United States Government Accountability Office

GAO

Report to Congressional Committees

March 2008

DEFENSE ACQUISITIONS

Assessments of Selected Weapon Programs

GAO

Accountability ★ Integrity ★ Reliability

GAO-08-467SP

March 2008

DEFENSE ACQUISITIONS

Assessments of Selected Weapon Programs

GAO Accountability·Integrity·Reliability

Highlights

Highlights of GAO-08-467SP, a report to congressional committees

Why GAO Did This Study

This report is GAO's sixth annual assessment of selected weapon programs. Since 2000, the Department of Defense (DOD) has roughly doubled its planned investment in new systems from $790 billion to $1.6 trillion in 2007, but acquisition outcomes in terms of cost and schedule have not improved. Total acquisition costs for major defense programs in the fiscal year 2007 portfolio have increased 26 percent from first estimates, compared with 6 percent in 2000. Programs have also often failed to deliver capabilities when promised. DOD's acquisition outcomes appear increasingly suboptimal, a condition that needs to be corrected given the pressures faced by the department from other military and major nondiscretionary government demands.

This report provides congressional and DOD decision makers with an independent, knowledge-based assessment of defense programs, identifying potential risks when a program's projected attainment of knowledge diverges from best practices. The programs assessed—most of which are considered major acquisitions by DOD—were selected using several factors: high dollar value, acquisition stage, and congressional interest. This report also highlights overall trends in DOD acquisition outcomes and issues raised by the cumulative experience of individual programs. GAO updates this report annually under the Comptroller General's authority to conduct evaluations on his own initiative.

To view the full product, including the scope and methodology, click on GAO-08-467SP. For more information, contact Michael Sullivan at (202) 512-4841 or SullivanM@gao.gov.

What GAO Found

Of the 72 programs GAO assessed this year, none of them had proceeded through system development meeting the best practices standards for mature technologies, stable design, or mature production processes by critical junctures of the program, each of which are essential for achieving planned cost, schedule, and performance outcomes. The absence of wide-spread adoption of knowledge-based acquisition processes by DOD continues to be a major contributor to this lack of maturity. Aside from these knowledge-based issues, GAO this year gathered data on four additional factors that have the potential to influence DOD's ability to manage programs and improve outcomes—performance requirements changes, program manager tenure, reliance on nongovernmental personnel to help perform program office roles, and software management. GAO found that 63 percent of the programs had changed requirements once system development began, and also experienced significant program cost increases. Average tenure to date for program managers has been less than half of that called for by DOD policy. About 48 percent of DOD program office staff for programs GAO collected data from is composed of personnel outside of the government. Finally, roughly half the programs that provided GAO data experienced more than a 25 percent increase in the expected lines of software code since starting their respective system development programs.

In response to previous GAO recommendations and congressional direction, DOD has recently taken actions that could help move the department toward more sound, knowledge-based acquisition processes. For example, a new concept decision review initiative, guidance for determining acquisition approaches based on capability need dates, and the establishment of review boards to monitor weapon system configuration changes could enable department officials to make more informed decisions in the early stages of a program and better match program requirements and resources, a key first step. Improvements to individual program acquisition outcomes will likely hinge on the success of initiatives like these, paired with knowledge-based strategies.

Analysis of DOD Major Defense Acquisition Program Portfolios (fiscal year [FY] 2008 dollars)

	FY 2000 Portfolio	FY 2005 Portfolio	FY 2007 Portfolio
Portfolio size			
Number of programs	75	91	95
Total planned commitments	$790 Billion	$1.5 Trillion	$1.6 Trillion
Commitments outstanding	$380 Billion	$887 Billion	$858 Billion
Portfolio performance			
Change to total RDT&E costs from first estimate	27 percent	33 percent	40 percent
Change in total acquisition cost from first estimate	6 percent	18 percent	26 percent
Estimated total acquisition cost growth	$42 Billion	$202 Billion	$295 Billion
Share of programs with 25 percent or more increase in program acquisition unit cost	37 percent	44 percent	44 percent
Average schedule delay in delivering initial capabilities	16 months	17 months	21 months

Source: GAO analysis of DOD data.

Contents

Foreword 1

Letter 3

Summary 3
Weapon Acquisition Outcomes Continue to Undermine DOD Investments 6
DOD Weapon System Programs Are Still Not Following a Knowledge-Based Approach 12
DOD Practices Continue to Contribute to Program Risk and Instability 23
Additional Factors Can Contribute to Poor Weapon Acquisition Outcomes 27
Recent DOD Actions Provide Opportunities for Improvement 31
How to Read The Knowledge Graphic for Each Program Assessed 33
Assessments of Individual Programs 34
Airborne Laser (ABL) 35
Aegis Ballistic Missile Defense (Aegis BMD) 37
Advanced Extremely High Frequency (AEHF) Satellites 39
Air Force Distributed Common Ground System (AF DCGS) Increment 2 41
Armed Reconnaissance Helicopter (ARH) 43
Advanced Threat Infrared Countermeasure/Common Missile Warning System 45
B-2 Spirit Advanced Extremely High Frequency (EHF) SATCOM Capability 47
B-2 Radar Modernization Program (B-2 RMP) 49
Broad Area Maritime Surveillance Unmanned Aircraft System 51
C-130 Avionics Modernization Program (AMP) 53
C-130J Hercules 55
C-5 Avionics Modernization Program (C-5 AMP) 57
C-5 Reliability Enhancement and Reengining Program (C-5 RERP) 59
CH-53K Heavy Lift Replacement (HLR) 61
Combat Search and Rescue Replacement Vehicle (CSAR-X) 63
CVN 21 Nuclear Aircraft Class Carrier 65
Distributed Common Ground System—Army (DCGS-A) 67
DDG 1000 Destroyer 69
E-2D Advanced Hawkeye (E-2D AHE) 71
EA-18G 73

Evolved Expendable Launch Vehicle (EELV)—Atlas V, Delta IV	75
Expeditionary Fire Support System (EFSS)	77
Expeditionary Fighting Vehicle (EFV)	79
Extended Range Munition (ERM)	81
Excalibur Precision Guided Extended Range Artillery Projectile	83
F-22A Modernization Program	85
Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)	87
Future Combat Systems (FCS)	89
Global Hawk Unmanned Aircraft System	91
Ground-Based Midcourse Defense (GMD)	93
H-1 Upgrades	95
Joint Air-to-Surface Standoff Missile (JASSM)	97
Joint Cargo Aircraft	99
Joint High Speed Vessel (JHSV)	101
Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)	103
Joint Strike Fighter (JSF)	105
Joint Tactical Radio System Airborne, Maritime, Fixed-Station (JTRS AMF)	107
Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)	109
JTRS Handheld, Manpack, Small Form Fit (JTRS HMS)	111
KC-X Program	113
Kinetic Energy Interceptors (KEI)	115
Littoral Combat Ship (LCS)	117
Littoral Combat Ship: Anti-Submarine Warfare (ASW)	119
Littoral Combat Ship: Mine Countermeasures (MCM)	121
Littoral Combat Ship: Surface Warfare (SuW)	123
LHA 6 Amphibious Assault Ship Replacement Program	125
Longbow Apache Block III	127
Light Utility Helicopter (LUH)	129
Multifunctional Information Distribution System (MIDS)	131
Multiple Kill Vehicle	133
Multi-Platform Radar Technology Insertion Program	135
Maritime Prepositioning Force (Future)/Mobile Landing Platform	137
Reaper Unmanned Aircraft System	139
Mine Resistant Ambush Protected (MRAP) Vehicle	141
Mobile User Objective System (MUOS)	143
Navstar Global Positioning System (GPS) Space & Control	145

National Polar-orbiting Operational Environmental Satellite System (NPOESS) 147
P-8A Multi-mission Maritime Aircraft 149
PATRIOT/MEADS Combined Aggregate Program (CAP) Fire Unit 151
Space Based Infrared System (SBIRS) High 153
Small Diameter Bomb (SDB), Increment II 155
Sky Warrior Unmanned Aircraft System (UAS) 157
Space Radar (SR) 159
Space Tracking and Surveillance System (STSS) 161
Terminal High Altitude Area Defense (THAAD) 163
Transformational Satellite Communications System (TSAT) 165
V-22 Joint Services Advanced Vertical Lift Aircraft 167
VH-71 Presidential Helicopter Replacement Program 169
Virginia-Class Submarine (SSN 774) 171
Wideband Global SATCOM (WGS) 173
Warfighter Information Network-Tactical (WIN-T), Increment 1 175
Warfighter Information Network-Tactical (WIN-T), Increment 2 177
Agency Comments 179

Appendixes

Appendix I: Scope and Methodology 181
Appendix II: Technology Readiness Levels 190
Appendix III: GAO Contact and Acknowledgments 192

Related GAO Products

196

Tables

Table 1: Analysis of DOD Major Defense Acquisition Program Portfolios 7
Table 2: Examples of Program Delays and Impacts 9
Table 3: Planned RDT&E and Procurement Funding for Major Defense Acquisition Programs, as of December 2006 10
Table 4: Outcomes for Weapon Programs in 2008 Assessment 14
Table 5: Significant Changes to Contract Prices for DOD Development Contracts 25
Table 6: Program Office Staffing Composition for 52 DOD Programs 30

Figures

Figure 1: Schedule Delays for Major Weapon Systems 9
Figure 2: Knowledge Achievement for Weapon System Programs in 2008 Assessment at Key Junctures 15
Figure 3: Maturity Levels of Critical Technologies for DOD Programs 16
Figure 4: Percentage of Programs Achieving Technology Maturity at Key Junctures 17
Figure 5: Percentage of Programs Releasing 90 Percent of Engineering Drawings by Key Junctures 19
Figure 6: Best Practices Compared to DOD Practices for Programs in 2008 Assessment 22
Figure 7: Average RDT&E Cost Growth for Programs since Initial Estimates 28
Figure 8: Depiction of a Notional Weapon System's Knowledge as Compared with Best Practices 34

Abbreviations

AESR	Advanced Electromagnetic Signature Reduction
AIRSS	Alternative Infrared Satellite System
AOA	Analysis of Alternatives
CASPER	Communication and Subsystem Processing Embedded Resource Communication Controller
CAVES WAA	Conformal Acoustic Velocity Sensor Wide Aperture Array
CBA	Capital Budget Account
CCD	Cockpit Control Display
CDR	critical design review
DACS	divert and attitude control system
DCMA	Defense Contract Management Agency
DDR&E	Director for Defense Research and Engineering
DIB	DCGS Integration Backbone
DOD	Department of Defense
DRR	Design Readiness Review
EMALS	electromagnetic aircraft launch system
ER	Extended Range
FAA	Federal Aviation Administration
FPA	focal plane array
FY	fiscal year

GAO	Government Accountability Office
GBI	Ground-based interceptors
GEO	geosynchronous earth orbit
HEO	highly elliptical orbit
HMSD	helmet-mounted sight displays
IAMD	Integrated Air and Missile Defense
ICAP	Improved Capability
IMU	inertial measurement units
ISR	intelligence, surveillance, and reconnaissance
JNN-N	Joint Network Node - Network
JPALS	Joint Precision Approach and Landing System
JTRS	Joint Tactical Radio System
LRIP	low-rate initial production
KDP	Key Decision Point
KP	knowledge points
MDA	Missile Defense Agency
MDAP	Major Defense Acquisition Program
MLP	Mobile Landing Platform
NA	not applicable
NASA	National Aeronautics and Space Administration
NLOS-C	Non-Line-of-Sight Cannon
NOAA	National Oceanic and Atmospheric Administration
NSS AP	National Security Space Acquisition Policy
RDT&E	research, development, test and evaluation
SAR	Selected Acquisition Report
SDACS	Solid Divert and Attitude Control System
SDB	Small Diameter Bomb
SM-3	Standard Missile 3
TBD	to be determined
TIP	Technology Insertion Program
TRTF	Tanker Replacement Transfer Fund
TSRM	Third Stage Rocket Motor
UAS	unmanned aircraft system
UHF	Ultra High Frequency
ULA	United Launch Alliance

Comptroller General
of the United States

United States Government Accountability Office
Washington, D.C. 20548

March 31, 2008

Congressional Committees

I am pleased to present GAO's sixth annual assessment of selected weapon programs. It comes at a time of large and growing national government fiscal imbalance and budget deficits that continue to strain all of our federal agencies' resources. Our nation faces a range of challenges that will require a more disciplined and balanced approach to discretionary and mandatory spending as we move into the 21st century. In the coming decades, our ability to sustain even the constitutionally enumerated responsibilities of the federal government will come under increasing pressure. Budget experts now agree that growing entitlement costs for mandatory spending programs like Social Security, Medicare, and Medicaid will, absent fundamental reforms, put intense and increasing pressure on discretionary spending programs or tax levels or both.

DOD's investment in weapon systems represents one of the largest discretionary items in the budget. While overall discretionary funding is declining, DOD's budget continues to demand a larger portion of what is available, thereby leaving a smaller percentage for other activities. DOD's investment in weapon acquisition programs is now at its highest level in two decades. The department expects to invest about $900 billion (fiscal year 2008 dollars) over the next 5 years on development and procurement with more than $335 billion, or 37 percent, going specifically for new major weapon systems. Every dollar spent inefficiently in developing and procuring weapon systems is less money available for many other internal and external budget priorities—such as the global war on terror and growing entitlement programs. These inefficiencies also often result in the delivery of less capability than initially planned, either in the form of fewer quantities or delayed delivery to the warfighter.

Unfortunately, our review this year indicates that cost and schedule outcomes for major weapon programs are not improving over the 6 years we have been issuing this report. Although well-conceived acquisition policy changes occurred in 2003 that reflect many best practices we have reported on in the past, these significant policy changes have not yet translated into best practices on individual programs. Flagship acquisitions, as well as many other top priorities in each of the services, continue to cost significantly more, take longer to produce, and deliver less than was promised. This is likely to continue until the overall environment for weapon system acquisitions changes. For example, a balanced, well-prioritized portfolio of weapon system acquisitions that allows for the right mix of weapon systems would alleviate the pressure each program now faces in winning funding from others; a knowledge-based business case at the outset of each program would alleviate overpromising on cost, schedule, and performance and would empower program managers; and more immediate accountability in the execution of each program would alleviate untimely decision making when programs do get into trouble.

The current DOD leadership has recently established initiatives designed to change the strategic environment at the weapon acquisition portfolio level. These initiatives reflect sound business concepts and could lead to better outcomes if implemented fully and correctly. However, policy without practice is not uncommon within the Department and the upcoming change in administration presents challenges in advancing progress through sustained implementation of best practices, as well as addressing new issues that may emerge. Significant changes will only be possible with greater, and continued, department level support, including strong and consistent vision, direction, and advocacy from DOD leadership, as well as sustained oversight by the Congress. Successful implementation will have significant implications for decisions made on individual programs, DOD's larger modernization goals, and the nation at large.

