AIR FORCE MISSION SUPPORT SYSTEM (AFMSS)

MPS-III

PFPS

Air Force ACAT IAC Program		**Prime Contractor**
Total Number of Systems:	2,900	AFMSS/UNIX-based Systems:
Total Program Cost (TY$):	$652M+	Sanders (Lockheed Martin)
Average Unit Cost (TY$):	N/A	AFMSS/PFPS Systems:
Full-rate production:	*Incremental*	Tybrin Corp
Blocks C2.0, C2.1	FY97	
Blocks C2.2	FY99	
PFPS 3.0, 3.01	FY98	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Air Force Mission Support System (AFMSS) program is developing a family of hardware and software products providing automated mission planning support for Air Force aircraft and precision guided munitions. AFMSS is becoming a significant command and control enhancement necessary to provide ***information superiority*** to the ***dominant maneuver*** force.

The acquisition of AFMSS is evolutionary. Software for Mission Planning Systems (MPS) is UNIX-based, runs on UNIX workstations, and is being released in "Blocks." Portable Flight Planning Software (PFPS) versions are Microsoft Windows-based and run on IBM-compatible PCs. AFMSS uses several hardware configurations comprised of commercial off-the-shelf hardware to meet system requirements.

AFMSS software is loaded on a specific hardware configuration with Aircraft/Weapon/Electronics modules and other Installable Software Modules to provide a mission planning environment (MPE) for each aircraft type. AFMSS MPEs for low observable (LO) aircraft include a software module

called the Common Low Observable Autorouter (CLOAR) to plan routes that minimize exposure to threat systems. Aircraft with electronic data transfer capability employ aircraft-unique hardware peripherals to prepare data transfer devices (DTDs) for uploading mission information into aircraft computers. The outputs of AFMSS-based MPEs are combat mission folders (consisting of maps, images, and flight information) and DTDs.

A Y2K solution has been fielded for all AFMSS users, except the A-10, for which an MPE is currently in operational test. Several Tanker Airlift Special Mission aircraft MPEs will be fielded after January 2000. These aircraft do not currently use automated mission planning tools.

The earliest MPS Block releases ran on the MPS-I and MPS-II hardware configurations. These older systems are currently being replaced by faster, more compact MPS-III hardware configurations; over 230 MPS-III hardware suites have been fielded to date. AFMSS MPS users will be upgrading to even more capable hardware suites in the short term; the B-2 to the MPS-IV hardware configuration and the F-16 and U-2 to the MPS-V hardware configuration. As noted above, AFMSS PFPS users employ conventional IBM-compatible PC workstations and laptops.

Eventually, all Air Force AFMSS users and Navy platforms using legacy mission planners will migrate to the Joint Mission Planning System (JMPS) architecture. JMPS is described in a separate annual report.

BACKGROUND INFORMATION

The AFMSS program began in 1990 with a UNIX-based automated mission planning system. Earlier versions had limited capabilities and did not fully meet user requirements.

Development of Block C2.0 software began in 1996 and was completed by 2QFY97. On February 21, 1997, DOT&E approved the baseline TEMP for Blocks C2.0 and C2.1 of AFMSS and the TEMP annex covering B-2 MPE testing. A test plan template for all aircraft types was also approved in February 1997. In addition, selected individual test plans for Block C2.0 MPEs were reviewed and approved by DOT&E prior to testing to ensure a consistent test approach.

Block C2.0 MPEs for several aircraft types underwent operational test and evaluation during 1997 and 1998. Overall, the effectiveness of Block C2.0 was rated as marginally satisfactory for all users except the F-117A and B-2. User requirements for the B-2 and F-117A MPEs were not met with Block C2.0 versions. Suitability for Block C2.0 was rated as unsatisfactory. Block C2.0 systems have now been upgraded or replaced by later AFMSS versions or PFPS-based MPEs.

Block C2.1 software completed development in 1998. Development of Block C2.2 software was completed in late CY98. On December 31, 1998, DOT&E approved the TEMP for Blocks C2.1 and C2.2. DOT&E has also approved test plans for operational test and evaluation of Block C2.2 MPEs for B-52H, B-1B, F-15E with AGM-130, and F-117A. The first Block C2.2 MPE, the B-2 v1.5, entered operational test and evaluation in December 1998. (Note that Block C2.2 is the UNIX, Y2K-compliant version of AFMSS software).

