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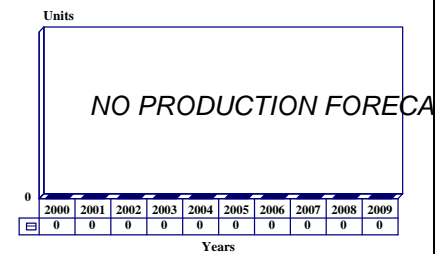
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TYQ-23(V) - Archived 6/2001

Outlook

- Upgrade and modernization of 31 TYQ-23 TAOMs completed
- Production cycle completed for all versions
- Major RDT&E funding continues under USMC Communications Systems program and the USAF Theater Air Control System project
- **Barring any additional activity, this report will be archived next year, 2001**

10 Year Unit Production Forecast
2000 - 2009



Orientation

Description. A transportable, modular, automated command and control system, produced in two versions: the US Marine Corps Tactical Air Operations Module (TAOM), designated TYQ-23(V)2, and the USAF Modular Control Equipment (MCE), designated TYQ-23(V)1.

Sponsor

US Air Force

Air Force Materiel Command
Electronic Systems Center
Hanscom AFB, Massachusetts (MA)
USA
(TAOM/MCE joint development)

US Marine Corps

Marine Corps Systems Command
Quantico, Virginia (VA)
USA
(TAOM joint development)

US Navy

Space & Naval Warfare Systems Command
Washington, DC
USA
(Contracting Activity)

Contractors

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Web site: <http://www.litton.com>
(Prime: development and production)

Status. Out of production but in service. Major modification/upgrade program completed.

Total Produced. An estimated 146 production TAOM/ MCE systems or its derivatives have been built through 1999.

Application. Command and control (C²) center/shelter that manages and coordinates fighter aircraft and air defense weapons.

Price Range. Based on a 1993 contract, the price of the TYQ-23(V)2 is about US\$5.7 million. Though the (V)1 price could not be determined, contracts calling for production of both models in the early 1990s reflected an averaged unit price of US\$5.6 million.

Technical Data

	<u>Metric</u>	<u>US</u>
Dimensions		
TYQ-23(V)2		
Shelter size:	2.44 m x 2.44 m x 6.1 m	8 ft x 8 ft x 20 ft
Weight (with all equipment & cabling):	749.1 kg	16,500 lb
Power:	30 kW, 400 Hz, 3-phase, 5-wire system	
Environmental:	Qualified to applicable MIL-STD-16400, MIL-STD-810C and MIL-STD-462 requirements	

Design Features. The TYQ-23(V) is a transportable, modular automated command and control (C²) system. Two basic configurations have been developed to satisfy the requirements of the US Marine Corps Tactical Air Operations Central (TAOC) and the Air Force Combat Reporting Center (CRC). Both versions feature four operator consoles, each equipped with a 256-square-inch (1651.46-sq-cm) multicolor situation display with radar/IFF video, graphics (symbols and lines) and alphanumeric. Each console also has a monochrome auxiliary display for alphanumeric only. Display size is 96 square inches (619.30 sq cm) and is touch entry for all operator/display interfaces. Each TAOM also has a printer for hard-copy generation.

Voice and data communications are via internal radios (UHF, VHF, HF) and external communication devices (radios, land lines, TRI-TAC circuit-switching devices and TTC-30). Selectable access from any operator console for any internal or external communications circuit is provided. The TYQ-23(V) datalink capability includes TADIL-A, TADIL-B, TADIL-C (one- and two-way) and ATDL-1. AUTODIN, JTIDS message standard (IJMS) and TADIL-J capabilities are now being implemented as preplanned product improvements. The system also provides voice communication recording.

The module is housed in a 20 foot (6 m) ANSI ISO shelter which contains all essential mission equipment, including data processing equipment; operator consoles; crypto gear; and UHF, VHF and HF radios. Antennas for each class of radio are an integral part of the TYQ-23. All equipment, including two environmental control units, can be powered from a single external power source. The TYQ-23 can be moved by fixed- or rotary-wing aircraft, ship, rail, truck or container transport with all operating equipment internally secured (except for external support equipment).