Gene L. Dodaro
Acting Comptroller General
of the United States

United States Government Accountability Office
Washington, D.C. 20548

March 31, 2008

Congressional Committees

This is GAO's sixth annual assessment of selected Department of Defense (DOD) weapon programs. During the past 6 years, GAO has reported on individual programs as well as many crosscutting problems with the acquisition process and has offered numerous recommendations on how DOD could improve acquisition outcomes. DOD's planned investment for new weapon systems now reflects the highest funding levels in two decades, with no significant decline expected in the near term. These levels will be difficult to sustain as the nation begins to address other long-term fiscal imbalances and as DOD encounters considerable pressure to reduce its investment in new weapons. DOD faces pressures within its own budget as new weapon system investments compete with funding needed to procure equipment and support military operations in Iraq and Afghanistan.

This report provides information on 72 individual weapon programs and assesses overall trends in DOD acquisition outcomes for decision makers to use as they determine the best ways to invest limited resources in the face of competing demands. Programs were selected for individual assessment based on several factors, including (1) high dollar value, (2) stage in acquisition, and (3) congressional interest. The majority of the 72 programs covered in the report are considered major defense acquisition programs by DOD.[1] We conducted this performance audit from June 2007 to March 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. Appendix I contains detailed information on our scope and methodology.

Summary

Since fiscal year 2000, DOD has significantly increased the number of major defense acquisition programs and its overall investment in them.

[1]Major defense acquisition programs (MDAP) are those identified by DOD that require eventual total research, development, test, and evaluation (RDT&E) expenditures of more than $365 million or $2.19 billion for procurement in fiscal year 2000 constant dollars.

Unfortunately, during this same time period, acquisition outcomes did not improve. Based on our analysis, total acquisition costs for the fiscal year 2007 portfolio of major defense acquisition programs increased 26 percent from first estimates, whereas the 2000 portfolio increased by 6 percent. Likewise, development costs for fiscal year 2007 programs increased by 40 percent from first estimates, compared to 27 percent for fiscal year 2000 programs. In most cases, programs also failed to deliver capabilities when promised—often forcing warfighters to spend additional funds on maintaining legacy systems. Our analysis shows that current programs are experiencing an average delay of 21-months in delivering initial capabilities to the warfighter, a 5-month increase over fiscal year 2000 programs.

Of the 72 weapon programs we assessed this year, no program had proceeded through system development meeting the best practices standards for mature technologies, stable design, and mature production processes—all prerequisites for achieving planned cost, schedule, and performance outcomes.[2] Eighty-eight percent of the programs in this assessment began system development without fully maturing critical technologies according to best practices. Ninety-six percent of the programs had not met best practice standards for demonstrating mature technologies and design stability before entering the more costly system demonstration phase. Finally, no programs we assessed had all of their critical manufacturing processes in statistical control when they entered production, and most programs were not even collecting data to do so. Also, programs assessed this year did not improve on the level of knowledge attained at critical junctures from those assessed in 2005. This year, in an effort to further understand the cause of poor DOD outcomes, we gathered data to determine whether two key systems engineering tools—preliminary design reviews and prototypes—had been used by key junctures to ensure appropriate knowledge before moving forward. Our analysis showed that only a small percentage of programs used either key tool to demonstrate the maturity of the product's design by critical junctures.

The results of our analysis indicate that DOD programs continue to be suboptimal and that the lack of knowledge at key junctures of system development continues to be a major cause of these outcomes. The final

[2]Not all programs provided information for every knowledge point or had proceeded through system development. Details of our scope and methodology can be found in appendix I.

result is lost buying power and opportunities to recapitalize the force. About 60 percent of the programs we assessed had to reset their business case at least once because they lacked necessary knowledge to reasonably estimate the cost and time it would take to develop and produce the product. The continuing absence of knowledge-based acquisition processes steeped in disciplined systems engineering practices—aimed at analyzing requirements to determine their reasonableness before a program starts—contributed significantly to this. Our work has shown that systems engineering is a best practice used by commercial firms to ensure that requirements are well understood and achievable within given resources before system development starts. Our analysis of requirements changes occurring after system development began within DOD programs indicates that this practice is not always used. Likewise, increased risks to the government can occur when DOD enters into contracts to develop these complex systems before performing thorough requirements analysis to ensure specific needs can be met. Finally, long development cycle times invite additional instability for programs.

In addition to gathering information on acquisition outcomes and the achievement of critical knowledge at key junctures, this year we also present new data as an indicator of other factors that could potentially influence DOD's ability to manage its programs and improve cost and schedule outcomes. These factors include changes in performance requirements, program manager tenure, composition of the government workforce, and because of its increasing importance to performance, software management. Our analysis of these factors can be summarized as follows:

- Unsettled requirements in acquisition programs can create significant turbulence. Sixty-three percent of the programs we received data from had requirement changes after system development began. These programs encountered cost increases of 72 percent, while costs grew by 11 percent among those programs that did not change requirements.

- Frequent program manager turnover occurs during system development. For programs started since 2001, the average tenure to date for program managers has been 17 months—less than half of what is prescribed by DOD policy—challenging continuity and accountability.

- DOD relies heavily on contractors to perform roles that have in the past been performed by government employees. For programs we assessed, about 48 percent of their staff was made up of individuals outside of the government; performing engineering, business, and supporting program management related roles. These data raise questions about whether DOD has the appropriate mix of staff and capabilities within its workforce to effectively manage programs.

- Programs continue to have difficulty managing software development for weapon systems. Roughly half of the programs that provided us data had more than a 25 percent growth in their expected lines of code since starting system development. Changes to the amount of software needing to be developed for such programs often indicate the potential for cost and schedule problems.

There is reason for optimism. Based in part on GAO recommendations and congressional direction, DOD has recently begun to develop several initiatives that, if adopted and implemented properly, could provide a foundation for establishing sound, knowledge-based business cases for individual acquisition programs and improving program outcomes. For example, a new concept decision review initiative, guidance for determining acquisition approaches based on capability need dates, and the establishment of review boards to monitor weapon system configuration changes are all designed to enable key department leaders to make informed decisions well ahead of a program's start. This should help DOD attain a closer match between each program's requirements and available resources. Improvements to individual acquisition program outcomes hinge on the success of these initiatives paired with rigorous knowledge-based acquisition strategies.

Weapon Acquisition Outcomes Continue to Undermine DOD Investments

DOD is not receiving expected returns on its large investment in weapon systems. Our analysis does not show any improvements in acquisition outcomes as programs continue to experience increased costs and delays in delivering capabilities to the warfighter. In fact, when compared to the performance of the fiscal year 2000 portfolio of major defense acquisition programs, cost and schedule performance for current programs is actually worse. Without improved acquisition outcomes in the future, achieving DOD's transformational objectives in a constrained fiscal environment is highly unlikely.

Trends in DOD's Weapon Acquisitions Investments and Outcomes since 2000

While DOD is committing substantially more investment dollars to develop and procure new weapon systems, our analysis shows that the 2007 portfolio of major defense acquisition programs is experiencing greater cost growth and schedule delays than programs in fiscal years 2000 and 2005.[3] For example, as shown in table 1, total acquisition costs for 2007 programs increased 26 percent from first estimates, whereas programs in fiscal year 2000 increased by 6 percent. Total RDT&E costs for programs in 2007 increased by 40 percent from first estimates, compared to 27 percent for programs in 2000.

Table 1: Analysis of DOD Major Defense Acquisition Program Portfolios

Fiscal year 2008 dollars

	Fiscal year		
	2000 portfolio	**2005 portfolio**	**2007 portfolio**
Portfolio size			
Number of programs	75	91	95
Total planned commitments	$790 Billion	$1.5 Trillion	$1.6 Trillion
Commitments outstanding	$380 Billion	$887 Billion	$858 Billion
Portfolio performance			
Change to total RDT&E costs from first estimate	27 percent	33 percent	40 percent
Change in total acquisition cost from first estimate	6 percent	18 percent	26 percent
Estimated total acquisition cost growth	$42 Billion	$202 Billion	$295 Billion
Share of programs with 25 percent or more increase in program acquisition unit cost	37 percent	44 percent	44 percent
Average schedule delay in delivering initial capabilities	16 months	17 months	21 months

Source: GAO analysis of DOD data.

Note: Data were obtained from DOD's Selected Acquisition Reports (dated December 1999, 2004, and 2006) or, in a few cases, data were obtained directly from program offices. Number of programs reflects the programs with Selected Acquisition Reports. In our analysis we have broken a few

[3]Our analysis in this area reflects comparisons of performance for programs meeting DOD's criteria for being major defense acquisition programs in fiscal year 2007 and programs meeting the same criteria in fiscal years 2005 and 2000. The analysis does not include all the same systems in all 3 years.

Selected Acquisition Report programs (such as Missile Defense Agency systems) into smaller elements or programs. Not all programs had comparative cost and schedule data, and these programs were excluded from the analysis where appropriate. Also, data do not include full costs of developing Missile Defense Agency systems.

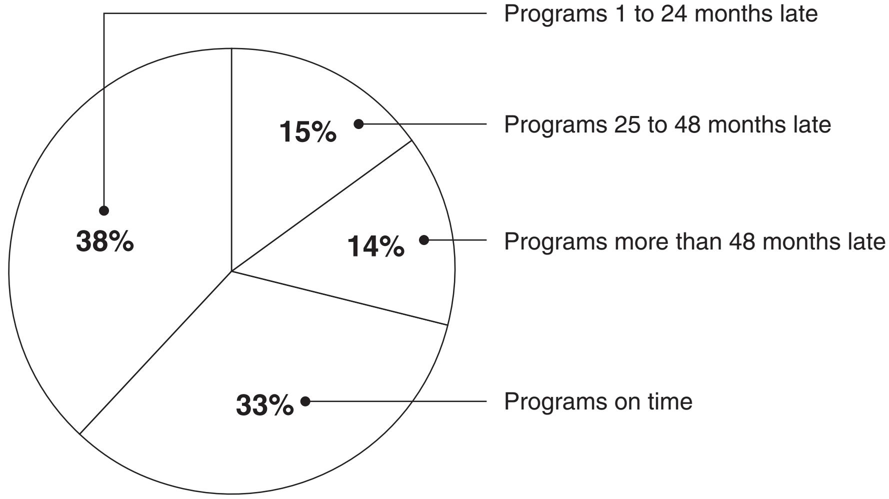
One way to measure program performance is in examining the cost growth as expressed in changes to program acquisition unit cost. This represents the value DOD gets per unit for the acquisition dollars invested in a certain program and shows the net effect of cost growth and quantity changes. According to our analysis of the 2007 portfolio, 44 percent of DOD's major defense acquisition programs are paying at least 25 percent more per unit than originally expected. The proportion of programs experiencing a 25 percent or more increase in program acquisition unit costs in fiscal year 2000 was 37 percent.

The consequence of cost growth is reduced buying power and lost opportunity costs for DOD. Every dollar spent on inefficiencies in acquiring one weapon system is less money available for other opportunities. Total acquisition cost for the current portfolio of major programs under development or in production has grown by nearly $300 billion over initial estimates. As program costs increase, DOD must request more funding to cover the overruns, make trade-offs with existing programs, delay the start of new programs, or take funds from other accounts.

Delivery of Operational Capabilities Continues to Be Late

As important as wasting investment dollars, DOD has already missed fielding dates for many programs and many others are behind schedule. The services' requirement for a new system is often based on replacing aging, legacy systems or filling an expected gap in capability, or both. The warfighter's urgent need for the new weapon system is often cited when the case is first made for developing and producing the system. However, on average, the current portfolio of programs has experienced a 21-month delay in delivering initial operational capability to the warfighter. As shown in figure 1, about two-thirds of the current programs have encountered some form of a delay.

Figure 1: Schedule Delays for Major Weapon Systems



Source: GAO analysis of DOD data.

Note: This reflects planned or actual delivery of initial capabilities for programs with comparable schedule data.

Because of program delays, warfighters often have to operate costly legacy systems longer than expected, find alternatives to fill capability gaps, or go without the capability. Table 2 shows examples where program delays in delivering initial capabilities have affected the military services.

Table 2: Examples of Program Delays and Impacts

Program delays	Impacts
WIN-T	The Army had to take extraordinary efforts to acquire an interim capability to fulfill a gap in communication capabilities for soldiers. The Army's optimistic acquisition approach for the Warfighter Information Network-Tactical (WIN-T) program created the impression that the capability gap was far smaller than it really was, and when the program experienced delays it forced the Army to work outside the normal processes and use supplemental funding to meet an urgent warfighter need. This effort later became the first increment of the WIN-T program.
F-22A and JSF	Because of delayed deliveries and quantity reductions with the F-22A and Joint Strike Fighter (JSF) aircraft, legacy systems (with less capability) will make up a larger proportion of the future fighter fleet for a longer period of time, and the services must now invest billions of dollars to modernize legacy aircraft to keep them available and capable to meet mission requirements. Despite this investment, several legacy F-15 aircraft were recently grounded because of structural safety concerns. Service officials have also raised concerns about whether the number of new aircraft will be sufficient to meet national security requirements with an acceptable level of risk.

(Continued From Previous Page)

Program delays	Impacts
Aerial Common Sensor	Significant delays in delivering the capabilities expected from the Aerial Common Sensor program are now requiring the Army and Navy to make unanticipated investments in already existing intelligence, surveillance, and reconnaissance systems at the same time that they are developing the new replacement systems.
Global Hawk	Delays in the Global Hawk program have contributed to the need to keep the U- 2 in the inventory longer than anticipated. The Air Force is now developing a plan to fully retire the U-2s a year later in 2013 and at a slower rate, which will increase the funds needed to operate and support these aircraft over this extended period.

Source: GAO.

Current U.S. Fiscal Challenges Will Affect DOD's Acquisition Funding

DOD is in a period of high investment that will be difficult to sustain given the many internal and external budgetary pressures faced by the department in today's fiscal environment. Over the next 5 years, DOD expects to expend approximately $900 billion in research, development, test, and evaluation and procurement funds (fiscal year 2008 dollars). About $335 billion, or 37 percent, is for the acquisition of its current portfolio of 95 major defense acquisition programs. To illustrate the significance of these investments, table 3 lists the top 10 programs that will dominate DOD's budget over that time. If the trend DOD is experiencing today continues into the future years, one can easily see how these programs, now 58 percent of funding for all Major Defense Acquisition Programs, could encompass a much larger share of the funding.

Table 3: Planned RDT&E and Procurement Funding for Major Defense Acquisition Programs, as of December 2006

Fiscal year 2008 dollars in billions

	Fiscal year					
Program	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Ballistic Missile Defense System	$8.9	$9.1	$9.1	$8.9	$8.8	**$44.9**
Joint Strike Fighter	6.7	6.9	8.1	8.4	11.3	**$41.4**
Virginia Class Submarine	2.9	3.7	3.9	3.8	4.7	**$19.0**
Future Combat Systems	3.6	3.2	3.2	3.2	3.7	**$17.0**
V-22 Joint Services Advanced Vertical Lift Aircraft	3.0	3.1	3.1	2.8	3.0	**$15.0**
DDG 1000 Destroyer	3.5	2.8	2.9	2.7	2.6	**$14.4**
Future Aircraft Carrier CVN-21	3.1	4.6	1.7	0.6	3.4	**$13.4**
F-22A	4.4	4.3	0.5	0.4	0.5	**$10.1**

(Continued From Previous Page)

Fiscal year 2008 dollars in billions

Program	Fiscal year 2008	2009	2010	2011	2012	Total
P-8A Multi–mission Maritime Aircraft	0.9	1.2	2.9	2.7	2.5	**$10.1**
F/A-18 EF	2.1	1.7	1.9	1.6	1.5	**$8.8**
Funding for Top 10 MDAP programs	39.1	40.6	37.3	35.2	42.0	**$194.2**
Funding for other 85 MDAP programs	33.2	31.5	26.9	25.4	24.1	**$141.1**
Total	**$72.3**	**$72.1**	**$64.2**	**$60.6**	**$66.1**	**$335.3**
Top 10 MDAP programs (percentage of total)	54	56	58	58	64	58

Source: GAO analysis of DOD data.