PFPS version 3.01 (for Windows-based PCs) provides basic flight planning capabilities for many Air Force (and Navy) aircraft. However, only a few aircraft (e.g., F-16) can prepare data transfer devices with PFPS. Users can perform basic flight planning with PFPS and transfer the routes to the UNIX-based system for subsequent loading into the aircraft, provided an MPE already exists for that specific

platform. The first MPE using PFPS 3.01 to enter operational test and evaluation was the F-16 SCU3+ in May 1998.

TEST & EVALUATION ACTIVITY

An operational test and evaluation, ranging in length from a few days to several months, is conducted for each aircraft's MPE. Under the direction of a representative of the designated operational test organization, qualified operations test personnel and experienced operational aircrews plan missions under operationally representative conditions and time constraints to determine if the MPEs are able to meet the requirements to generate mission plans in a timely manner. For aircraft with data transfer devices, planners transfer missions to cartridges and the accuracy of the data loaded into the aircraft is checked. Suitability data are also collected for some MPE types.

Table 1 shows aircraft MPEs that have undergone testing during recent periods of AFMSS operational test and evaluation activity (FY99).

Table 1. Summary of Recent AFMSS OT&E Activity

Operational Test Organization	AFMSS Blocks C2.1 and C2.2 OT&E, July 1998 - (Continuing)	PFPS Versions 3.0 and 3.01 OT&E, October 1997 - (Continuing)
AFOTEC Det 2, Eglin AFB, FL	B-52H	KC-135R C-17
28th Test Squadron, Air Warfare Center (AWFC), Eglin AFB, FL	C-130 Self-Contained Navigation System (SCNS) (Block C2.1b) B-1B (Blocks C2.1b and C2.2a) F-15 Multi-Stage Improvement Program (MSIP) F-15E with AGM-130 F-16 PO4 (HTS)	F-16 (various blocks) C-130 (various designations) C-5 (partial) HH/MH-60G
72nd Test and Evaluation Squadron of AWFC, Whiteman AFB, MO	B-2	

The Air Force states that initial versions of Y2K-compliant, Block C2.2 MPEs completed operational test and evaluation for all applicable UNIX users, including the following aircraft not listed above: F-117A, U-2, F-16 PO4b, and F-15E Suite 3.1M. The Air Force also states that the 33rd Flight Test Squadron of Air Mobility Command completed operational test and evaluation of a C-141B MPE based on PFPS in May 1999.

Block C2.1 MPEs: Only two Block C2.1 MPEs have undergone operational test and evaluation, those for B-1B and the C-130 Self-Contained Navigation System (SCNS). The C-130 Self-Contained Navigation System MPE, including air-drop planning software, was tested in October 1998 and found to be satisfactory for accuracy and other effectiveness measures. Takeoff and landing data functions failed to meet requirements for accuracy, so the system was released for operational use with takeoff and landing data decertified. Suitability was only partially resolved due to a lack of reliability and maintainability test data. Due to these issues, this version was never fielded for C-130. Instead, the C-130 was moved to the AFMSS PC-product—PFPS.

Operational test and evaluation of the B-1B Block C2.1 MPE was completed in February 1999. The system was found to be marginally acceptable and was recommended for release for training purposes only, not combat use. Significant problems included: (1) failure of the Joint Direct Attack Munition's (JDAM) planning tools in compensating for winds; and (2) the system's inaccurate

calculation of Launch Acceptability Regions for JDAM releases. The system also failed to meet requirements for planning time. An excessive amount of time was required to prepare JDAM missions. Suitability was rated as marginal because of intermittent crashes and poor reliability of the Portable Cartridge Transfer Unit. A newer Block C2.2 B-1B MPE has been tested subsequent to the Block C2.1 version (see below).

Block C2.2 MPEs: Operational test and evaluation of the first Block C2.2 Y2K compliant MPE was completed in February 1999 for the B-52H aircraft. Effectiveness and suitability issues were given overall ratings of satisfactory. The system had a number of improvements over the earlier C2.0 release, but was still considered complex and difficult to use. Reliability of the MPS-III hardware used for this system did not meet requirements. However, operational availability met threshold requirements.

