden. More than 70 percent of the contract value has been produced in the US by GTE and other US contractors.

Some controversy regarding TRI-TAC has centered on the fact that while the MSE and TRI-TAC both were procuring the same type of equipment, in some cases, prices were lower for MSE because of its equipment cost cap. Congress then mandated that any equipment being procured for the TRI-TAC program could not cost more than similar equipment, which was being procured for the MSE program.

Please see Forecast International's "Mobile Subscriber Equipment (MSE)" *report, located in any of the following binders:* C^3I, Electronics Systems, Land & Sea-Based Electronics, and AN Equipment.

Agency Responsibilities. The US Army is responsible for the following elements: TTC-39, TYC-39, Digital Group Multiplexer, Communications System Control Element (CSCE), Mobile Subscriber Equipment (MSE), Net Radio Interface (NRI), Modular Record Traffic Terminal (MRTT), and modification to GRC-177 radios. Managed by CECOM, Ft. Monmouth, NJ.

The US Air Force (USAF) is responsible for the following elements: Tactical Communications Control Facilities (TCCF), Digital Non-secure Voice Terminal (DNVT), Communications Nodal Control Element (CNCE), Digital Tropo Radio (TRC-170), Tropo/ Satellite Support Radio (TSSR), Tactical Digital Facsimile (TDF), Fiber-Optic Interface Unit (TAC-1) and the Short Range Wide-Band Radio (SRWBR). Managed by Electronic Systems Division, Hanscom AFB, MA.

The US Marine Corps (USMC) is responsible for the Unit Level Circuit Switch (ULCS) and the Unit Level Message Switch (ULMS).

The US Navy (USN) is responsible for the Advanced Narrow-band Digital Voice Terminal (ANDVT), which is managed by the Space and Naval Warfare Electronic Systems Command.

The National Security Agency is responsible for developing and integrating COMSEC into TRI-TAC for both trunk and loop security.

Block Upgrades. In 1999, the USAF initiated the Tactical Communications Integration Program, and concluded Phase I of the joint tactical switch software development by the USAF and US Army. Planning was also initiated for resolving compatibility problems between USAF TRI-TAC and US Army MSE equipment. Fabrication of 60 developmental front-end hardware processor cards to demonstrate the Unit Level Tactical Data Switch (ULTDS) interface with personal computers and local-area networks began. Other work supported limited fielding of ULTDS engineering models for purposes of user evaluation.

Initiation of detailed development planning to resolve USAF data incompatibility problems began in 1991. Other work focused on continued development to improve compatibility with the US Army MSE; release of government-developed prototype System Process System Control (SPSC) software; continued CSCE software development to accommodate changes made to TTC-39D and TYC-39A; improvements to TTC-39(V) circuit switch interface to MSE at corps and below; use of engineering development model (EDM) GYC-7 data switches for ULTDS/ULCS software integration and support (P^3I) to the ULCS; and evaluation of Fleet Marine Force recommendations for ULTDS upgrades.

By 1992, TRI-TAC program work included supporting the NATO communications restructuring; developing the multi-channel operational line evaluator (MOLE) for the TSC-100A, TSC-94A, and the TRC-170; beginning full-scale development of the System Planning and Control System (SPCS); initiating software modifications to the TYC-39 and TTC-39 for Corps/ NATO interface; initiating software development for ISYSCON; and incorporating ULTDS software improvements.

By the end of 1993, the US Army's program accomplishments consisted of preparing Block I system segment specifications, conducting the system requirements review, and completing the top-level design. USMC accomplishments included continued software improvements; identification and definition of an ITSDN-compatible protocol suite for the ULCS data-switching network as required by the Defense Intelligence Systems Agency; and support of Marine Tactical Command and Control System development.

Communications Control work consisted of developing a satellite planning module and incorporating it into a software release; developing a position location reporting system manager module integrated into the SPEED software suite; and enhancing multi-channel radio frequency planning and profiling.

The system design review and the preliminary design review were completed in 1994. Other TRI-TAC program work included software improvements to make the ULCS data module compatible with the Government Open Systems Interconnection Profile (GOSIP);

performing conceptual demonstration and prototyping of the TDN; and developing a software upgrade to the MSC-63A Tactical Communications Center.

Also during 1994, Communications Control work centered on the continuation of the Pre-Planned Product Improvement program; development of a frequency deconfliction (co-site analysis) module to predetermine potential interference between/among transmitters located within close proximity; and development of an enhanced High frequency Communications Planner to better aid the communication in planning and profiling high frequency communications.

The TRI-TAC agenda for 1995 called for completing Block I Design, conducting the Critical Design Review, implementing the Block II option; and continuing ULS software transition to ITSDN and GOSIP protocols. Improvements were made to the map display in order to provide an enhanced background on which to overlay the radio profiles and mapping features of SPEED.