Note: Numbers may not add due to rounding. The Ballistic Missile Defense System is composed of several programs. We have assessed several of these programs later in this report.

In addition, other military needs can be expected to challenge the funding for these investments. Within DOD's internal budget, investment in new weapon systems competes with those funds necessary to replace equipment and sustain operations in Iraq and Afghanistan. Between September 2001 and May 2007, DOD has been provided $542.9 billion to support the global war on terror. War operations have identified the need for new, alternative systems and have resulted in greater wear on existing weapons that will need refurbishment or replacement sooner than expected. For example, DOD's urgent need for armored vehicles to protect personnel from mine blasts, are not included in the planned acquisition costs for the December 2006 major defense programs discussed above. These vehicles are estimated to cost about $13.5 billion between 2006 and 2008.[4]

Other government spending priorities will place external pressure on DOD's planned investment in major weapon systems. As nondiscretionary programs like Social Security, Medicare, and Medicaid consume a growing percentage of the available budget, discretionary programs—including defense—face competition for increasingly scarce resources. As a result, sustaining real topline budget increases in any discretionary program will

[4]These figures represent cost and quantity estimates based on Presidents' budgets and supplemental requests for fiscal years 2006 through 2008 but do not include recent orders for more vehicles.

be difficult. DOD's investment in weapon systems represents one of the largest discretionary items in the budget. Since 1978, discretionary funding has decreased from 52 percent of the federal budget to an estimated 37 percent in 2007. While the percentage of discretionary funding is declining, DOD's budget continues to demand a larger portion of what is available, thereby leaving a smaller percentage for other activities.

DOD Weapon System Programs Are Still Not Following a Knowledge-Based Approach

We continue to find that a prime contributor to DOD's poor program outcomes is the lack of widespread adoption of a knowledge-based acquisition process within DOD despite polices that support such a process. Our assessment of 72 weapon systems shows that DOD programs continue to proceed through critical junctures with knowledge gaps that expose programs to significant, unnecessary technology, design, and production risks. Because of this, many programs in our assessment have experienced cost growth and schedule delays. Our analysis also shows that there has not been an increase in the share of programs achieving key elements of product knowledge at critical junctures over what we found in our 2005 assessment. As a result, DOD programs are likely to continue to experience a cascade of negative effects that affect both costs and schedules.

A Knowledge-Based Acquisition Approach Can Lead to Better Program Outcomes

In order to have good outcomes, best commercial practices require the use of a knowledge-based approach to product development that demonstrates high levels of knowledge before significant commitments are made. This type of strategy is essential for getting better outcomes for DOD programs. The achievement of the right knowledge at the right time enables leadership to make informed decisions about when and how best to move into various acquisition phases. In essence, knowledge supplants risk over time. This building of knowledge consists of information that should be gathered at three critical points over the course of a program:

- **Knowledge point 1**: Resources and needs match. Achieving a high level of technology maturity by the start of system development is an important indicator of whether this match has been made.[5] This means that the technologies needed to meet essential product requirements have been demonstrated to work in their intended environment. In addition, the producer has completed a preliminary design of the product that shows the design is feasible.

- **Knowledge point 2**: Product design is stable. This point occurs when a program determines that a product's design is stable—that is, it will meet customer requirements, as well as cost, schedule, and reliability targets. A best practice is to achieve design stability at the system-level critical design review, usually held midway through system development. Completion of at least 90 percent of engineering drawings at the system design review provides tangible evidence that the design is stable, and a prototype demonstration shows that the design is capable of meeting performance requirements.

- **Knowledge point 3**: Production processes are mature. This point is achieved when it has been demonstrated that the company can manufacture the product within cost, schedule, and quality targets. A best practice is to ensure that all key manufacturing processes are in statistical control—that is, they are repeatable, sustainable, and capable of consistently producing parts within the product's quality tolerances and standards—at the start of production. Demonstration of a fully integrated product in its intended environment shows that the product works as needed.

Outcomes for the Programs We Assessed Mirror Outcomes for the Overall DOD Major Acquisition Program Portfolio

For this report, we assessed 72 individual programs and found that outcomes for a large portion of those programs are consistent with DOD's

[5]The start of system development as used here indicates the point at which significant financial commitment is made to design, integrate, and demonstrate that the product will meet the user's requirements and can be manufactured on time, with high quality, and at a cost that provides an acceptable return on investment. System development follows concept refinement and technology development which is intended to mature technologies and deliver a preliminary design of the proposed solution.

overall portfolio of major defense acquisition programs—they cost more and are taking longer to field than originally planned (see table 4).[6]

Table 4: Outcomes for Weapon Programs in 2008 Assessment

Performance indicators	Outcomes to date
Increase in RDT&E costs from first estimate	38 percent
Share of programs with more than 25 percent growth in program acquisition unit cost	47 percent
Average schedule delay in delivering initial capabilities	23 months

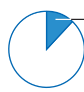
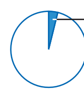
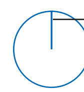
Source: GAO analysis of DOD data.

Note: Not all programs in our assessment have entered system development or had comparable first and latest estimates to measure outcomes. These programs were not included in our analysis. Details of our scope and methodology can be found in appendix I.

In assessing the 72 weapon programs, we found no evidence of widespread adoption of a knowledge-based acquisition strategy. The majority of programs in our assessment this year proceeded with lower levels of knowledge at critical junctures and attained key elements of product knowledge later in development than expected under best practices. The building of knowledge over a product's development is cumulative, as one knowledge point builds on the next, and failure to capture key product knowledge can lead to problems that eventually cascade and become magnified throughout product development and production. Consequently, programs managed without the knowledge-based process are more likely to have surprises in the form of cost and schedule increases. Figure 2 compares the degree of cumulative product knowledge at critical decision points for DOD programs in our assessment versus best practices standards.

[6]While the programs we assessed were not chosen to be representative of the broader defense acquisition portfolio, the outcomes of the programs in our assessment closely mirror those of the 2007 portfolio of major defense acquisition programs discussed earlier in this report.

Figure 2: Knowledge Achievement for Weapon System Programs in 2008 Assessment at Key Junctures

Key junctures	Development start	Design review	Production start
	Knowledge point 1	**Knowledge point 2**	**Knowledge point 3**
Best practices	Mature all critical technologies	Achieve knowledge point 1 on time and complete 90 percent of engineering drawings	Achieve knowledge points 1 and 2 on time, and have all critical processes under statistical control
DOD outcomes[a]	 12 percent of programs	 4 percent of programs	 0 percent of programs[b]

Source: GAO analysis of DOD data.

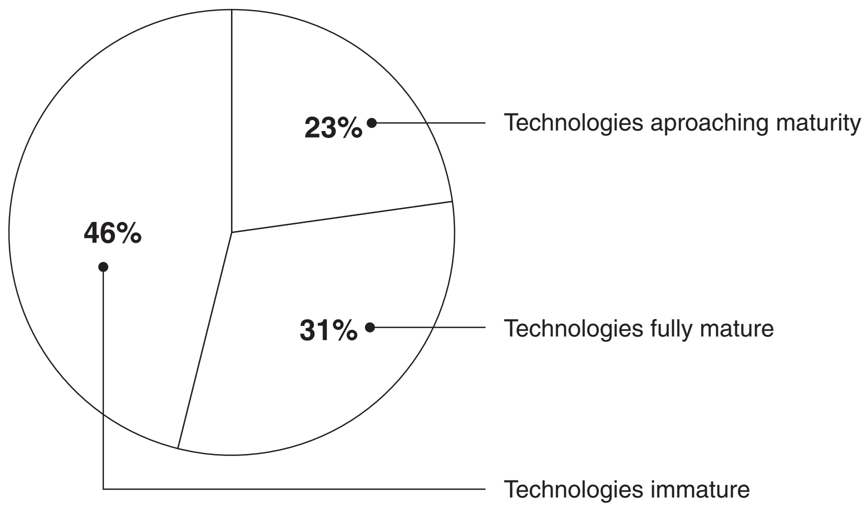
[a]Not all programs provided information for each knowledge point or had passed through all three key junctures.

[b]In our assessment, two programs—the Light Utility Helicopter and the Joint Cargo Aircraft—are depicted as meeting all three knowledge points when they began at production start. We excluded these two programs from our analysis because they were based on commercially available products and we did not assess their knowledge attainment with our best practices metrics.

Programs Enter System Development without Mature Technologies or Sound Preliminary Design

Very few programs start system development with evidence that the proposed solution is based on mature technologies and proven design features. Achieving knowledge point 1 at system development start makes it easier to reach the remaining two knowledge points at the right time. Only 12 percent of the programs in our assessment demonstrated all of their critical technologies as fully mature at the start of system development, meaning that 88 percent fell short of achieving knowledge point 1. Without mature technologies, it is difficult to know whether the product under design will meet customer requirements or if the design allows enough space for technology integration. As shown in figure 3, for the 356 critical technologies at system development start in the programs we assessed, only 31 percent were fully mature and only another 23 percent were approaching full maturity. This means that programs accepted 164 technologies, or 46 percent, into their product's design based on no more than a laboratory demonstration of basic performance, technical feasibility, and functionality, and not on a representative model or prototype demonstration close to form and fit (size, weight, and materials) in a relevant or realistic environment. In some cases, technologies were in very early technology development stages when weapon program managers accepted them as part of their system development programs.

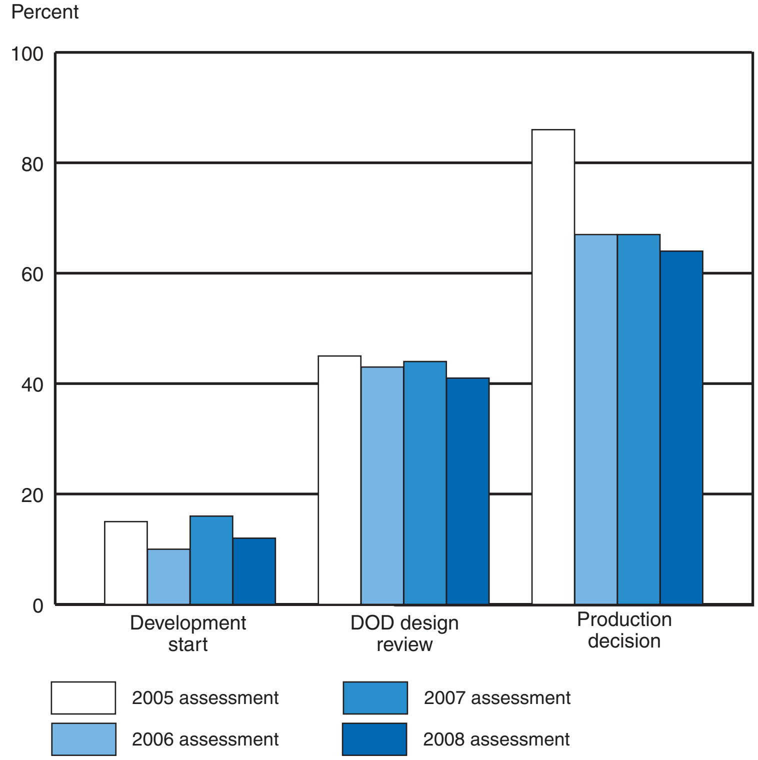
Figure 3: Maturity Levels of Critical Technologies for DOD Programs



Source: GAO analysis of DOD data.

Programs that are still working to mature technologies while they are also maturing the system design and preparing for production have higher cost growth than programs that start system development with mature technologies. For those programs in our assessment with immature technologies at system development start, the total RDT&E costs grew by 44 percent more than for programs that began with mature technologies. More often than not, programs were still maturing technologies late into system development and even into production. This trend is troublesome, as we have found the share of programs with fully mature technologies prior to production has actually decreased from our 2005 assessment (see fig. 4).

Figure 4: Percentage of Programs Achieving Technology Maturity at Key Junctures



Source: GAO analysis of DOD data.

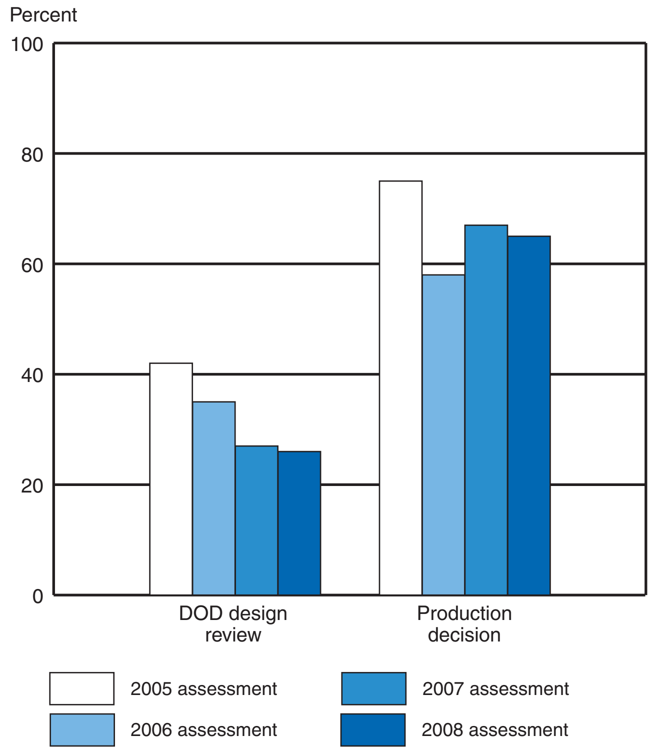
In addition to ensuring that technologies are mature by system development start, best product development practices suggest that the developer should have delivered a preliminary design of the proposed solution based on a robust systems engineering process before committing to system development. This process should allow the developer to analyze the customer's expectations for the product and identify gaps between resources and expectations, which then can be addressed through additional investments, alternate designs, and ultimately trade-offs. Only 10 percent of the programs in our assessment had completed their preliminary design review prior to committing to system development. For programs that had not completed the preliminary design review, it was an average of about 2 1/2 years into system development before the review was completed or was planned to be completed. GAO's work has shown that successfully completing this review and delivering a sound preliminary design based on mature technological solutions leads to better and more predictable program outcomes. DOD programs, like the Aerial Common

Sensor and Joint Strike Fighter, that did not deliver sound preliminary designs at system development start and discovered problems early in their design activities required substantial resources be added to the programs or, in the case of Aerial Common Sensor, termination of the system development contract.

