

PAIRS CASE 2022-C-0298

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Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

B-2 DISPLAY MODERNIZATION (B-2 BDM)

Selected Acquisition Report (SAR)



AS OF THE FY 2023 PRESIDENT'S BUDGET
U.S. AIR FORCE

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Program Manager

Name: Col Cory Brown

Date Assigned: June 30, 2020

Address: 2690 Loop Road West, Area B, Building 556 WPAFB, OH 45433

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Mission and Description

The B-2 Display Modernization (BDM) program is the restructured B-2 Defensive Management System Modernization (DMS-M) program. DMS-M de-scope has been limited to the modernization of B-2 cockpit displays and returning the DMS-M test jet—Aircraft Vehicle (AV) 1087—to the operational fleet. B-2 BDM will address the fleet's top driver for degraded mission readiness, obsolescence and repair challenges in the existing displays subsystem. The upgraded displays will ensure the B-2 will continue to be an effective strategic deterrent for the life of the platform.

Executive Summary

Program Highlights since Last Report

Significant Accomplishments: In February 2020, SAF/AQ directed the Defensive Management System – Modernization (DMS-M) program to **be restructured to a display only program** significantly reducing scope, and was renamed B-2 Display Modernization (BDM). B-2 BDM established a new Service Cost Position. Previous DMS-M SARs can be referenced for program accomplishments and transition history.

In FY 2021/2022 the B-2 BDM program accomplished the events below. These activities set the foundational baseline for entry into Milestone C in early fiscal year FY 2023. Air Vehicle (A/V) 1087 Milestones are included as part of the B-2 BDM scope.

- January 2021 ADM for name change to B-2 BDM from Defensive Management Systems-Modernization (DMS-M) was approved
- January 2021 APB was approved for B-2 BDM
- February 2021 Preliminary Design Review (PDR) conducted
- June 2021 Schedule Baseline Review (SBR)
- February 2022 Collins (sub-contractor) Critical Design Review (CDR)

Major contract awards/Modifications in FY 2021/2022:

- January 2021 Engineering & Manufacturing Development (EMD) proposal submitted
- February 2021 EMD UCA Award
- April 2021 EMD Technical Evaluation complete
- June 2021 Business Clearance
- December 2021 EMD contract definitized
- January 2022 Production Request for Proposal (RFP) Released
- February 2022 Northrup Grumman (NG) AV 1087 Not To Exceed for relocation to Whiteman Air Force Base, acceleration proposal received

Forecasted B-2 BDM FY 2022 events include: Detailed Design Review and Engineering Design Units deliveries.

Significant Issues:

Funding status: B-2 BDM program is using the FY 2023 President's Budget which removes the artificial breach from the de-scoped DMS-M program.

B-2 BDM does not require any additional 3600 funding adjustments, however, the B-2 BDM will continue to be forward financed throughout the duration of EMD because 3600 is mis-phased. The B-2 BDM cost estimate has been updated to reflect the definitized EMD contract value and the decision to do a one-phase de-mod of A/V 1087. Both resulted in a reduction to the B-2 BDM funding requirement. The B-2 BDM P&D RFP was released in January 2022.

Testing status: The new displays will be tested according to the specifications documented in the EMD contract. Northrop Grumman and the System Program Office (SPO) are in collaboration on the test requirements. An Integrated Test Team is defining the test plan for the displays.

Software component: B-2 BDM software updates approximately 100 lines of code. The B-2 BDM software component is relatively insignificant compared to the DMS-M effort of 1,000,000 lines of code. B-2 BDM software development will be baselined to P6.3.1 configuration, and later companioned into a future P6.X Integrated Functional Capability (IFC). There remains a cost and schedule risk related to IFC integration requirements.

The Total Acquisition Cost of 2,238.5 includes sunk costs from the DMS-M program.