During 1997, development began on a Foliage Model that predicts what effect the density, distance, and type of foliage will have on the ability of a transmitter to close a radio link. A Circuit Route Planning Module that generates and analyzes primary and alternate circuit routing, generates plots of circuit networks, and generates the routing of specified high internet circuits, was also scheduled during this time period.

Procurement. The US Army began equipping its more than 25 EAC-level signal battalions and separate companies with TRI-TAC equipment in 1988. Fielding continued through 1995, by which time almost all active and reserve EAC signal units were equipped with TRI-TAC and/or MSE. The cost for RDT&E, equipment, and fielding was estimated to cost nearly US$2 billion.

Software. In recent years the emphasis has shifted from hardware procurement to increased capabilities via software upgrades. Accomplishments in 1996 included the initiation of system designs for IOT&E software baseline; completing BSM v4.0, system P0 integration test; and preparing for the Force XXI test.

Funding for 1997 supported a developmental progress review (DPR) of the IOT&E baseline; participation in the Force XXI Divisional AWE; completion of IOT&E software baseline and training/testing support; and initiation of systems design, code, unit test, and system testing of the P2 baseline software.

The following year, 1998, included continuing the DPR, code, unit test, system test and complete system designs for the P2 software baseline, and releasing and conducting Follow-On Test and Evaluation (FOT&E) for P2 baseline (Increment 1 & 2). Development of the initial first digitized division (FDD) and continued Force XXI Advanced Warfighter Experiment (AWE) support proceeded.

Achievements in 1999 reportedly involved DPR, code, unit test, system test, and complete system designs for the P2 software baseline; integration of FDD-B2 software coding; development of the enhanced FDD (WIN-T) dynamic management capability; and completion of code and DPR for the P3 baseline.

In 2000, activities centered on P2 Inc 1 Limited user test training; P2 Inc 1 LUT Testing; numerous P2 Inc 2 tests and training; P2 Inc 2 software releases; and a concept requirements review for P2 Inc 3.

Activities in 2001 have focused on Integrated System Control (ISYSCON) exercises, Tactical Internet (TI) V(4) activities, and Joint Network Management System (JNMS) procedures. ISYSCON activities are scheduled to include P2 Inc 2 training, Formal Qualification Testing (FQT), confidence testing, and OT&E training. TI V(4) exercises are planned to include the completion of fielding and training of Block 2, the initiation of software requirements, design, and coding of Block 3, and the integration of TI V(4) on Force XXI Battle Command Brigade and Below ($FBCB^2$) Block 3. JNMS activities are expected to include the initiation of concept requirement and analysis, system design, software integration, and training for user evaluation.

Also in 2001, there is a requested increase of US$19 million. US$10.5 million of this is requested for Joint JNMS activities and US$9 million is requested for TI Manager V(4) activities.

Latest Information. On the first day of FY02, the Joint Network Management System program replaced the TRI-TAC program. The Joint Network Management System (JNMS) program is funded under Program Element 0604783A, Project 363.

The Joint Network Management System (JNMS) is a Commander in Chief (CINC), Commander, Joint Task Forces (CJTF) joint communications planning and management tool. JNMS is automated by software. The Joint Network Management System will promote force level situational awareness; provide enhanced flexibility to support the commander's intent; improve management of scarce spectrum resources; and provide increased security of critical communications systems and networks.

For details of the JNMS, see separate report titled "Joint Network Management System."

Funding

Funding for the TRI-TAC program ended in FY 2001.

Recent Contracts

There are no known contracts for the TRI-TAC program.