Programs Continue to Move into System Demonstration and Production without Achieving Design Stability

As previously shown in figure 2, only a small portion of the programs in our assessment that have held a design review captured the necessary knowledge to ensure that they had mature technologies at system development start and a stable design before entering the more costly system demonstration phase of development. Over half of the programs in our assessment did not even have mature technologies at the design review (knowledge that actually should have been achieved before system development start). Also less than one-quarter of the programs that provided data on drawings released at the design review reached the best practices standard of 90 percent, which is a smaller share than programs in our 2005 assessment (see fig. 5). Knowing that a product's design is stable before system demonstration reduces the risk of costly design changes occurring during the manufacturing of production representative prototypes—when investments in acquisitions become more significant. Even by the beginning of production, more than a third of the programs that had entered this phase still had not released 90 percent of their engineering drawings.

Figure 5: Percentage of Programs Releasing 90 Percent of Engineering Drawings by Key Junctures



Source: GAO analysis of DOD data.

We have found that programs moving forward into system demonstration with low levels of design stability are more likely than other programs to encounter costly design changes and parts shortages that in turn cause labor inefficiencies, schedule delays, and quality problems. In addition, we found that over 80 percent of the programs providing data did not or did not plan to demonstrate the successful integration of the key subsystems and components needed for the product through an integration laboratory, or better yet through testing an early system prototype by the design review. Demonstrating that the system can be successfully integrated before the critical design review is a best practice that provides additional evidence of design stability before a program makes costly investments in materials, manufacturing equipment, and personnel to begin building production representative prototypes for the system demonstration phase. For example, the Navy's E-2D Advanced Hawkeye moved past the design review and entered systems demonstration without fully proving—through the use of an integration lab or prototype—that the design could be successfully integrated. The program did not have all the components operational in a systems integration lab until almost 2 years after the design review. While the program estimated it had released 90 percent of the drawings needed for the system by the design review, as it was conducting system integration activities, it discovered that it needed substantially more drawings. This increase means that the program really had completed only 53 percent of the drawings prior to the review, making it difficult to ensure the design was stable.

Programs Enter Production without Demonstrating Acceptable Manufacturing and Test Performance

In addition to lacking mature technologies and design stability, most programs have not or do not plan to capture critical manufacturing and testing knowledge before entering production. This knowledge ensures that the product will work as intended and can be manufactured efficiently to meet cost, schedule, and quality targets. Of the 26 programs in our assessment that have had production decisions, none of them provided data showing that they had all their critical processes in statistical control by the time they entered into the production phase.[7] In fact, only three of these programs indicated that they had even identified the key product characteristics or associated critical manufacturing processes—key initial steps to ensuring critical production elements are stable and in control. Failing to capture key manufacturing knowledge before producing the product can lead to inefficiencies and quality problems. For example, the Wideband Global SATCOM program encountered cost and schedule delays because contractor personnel installed fasteners incorrectly. Discovery of the problem resulted in extensive inspection and rework to correct the deficiencies, contributing to a 15-month schedule delay. The Missile Defense Agency's Ground-Based Midcourse Defense system continues to encounter quality issues with delivered interceptors. Officials believe inadequate controls may have allowed less reliable or inappropriate parts to be incorporated into the manufacturing processes of two key subsystems.

[7]We have excluded two programs from this calculation, Light Utility Helicopter and Joint Cargo Aircraft. While we have assessed these programs as having mature manufacturing processes, this is because they are commercial acquisitions, not because processes were demonstrated to be in statistical control. Also, the Multifunctional Information Distribution System (MIDS) program indicates that its two critical processes are in statistical control but it has not formally entered the production phase.

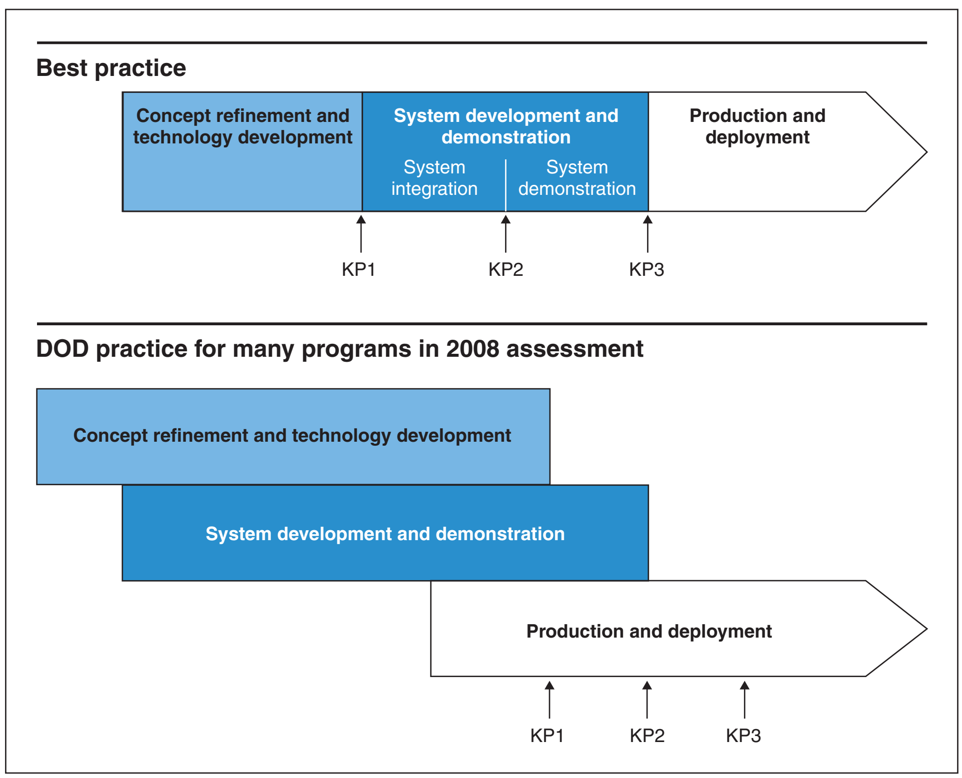
In addition to demonstrating that the product can be built efficiently, GAO's work has shown that production and post-production costs are minimized when a fully integrated, capable prototype is demonstrated to show it will work as intended and in a reliable manner. We found that many programs are very susceptible to discovering costly problems late in development, when the more complex software and advanced capabilities are tested. Of the 33 programs that provided us data about the overlap between system development and production, almost three-quarters still had or planned to have system demonstration activities left to complete after production had begun. For nine programs, the amount of system development work remaining was estimated to be over 4 years. This practice of beginning production before successfully demonstrating that the weapon system will work as intended increases the potential for discovering costly design changes that ripple through production into products already fielded, and usually require substantial modification costs at a later time.

Forty programs we assessed provided us information on when they had or planned to have first tested a fully configured, integrated production representative article (i.e., prototype) in the intended environment. Of these, 38 percent reported that they had already conducted or planned to conduct a development test of a fully configured, integrated prototype before they make a production decision. In other cases, we found instances where it would be several years after production has begun before the fully integrated, capable product was first tested. We also found examples where product reliability is not being demonstrated in a timely fashion. Making design changes to achieve reliability requirements after production begins is inefficient and costly. For example, during flight tests in 2007, the Air Force's Joint Air-to-Surface Standoff Missile encountered four failures during four tests, resulting in an overall missile reliability rate of less than 60 percent despite being more than 5 years past the production decision. The failures halted procurement of new missiles by the Air Force until the problems could be resolved.

DOD's Practices Lead to Concurrent Development, Test, and Production

The absence of a knowledge-based acquisition process results in DOD continuing to develop new weapon systems in a highly concurrent environment, which forces acquisition programs to manage technology, design, and manufacturing risks at the same time and can lead to waste from costly rework. This environment has made it difficult for either DOD or congressional decision makers to make informed decisions because appropriate knowledge has not been available at key decision points. Rather than seeking to reduce risk early in programs, DOD's common practice for managing this environment has been to create aggressive risk mitigation plans in its programs after poor investment decisions have been made. Figure 6 shows a generalization of the overlapping, concurrent approach that DOD uses to develop its weapon systems. As discussed earlier, in a large percentage of cases, DOD programs were still maturing technologies, stabilizing designs, and bringing production processes into control long after the program had entered production. This means that these programs were not achieving all three knowledge points (KP) until after entering production, long after the programs passed through decision points when this knowledge should have been available—a high-risk approach.

Figure 6: Best Practices Compared to DOD Practices for Programs in 2008 Assessment



Source: GAO.

More important, the problems created by this concurrent approach on individual programs can profoundly affect the pressure placed on DOD's budget. It is difficult to prioritize and allocate limited budgets among needed requirements when acquisition programs' costs and schedules are always in question. Programs that are managed without the knowledge-based process are more likely than other programs to have unpredictable cost and schedule implications that are accommodated by either reducing overall program quantities or disrupting the funding of other programs. Because of these disruptions, decision makers are not able to focus on a balanced investment strategy.

DOD Practices Continue to Contribute to Program Risk and Instability

Our work has shown that knowledge-based acquisition processes for individual programs are often lacking because DOD acquisition practices necessary to ensure effective implementation are not always followed, despite policies and guidance to the contrary. We have frequently reported on the importance of having a solid, executable business case before committing resources to new product development. In its simplest form, a sound business case provides evidence that (1) the warfighter's needs are valid and can best be met with the chosen concept and (2) the chosen concept can be developed and produced within existing resources—that is, proven technologies, along with adequate funding, design knowledge, and time to deliver the product when needed. Without the timely use of systems engineering activities, DOD does not effectively translate customer wants into specific product characteristics and functions, and ultimately into a preferred design. As a result, DOD weapon programs suffer from unexecutable business cases, resulting in unsettled requirements and funding instability, which can lead to unnecessary risks and long development cycle times.

Absence of Disciplined Systems Engineering Practices Leads to Unexecutable Business Cases

The absence of a knowledge-based acquisition process steeped in disciplined systems engineering practices contributes greatly to DOD's poor acquisition outcomes. Systems engineering is a process that translates customer wants into specific product features for which requisite technological, software, engineering, and production capabilities can be identified. These activities include requirements analysis, design, and testing to ensure that the product's requirements are achievable and designable given available resources. However, it is not just the use of systems engineering in the development of a new product or weapon system, but also when it is used, that makes it a best practice. Early systems engineering provides knowledge that enables a developer to identify and resolve gaps before product development begins, such as overly optimistic requirements that cannot be expected to be met with current resources. Consequently, establishing a sound acquisition program with an executable business case depends on determining achievable requirements, based on systems engineering, that are agreed to by both the acquirer and the developer before a program's initiation.

DOD programs often do not conduct systems engineering in a timely fashion to support critical investment junctures within programs or, in some cases, omit key systems engineering activities altogether. For example, the C-130 Avionics Modernization Program did not adequately analyze the product's requirements at the program's outset, a key systems engineering activity. As a result, when the program needed to integrate new avionics into the test aircraft, the amount of wiring and the number of harnesses and brackets needed for the installation had been underestimated by 400 percent. In another example, B-2 Radar Modernization Program officials also stated some key aspects of the systems engineering process were not completed. This caused schedule delays when technical problems with the antenna performance were discovered during flight testing. We have recently reported on the impact that poor systems engineering practices have had on several programs such as the Global Hawk Unmanned Aircraft System, F-22A, Expeditionary Fighting Vehicle, Joint Air-to-Surface Standoff Missile, and others.[8]

While these are anecdotal examples, they are indicative of the type of uncertainty that exists when DOD programs begin. Based on information obtained from 43 programs, our analysis shows that 58 percent of the programs had to reset their baseline at least once. Some programs have had a significant number of rebaselines, such as the V-22 program, which has had to reset its baseline 10 times.

Program Uncertainties Lead to Unnecessary Risks

DOD often sets optimistic requirements for weapon programs that require new and unproven technologies. Unfortunately, when early analysis is not performed to ensure that specific DOD needs can be met and that requirements are firmly established and understood prior to starting system development, increased cost risk to the government can occur. During weapon system development, DOD often asks prime contractors to

[8]GAO, *Best Practices: Increased Focus on Requirements and Oversight Needed to Improve DOD's Acquisition Environment and Weapon System Quality,* GAO-08-294 (Washington D.C.: Feb. 1, 2008).

develop cutting-edge systems and awards cost reimbursement type contracts for which the government pays the allowable incurred costs to the extent provided by the contract.[9] In these cases, the government reimburses the contractor for its best efforts in completing the contract requirements. However, because the government often does not perform the proper up-front analysis to determine whether its needs can be met, significant contract cost increases can occur as the scope of the requirements changes or becomes better understood by the government and contractor. As such, the consequences of poorly formed and analyzed requirements are manifested in these changes to contract costs over the course of the period of performance, with the government taking on the burden of the increases. For example, the Joint Strike Fighter and Future Combat Systems (FCS) are expected to be developed on a cost reimbursable basis for 12 years. As of fiscal year 2007, DOD anticipates having to reimburse the prime contractors on these two programs nearly $13 billion more for their work activities than initially expected. Table 5 illustrates eight development programs within the scope of our review that use cost reimbursement type contracts and have experienced or anticipate significant increases to initial contract prices.

Table 5: Significant Changes to Contract Prices for DOD Development Contracts

Then year dollars in millions

Program	Prime contractor	Initial contract target price [a]	DOD's estimated price at completion	Actual or anticipated price change	Percentage change
Joint Strike Fighter	Lockheed Martin	$18,981.9	$25,873.2	$6,891.3	36
Future Combat Systems[b]	Boeing	$14,924.8	$20,882.9	$5,958.1	40
National Polar-orbiting Operational Environmental Satellite System	Northrop Grumman	$2,942.7	$5,106.0	$2,163.3	74
Advanced Extremely High Frequency Satellites	Lockheed Martin	$2,839.0	$4,149.3	$1,310.3	46
Expeditionary Fighting Vehicle	General Dynamics	$712.1	$1,283.9	$571.8	80

[9]In contrast, a firm-fixed price contract provides for a pre-established price, and places more risk and responsibility for costs and resulting profit or loss on the contractor and provides more incentive for efficient and economical performance. With either a cost reimbursement or a firm-fixed price type contract, if the government changes the requirements after performance has begun, which then causes a price or cost increase to the contractor, the government must pay for these changes.

(Continued From Previous Page)

Then year dollars in millions

Program	Prime contractor	Initial contract target price [a]	DOD's estimated price at completion	Actual or anticipated price change	Percentage change
Excalibur Precision Guided Extended Range Artillery Projectile	Raytheon	$51.2	$518.0	$466.8	912
C-130 Avionics Modernization Program	Boeing	$484.6	$2,048.4	$1,563.8	323
Joint Tactical Radio System Ground Mobile Radio	Boeing	$235.5	$966.3	$730.8	310

Source: GAO analysis of data from DOD's Selected Acquisition Reports.

[a]Price means cost plus any fee or profit applicable to the contract type.

[b]Future Combat Systems began under an Other Transaction Authority agreement but was converted to a traditional contract subject to the Federal Acquisition Regulation in 2005. Both the agreement and the contract provided for reimbursement of the vendors costs. The initial contract target price reflects the price under the Other Transaction Authority agreement and DOD's estimated price at completion reflects estimated costs of the contract.

We have found examples of programs extending the use of cost reimbursement contracts into the production phase instead of using fixed priced contracts, reflecting uncertainties as programs enter production. For example, the Joint Strike Fighter plans to use cost reimbursement contracts for as many as 7 years worth of low-rate initial production orders. According to program officials, it hopes to transition to a fixed price contract sometime before full-rate production, but by this time it could have procured over 275 aircraft at a cost of over $40 billion.