Version 3. The US Air Force produced and installed a Pre-Planned Product Improvement (P³I) upgrade kit to

its -23(V)1 systems. This P³I kit provides the following additional capabilities:

- SATCOM interface capability
- JTIDS integration and TADIL-J capability
- Replacement of the mass memory unit with a mass memory controller
- VHF radio upgrades
- Addition of a SINCGARS radio
- Replacement of the operator console unit's firmware with UNIX-based DII COE Ada code

These systems are designated TYQ-23(V)3.

Version 4. The US Marine Corps also undertook a TAOM upgrade program, including the following additional capabilities:

- New-open-architecture, COTS-based workstations
- New laser printer
- Replacement of the voice control access unit hardware with a windowed software version
- Addition of an electro-optic local area network
- Implementation of the TADIL-J J3.6 message set (Link 16)
- Replacement of the mass memory unit
- Replacement of the operator console unit firmware with UNIX-based DII COE Ada code

These TAOMs are designated TYQ-23(V)4.

Operational Characteristics. The system processes radar and identification friend or foe (IFF) data from interfaced associated radars and automatically exchanges processed surveillance information over digital datalinks with other command and control systems, such as the E-3 AWACS, the E-2C, the Navy Tactical Data System and the NATO Air Defense Ground Environment. In addition, Air Force and Air National Guard Modern Tracking Systems (MTS) utilizing the TYQ-23(V) are being interfaced with Federal Aviation Administration (FAA) radars to further enhance coverage. Using this netted surveillance data, TYQ-23(V) weapons controllers manage and coordinate

fighter aircraft and surface-to-air missiles in engaging and destroying threat targets. The system is used as well to control friendly aircraft in such tasks as navigational assistance, search and rescue, and air-to-air refueling. The TYQ-23(V) can also operate independently of its associated radars by receiving data over standard datalinks.

The TYQ-23(V) data processing language is High Order (CMS-2). The implemented distributed pro-

cessing architecture includes Real-Time Operating System (RTOS), Data Management System (DMS), Performance Monitor (PERM), and Applications Program (APP) capabilities. The system can be repaired by operators using computer-assisted fault detection and isolation diagnostics. The Tactical Air Operations Module (TAOM, or (V)1 model) has demonstrated a mean time to repair (MTTR) of less than 12 minutes. On-line performance monitoring of all installed equipment is also provided.

Variants/Upgrades

TYQ-23(V)1. The Modular Control Equipment (MCE) version for the US Air Force's Combat Reporting Center (CRC). It replaces command and control equipment fielded in the 1960s under Air Force 407L and 495L programs.

TYQ-23(V)2. The Tactical Air Operations Module (TAOM) version for the US Marine Corps' Tactical Air Operations Central (TAOC).

TYQ-23(V)3. Designation given to Pre-Planned Product Improvement (P³I) upgrade to the TYQ-23(V)1 system for the USAF.

TYQ-23(V)4. Designation given to the upgrade program of the USMC TYQ-23(V)2 TAOM.

Continual Upgrades. The TAOM and MCE have been subjected to ongoing upgrade/modernization programs since initially developed in the 1980s. Some of these are provided in kits, as illustrated in the September 1995 contract. Furthermore, a 1996 contract provides for migration to an open-system architecture (using Ada) and the replacement of the Operator Console Units with

commercial off-the-shelf (COTS) and government off-the-shelf (GOTS) workstations. Other work includes adding automated AATO, JTIDS, TADIL-J, SINCGARS and GMF/SATCOM interfaces (see **Program Review** section, below).

Shelterized JTIDS Prototype. Two TYQ-23 shelterized JTIDS prototypes were developed in 1997 under a US\$10.5 million modification to a previous support/improvements contract. They house a JTIDS terminal and associated components, provide an interface to the TAOM, and provide space and power reserve for housing a Global Command and Control System (GCCS)/Defense Information Infrastructure Common Operating Environment (DII COE) for a Marine Air-Ground Task Force (MAGTF) C⁴I baseline.

