Raytheon

F-16 Modular Mission Computer (MMC)

A cost-effective mid-life update for the F-16, the Modular Mission Computer combines advanced computing capabilities for both weapons and avionics in a single high performance system.

Benefits

- Replaces three computers with one superior system, reducing weight by 55%, volume by 42% and power usage by 32%
- Increases computer processing power and memory capacity
- Offers proven reliability of more than 1245 hours MTBF
- Lowers life-cycle maintenance and diagnostics costs
- Enhances pilot situational awareness
- Supports easy future growth

Advanced Capabilities for Extended F-16 Life

The Modular Mission Computer (MMC) provides airborne processing power that will allow the F-16 to execute mission requirements well into the 21st century. As a member of Lockheed Martin's F-16 team, Raytheon developed the MMC to enable the aircraft to meet present and future mission challenges through advanced and expandable computing capabilities.

The MMC is at the heart of the F-16 Mid-Life Update and Common Configuration Implementation Program (CCIP), increasing mission capability and supporting the aircraft's overall growth potential. For pilots, the MMC enhances situational awareness, air-to-air capabilities, targeting accuracies, and information. In addition, the MMC provides generation and control of symbology on the HUD Display Unit and control of the avionics system master mode, sub-mode, and delivery options. With incorporation of the MMC, the F-16 can take greater advantage of such growth technologies as helmet-mounted cueing systems, advanced weapons loads, reconnaissance pods, and forward-looking infrared targeting and navigation systems.

A Cost-effective Solution

The MMC cost effectively expands the F-16's capabilities by replacing three of the aircraft's original computers—the Heads-Up Display Electronics Unit, the General Avionics Computer/Fire Control Computer, and the Central Interface Unit Stores Management Computer—with one superior system. The new streamlined system delivers enhanced computing power for the F-16's avionics and weapon systems.

The MMC also incorporates leading-edge test technologies that lower life-cycle costs for maintenance and diagnostics. The system provides 95 percent fault isolation to one module and 98 percent fault isolation to two modules. Each MMC module, except the power supplies, contains an IEEE 1149.1 JTAG scan controller.

Reliable, High Performance Processing

The MMC offers reliability of more than 1245 hours mean time between failure (MTBF). This proven, highly dependable system is now in its third generation. The latest version, the MMC7000, features a 64-bit wide architecture and significant enhancements, including 2× the amount of FLASH provided by its predecessor, the MMC5000. Each processor module has 10 MB of main memory, as well as internal caches—32 KB of Level 1 cache

and 256 KB of Level 2 cache—to increase memory transfer rates and processing speed.

The MMC7000 provides six dual redundant MIL-STD-1553B channels as the primary external communication links to the avionics subsystem. All avionics processing is performed with the MIPS® Instruction Set Architecture (ISA). Comparative features of the MMC7000 and its predecessors are shown in the table below.

Easy Future Growth

The MMC's modular design allows two-level maintenance (i.e., flight-line replacement of line replaceable modules), eliminating the need to remove and replace the entire computer. The MMC 7000 configuration provides a core cluster of 15 modules in the 24-slot chassis—six processor modules, four I/O modules, and five power supply modules. This leaves nine growth slots for adding modules to support future missions.

The MMC combines commercially available software with unique capabilities and interfaces to the MMC Computer Development System. Using this system, application developers can easily develop and debug their target programs. Raytheon has also demonstrated C++ language capability with the MMC, providing greater flexibility for software updates.

Worldwide Customer Base

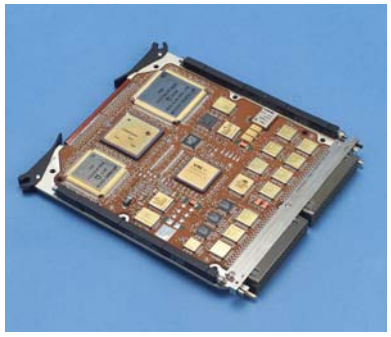
Raytheon has delivered over 1100 shipsets to date and has approximately 350 more on order. Customers include the U.S. Air Force and numerous international governments, including Belgium, Chile, Denmark, Greece, the Netherlands, Norway, Oman, Poland, Portugal, Taiwan and Turkey.

Part of a Family of Solutions

A leading-edge developer of avionics systems, Raytheon designs and manufactures the airborne processors for the F/A-18 Hornet and Super Hornet, F-22A Raptor, and F-35 Joint Strike Fighter. The company also produces a real-time secure operating system, RT Secure™, and is developing multi-level secure networks for crucial information transfer across military forces and assets. These products will support the future network-centric battlespace and will ultimately be integrated with the MMC.

Internal view of chassis

External view of chassis



Processor module

Processor Module Features

MMC3000 (original version):	MIPS® R3500 32-bit RISC architecture CPU
	4 MB main memory
	64 KB external instruction and data cache memory
MMC5000 (second generation):	RM5260 CPU (MIPS® ISA)
	10 MB main memory
	32 KB internal cache
MMC7000 (third generation):	RM7000A CPU (MIPS® IV ISA)
	10 MB main memory
	32 KB Level 1 cache
	256 KB Level 2 cache
Communication links to aircraft:	Six dual redundant MIL-STD-1553B channels act as primary external communication links for all MMC versions.
Communication links to weapons:	Two dual redundant weapons bus channels (direct coupled MIL-STD-1553B)

Comparative Processor Performance

	Original	MMC 3000	MMC 5000	MMC 7000
Processing	1×	47×	132×	484×
Memory	1×	12×	45×	58×

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Customer Success Is Our Mission