Long DOD Development Cycle Times Contribute to Instability

A hallmark of an executable program with a sound business case is short development cycle times. Long cycle times promote instability, especially considering DOD's tendency to have changing requirements and program manager turnover. In fact, DOD itself suggests that system development should be limited to about 5 years. Time-defined constraints such as this are important because they serve to limit the initial product's requirements, allow for more frequent assimilation of new technologies into weapon systems, and speed new capabilities to the warfighter. Most programs we assessed were based on cycle times much longer than those prescribed through best practices. While there are isolated examples of programs with cycle times shorter than 5 years, the majority of programs included in our assessment were established with cycle times much longer than this. For 34 programs that have been started since 2001, only 11 programs (32 percent) even planned their development cycle times to be less than 5 years.

Additional Factors Can Contribute to Poor Weapon Acquisition Outcomes

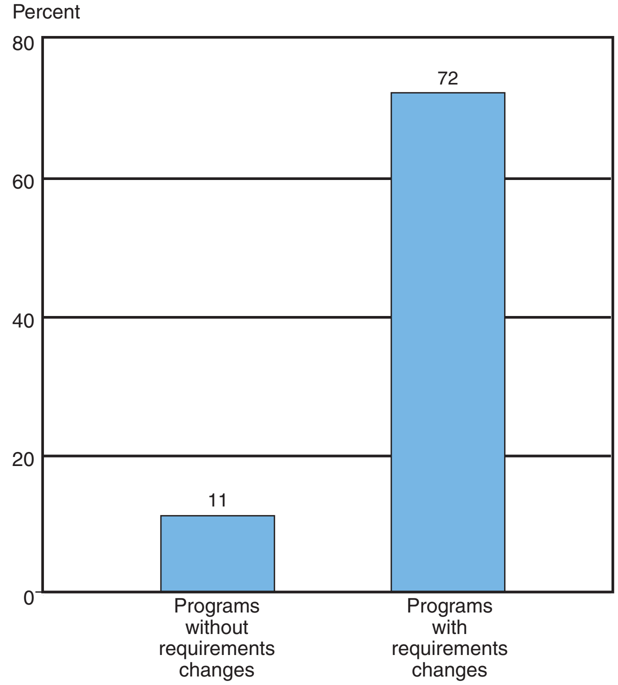
This year we also gathered new data focused on other factors we believe could have a significant influence on DOD's ability to improve cost and schedule outcomes. Foremost, several DOD programs in our assessment incurred requirements changes after the start of system development and also experienced cost increases. At the same time, DOD's practice of frequently changing program managers during a program's development makes it difficult to hold them accountable for the business cases that they are entrusted to manage and deliver. We also found that DOD is relying more on contractors to support the management and oversight of weapon system acquisitions and contracts, which could add risk to programs. Finally, as programs rely more heavily on software to perform critical functions for weapon systems, we found that a large number of programs are encountering difficulties in managing their software development.

Stable Requirements Are Needed for Improved Outcomes

As stated previously, establishing a valid need and translating that into system requirements is essential for obtaining the right program outcome. Without these, DOD increases the risk that it will pay too much for the system or enter too quickly into a business case that exposes the department to unnecessary risks. However, once DOD system development programs are under way, and despite efforts to define needed capabilities, product requirements often do change—the problem or threat the program was seeking to address changes or the user and acquisition communities may simply change their minds about a program. Among the 46 programs we surveyed, 63 percent of them indicated that requirements had changed in some fashion (additions, reductions, or deferments) since system development start. Our analysis of program data shows that this instability can have a profound impact on a program's costs. Figure 7 illustrates how RDT&E costs increased by 11 percent over initial estimates for programs that have not had requirements changes, while they increased 72 percent among those that had requirements changes.[10]

[10]This average does not include the C-130 J program because of its extreme RDT&E cost growth. The average including C-130 J is 210 percent.

Figure 7: Average RDT&E Cost Growth for Programs since Initial Estimates



Source: GAO analysis of DOD data.

Frequent Changes to Program Management Reduce Accountability

DOD frequently changes program managers during a product's development program, making it difficult to hold one program manager accountable for the content of the program's business case when it is established and to ensure that a knowledge-based acquisition process is followed. According to DOD policy, the assignment period for program managers is required to be at least until completion of the major milestone that occurs closest in time to the date on which the manager has served in the position for 4 years. We recently reported that rather than lengthy assignment periods, as suggested by best practices and DOD's own policy, many of the programs we reviewed had multiple program managers within the same milestone.[11] Our analysis indicates that for 39 major acquisition programs started since March 2001, the average time in system development was about 37 months. The average tenure for program

[11]GAO, *Defense Acquisitions: Department of Defense Actions on Program Manager Empowerment and Accountability,* GAO-08-62R (Washington, D.C.: Nov. 9, 2007).

managers on those programs during that time was about 17 months—less than half of what is required by DOD policy. This practice may promote shortsightedness, challenge continuity, and reduce accountability for poor outcomes. It might also discourage managers from raising issues and addressing problems early, keeping them from realistically estimating the resources needed to deliver the program. Consequently, program managers may have little incentive to pursue knowledge-based acquisition approaches, as program funding is not tied to successfully reaching knowledge points before a program can move forward.

As part of a new strategy for program manager empowerment and accountability, DOD plans a variety of actions to enhance development opportunities, provide more incentives, and arrange knowledge-sharing opportunities. For example, DOD intends to increase "just-in-time" training, establish a formal mentoring program, and plans to explore the use of monetary awards. However, the new practices DOD is planning to implement will not be as effective as they could be until DOD ensures that program managers are given acquisition programs that are executable—that is, programs that are the result of an integrated, portfolio-based approach to investments and that have a sound business case. Only then will program managers be placed in a better position to carry out their programs in a manner suited for successful outcomes.

DOD Relying Heavily on Contractors to Support Program Management Responsibilities

The federal government is increasingly reliant on the private sector in general and contractors in particular to deliver a whole range of products and services, provide hard to find skills, augment capacity on an emergency basis, and reduce the size of government.[12] At a time when weapon acquisitions are becoming more complex and larger in size, DOD is likewise relying more on contractors and other non-government personnel to help manage and oversee weapon system programs and their contractors. On the basis of our work looking at various weapon systems, we have observed that DOD has given contractors increased program management responsibilities for activities such as developing requirements, designing products, and estimating costs—key aspects of setting and executing a program's business case. Table 6 shows that the 52 DOD programs that provided information indicated that about 48 percent

[12] *Report of the Acquisition Advisory Panel to the Office of Federal Procurement Policy and the United States Congress* (January 2007).

of the program office staff was composed of individuals outside of the government.

Table 6: Program Office Staffing Composition for 52 DOD Programs

Percentage of staff

	Program management	Administrative support	Business functions	Engineering and technical	Other	Total
Government	**70**	**39**	**64**	**48**	**45**	**52**
Support contractors	22	60	35	34	55	36
Other non-government[a]	8	1	1	18	1	12
Total non-government	**30**	**61**	**36**	**52**	**56**	**48**

Source: GAO analysis of DOD data.

Note: Table may not add due to rounding.

[a]Other includes federally funded research and development centers, universities, and affiliates.

GAO has noted that the DOD workforce faces serious challenges and has expressed concerns about DOD's reliance on contractors to perform roles that have in the past been performed by government employees. Without the right-sized workforce, with the right skills, we believe this could place greater risk on the government for fraud, waste, and abuse.[13] In part, this increased reliance has occurred because DOD is experiencing a critical shortage of certain acquisition professionals with technical skills as it has downsized its workforce over the last decade. For example, in a prior review of space acquisition programs, we found that 8 of 13 cost-estimating organizations and program offices believed the number of cost estimators was inadequate and we found that 10 of those offices had more contractor personnel preparing cost estimates than government personnel. We also found examples during this year's assessment where the program offices expressed concerns about having inadequate personnel to conduct their program office roles.

[13]GAO, *DOD Transformation: Challenges and Opportunities*, GAO-08-323CG (Washington D.C.: Nov. 29, 2007).

Effective Software Management Necessary for Delivering Critical Capability

Modern weapon systems are increasingly more dependent on software than anytime before, and the development of complex software represents a potential leap forward in operational capability for any number of DOD defense acquisitions. Much of a system's functionality is controlled by software. Technological advancements have even made it possible for software to perform functions once handled by hardware. As this demand for complex software grows, the use of disciplined, structured development processes that measure, manage, and control software requirements is essential to delivering software-intensive systems on time and within budget. Our prior work has shown that one key metric used by leading software developers is to measure changes to the amount of software code developed for the program.[14] Size metrics, such as lines of code, are used to compare the amount of software code produced with the amount originally estimated. Changes to the size needed can indicate potential cost and schedule problems.

We have found cases where programs continue to have difficulties in managing software development for weapon systems. Roughly half of the programs that provided us software data had at least a 25 percent growth in their expected lines of code since system development started. For example, software requirements were not well understood on the FCS program when the program began, and as the program moves toward preliminary design activities, the number of lines of software code has nearly tripled. Also, the Expeditionary Fighting Vehicle program experienced software growth during system development, and the Marine Corps testing agency identified software test failures as a factor affecting the system's reliability.

Recent DOD Actions Provide Opportunities for Improvement

In February 2007, DOD, in response to congressional direction, issued a report on the department's acquisition transformation initiatives and the goals established to achieve change.[15] Within that report, DOD noted that every aspect of how the department does business was being assessed and streamlined to deliver improved capabilities to the warfighter and visibility

[14]GAO, *Defense Acquisitions: Stronger Management Practices are Needed to Improve DOD's Software-intensive Weapon Acquisitions*, GAO-04-393 (Washington, D.C.: Mar. 1, 2004).

[15]Department of Defense, *Secretary of Defense, Defense Acquisition Transformation: Report to Congress* (Washington, D.C.: February 2007).

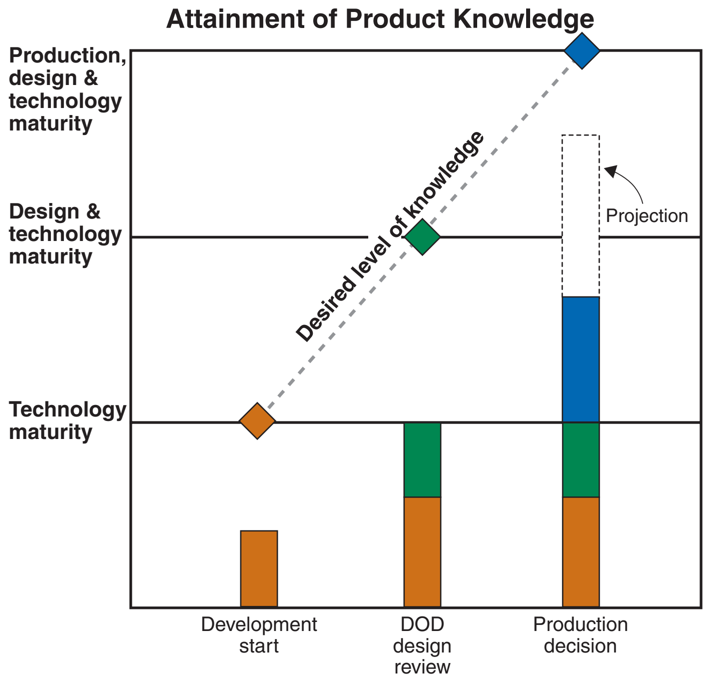
to executive leadership. The report also noted the need for continuous and evolutionary changes across the DOD acquisition system, especially with regard to determining which assets and investments to acquire in order to meet desired capabilities. Future reports on acquisition transformation are expected to build on the outcomes of initiatives described in that report. As such, DOD has set forth its intention to change the strategic environment at the portfolio level. DOD also plans to implement new practices mentioned earlier, similar to past GAO recommendations that are intended to provide program managers more incentives, support, and stability. The department acknowledges that any actions taken to improve accountability must be based on a foundation whereby program managers can launch and manage programs toward greater performance, rather than focusing on maintaining support and funding for individual programs. DOD acquisition leaders have told us that any improvements to program managers' performance hinge on the success of these departmental initiatives.

We have reported that DOD should develop an overarching strategy and decision-making processes that prioritize programs based on a balanced match between customer needs and available department resources. Within its strategy and other reports, DOD has highlighted several initiatives that, if adopted and implemented properly, could provide a foundation for improved outcomes. For example, DOD is experimenting with a new concept decision review practice, selection of different acquisition approaches according to expected fielding times, and panels to review weapon system configuration changes that could adversely affect program cost and schedule. The DOD strategy emphasizes that initiatives designed to improve program manager performance can be successful only if the strategic objectives are accepted and implemented. In addition, in September 2007 the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics issued a policy memorandum to ensure weapon acquisition programs are able to demonstrate key knowledge elements that could inform future development and budget decisions. This policy directed pending and future programs to include acquisition strategies and funding that provide for two or more competing contractors to develop technically mature prototypes through Milestone B (knowledge point 1), with the hope of reducing technical risk, validating designs and cost estimates, evaluating manufacturing processes, and refining requirements. Each of the initiatives is designed to enable more informed decisions by key department leaders well ahead of a program's start, decisions that provide a closer match between each program's requirements and the department's resources. Our work has shown that if this is to occur, all of the players involved with acquisitions—the requirements community, the comptroller, the Under Secretary of Defense for Acquisition, Technology, and Logistics; and perhaps most importantly, the military services—must be unified in implementing these new policies from top to bottom.

How to Read The Knowledge Graphic for Each Program Assessed

We assess each program in two pages and depict the extent of knowledge in a stacked bar graph and provide a narrative summary at the bottom of the first page. As illustrated in figure 8, the knowledge graph is based on the three knowledge points and the key indicators for the attainment of knowledge: technology maturity (depicted in orange), design stability (depicted in green), and production maturity (depicted in blue). A “best practice” line is drawn based on the ideal attainment of the three types of knowledge at the three knowledge points. The closer a program’s attained knowledge is to the best practice line, the more likely the weapon will be delivered within estimated cost and schedule. A knowledge deficit at the start of development—indicated by a gap between the technology knowledge attained and the best practice line—means the program proceeded with immature technologies and faces a greater likelihood of cost and schedule increases as technology risks are discovered and resolved.

Figure 8: Depiction of a Notional Weapon System's Knowledge as Compared with Best Practices



Source: GAO.

An interpretation of this notional example would be that the system development began with key technologies immature, thereby missing knowledge point 1. Knowledge point 2 was not attained at the design review, as some technologies were still not mature and only a small percentage of engineering drawings had been released. Projections for the production decision show that the program is expected to achieve greater levels of maturity but will still fall short. It is likely that this program would have had significant cost and schedule increases.