Timetable

Year	Major Development
FY 1971	Joint Tactical Communication Office (TRI-TAC) established
FY 1976	Raytheon begins full-scale development of the TRC-170
FY 1979	Production of TTC/TYC-39 begins; TCCF delivered by Martin-Marietta
FY 1980	Milestone II for the Unit Level Message Switch
FY 1981	Production decision for the Digital Group Multiplexer (DGM) equipment
FY 1982	USAF Evaluation Report for UXC-4(V) IOT&E Phase II; Initial Operational Capability for TTC-39; the TTC-39, TYC-39, GRC-144 (Mod), TRC-170, Digital Multiplexer family and the Digital Subscriber Voice Terminal, all in production
FY 1983	TTC-39 and TYC-39 fielded; production decision to buy Digital, Non-secure Voice Terminals; Responsibility for CSCE transferred from the USAF to US Army; Communications Nodal Control Element enters into production
FY 1984	Milestone II for the Unit Level Circuit Switch; full-scale development of Unit Level Message Switch completed; NRI production award; DGMs and DNVTs fielded; contracts awarded for Tactical Digital Facsimile and Communications Nodal Control Element; modification contract awarded to upgrade the processor and memory of the SST; IOT&E begins for MRTT program and the ULS program; first TRC-170 delivered to Army; production decision for the ANDVT
FY 1985	Contracts awarded for the Unit Level Circuit Switch and the Single Subscriber Terminal; SDNRIU fielded; Unit Level Message Switch IOT&E begun; contract for the Light-weight Digital Facsimile; USMC begins full-scale development of digital fiber-optic programs and evaluation of a tactical throw-on-ground analog fiber-optic cable system; Initial Operational Capability for DNVT; Initial deliveries of TSSR; First contract award for MSE
FY 1986	Contract for the Communications System Control Element; Initial Operational Capability for TDF; contract for ULCS awarded; Army conducts production IPR for ULCS and ANDVT; Initial Operational Capability for the TAC-1 and the TCCF
FY 1987	Base phase for TRI-TAC Block III architecture plan; USMC conducts DT/OT of GYC-7; US Army modifies the TTC-39 to add control capability instead of buying CNCEs; completes TRI-TAC Mode VI interface to TYC-39; completes NDI production preparations, completes development contract for initial DGM test program set; USAF supports fielding of TRC-170s and CNCE: initiates investigation on low-cost alternatives to canceled MTCC
FY 1988-95	Baseline architecture phase for TRI-TAC Phase III
FY 1988	USMC evaluates upgrades to ULCS and GYC-7; Army continues TTC-39A modifications and supports various testing; USAF's new integration tasks include incorporation of SST into older TGC-27/28 message van systems, integration of TRI-TAC equipment into the Air Support Operations Center vans and support of JTC^3A development; Army begins equipping the first of more than 25 EAC signal battalions and separate companies with TRI-TAC equipment; deliveries of more than 1,500 DGMs by GTE in a subcontract to Raytheon; IOC/First Unit Equipped (FUE) for DGM
FY 1989	USMC completes preparation of GYC-7 and begins production of fiber-optic appliqué; Army initiates development of TYC-39 PIP to provide main memory upgrade; USAF

Year	**Major Development**
	initiates TAPES software development to support TTC-39A; FUE for GRC-222; FUE and IOC for TTC-49; UXC-7 production deliveries for Army TRI-TAC requirement completed; Laguna Industries awarded contract to downsize TRC-138A/B, TRC-173/175, and TRC-174
FY 1990	Initial operational capability of ULCS for USMC operational forces; FUE for CSCE; FUE and IOC for UGC-144, FUE for KY-90 SDNRIU
FY 1991	Initiated development planning to resolve data/message interoperability/incompatibility problems caused by the cancellation of the Modular Tactical Communications Center program; FUE for TYQ-30(V)1/2 and TYQ-31
FY 1992	Initiate software modifications to TYC-39 and TTC-39 for Corps/NATO interface; SPCS FSD; fielding of TTC-46 and TTC-48 for TRI-TAC; FUE and IOC for FOTS-LH
FY 1993	Conclusion of TRI-TAC integration activities; MSE fully fielded
FY 1995	Complete Block I software, software development award for Block II
FY 1996	Complete converting TTC-39s to A standard; architecture phase of TRI-TAC Block III begun
FY 1996-1999	Development of the P2, IOT&E, and P3 software upgrades, fabrication of LRIP prototypes, support for IOT&E, and initiation of Nodal Management
FY 2002	On the first day of FY 2002, the Joint Network Management System program replaced the TRI-TAC program

Worldwide Distribution

TRI-TAC is a **US Department of Defense** interservice communications program.

Forecast Rationale

TRI-TAC is a US tactical communications system used by the US Air Force, Army and Marine Corps. It is also known as the Joint Tactical Communications Program and has been called the Multi-Service Communications System.

The TRI-TAC program was initiated in 1971 with the institution of a Joint Tactical Communications Office. This office was originally tasked with designing and executing a tri-service tactical communication system. As time went on and production of the TRI-TAC components was completed, the objectives of the TRI-TAC program were altered to accommodate the changing needs of the program.

On the first day of FY02, the Joint Network Management System program replaced the TRI-TAC program. Consequently, the TRI-TAC program is no longer being funded. The Joint Network Management System (JNMS) program is funded under Program Element 0604783A, Project 363. For details of the JNMS, see separate report titled "Joint Network Management System."

Forecast International will keep the TRI-TAC report active for the next couple of years in case the US Department of Defense decides to reactivate it.

Ten-Year Outlook

On the first day of FY02, the Joint Network Management System program replaced the TRI-TAC program. Consequently, the Ten-Year Outlook chart for the TRI-TAC program has been omitted.

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