CCTA. As part of a contract awarded in December 1996, Litton provided a mobile tactical C² system, called the CCTA, for the Italian Air Force. Though a variant of the TYQ-23(V), the ways in which the CCTA differs from the versions fielded in the US have not been identified.

Program Review

Background. In September 1979, Litton Corporation received a contract for the design of the TYQ-23 Module; fabrication of the engineering development model (EDM) was completed in 1985. In May 1987, the company received an initial production contract for five first-article and two production TAOMs (TYQ-23(V)2) for the Marine Corps and four first-article MCEs (TYQ-23(V)1) for the Air Force, plus related radar interface groups, spares, training and technical data in the amount of US\$223.2 million.

Litton received US\$153.6 million in February 1988 for an FY88 production option for nine TAOMs and nine MCEs, and a US\$94.7 million development contract shortly thereafter. The FY89 production option award for 12 TAOMs and 13 MCEs for a total value of US\$156.9 million was followed by a series of option

awards. A September 1990 contract, worth US\$201.9 million, entailed seven TYQ-23(V)2s for the Marines and 26 (V)1s for the Air Force, as well as related equipment, spares and training for shore use; it was completed in 1995. Other production contracts included a June 1991 award (US\$121.9 million) for one (V)1 and 21 (V)2s; a June 1992 award (US\$91.6 million) for four (V)1s and 14 (V)2s; and a June 1993 award (US\$46.3 million) for eight (V)2s.

The TYQ-23(V) has seen considerable operational use. The Marine Corps deployed two prototype units in Saudi Arabia for use during Operation Desert Storm during the initial buildup phase, where they provided a fast deployable air traffic control capability. It was again deployed in 1993, to assist in the UN/NATO Operation Deny Flight over Bosnia-Herzegovina.

US Air Force TYQ-23 work is performed under PE#0207412F, Theater Air Control System, within Project 485L, Theater Air Control System Improvements (TACSI). This operational system development program consists primarily of Modular Control Equipment Pre-Planned Product Improvements (MCE P³I) replacing obsolete equipment in the ground tactical air control system (GTACS). The modernization upgrades C² interoperability, flexibility, mobility, communications and worldwide operation. The Air Force has structured the MCE P³I effort into multiple phases. The first phase integrated secure, anti-jam UHF radios, upgraded the weapons control and Joint Tactical Air Operations software, and developed a Chemical, Biological and Radiological (CBR) protection capability. These improvements were incorporated into the production line.

Current Air Force R&D program activity includes integration of the following: a Joint Tactical Information Distribution System (JTIDS)/Tactical Digital Information Link-J (TADIL-L) capability; an Automated Air Tasking Order (AATO) capability; and secure anti-jam VHF (SINCGARS) radios, as well as upgrades to the Ground Mobile Forces/Satellite Communications (GMF/SAT-COM) digital communications interfaces. The TACSI program element also includes production of JTIDS terminals, JTIDS Modules (JMs) and JTIDS Interface Boxes (JIBs), all of which are required to integrate JTIDS into the MCE. The next phase included a software interoperability upgrade to the TADIL-J Reissue 2 baseline, which progresses toward a Theater Missile Defense capability and implementation of the Interim JTIDS Message Specification (IJMS) capability.

The Air Force announced that it had no plans to acquire additional units after the fulfillment of the June 1993 contract. The last of 18 systems went to the Air National Guard in 1994. The Marine Corps finished its procurement with 42 TAOMs. In all, 144 systems have been ordered through the joint Air Force/Marine Corps program, for a total contract value (including support, ancillary equipment and improvements) of approximately US\$1.2 billion.

Activities relating to the TAOM in FY95 and FY96 were conducted under PE#0206626M, Marine Corps C³ Systems, Project C0103, Tactical Air Operations. In FY97, EMD of TADIL-J/JTIDS was completed and a TAOM/JTIDS interface developed. In line with these efforts, the development of two TYQ-23 shelterized JTIDS prototypes as called for in a November 1996 contract was completed in June 1997.