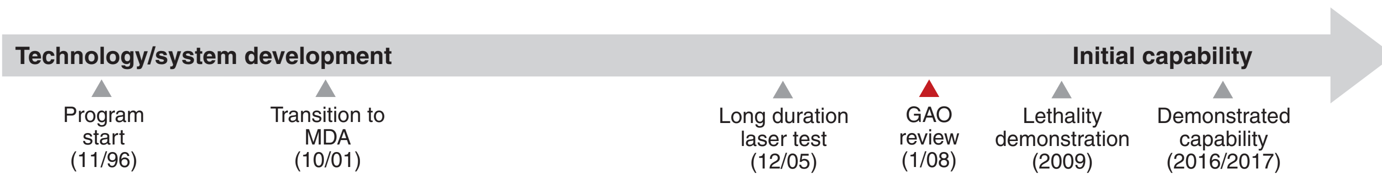
Assessments of Individual Programs

Our assessments of the 72 weapon programs follow.

Airborne Laser (ABL)

MDA's ABL element is being developed to destroy enemy missiles during the boost phase of their flight. Carried aboard a modified Boeing 747 aircraft, ABL employs a beam control/fire control subsystem to focus the beam on a target, a high-energy chemical laser to rupture the fuel tanks of enemy missiles, and a battle management subsystem to plan and execute engagements. We assessed the system's prototype design that is expected to lead to a lethality demonstration in 2009.

Source: Airborne Laser Program Office.



Program Essentials

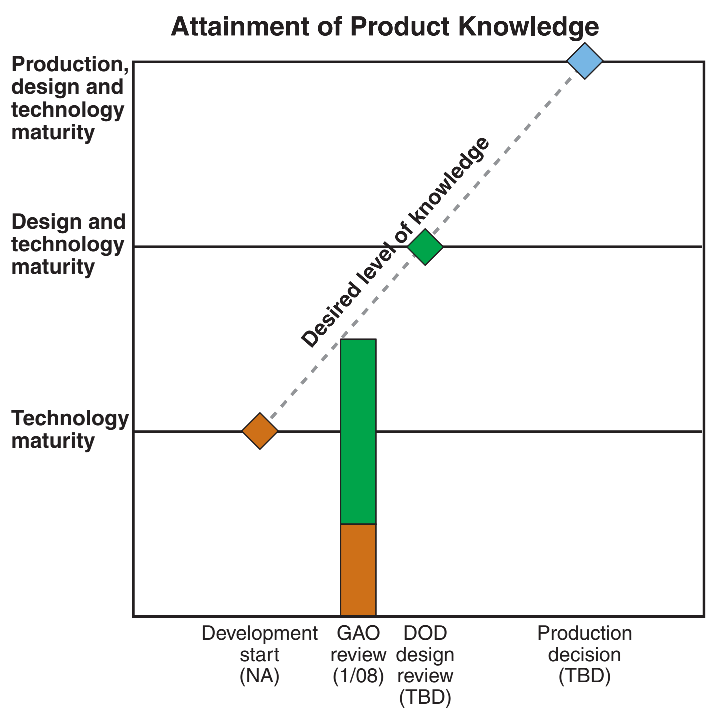
Prime contractor: Boeing
Program office: Kirtland AFB, N.M.
Funding FY08-FY13:
R&D: $3,496.0 million
Procurement: $0.0 million
Total funding: $3,496.0 million
Procurement quantity: NA

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$8,127.4	NA
Procurement cost	NA	0	NA
Total program cost	NA	$8,127.4	NA
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Cost data include all known costs from the program's inception through fiscal year 2013.

None of ABL's critical technologies are fully mature, yet MDA has released 100 percent of the prototype's engineering drawings. Program officials expected to demonstrate the prototype's critical technologies during a flight test planned for late 2008, but recent integration issues and technical challenges delayed that test until 2009. Additional drawings may be needed if problems encountered during future testing necessitate design changes. The work for ABL's prime contract was rebaselined in 2004 and refined again in 2005. However, the contractor continued to experience cost and schedule delays in 2006. In May 2007, the program replanned its contract work again, increasing costs and extending the length of the contract. Subsequent to the replan, the contractor continued to overrun its cost and schedule budgets through fiscal year 2007.



ABL Program

Technology Maturity

The program office assessed all seven of its critical technologies—the six-module laser, missile tracking, atmospheric compensation, transmissive optics, optical coatings, jitter control, and managing the high-power beam—as nearly mature. According to program officials, all of these technologies have been demonstrated in a relevant environment.

Although the program office assessed jitter control as nearly mature, it considers this technology to be a high risk to the program. Jitter is a phenomenon pertaining to the technology of controlling and stabilizing the high-energy laser beam so that vibration unique to the aircraft does not degrade the laser's aimpoint. It is critical to imparting sufficient energy to the target to rupture its fuel tank. The program's assessment of this technology is based on models that have been anchored to measurements taken during recent ground and flight tests. On the basis of current jitter measurements, officials are confident that they can successfully execute a key flight test planned for 2009.

The program plans to demonstrate all of its critical technologies during this flight test of the system prototype, referred to as a lethality demonstration, in which ABL will attempt to shoot down a short-range ballistic missile. Although the program had expected to complete the lethality demonstration in 2008, software integration issues and recent technical challenges associated with the system's beam control/fire control component delayed the demonstration until 2009.

Design Stability

We could not assess ABL's design stability because the element's initial capability will not be fully developed until the second aircraft is well underway. While the program has released 100 percent of its engineering drawings for the prototype, it is unclear whether the design of the prototype aircraft can be relied upon as a good indicator of design stability for the second aircraft. More drawings may be needed if the design is enhanced or if problems encountered during flight testing force design changes.

Production Maturity

We did not assess the production maturity for the system's prototype because statistical process control data are not available due to the limited quantity of hardware being produced for the prototype aircraft.

Other Program Issues

MDA estimates that it will have spent approximately $5.1 billion for its ABL element from its inception in 1996 through its lethality demonstration in 2009. For years, the program has faced significant cost and schedule growth. In 2004, the ABL program restructured its prime contract work to focus on executing near-term milestones within budget and on schedule. However, since that restructure, the program has continued to experience cost growth and schedule delays. During 2005, the program further refined its work plan to ensure it could meet its cost and schedule objectives. However, a year later, the ABL program encountered new technical challenges that contributed to additional cost increases and schedule slippage. Consequently, program officials reevaluated the program and implemented a new baseline for all remaining work. In 2007, the ABL program once again modified its prime contract, increasing the cost ceiling by $253 million and extending the period of performance by approximately 1 year. The prime contract is currently valued at about $3.9 billion and is expected to end in February 2010.

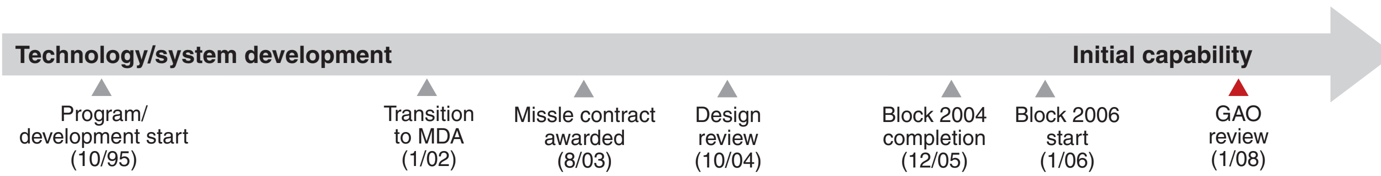
Agency Comments

In commenting on a draft of this assessment, the ABL Program Office concurred with our asssessment. The program office also provided technical comments, which were incorporated as appropriate.

Aegis Ballistic Missile Defense (Aegis BMD)

MDA's Aegis BMD element is a sea-based missile defense system being developed in incremental, capability-based blocks to protect deployed U.S. forces, allies, and friends from short-to-medium range ballistic missile attacks. Key components include the shipboard SPY-1 radar, Standard Missile 3 (SM-3) missiles, and command and control systems. It will also be used as a forward-deployed sensor for surveillance and tracking of intercontinental ballistic missiles. We assessed the SM-3 Block IA, to be delivered in Block 2006.

Source: Aegis BMD Program Office.



Program Essentials

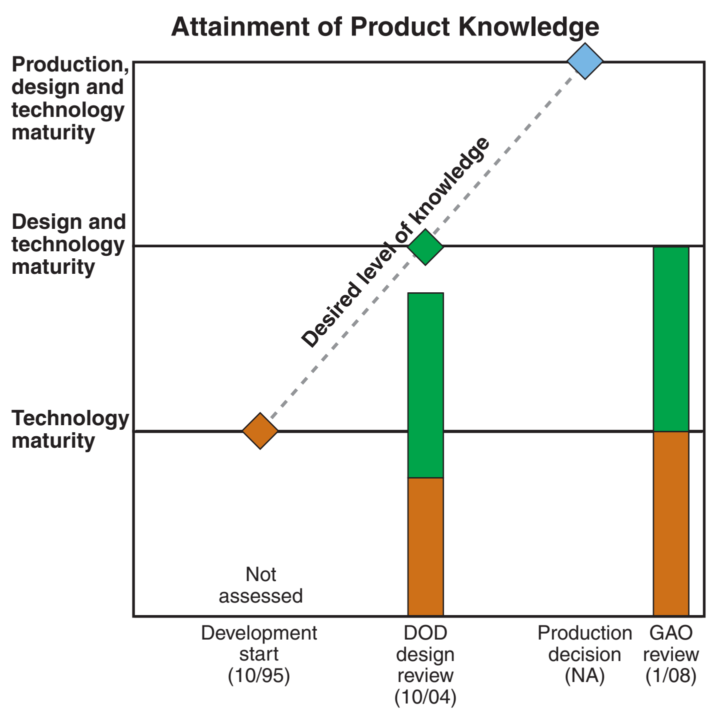
Prime contractor: Lockheed Martin, Raytheon
Program office: Dahlgren, Va.
Funding FY08-FY13:
R&D: $6,196.9 million
Procurement: NA
Total funding: $6,196.9 million
Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 07/2007	Percent change
Research and development cost	NA	$11,233.1	NA
Procurement cost	NA	0	NA
Total program cost	NA	$11,233.1	NA
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Columns include known costs from the program's inception through fiscal year 2013.

Program officials report all Block IA critical technologies are mature. Our data indicate that one of the technologies is less mature. The Solid Divert and Attitude Control System (SDACS) pulse one has been successfully flight tested since our last report. However, the zero pulse mode of the missile's third stage rocket motor has not been demonstrated in an operational environment. Officials also report the missile's design is stable with 100 percent of its drawings released to manufacturing and they do not anticipate any design changes. The Block IA missile is in production but officials state that the contractor's processes are not mature enough to collect statistical data. Instead, other means are being used to gauge production readiness.



Aegis BMD Program

Technology Maturity

We reported last year that two of the three technologies critical to the SM-3 Block IA missile, the Solid Divert and Attitude Control System (SDACS) and the Third Stage Rocket Motor (TSRM), were not mature. Since our last report, one of the SDACS's pulse modes, pulse one, which allows the kinetic warhead to divert in order to adjust its aim, has flown three times, in April, June, and November 2007. Pulse one was used to shift the warhead's aim just prior to intercept and all tests resulted in successful intercepts. The other pulse mode of the SDACS, pulse two, is identical in technology and functionality as pulse one but has not been flight tested. Program officials state that both pulse modes have been successfully tested in four consecutive ground tests but that it is difficult for the SDACS to use both pulse modes in a flight test because the first pulse has provided sufficient divert capability to make the intercept. Program officials state that an artificiality would have to be built into the flight test in order to guarantee the use of pulse two. Additionally, program officials consider pulse two to be a margin to the system since it is designed to provide additional energy, if needed, after employing pulse one, to make the necessary maneuvers to intercept the target in the desired spot for maximum destruction. Similarly, the zero pulse mode of the TSRM that increases the missile's capability against shorter-range threats has not been flight tested. Although the production design of the TRSM attitude control system passed qualification testing in February 2007 and has been integrated into the manufacturing line, the zero pulse mode is not scheduled for flight testing due to range safety limitations.

Design Stability

Program officials reported that the design for the SM-3 Block IA missiles being produced during Block 2006 is stable, with 100 percent of its drawings released to manufacturing. Program officials do not anticipate additional design changes.

Production Maturity

We did not assess the production maturity of the SM-3 missiles being procured for Block 2006. Program officials stated that the contractor's processes are not yet mature enough to statistically track production processes. The Aegis BMD program continues to use other means to assess progress in production and manufacturing, such as tracking rework hours, cost of defects per unit, and other defect and test data.

Other Program Issues

The original Aegis BMD program goals for Block 2006 included delivery of 19 SM-3 Block IA U.S. missiles. Last year, program officials reduced the goal to 15. Since that time, delivery goals have been reduced to 12, because the contractor did not have the production capacity to deliver both foreign military sales missiles and U.S. missiles. Although Raytheon reported no cost or schedule growth, because much of the SM-3 Block IA contract work was being reported as a level of effort, it was difficult to assess true performance since it could not be practically measured by discrete earned value techniques. According to American National Standards Institute guidelines adopted by DOD, only work that does not result in a product should be reported as level of effort under earned value management. However, in August 2007, Raytheon reported 73 percent of the contract work as level of effort, some of which was identified as possibly unjustified and appearing excessive by a team composed of technical and functional experts during a 2007 review. Since that time, program officials report that they were able to implement earned value management reporting on future delivery contracts and stated in January 2008 that Raytheon had reduced the contract level of effort work to 18 percent.

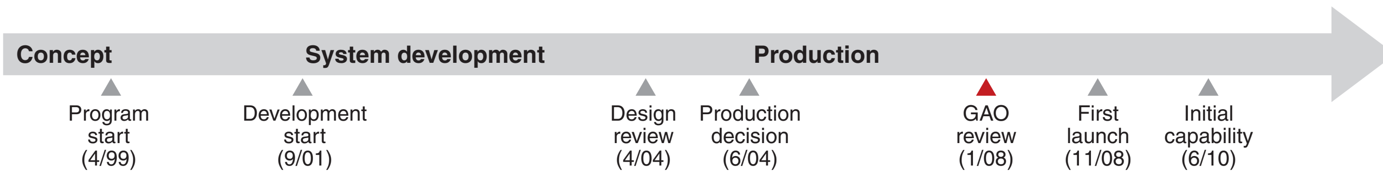
Agency Comments

Technical comments provided by the program office were incorporated as appropriate. In addition, program officials stated that they believe the TSRM is a mature technology and add that is has been successfully flown in multiple missions in increasingly realistic operational environments. Program officials consider the zero pulse mode of the third stage rocket motor to be marginal to the system and explain that the capability is difficult to demonstrate in an operational environment due to range safety limitations. Additionally, program officials state that all design verification tests for both the SDACS and the TSRM have been completed, all requirements have been exceeded, and qualification tests for the capabilities have been completed and verified by Johns Hopkins University Applied Physics Laboratory and the Indian Head Division, Naval Warfare Center.

Advanced Extremely High Frequency (AEHF) Satellites

The Air Force's AEHF satellite system will replenish the existing Milstar system with higher-capacity, survivable, jam-resistant, worldwide, secure communication capabilities for strategic and tactical warfighters. The program includes satellites and a mission control segment. Terminals used to transmit and receive communications are acquired separately by each service. AEHF is an international partnership program that includes Canada, the United Kingdom, and the Netherlands. We assessed the satellite and mission control segments.

Source: Advanced EHF Program Office.