Significant Developments since Program Initiation

History of Significant Developments Since Program Initiation	
Date	Significant Development Description
March 2016	Milestone B was approved.
May 2017	MDA approved an Acquisition Strategy.
May 2017	An Undefinitized Contract Action awarded.
January 2018	A cost capability trade analysis was approved by Air Force Global Strike Command.
March 2018	Delta Preliminary Design Review was completed.
June 2018	Updated SCP was signed.
November 2018	DMS-M CDR was completed.
June 2019	Contract was definitized for \$738M.
November 2019	First software build was tested and certified.
February 2020	USD (A&S) delegated program to USAF as an ACAT-IC.
February 2020	ADM to de-scope the program to displays only.
May 2020	PD7.0.1 Flight Readiness Review.
May 2020	PD7.0.1 First Flight.
August 2020	B-2 BDM EMD RFP Released.
August 2020	DMS-M de-scope contract mod awarded.
September 2020	B-2 BDM Acquisition Strategy approved.
September 2020	PD7.0.1 FCF Customer Acceptance Test.
October 2020	ADM from SAE delegating MDA to the PEO.
November 2020	System Functional Review/System Requirements Review.
November 2020	SCP approved.
January 2021	APB approved.
January 2021	B-2 BDM EMD Proposal submitted for MDU-R and 1087 Demod.
January 2021	ADM for name change to B-2 BDM.
February 2021	EMD UCA Award.
February 2021	Preliminary Design Review Conducted.
April 2021	EMD Technical Evaluation.
June 2021	Program Schedule Baseline Review Conducted.
June 2021	Business Clearance.
December 2021	EMD Contract definitized.
January 2022	Production RFP Released.

Schedule

Schedule Events

Schedule Events				
Events	Development AP Objective	Current APB Development Objective/Threshold		Current Estimate
Materiel Development Decision	Jun 2010	Jun 2010	Jun 2010	Jun 2010
Milestone A	Aug 2011	Aug 2011	Aug 2011	Aug 2011
Milestone B	Mar 2016	Mar 2016	Mar 2016	Mar 2016
Displays Flight Justification Qualification	N/A	May 2023	Nov 2023	June 2023
Milestone C	Dec 2019	Sep 2024	Mar 2025	Sep 2024
Force Development Evaluation/Aircraft Monitor and Control (FDE/AMAC) Test Start	N/A	Jul 2025	Jan 2026	Jul 2025
Full Operational Capability	N/A	Mar 2026	Sep 2026	Mar 2026

Significant Schedule Risks

Significant Schedule Risks	
Displays Flight Justification Qualification (May 2023)	
1.	MDU-R Hardware: If Display Engineering Unit or Flight Test Unit is delayed then critical path for test and fielding will be impacted. Currently managed as likelihood of two, consequence three in program risk management process. Next mitigation step is to conduct DDR in CY 2022 to set the product baseline and confirmed the program is on track for EDU delivery.
2.	Airworthiness Critical Safety Electromagnetic Interference/Electromagnetic Environment (EMI/EME), Temperature and Vibration Qualification: If B-2 BDM displays do not meet electromagnetic, temperature and vibration qualification to safety critical levels, then more extensive hardware design may be required to meet airworthiness criteria. Currently managed as a likelihood of 3 consequence of 3 in the B-2 BDM risk management program. Vendor showed the government whether their design meets the EMI/EME, vibe and temp requirements of this program during Preliminary Design Review (PDR) April 2021. The System Requirements Review yielded no concerns with being able to meet safety critical standards that are new to the B-2 platform since the original displays were fielded. Next mitigation step is to monitor MDU-R DDR in April 2022.
3.	MDU-F3 Software System Tracking Reports (SSTRs): If high-priority MDU-F3 or unplanned SSTRs testing require a redesign to address issues then unknown cost and schedule impacts may be realized to field the MDU-F3. Currently managed as a likelihood of 2 consequence of 3 in the B-2 BDM risk management program. Next mitigation step is to monitor subcontractor CDR in February 15-16 2022, and assess the contractor Detailed Design Review (DDR) in April 2022.
Force Development Evaluation/Aircraft Monitor And Control (FDE/AMAC) Test Start (July 2025)	
1.	Extra Enterprise Software Development: If extra Enterprise Software Development is required in any B-2 enterprise Integrated Functional Capability (IFC) between now and B-2 BDM IFC certification, then it may alter projected B-2 BDM IFC P6.3.1 certification, and later companioning. Currently managed as a likelihood of 1, consequence of 2 in the B-2 BDM risk management program. Next mitigation step is to partner with an