A Block C2.2 version of the B-1B MPE was tested in March and April 1999. The system was rated unsatisfactory for effectiveness and marginal for suitability. The principal effectiveness shortcomings were in the areas of JDAM mission planning, inaccurate takeoff and landing data, and route planning that was difficult due to inaccurate software implementation of auto wing sweep. Suitability was rated as marginal because of the Portable Cartridge Transfer Unit's reliability (as was also reported for the Block C2.1 version of the B-1B MPE). The test organization recommended that the MPE not be released to operational units. However, because of the need to deploy B-1Bs for Operation Allied Force, a decision was made to grant a waiver for use of the MPE for Operation Allied Force missions. Although the B-1B is capable of delivering JDAMs, the B-1B MPE was not used for JDAM planning during Operation Allied Force because B-1Bs were not tasked to deliver them. The Air Force states that in May 1999, Air Combat Command removed all caveats and certified the B-1B MPE for operational use.

A Block C2.2 F-15 Multi-Stage Improvement Program MPE was tested in March 1999. The system was rated satisfactory for effectiveness and suitability.

A Block C2.2 MPE for the F-15E with AGM-130 was tested in April and May 1999. Preliminary results indicate that the system will be rated satisfactory for effectiveness and suitability.

The F-16 PO4 Block 40T5/50T4 MPE, using AFMSS Block C2.2 core, was tested in April and May 1999. The system was rated satisfactory for effectiveness and suitability (with the stipulation that the Mission Data Conversion tool not be used for importing routes from PFPS).

The B-2 MPE employing Block C2.2 was assessed from December 1998-March 1999. The system was rated as satisfactory for route planning and weapon delivery planning. For these functions, the system was considered a major improvement over previous versions. Much of the improvement was a result of faster MPS-IV hardware (three to four times faster than MPS-II). The autorouting function of CLOAR was still rated unsatisfactory due to its inability to select a route with the lowest susceptibility to threats. However, a manually derived route could be successfully evaluated by the CLOAR route evaluation function.

Table 2 shows a summary of operational test and evaluation results for MPEs based on Blocks C2.1 and C2.2 of AFMSS.

Table 2. Summary of OT&E Results for MPEs based on AFMSS Block C2.1 and C2.2 Core Software

MPE	Effectiveness Rating	Suitability Rating
C-130 SCNS (with Block C2.1)	Satisfactory	Unresolved
B-1B (with Block C2.1)	Marginal for Training Use Only - Unsatisfactory for Combat Use	Marginal
B-52H (with Block C2.2)	Satisfactory	Satisfactory
B1B (with Block C2.2)	Unsatisfactory	Marginal
F-15 MSIP (with Block C2.2)	Satisfactory	Satisfactory
F-16 PO4 40T5/50T4 (with Block C2.2)	Satisfactory	Satisfactory
B-2 (with Block C2.2)	Satisfactory for Route and Weapon Delivery Planning - Unsatisfactory for CLOAR	Unresolved

PFPS MPEs: The basic software for PFPS version 3.01 was tested from April-July 1998. The software was recommended for release, with the exception of the threat depiction tool. The threat depiction tool was found to present incorrect information on terrain masking results. PFPS 3.01 supports the following aircraft with basic flight planning capability: A-10, B-1B, B-52H, C-141B, C-27A, E-3A, E-4B, EF-111, F-117A, F-15 (various), F-16 (various), C-130 (various), KC-10, C-135 (various), H-53, and T-38. Although the PFPS software has embedded flight performance modules for many aircraft types, MPEs for each aircraft type are still individually tested and certified before operational use.

Recent PFPS tests include operational test and evaluation of the PFPS-based MPE for the KC-135R. This test was completed by AFOTEC in March 1999. Effectiveness was resolved as satisfactory. Suitability was rated unsatisfactory due to inadequate documentation and system support when loading software onto the Panasonic CF-25 ruggedized laptop computer.

A Mission Data Loader for the KC-135R, using PFPS 3.01, was also tested in December 1998 and rated as satisfactory for effectiveness and suitability. The Mission Data Loader is used to support loading Digital Aeronautical Flight Information Files into the aircraft.

Several periods of operational test and evaluation have been conducted on PFPS MPEs for various F-16 categories. The results of these tests have been satisfactory ratings, except for takeoff and landing data on the F-16 Block 50T4.

A PFPS-based MPE for the HH/MH-60G helicopter was tested in March 1999. The system was rated unsatisfactory for effectiveness and satisfactory for suitability. The unsatisfactory rating resulted because the system loads erroneous data into the data transfer devices. The unit was not recommended for release to operational units. The Air Force states that after the using command reviewed the test results and the test organization's evaluation, the HH-60 MPE was certified and released to operational units in the field.