Program Essentials

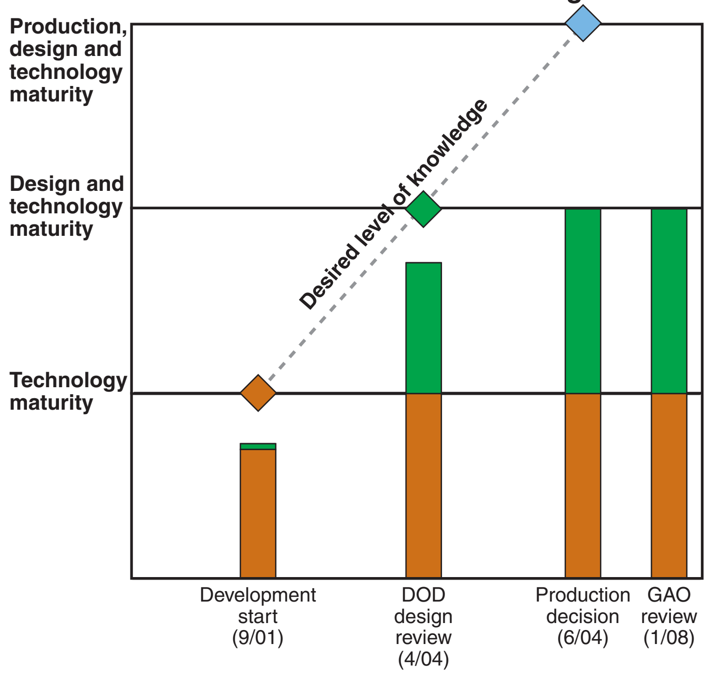
Prime contractor: Lockheed Martin
Program office: El Segundo, Calif.
Funding needed to complete:
- R&D: $1,078.9 million
- Procurement: $93.6 million
- Total funding: $1,172.9 million
- Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of 10/2001	Latest 12/2006	Percent change
Research and development cost	$4,669.0	$6,098.9	30.6
Procurement cost	$1380.9	$718.9	-47.9
Total program cost	$6,050.0	$6,817.3	12.9
Program unit cost	$1,209.993	$2,272.443	87.8
Total quantities	5	3	-40.0
Acquisition cycle time (months)	111	134	20.7

The AEHF program's technologies are mature and the design is stable. We could not assess production maturity because the program office does not collect statistical process control data. In September 2007, the program announced a launch slip of over 6 months because technical problems with some hardware components delayed the start of system-level environmental testing. Because of concerns about the development of the Transformational Satellite Communications System (TSAT) and a possible gap in capabilities, the conference report accompanying the Defense Appropriations Act for Fiscal Year 2008 encouraged the Air Force to procure an additional AEHF satellite.

Attainment of Product Knowledge



AEHF Program

Technology Maturity

According to the program office, all 14 AEHF critical technologies are mature, having been demonstrated in a relevant environment. All hardware has been integrated into the first satellite for system-level environmental testing.

Design Stability

The AEHF's design is stable. All expected design drawings have been released and the program completed system-level critical design review in April 2004.

Production Maturity

Production maturity could not be assessed, as the program office does not collect statistical process control data.

Other Program Issues

Since our assessment of the AEHF last year, subcontractors delivered all major subsystems, including the propulsion unit, antennas, and payload to the prime contractor for final integration into the first satellite. However, because of technical difficulties with some key hardware components, the payload was incomplete when delivered. Although the program began system integration and some functional testing, it could not proceed with system-level environmental testing until all satellite hardware was in place. Because of this delayed start, the launch of the first two satellites will also be delayed. In September 2007, the program office determined the launch of the first satellite will slip over 6 months, from April 2008 to November 2008. The second satellite will be delayed over 3 months, from April 2009 to August 2009. The program office estimated the cost of the slip to be between $230 million and $250 million. The program office expects to keep the same schedule of April 2010 for the third satellite.

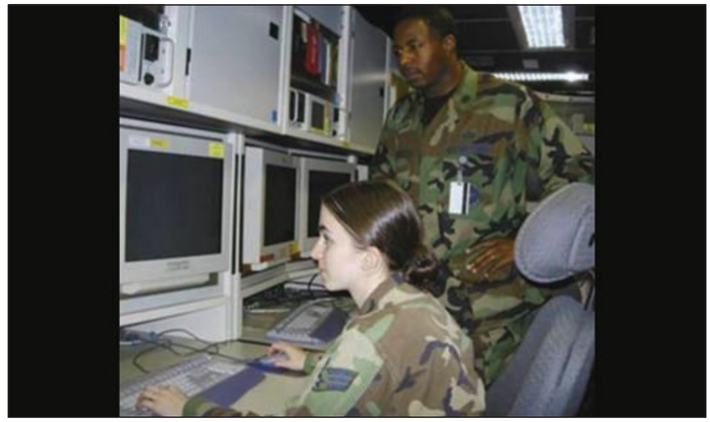
The original AEHF program included the acquisition of five satellites. In December 2002, satellites 4 and 5 were deleted from the program with the intention of using three AEHF satellites and the first TSAT satellite to achieve full operational capability. However, because of concerns that delays in developing and fielding TSAT could result in a gap in protected communications capability, the conference report accompanying the Defense Appropriations Act for Fiscal Year 2008 encouraged the Air Force to procure an additional AEHF satellite and provided funding for advanced procurement of the forth AEHF satellite. Program officials stated the primary challenges associated with procuring a fourth satellite are obsolescence of electronic components and a minimum 3-year production gap between the third and fourth satellites, making the fourth satellite much more costly than the third satellite. The officials stated if the fourth satellite is fully funded, the earliest possible launch would be in 2013.

Agency Comments

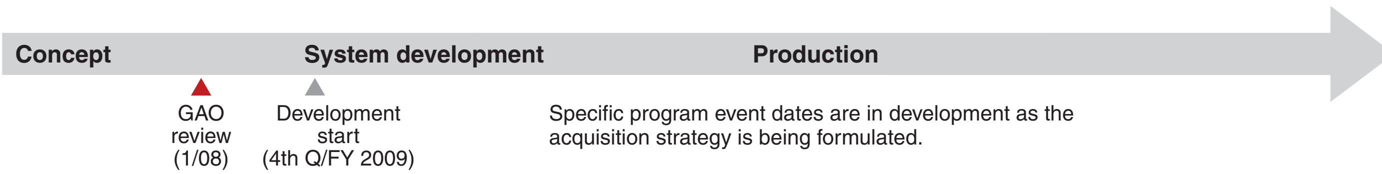
In commenting on a draft of this assessment, the Air Force provided technical comments, which were incorporated as appropriate.

Air Force Distributed Common Ground System (AF DCGS) Increment 2

AF DCGS provides a global intelligence, surveillance, and reconnaissance (ISR) capability for the Air Force. AF DCGS provides all-source intelligence information, including time critical targeting and direct threat warning information from various sensors to the joint task force commander and echelons below. AF DCGS is part of DOD's DCGS Enterprise, a cooperative effort among the military services and national agencies to provide interoperable ISR systems and data. We assessed AF DCGS Increment 2.



Source: 30th Intelligence Squadron, U.S. Air Force.



Program Essentials

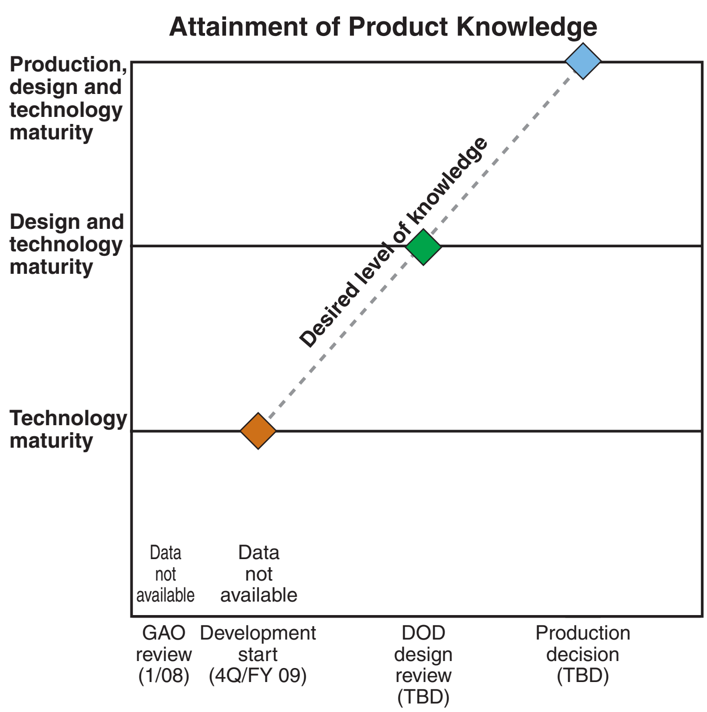
Prime contractor: TBD
Program office: Hanscom AFB, Mass.
Funding needed to complete:
R&D: $318.3 million
Procurement: $943.6 million
Total funding: $1,278.8 million
Procurement quantity: 1

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$477.4	NA
Procurement cost	NA	$1,545.2	NA
Total program cost	NA	$2,126.5	NA
Program unit cost	NA	$2,126.518	NA
Total quantities	NA	1	NA
Acquisition cycle time (months)	NA	NA	NA

The current estimate is representative of the entire AF DCGS effort, which includes funding for Block 10.1, Block 10.2, and Increment 2. In addition, DCGS is considered a single system with mutiple sites; therefore only one system will be procured.

AF DCGS is an operational system undergoing net-centric and technology transformation. The program is composed of three blocks or increments: (1) Block 10.1 is currently fielded and provides operational networked ISR; (2) Block 10.2, considered a technology refresh program, will provide a net-centric infrastructure and is scheduled for fielding in fiscal year 2008; and, (3) Increment 2, a future capability, will provide multi-intelligence net-centric operations, a layered service oriented architecture, and automated analysis and fusion, among other capabilities. The Increment 2 Capabilities Development Document is currently undergoing review by the Joint Requirements Oversight Council, while Increment 2 is scheduled to enter system development in the fourth quarter of fiscal year 2009. Specific program event dates are still in development as the acquisition strategy is being formulated.



AF DCGS Program

Technology Maturity

AF DCGS provides the Air Force with a ground-based "system of systems" capable of (1) tasking intelligence sensors, and (2) receiving, processing, exploiting, and disseminating data from airborne and national reconnaissance platforms and commercial sources. Increment 2 will upgrade the net-centric baseline system, focusing on signal intelligence and data fusion. These upgrades will use commercial hardware and software for most of the fielded capabilities. No development or specially produced hardware will be utilized. Those items that are government-unique will be procured through other programs.

The program has yet to define specific critical technologies for Increment 2, but has identified critical technology areas such as data fusion, imagery automated extraction, and knowledge management, among others. A technology readiness assessment is planned for the third quarter of fiscal year 2008.

Design Stability

Design drawings are not available, as Increment 2 has yet to begin development.

Other Program Issues

AF DCGS and other DCGS systems are highly dependent on the DCGS Integration Backbone (DIB). The DIB is a common set of enterprise services and standards that serves as the foundation for the interoperability and data sharing across the DCGS enterprise. The DIB program is pursuing an evolutionary acquisition strategy and has delivered early versions of the product. To date, the DIB has achieved successful connectivity and data sharing in a demonstration with Army, Air Force, and Navy laboratories. According to a DIB program official, the next major milestone for the DIB is the planned delivery of a new version that will focus on interoperability testing and certification. The delivery of the new DIB software is scheduled for the first quarter of fiscal year 2009 to support the DCGS-Army version 4.

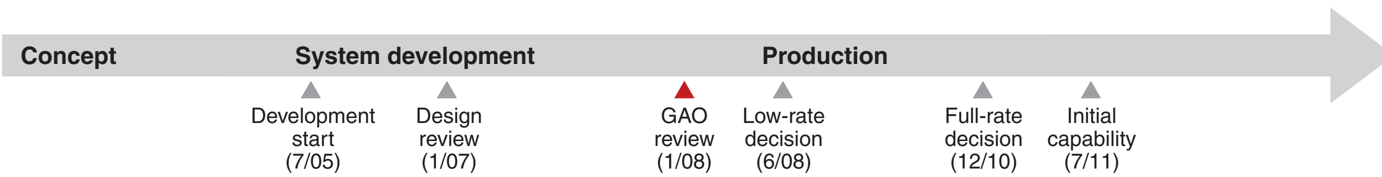
Agency Comments

In commenting on a draft of this assessment, the Air Force provided technical comments, which were incorporated where appropriate.

Armed Reconnaissance Helicopter (ARH)

The Army's ARH is expected to provide reconnaissance and security capability for air and ground maneuver teams. The ARH was to combine a modified off-the-shelf airframe with a non-developmental item mission equipment package and is replacing the Kiowa Warrior helicopter fleet. A streamlined acquisition strategy was proposed for the ARH program in order to support current military operations.

Source: ARH Prototype #1 Flight Testing at Bell Helicopter, ©2006 Bell Helicopter, A Textron Company.



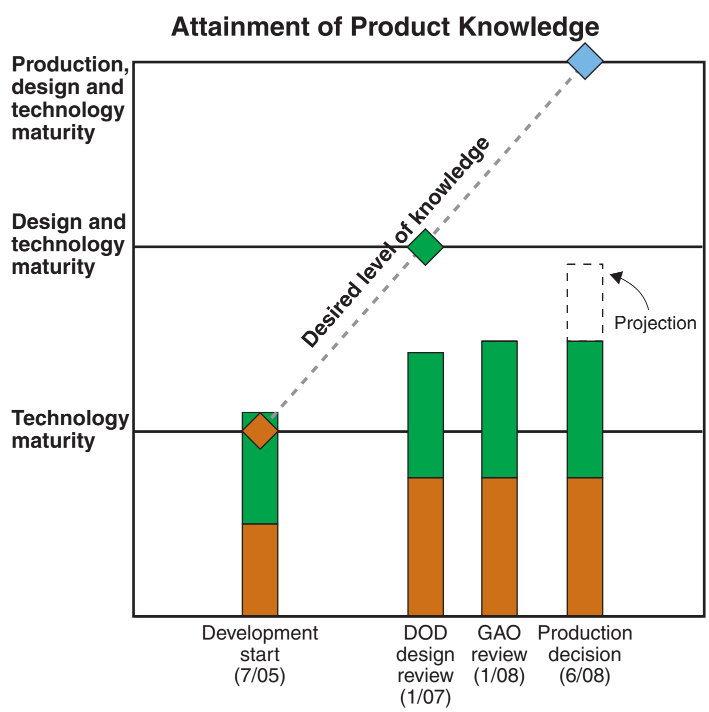
Program Essentials

Prime contractor: Bell Helicopter Textron
Program office: Huntsville, Ala.
Funding needed to complete:
R&D: $386.5 million
Procurement: $4,977.4 million
Total funding: $5,363.9 million
Procurement quantity: 512

Program Performance (fiscal year 2008 dollars in millions)

	As of 07/2005	Latest 08/2007	Percent change
Research and development cost	$388.3	$750.9	93.4
Procurement cost	$3,019.5	$4,977.4	64.8
Total program cost	$3,407.7	$5,728.3	68.1
Program unit cost	$9.260	$11.188	20.8
Total quantities	368	512	39.1
Acquisition cycle time (months)	47	72	53.2

Since our assessment of the ARH program last year, the program has progressed through the critical design review, but has experienced multiple issues integrating and qualifying one of two critical technologies. Program officials currently project the sensor technology will not demonstrate maturity until at least the planned production decision in June 2008. While the current ARH design is stable, the ARH program issued a stop-work order in March 2007 and remains in flux until a future Defense Acquisition Board meeting. According to program officials, the board will consider the current acquisition program as well as the results from a Center for Naval Analyses study to help define the future plan for the program.