	appropriate future IFC based on display hardware availability and timing of other planned B-2 upgrades. IPT is requesting approval through board processes and outlining a regression plan.
2.	Air Force Flight Standards Agency (AFFSA) Display Endorsement: If the B-2 BDM hardware requirements and design do not address the deficiencies recorded in the Multi-Purpose Display Unit, Form, Fit, Function (MDU-F3) program, then the Air Force Flight Safety Agency endorsement process will drive design changes. Currently managed as a likelihood 2, consequence 3 in the B-2 BDM risk management program. Next mitigation step will be implementation of recommendation is to show deficiency resolution at MDU-R DDR in April 2022.
3.	B-2 BDM Software Companioning: If B-2 BDM cannot aligned at the beginning of a future HSC N block for IFC companioning, then B-2 BDM will incur additional costs requiring an individual Operational Flight Control (OFC) due to the absent of another IFC flight test cost share. Currently managed as a likelihood of 3, consequence of 3 in the B-2 BDM risk management program. Next mitigation step is B-2 BDM presenting to the ETRB in Jan 2022 for approvals.
Current Estimate (December 2021)	
1.	Procurement supply delay: If the Contractor is unable to reduce production component lead times (contractor's initial estimate is 515d for 10% of the parts) and or the production proposal exceeds USG cost estimates, then program acquisition strategy and option buys will be impacted. Currently managed as a likelihood of four, consequence of five in the B-2 BDM risk management program. With the release of the Production RFP January 24, 2022, the program office will receive a more mature assessment of component lead times and costs. The DMS-M basis of MDU design is fairly mature and parts costs known. The Quick Reaction Architecture Study accompanied a MDU-R formal PDR and System Requirement Review conducted. There are ~ 100 lines of software, no air vehicle modifications, low risk for hardware with MDU-R with 62 components different from MDU-F3. Program concurrence on PDR completed, DDR in April 2022 and B-2 BDM subsystem performance demonstration in System Integration Laboratory during EMD phase. Controlled approval via contract, technical reviews, and price matrix curve gates for production hardware buys/builds quantities in the RFP SOW to mitigate risk.
2.	FY 2023 CRA: B-2 BDM 3010 Production contract is a new start in FY 2023. If FY 2023 CRA occurs, contract award will be delayed until FY 2023 President's Budget is passed. Currently managed as a likelihood of 4, consequence of 3 in the B-2 BDM risk management program. Next mitigation step is to monitor programs and schedule implications related to SECAF FY 2023 budget. If budget delays occur, B-2 Enterprise may request funding to not impact production execution.

Performance

Performance Characteristics				
SAR Baseline Development Estimate	Current APB Development Objective/Threshold		Demonstrated Performance	Current Estimate
Display Availability				
N/A	(T=O) The B-2 BDM displays shall have a minimum Operational Availability of 99.7%.	The B-2 BDM displays shall have a minimum Operational Availability of 99.7%.	TBD	(T=O) The B-2 BDM displays shall have a minimum Operational Availability of 99.7%.
Display Reliability				
N/A	(T=O) The B-2 BDM displays shall have a Material Reliability of 85% for a 36 hour mission.	The B-2 BDM displays shall have a Material Reliability of 85% for a 36 hour mission.	TBD	(T=O) The B-2 BDM displays shall have a Material Reliability of 85% for a 36 hour mission.
DPU Functionality				
B-2 DMS Mod shall maintain mission-critical legacy DPU capability in addition to enhancements provided by B-2 DMS Mod consistent with Integrated Functional Capability Production Version 6 baseline.	N/A	N/A	TBD	N/A
Survivability				
The aircraft with B-2 DMS Mod installed shall meet RCS levels of the B-2 WSS, Appendix 70	N/A	N/A	TBD	N/A
Sustainment (Availability) has two components: Ao & Am				
The Ao of the B-2 DMS Mod upgrade shall be a minimum of 99.7% at system maturity. B-2 DMS Mod shall support the B-2 DMS Mod B-2 fleet platform Am target of 60% without the need for component cannibalizations.	N/A	N/A	TBD	N/A

Requirements Source

- AFGSC 20-013 (P) (FOUO) B-2 Displays Modernization Program 1087, signed 15 Jan 2020, Col Kevin Kippie, AFGSC/A5BA