Operational testing of the MPE for the C-141B was completed in May 1999. The system was rated as satisfactory except for takeoff and landing data functions. The system was recommended for operational use for climb, cruise, and descent only.

A C-17 MPE was tested during May and June 1999. The system was rated as satisfactory for effectiveness, but with several limitations. The system cannot plan airdrop profiles. Problems were also

encountered when loading data into the aircraft mission computer. Primary route data were lost if a stored route segment was inserted into a primary route. The system was rated as unsatisfactory for suitability because of deficiencies in software load procedures, hardware configuration, and the training program.

Table 3 summarizes the results of recent operational test and evaluation for MPEs based on PFPS 3.01.

Table 3. Summary of OT&E Results for MPEs based on PFPS 3.01 Software

MPE	Effectiveness Rating	Suitability Rating
KC-135R	Satisfactory	Unsatisfactory
KC-135 Mission Data Loader	Satisfactory	Satisfactory
F-16 (various blocks)	Satisfactory Except for TOLD on F-16 Block 50T4	Satisfactory
C-130 (various designations)	Satisfactory for C-130 SCNS and MC-130H	Satisfactory for C-130 SCNS and MC-130H
C-5 Navigation Data Loader	Satisfactory	Satisfactory
HH/MH-60G	Unsatisfactory	Satisfactory
C-17	Satisfactory (with limitations)	Unsatisfactory

TEST & EVALUATION ASSESSMENT

In general, UNIX-based AFMSS has been a problematic, trouble-plagued program. While some versions have worked acceptably (albeit with many workarounds), the more demanding versions have not been operationally effective or suitable, particularly in earlier versions. User acceptance and confidence in these versions are low.

UNIX-based MPEs using Block C2.2 core software that was tested in the past year have shown improvements over their predecessors in functionality and timeliness. Faster MPS-III and MPS-IV hardware mitigate, to some extent, the effects of operator and system errors because they can be corrected faster. However, despite improvements in UNIX-based MPEs, users continue to complain about system size, excessive mission planning times and slow operating speed, complexity of operation, and extensive training requirements. The quality of chart production remains poor and the times required to prepare and print mission plans are still excessive.

A fully effective MPE has yet to be delivered for the B-1B due in part to issues unique to the B-1B. The CLOAR used by B-2 and F-117A MPEs is still unsatisfactory. Both the B-2 and the F-117A have alternatives to CLOAR for performing LO routing. The B-2 community is developing an autorouting module named OPUS. The “Interim F-117A MPE” is already operational using the BONN Target Area Planning (TAP®) Module for LO routing.

AFMSS experience during Operation Allied Force was consistent with OT&E findings. While mission planning was successfully accomplished, many difficulties were encountered. Among user complaints were that UNIX-based AFMSS systems were large, slow, complex, difficult to use, crashed often, and did not interface with participants.

To help with the intense system administration duty, the Air Force has deployed 61 system support representatives to the field to aid units in training and solving system problems. Users report that these personnel are extremely valuable and, in some cases, indispensable.

Aircraft with complex missions and weapon delivery planning functions (e.g., B-2, B-52H, and F-117A) cannot be supported by PFPS-based systems and are likely to be dependent on UNIX-based MPEs for several more years. Other users, even those with satisfactory UNIX-based systems, (e.g., F-16 and C-130) have migrated to PFPS, as components become available to support preparing the data transfer devices.

PFPS-based MPEs have generally been rated satisfactory for effectiveness. There are some exceptions to satisfactory ratings, particularly takeoff and landing data functions for several aircraft types. One particular laptop was found to be unsatisfactory for suitability because users in the field could not load software. The C-17 PFPS-based MPE was found to be unsatisfactory for suitability (as noted above).

PFPS has found high acceptance among users for its ease of use for basic flight planning needs. A new PFPS release (version 3.1) is scheduled for operational test and evaluation beginning in December 1999. The next generation of planning systems, being developed in the JMPS program, will be designed with PFPS 3.1 capabilities as the starting point.

RECOMMENDATIONS

DOT&E recommends that the Air Force continue to give high-level attention and adequate funding to continue to correct the most critical problems and maintain/improve UNIX-based AFMSS. Although all AFMSS functions will eventually migrate to JMPS by approximately 2007, in the near term, only the UNIX-based system will have the capacity to perform autorouting and plan precision guided munitions delivery.