

Lockheed martin aeronautics – f-16 modular mission computer application software

[Technology](#), [Computer](#)



About the Company: Although they are a global security and information technology company, the majority of Lockheed Martin's business comes from U. S Department of Defense and Federal Agencies. In fact, they are the largest provider of IT services, systems integration, and training to the U. S Government. The remaining portion of Lockheed Martin's business is comprised of international government and some commercial sales of products, services and platforms. Lockheed Martin's operating units are organized into broad business areas - Aeronautics: \$11. billion in 2008 sales includes tactical aircraft, airlift, and aeronautical research and development lines of business. Electronic Systems: \$11. 6 billion in 2008 sales includes missiles and fire control, naval systems, platform integration, simulation and training and energy programs lines of business. Information Systems & Global Services: \$11. 6 billion in 2008 sales includes C4I (stands for "Command, Control, Communications, Computers, and Intelligence"), federal services, government and commercial IT solutions.

Space Systems: \$8 billion in 2008 sales includes space launch, commercial satellites, government satellites, and strategic missiles lines of business.

Something about the F-16 - The Lockheed Martin F-16 Fighting Falcon is a multirole jet fighter aircraft originally developed by General Dynamics for the United States Air Force. Designed as a lightweight, daytime fighter, it evolved into a successful multirole aircraft. Over 4400 aircraft have been built since production was approved in 1976 and it currently serves in the air forces of 25 nations. About the Software:

The Aeronautics division of LM's, based in Fort Worth, Texas has used the OMG's MDA to develop Application Software for the F-16 Modular Mission Computer. This software is cross-platform compatible and has highly increased productivity and quality. Just as the highly demanding environment of avionics software development and the MMC (Modular Mission Computer) itself. What is the MMC? The Modular Mission Computer is a cost-effective MLU (Mid - Life Update) for the F-16, which combines advanced computing capabilities for both weapons and avionics in a single high performance system.

Developed by Raytheon (Lockheed Martin's F-16 team), it replaces three computers with one superior system, reducing weight by 55%, volume by 42% and power by 32%. What is OMG's MDA? OMG (Object Management Group) - since 1989 - is a non - profit computer industry consortium. Their board of directors represents most of the organizations that shape, enterprise and internet computing today. Their membership includes hundreds of organizations, most of them representing virtually every large organization in the computer industry and many smaller ones.

MDA (Model Driven Architecture) is a modeling standard, which along with UML (Unified Modeling Language), enable powerful visual design, execution and maintenance of software and other processes, including IT Systems Modeling and Business Process Management. When and why was this software developed? The MMC upgrade was a part of the MLU process of the F-16. When plans of replacing the F-16 (in operation since 1979) with its successor in 1999 stalled, they decided to modernize the aircraft, which

became the MLU (Mid -Life Update). Part of this modernization process was developing software with cross - platform compatibility.

The goal should be to provide cross-platform compatibility of Application Software despite any Implementation, or platform specific, changes: that is, changes to the Hardware Platform, the Software Execution Platform, or the Application Software Interface {draw: frame} The development Process - The F-16 MMC team originally used traditional CASE tools with an OO modeling notation to specify the software before manually coding it in Ada (Language extended from Pascal). When they migrated their development to Kennedy Carter's iUML tool, they gained the ability to use a UML action language which made their UML models executable.

They could then test their UML models to verify their intended behavior before hand-coding the implementation. More recently they have used Kennedy Carter's iCCG product to specify, in eXecutable UML, an Ada code generator which can automatically generate 100% of the Ada implementation. By this means they guarantee that their UML models are entirely platform independent and portable across any future platform. {draw: frame} eXecutable UML Modeling: Overview xUML models are a complete representation of the problem space (not a top-level or preliminary design) Modeling is performed using a

Unified Modeling Language (UML) representation Modeling makes use of a precise Action Specification Language (ASL) and is therefore executable (providing early validation of the models) Each xUML model is a Platform

Independent Model (PIM), that is, completely implementation-independent (i. e. independent of the hardware platform, the software execution platform, and the application software interface) _Design Tagging: _Overview Whereas xUML modeling is platform- independent, Design Tagging is platform-specific (i. e. pecific to a particular Application Software Interface) Platform-specific design decisions (only those needed to support code generation) are made during Design Tagging, and are represented with design tag values that are applied to the xUML models The most standard implementation is always assumed by the code generator, such that only exceptions must be tagged Design Tagging is overlaid on (not embedded in) the xUML models, such that it may be included or excluded Design Tagging: Specifying the PIM to PSM Mapping {draw: frame} Automatic Code Generation: Overview

Automatic code generation is simply an extension of the code generation technique used for simulation of the eXecutable UML models on the development platform, this extension being for the target (embedded) platform The code generator is developed within the same environment as the application software using the same eXecutable MDA strategy {text: list-item} Nearly all implementation-specific design tasks (all but the design decisions represented by design tag values) are performed by the code generator, not the software developers Advantages of the eXecutable MDA Approach

Increased Quality The majority of software developers are isolated from implementation details, allowing them to focus on a thorough analysis of the application space Maintenance of the application source code is eliminated,

while maintenance of the xUML models is ensured Defect injection (and the resulting rework) is reduced by automating the software phase in which most defects are injected {text: list-item} Increased Productivity Rework is reduced Early validation through simulation reduces rework {text: list-item}

Higher quality implementation (due to automation) reduces rework Software development p time is reduced by automating the implementation phase Application Software development schedule is reduced by at least 20% The code generator, not each software developer, performs the majority of implementation-specific design tasks 40-60% of physical source code Cross-Platform Compatibility One Application Software xUML Model database may be reused (as is) on any platform for which a mapping is defined (i. e. a code generator is developed) xUML models are compatible with any hardware platform, any Software Execution Platform, and any Application Software Interface xUML models are compatible with any implementation language

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