- AFGSC 20-013 B-2 Displays Modernization Program Requirements Addendum 1, signed 30 May 2020, Maj Matthew Roberson, AFGSC/A5BA
- AFGSC 20-013 B-2 Displays Modernization Program Requirements Addendum 2, signed 12 August 2020, Maj Matthew Roberson, AFGSC/A5BA

Acquisition Budget Estimate

Total Acquisition Cost

Category	Base Year	Development APB (05/16/2016)	APB Name (Current) (01/30/2021)		Budget Estimate PB 2023		Deviation
		Objective (BY\$)	Objective (BY\$)	Threshold (BY\$)	BY\$	TY\$	
RDT&E	2016	1821.90	2060.37	2266.41	2068.11	2146.42	
Procurement	2016	734.30	80.86	88.95	58.38	72.41	
MILCON	2016	0.00	0.00	0.00	0.00	0.00	
Acq. O&M	2016	0.00	0.00	0.00	0.00	0.00	
Total		2556.20	2141.23	2355.35	2126.48	2218.83	
PAUC	2016	127.81	107.06	117.77	106.32	110.94	
APUC	2016	45.89	5.05	5.56	3.65	4.53	

Total End Item Quantity

Quantity Category	Current APB Quantity	Current Estimate Quantity
Development	4	4
Procurement	16	16

Budget Notes

The "Current Estimate" column above reflects the FY 2023 PB which reflects program restructure to displays only.

In 2020, the B-2 BDM Service Cost Position was established, restructured from the DMS-M program. This SCP identified FY23-FY25 funding disconnects; B-2 BDM SCP reflected FY21-26 \$245.8M RDT&E / \$98.2M 3010. Full funds realignment occurred with B-2 BDM definitization and FY23 budget cycle.

Risk and Sensitivity Analysis

Risks and Sensitivity Analysis	
Current Baseline Estimate (January 2021)	
1.	There are no known risks identified with this baseline estimate.
Original Baseline Estimate (May 2016)	
1.	Flight Test Schedule-IF insufficient developmental flight test data collection due to software availability occurs THEN System Verification Review will slip causing Milestone C delay.
Revised Original Estimate (N/A)	
1.	None
Current Procurement Cost (December 2021)	
1.	There are no known risks identified with this program at this time.

Unit Cost

Current Baseline Compared with Current Estimate

Category (\$M)	Current APB (January 2021)	Current Estimate (December 2021)	% Change	NMC Breach
PAUC				
Cost	2141.23	2126.48	-	-
Quantity	20	20	-	-
Unit Cost	107.06	106.32	0.00%	
APUC				
Cost	80.86	58.38	-	-
Quantity	16	16	-	-
Unit Cost	5.05	3.65	-25.74%	

Original Baseline Compared with Current Estimate

Category (\$M)	Original APB (May 2016)	Current Estimate (December 2021)	% Change	NMC Breach
PAUC				
Cost	2556.2	2126.48	-	-
Quantity	20	20	-	-
Unit Cost	127.810	106.32	-16.37	
APUC				
Cost	734.3	58.38	-	-
Quantity	16	16	-	-
Unit Cost	45.894	3.65	-91.82	

Unit Cost Notes

The Original Baseline reflects the May 2016 APB as part of the DMS-M program which included replacement of Legacy Multi-function Display Unit (MDU) with previously completed MDU-F3 program and New Display Processing subsystem – Advanced Graphics Processor (AGP).

Contracts

Contract Data				
Contract Number	FA8616-14-D-6060			
Effort Number				
Contract Type	FFP			
Modification Number	PZ0002			
Modification Date	December 16, 2021			
Award Date	February 26, 2021			
Definitization Date	December 16, 2021			
Order Number	FA8616-21-F-0121			
CAGE Code/CAGE Legal Name	1W025 / Northrop Grumman Systems Corporation			
Contract Title	B2 Display Modernization			
Contract Address	AF Life Cycle Management Center, 2600 Loop Rd W. AMC III, Bldg 556, Wright-Patterson AFB OH 45433-7148			
Contracts/Effort Price, Quantity, and Performance (\$M)				
Initial Target Price	178.8	Current Target Price	155.4	
Initial Ceiling Price	N/A	Current Ceiling Price	N/A	
Contract's EAC	155.4	PM's EAC	155.4	
Initial Quantity	N/A	Current Quantity	0	Delivered Quantity 0
BAC	N/A	BCWP	N/A	ACWP N/A
BCWS	N/A	Cost Variance	N/A	Schedule Variance N/A