It was reported in mid-1998 that USAF and Air National Guard units that are equipped with the TYQ-23 were being interfaced with FAA radars for enhanced and increased coverage.

In FY99, USMC work on the TYQ-23 came under PE#0206313M, Marine Corps Communications Systems, Project C2273, Air Operations C² Systems. This project plans and coordinates Navy and Marine air combat operations and interfaces with joint and combined forces air operations; it also interfaces with fire support C². It comprises systems used to detect aircraft and missiles, process the sensed information, deliver the processed information to the Advanced Tactical Air Command Central (ATACC), and conduct the air battle. The Tactical Air Operations Module (TAOM) is among this project's systems; it serves as the center for directing aircraft and anti-air systems in real time (as part of the joint air battle).

Heretofore a US-only program, the TYQ-23 scored its first international sale in December 1996 when Litton won a US\$20 million contract to manufacture, test and deliver a CCTA module for the air command and control system operated by the Italian Air Force. Under terms of the contract, Litton would work with Alenia to provide equipment for functions of the C² system. The Italian Air Force had been introduced to the TYQ-23(V) as the result of the Persian Gulf War and Operation Deny Flight over Bosnia-Herzegovina, and the CCTA is a variant of it.

Although the production cycle for TYQ-23 has ended, major RDT&E funding continues for the USMC's Communications Systems program and the USAF's Theater Air Control System project. More modernization and production of variant systems in the years ahead is likely.

Funding

<u>US FUNDING</u>									
	<u>FY98</u>		<u>FY99</u>		<u>FY00</u>		<u>FY01</u>		
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	
<u>RDT&E (Marine Corps)</u>									
PE#0206313M									
Marine Corps									
Communications Systems									
Project C2273									
Air Operations C2									
Systems ^(a)									
	-	4.3	-	6.3	-	16.4	-	25.7	
<u>RDT&E (Air Force)</u>									
PE#0207412F									
Theater Air Control System									
Project 485L									
Theater Air									
Control System									
Improvements (TACSI) ^(b)									
	0.4		-	0.4	-	0.4	-	0.4	
	<u>FY02</u>		<u>FY03</u>		<u>FY04</u>		<u>FY05</u>		
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	
<u>RDT&E (Marine Corps)</u>									
PE#0206313M									
Marine Corps									
Communications Systems									
Project C2273									
	-	23.0	-	8.6	-	6.8	-	4.1	
<u>RDT&E (Air Force)</u>									
PE#0207412F									
Project 485L									
	-	0.4	-	0.4	-	0.4	-	3.3	
	<u>FY98</u>		<u>FY99</u>		<u>FY00</u>		<u>FY01</u>		
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	
<u>Procurement (USMC)</u>									
Air Operations C2									
Systems									
	-	11.1	-	8.2	-	4.2	-	3.2	
<u>Procurement (USAF)</u>									
Theater Air									
Control System									
Improvements (TACSI)									
	36.2		-	26.8	-	37.9	-	36.4	

All US\$ are in millions.

Sources: FY99/00 PEDS, FY00/01 P-1

^(a)This program coordinates and plans Navy and Marine Corps air combat operations. The TAOM is the center for directing aircraft and anti-air systems in real time as part of the joint air battle. Development of the TAOM/JTIDS interface was completed in FY97.

^(b)This program provides for major improvements to the existing Tactical Air Control System, or Ground Theater Air Control System (GTACS) designed in the 1960s. Current R&D includes JTIDS integration; JTIDS production funding is also included.

(Note: While the US Marine Corps and the US Air Force employ the TYQ-23, the US Navy Space and Naval Warfare Systems Command is the funding agent for development, while the US Air Force Electronic Systems Center directs development jointly with the Marine Corps Systems Command.)

