

B-2 Radar Modernization Program (RMP) Mode Set One (MS 1)

The B-2 Radar Modernization Program (RMP) Mode Set One (MS 1) is operationally effective, suitable, and survivable with some limitations.

System Overview

The B-2 RMP replaces elements of the aircraft's legacy radar hardware and software with an active electronically scanned array radar system operating in a new frequency band of the electromagnetic communications spectrum. The legacy B-2 radar system operates within an electromagnetic communications frequency band where the U.S. Government is designated as a secondary user. Secondary user status means that the B 2 radar system cannot interfere with primary users. There were no other competing users operating within the legacy radar frequency band when the B-2 aircraft was initially developed and fielded. The recent emergence and licensing of primary commercial users within that frequency band required the Air Force to retrofit the B-2 radar system and shift to an operating frequency band for which the the U.S. Government holds a primary user license. The B-2 RMP is intended to provide the same operational capabilities as the legacy radar system without degrading the aircraft's low observable characteristics, avionics, and defensive systems capabilities. B-2 RMP does not provide additional enhancements to existing B-2 radar operating modes or capabilities.

RMP delivers two sets of radar capabilities to the B-2. RMP MS 1 capabilities encompass five radar modes necessary for B-2 conventional weapons mission execution. RMP Mode Set Two (MS 2) capabilities encompass additional radar navigation and targeting modes necessary to support B-2 nuclear weapons missions.

Test Adequacy

The operational testing of the B-2 RMP MS 1 adequately supported an evaluation of the system's operational effectiveness, suitability, and survivability.

Air Force Operational Test and Evaluation Center (AFOTEC) conducted RMP MS 1 Initial Operational Test and Evaluation (IOT&E) from October through December 2008. Operational test aircrews planned and flew operationally representative missions, and operational maintainers performed RMP maintenance actions to accomplish IOT&E. Testing included mission planning, flight test, and associated maintenance activities necessary to support radar operation and sortie generation. IOT&E assessed production representative RMP system hardware, software, publications, and maintenance equipment.

The Director, Operational Test and Evaluation (DOT&E) assessment of operational effectiveness and suitability included supplemental data from production representative RMP developmental test missions during 2008 and additional suitability data from the Air Force Air Combat Command (ACC) post-IOT&E Force Development Evaluation (FDE) of B 2 RMP MS 1 capabilities conducted from April to September 2009.

AFOTEC will assess RMP MS 2 navigation and targeting capabilities in follow-on test and evaluation (FOT&E) of the full-rate production RMP system. RMP MS 2 FOT&E is scheduled to begin in November 2009.

Operational Effectiveness

RMP MS 1 is operationally effective with some limitations in the weather avoidance mode. RMP detection and display of weather phenomena was inconsistent with the actual weather location relative to the aircraft; weather phenomena such as thunderstorms were approximately five miles closer to the aircraft in than cockpit-displayed RMP detections. Operational aircrews must increase desired weather avoidance distances by five miles to compensate for this inconsistency. DOT&E assesses that this limitation will not preclude the B 2 from accomplishing its conventional operational missions.

RMP effectiveness in the other MS 1 radar operating modes was as good as that of the legacy radar. RMP-configured B-2 mapping, targeting, aircraft rendezvous, and weapons accuracy performance was at least as good as the legacy system.

Operational Suitability

RMP is operationally suitable with some limitations. RMP met user needs for reliability, maintainability, supportability, deployability, and availability with some exceptions.

The demonstrated RMP system mean time between failure (MTBF) met the Air Force requirement. DOT&E's assessment included 430.8 hours of RMP flight test data from missions flown through July 31, 2009. The Air Force MTBF requirement

is 68.1 hours, and RMP achieved a system MTBF of 71.8 hours in the test period. In comparison with the legacy radar MTBF, DOT&E assesses there is reasonable confidence that RMP MTBF is no worse than that of the legacy radar system.

Incomplete aircrew and maintenance technical publications required work-around actions to ready RMP aircraft for flight missions. Additionally, a modified hand tool was required and procured to facilitate removal and installation of RMP antenna components. These suitability shortfalls did not adversely affect RMP maintainability or supportability.

RMP-configured aircraft availability was slightly higher than that of the legacy radar equipped B-2. The RMP availability requirement is derived from the RMP system MTBF and mean time to repair requirements. During the test period, RMP achieved 95.8 percent availability against the derived requirement of 95.6 percent. In comparison with the legacy radar availability, DOT&E assesses there is reasonable confidence that RMP availability is no worse than that of the legacy system.

The RMP On-Board Test System (OBTS) is designed to provide 100 percent detection of radar system hardware or software faults. There was one hardware failure occurrence where OBTS did not detect the failed radar hardware module. Follow-on operational testing or assessment of OBTS performance in B-2 operational units is required to confirm that OBTS capability meets the user-defined requirements.

Operational Survivability

The RMP-configured B-2 is as survivable as the legacy radar-equipped aircraft. Both a legacy radar equipped B-2 and an RMP-configured B-2 flew side-by-side missions against operationally representative threat scenarios to evaluate and compare RMP vulnerability to threat detection. In direct comparison testing with the legacy radar-equipped B-2, results demonstrated that RMP did not increase B-2 susceptibility to detection by threat system radars. Flight testing demonstrated that the RMP operating frequencies did not interfere with performance of the B-2 Defensive Management System. Furthermore, RMP incorporation did not adversely affect B-2 radar or infrared signatures.

Recommendations

B-2 Radar Modernization Program Mode Set One is effective, suitable, and survivable for combat operations with some limitations. To address these limitations and meet the user's stated needs, the Air Force should accomplish the following:

1. Ensure that B-2 aircrews are fully trained on RMP MS 1 weather avoidance mode limitations, and establish operational procedures that enable mission accomplishment given the weather avoidance mode display discrepancies.
2. Complete, verify, and validate the applicable RMP aircrew and maintenance technical publications to support RMP sortie generation and mission execution.
3. Evaluate RMP On-Board Test System performance through follow-on operational testing or assessment of system performance in B-2 operational units to confirm system capability meets the user-defined requirements.