Contract Data				
Contract Number	FA8616-14-D-6060 0002			
Effort Number	EMD – Delivery Order 0002			
Contract Type	FFP			
Modification Number	35			
Modification Date	June 3, 2019			
Award Date	May 24, 2017			
Definitization Date	June 3, 2019			
Order Number	0002			
CAGE Code/CAGE Legal Name	1W025 / Northrop Grumman Systems Corporation			
Contract Title	DMS-M EMD			
Contract Address	AF Life Cycle Management Center, 2600 Loop Rd W. AMC III, Bldg 556, Wright-Patterson AFB OH 45433-7148			
Contracts/Effort Price, Quantity, and Performance (\$M)				
Initial Target Price	1,282	Current Target Price	1,209	
Initial Ceiling Price	N/A	Current Ceiling Price	N/A	
Contract's EAC	155.4	PM's EAC	155.4	
Initial Quantity	N/A	Current Quantity	0	Delivered Quantity 0
BAC	N/A	BCWP	N/A	ACWP N/A
BCWS	N/A	Cost Variance	N/A	Schedule Variance N/A

Technologies and Systems Engineering

Significant Technical Risks

Significant Technical Risks	
Displays Flight Justification Qualification (May 2023)	
1.	MDU-R Hardware: If Display Engineering Unit or Flight Test Unit is delayed then critical path for test and fielding will be impacted. Currently managed as likelihood of 2, consequence 3 in program risk management process. Next mitigation step is to conduct Detailed Design Review (DDR) (i.e. contractor's MDU-R CDR) in April 2022 the product baseline, to confirm the program is on track for EDU delivery.
2.	Airworthiness Critical Safety Electromagnetic Interference/Electromagnetic Environment (EMI/EME, Temperature and Vibration Qualification: If B-2 BDM displays do not meet electromagnetic, temperature and vibration qualification to safety critical levels, then more extensive hardware design may be required to meet airworthiness criteria. Currently managed as a likelihood of three consequence of three in the B-2 BDM risk management program. Next mitigation step the vendor showed the government whether their design meets the EMI/EME, vibe and temp requirements of this program during PDR in April 2021 under the quick reaction study bridge contract. System Requirements Review yielded no concerns with being able to meet safety critical standards that are new to the B-2 platform since the original displays were fielded. Next mitigation step is to monitor MDU-R DDR in 2022
Force Development Evaluation/Aircraft Monitor And Control (FDE/AMAC) Test Start (July 2025)	
1.	Extra Enterprise SW Development: If extra Enterprise Software Development is required in any B-2 enterprise Integrated Functional Capability (IFC) between now and B-2 BDM IFC certification, then it may alter projected B-2 BDM IFC P6.3.1 certification, and later companioning. Currently managed as a likelihood of 1, consequence of 2 in the B-2 BDM risk management program. Next mitigation step is to partner with an appropriate future IFC based on display hardware availability and timing of other planned B-2 upgrades. IPT is requesting approval through board processes and outlining a regression plan.
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implications related to SECAF FY 2023 budget. If budget delays occur, B-2 Enterprise may request funding to not impact production execution.

Deliveries and Expenditures

Deliveries

Delivered to Date	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	0	0	4	0.00%
Production	0	0	16	0.00%
Total Program Quantity Delivered	0	0	20	0.00%

Expenditures

Total Acquisition Cost: 2231.35

Expended to Date: 1778.50

Percent Expended: 79.71%

Total Funding Years: 17

Years Appropriated: 11

Percent Years Appropriated: 64.71%

Appropriated to Date: 1963.7

Percent Appropriated: 87.72%

Low Rate Initial Production

LRIP Note

B-2 BDM does not have a LRIP mandate due to the small size of the B-2 fleet.

Operating and Support Costs

O&S for B-2 BDM will be supported by B-2 Enterprise contracts, and not under the B-2 BDM contract.