Recent Contracts

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Litton	9.8	Mar 1996 – Undefined CPFF/FP contract for engineering support and improvements to the US Marine Corps' Tactical Air Operating Module (TAOM), including added operational requirements, migration to an open-system architecture and correction of logistically insupportable high-failure items. Work includes replacement of Operator Console Units with COTS/GOTS operator workstations, and modifications of the Sector Anti-Air Warfare Facility gateways for voice Integrated Services Digital Network. Completed May 1997. (M67854-96-C-2018)
Litton	10.5	Nov 1996 – Undefined modification to previous contract for development of two Marine Corps AN/TYQ-23 shelterized JTIDS prototype systems. Completed June 1997. (M67854-96-C-2018, M-A-GTF)
Litton	20	Dec 1996 – Contract with Italian Air Force for the manufacture, test and delivery of enhanced air command and control, air control function (CCTA) modules, a variant of the TYQ-23(V)1/2. Work completed December 1998.
Litton	19	Oct 1998 – A contract to upgrade and modernize 31 AN/TYQ-23 Tactical Air Operations Modules (TAOMs). The legacy console was replaced with commercial workstations, and a Fibre-Channel LAN, updated software, a theater ballistic radar interface and Y2K compliance were incorporated. Work completed at the end of 1999.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Sep	1979	Litton selected to develop TAOM
	1982	USAF joins program to develop MCE
	1985	Engineering developmental models delivered
May	1987	Initial production contract
Late	1990	Two TAOMs deployed to Saudi Arabia
Jul	1991	Production deliveries begin
Mar	1992	Begin P ³ I in-plant Block B development testing; recertification of TAOC
FY	1994	Begin Block C development
FY	1995	MCE P ³ I OM Interface Kit development completed
Sep	1995	Last deliveries of full systems to Marine Corps and Air Force
FY	1996	Development of interoperability upgrades to MCE P ³ I system begun
Dec	1996	First international sale of TYQ-23(V), as CCTA variant
FY	1997	Continued development of interoperability upgrades to MCE P ³ I system; continued program support, test and other, miscellaneous efforts
Late	1998	Delivery of CCTA version of TYQ-23(V) to Italian Air Force

Worldwide Distribution

The TYQ-23(V) is in service with the **US Marine Corps** and **Air Force** and also with the air force of **Italy**.

Forecast Rationale

The Litton Corporation received its first contract for the design of the TYQ-23 Module in September 1979. In 1987, two years after fabrication of the engineering development model (EDM) was completed, the company received an initial production contract for four first-article MCEs (TYQ-23(V)1) for the Air Force and five first-article and two production TAOMs (TYQ-23(V)2) for the Marine Corps. Since then, a total of 144 systems (102 for the USAF and 42 for the USMC) have been delivered.

A transportable, modular automated command and control (C²) system used primarily for tactical air traffic control functions, TYQ-23(V) processes radar and IFF data from interfaced associated radars and automatically exchanges processed surveillance information over digital datalinks with other command and control systems.

The US-owned TYQ-23 systems have undergone extensive modification and upgrading. Both the USAF and USMC upgraded the system communications, workstations, LAN network, and other components. These systems now carry the designations TYQ-23(V)3 and TYQ-23(V)4, respectively.

Continued modernization and production of variant systems ahead is likely in the years as indicated by major increases in RDT&E funding for the USMC's Communications Systems program and the USAF's Theater Air Control System project. Despite this, however, the production cycle for the TYQ-23 has ended.

The program did receive a slight boost in 1996 when the Italian Air Force contracted for the delivery of two modified TYQ-23(V)1 systems. This raised hopes at Litton that the order would lead to additional export contracts. Potential clients include various NATO members, Kuwait, Saudi Arabia and South Korea. These additional export orders have yet to materialize and appear less likely with each passing year.

As indicated in the 10-year forecast below, production has been zeroed out due to the delivery of all TYQ-23 systems and derivatives to their respective customers. No additional export orders are indicated for the foreseeable future.

Barring any additional activity, this report will be archived next year, 2001.

Ten-Year Outlook

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