ARH Program

Technology Maturity

One of the program's two critical technologies, the engine, is mature. The sensor is not projected to be fully mature until at least the planned production decision in June 2008. The sensor selected for the ARH was designed and developed as a collaborative effort with the Marines and the Navy for combat helicopter operations. An earlier version of the sensor is currently fielded in the Iraqi theater on a Marine helicopter. An updated version of the currently fielded sensor was proposed by the lead contractor for integration onto the ARH platform. Although previous sensor technology has been used in the Marine helicopter, the updated sensor hardware and related software have not been integrated and tested at the component system level within the ARH sensor suite to determine their functionality and reliability. This is an important consideration since the lead contractor has proposed the Army use results from the original sensor configuration's testing to support its qualification on the ARH.

According to program officials, the integration and qualification issues with the sensor have contributed heavily to the risks of the program. At the beginning of the program, the lead contractor proposed the Navy lead efforts to flight test and qualify the sensor. However, according to the Army Test and Evaluation Command, there were significant differences between sensor and airframe configurations that could result in additional test requirements that were not anticipated by the lead contractor's proposal. Program officials stated that after contract award, it became apparent that the Navy effort was behind schedule projections and that ARH would bear the burden of development. Subsequently, the lead contractor performed significant development and testing in order to mature the sensor, which resulted in placing the development, integration, and qualification risk on the ARH program.

Design Stability

According to the program office, the basic design of the ARH is stable with 98 percent of drawings released to manufacturing at the design review in January 2007. Additionally, program office officials stated the ARH program is an assembly and integration effort with moderate design effort.

Production Maturity

We could not assess production maturity because, according to the program office, it does not plan to collect statistical process control data. However, to determine the maturity of the ARH production capability for the June 2008 decision, the Army will conduct a Production Readiness Review (including an assessment of the Engineering and Manufacturing Readiness Levels), review facility plans and limited tooling development, conduct an operations capacity analysis, and assess lean manufacturing initiatives.

Other Program Issues

In March 2007, the ARH program office released a stop-work order to the contractor as a result of greater than 50 percent development cost growth and low-rate initial production pricing disagreements. The contractor requested and received permission to continue work at its own risk and submitted a plan to convince the Army that it can complete the contract as intended. According to program officials, the Army has met with the Army System Acquisition Review Council and the Army Acquisition Executive, to consider proposed alternative courses of action. Further, an independent study by the Center for Naval Analyses was completed as directed by the Army Acquisition Executive to determine the root cause of failures prior to continuing work on meeting the ARH requirement. According to program officials, the study made numerous recommendations to be considered at a future Defense Acquisition Board meeting.

Prior to the stop-work order, an increase in acquisition quantities and delays in receiving low-rate initial procurement quantities required to support the initial operational test and evaluation led to cost increases and negative schedule variances during development.

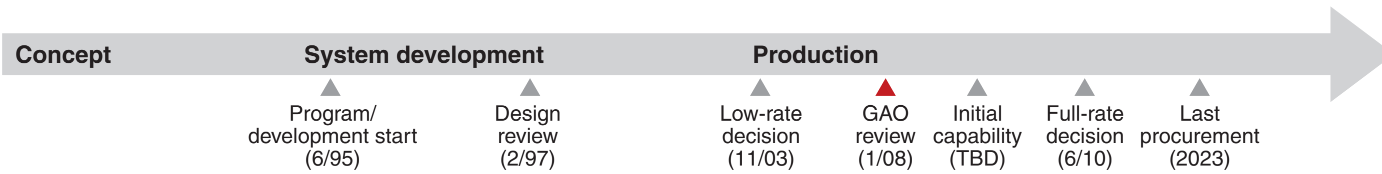
Agency Comments

In commenting on the draft of this assessment, the program office stated that leveraging off the Navy testing is a positive approach because the Navy shipboard standards are more stringent with regard to electro magnetic interference and emission-shielding requirements. Other technical comments were provided and incorporated as appropriate.

Advanced Threat Infrared Countermeasure/Common Missile Warning System

The Army's and Special Operations Command's ATIRCM/CMWS is a component of the Suite of Integrated Infrared Countermeasures planned to defend U.S. aircraft from advanced infrared-guided missiles. The system will be employed on Army and Special Operations aircraft. ATIRCM/CMWS includes an active infrared jammer, missile warning system, and countermeasure dispenser capable of loading and employing expendables, such as flares and chaff.

Source: BAE Systems.



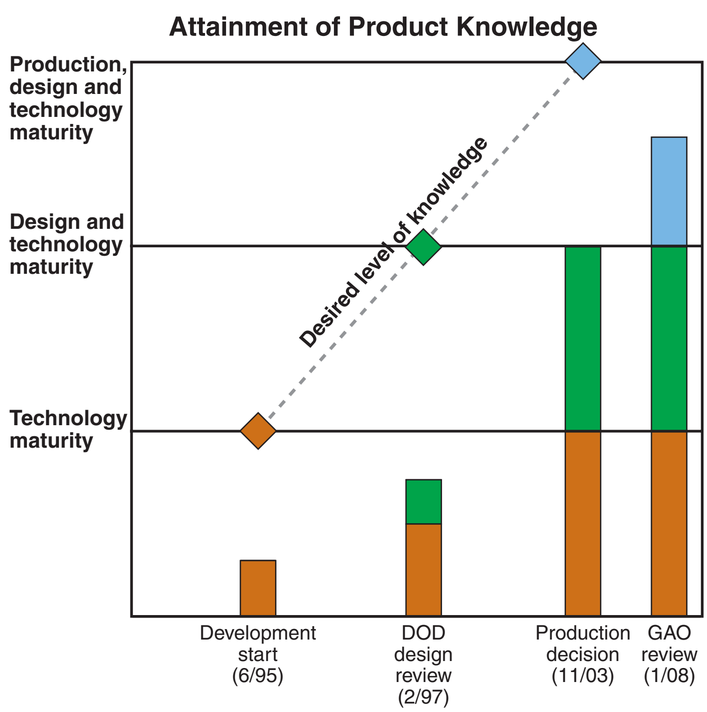
Program Essentials

Prime contractor: BAE Systems North America
Program office: Huntsville, Ala.
Funding needed to complete:
- R&D: $155.1 million
- Procurement: $3,105.9 million
- Total funding: $3,260.9 million
- Procurement quantity: 1,347

Program Performance (fiscal year 2008 dollars in millions)

	As of 03/1996	Latest 12/2006	Percent change
Research and development cost	$636.9	$797.9	25.3
Procurement cost	$2,604.8	$4,515.3	73.3
Total program cost	$3,241.7	$5,313.2	63.9
Program unit cost	$1.048	$1.480	41.3
Total quantities	3,094	3,589	15.9
Acquisition cycle time (months)	Classified	Classified	Classified

The ATIRCM portion of the program is in low-rate production and the CMWS portion is in full-rate production. The technologies for CMWS are mature and the design is stable. Currently, the program's production processes are at various levels of control. The CMWS portion of the program entered limited production in February 2002 to meet urgent deployment requirements. However, full-rate production for both components was delayed because of reliability problems. Over the past several years, the program has had to overcome cost and schedule problems brought on by shortfalls in knowledge. Key technologies were demonstrated late in development, and only a small number of design drawings were completed by the design review.



ATIRCM/CMWS Program

Technology Maturity

All five critical technologies are now considered mature. Four of the critical technologies did not mature until after the design review in February 1997. Although the infrared jam head is now considered mature, it still has reliability problems. A reliability test was to be conducted in November 2007 to determine if problems were resolved.

Design Stability

The basic design of the system is complete, with 100 percent of the drawings released to manufacturing. However, the program office expects the number of drawings to change because the infrared jam laser and the infrared lamp will be replaced with a multi-band laser. The number of drawings or potential changes is not known because the technical data package has not been received.

Production Maturity

According to program officials, the number of key manufacturing processes dropped from 26 to 17 in the past year because the program outsourced some of the electro-optic mission sensor's components. The processes are in various phases of control. The CMWS production portion of the system has stabilized and benefited from increased production rates. Also, processes supporting both ATIRCM and CMWS will continue to be enhanced as data are gathered, and lessons learned will be included in the processes.

The Army entered limited CMWS production in February 2002 to meet an urgent need. Subsequently, full-rate production was delayed for both components due to reliability testing failures. The program implemented reliability fixes to six production representative subsystems for use in initial operational test and evaluation. These systems were delivered in March 2004. Due to ATIRCM performance issues, the full-rate production decision for the complete system was delayed until June 2011. However, the program office has an objective of achieving full-rate production in June 2010.

Other Program Issues

The Army uses the airframe as the acquisition quantity unit of measure even though it is not buying an ATIRCM/CMWS system for each aircraft. When the program began, plans called for putting an ATIRCM/CMWS on each aircraft. Due to funding constraints, the Army reduced the number of systems to be procured and will rotate the systems to aircraft as needed. The Army is buying kits for each aircraft, which include the modification hardware, wiring harness, and cables necessary to install and interface the ATIRCM/CMWS to each platform. Previously, the approved program was for 1,710 ATIRCMs; however, in May 2007, the Army reduced the number of ATIRCMs to 1,076 after a comprehensive requirements review. The current approved program is for 1,076 ATIRCMs, 1,710 CMWSs, and 3,571 kits to use for aircraft integration. However, the Army acquisition objective for planning purposes is for a quantity of 2,332 ATIRCMs, 2,752 CMWSs, and 4,393 kits. To determine the acquisition objective, the U.S. Army Aviation Warfighting Center looked at each aircraft and determined aircraft survivability equipment suites based on aircraft missions. According to a program official, a new cost estimate for the additional systems has not been completed because the new quantity has not been approved.

Agency Comments

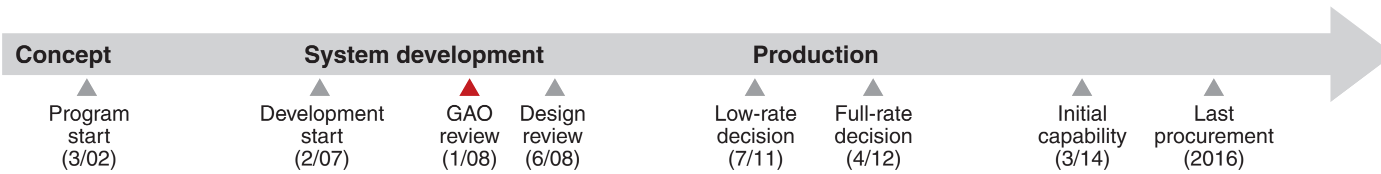
The ATIRCM/CMWS program continues to focus efforts on Global War on Terrorism force protection requirements. In response to a November 2003 memo from the Acting Secretary of the Army to equip all Army helicopters deployed to combat theaters with the most effective defensive systems, the program office accelerated the CMWS portion. These accelerated efforts provided the CMWS ahead of the planned schedule (February 2007). CMWS Initial Operational Test and Evaluation and full-rate production decision events were successfully completed during this reporting period.

Due to delays in receipt of reprogramming funding, funds intended for the ATIRCM program were utilized to maintain the CMWS acceleration. The rebaselined ATIRCM program efforts are now continuing, with Initial Operational Test and Evaluation planned for November 2009. This rebaselined plan was presented and approved by the Army Acquisition Executive in December 2005.

B-2 Spirit Advanced Extremely High Frequency (EHF) SATCOM Capability

The Air Force B-2 EHF SATCOM is a new satellite communication system designed to upgrade the current avionics infrastructure, replace the ultra high frequency (UHF) system, and ensure continued secure, survivable communication capability while maintaining the B-2 low-observable signature. The program has three increments: Increment 1 includes upgraded flight management computer processors, Increment 2 adds antennaes and radomes, and Increment 3 allows connectivity to the Global Information Grid. Increment 1 is the only increment currently in system development.

Source: B-2 Program Office.



Program Essentials

Prime contractor: Northrop Grumman
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
- R&D: $436.5 million
- Procurement: $117.6 million
- Total funding: $554.1 million
- Procurement quantity: 21

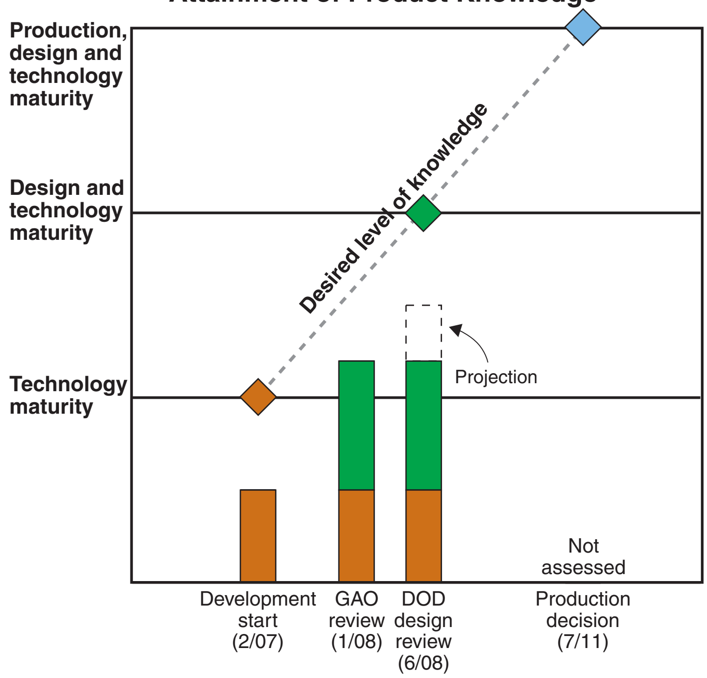
Program Performance (fiscal year 2008 dollars in millions)

	As of 05/2007	Latest 08/2007	Percent change
Research and development cost	$557.9	$557.9	NA
Procurement cost	$117.6	$117.6	NA
Total program cost	$675.5	$675.5	NA
Program unit cost	$32.167	$32.167	NA
Total quantities	21	21	NA
Acquisition cycle time (months)	85	85	NA

The total quantity of 21 units includes 4 to be bought with R&D funds and 17 to be bought with procurement funds. All 21 units will eventually be placed on operational B-2 aircraft. Data reflects Increment 1 only.

All five of the B-2 EHF SATCOM critical technologies for Increment 1 are approaching maturity, but are not expected to be fully mature until after the design review. The program office considers the design to be stable since it uses hardware that is currently in use in another aircraft. However, the uncertainty with technology maturity could affect system integration activities and design stability. While Increments 2 and 3 are not yet in development, areas of potential concern already exist. According to the program office, Increment 2 will require physical changes--integration of large radomes and antenna--that present additional risk to the low-observable nature of the aircraft. Further, Increment 3 requirements are not yet defined or funded.

Attainment of Product Knowledge



B-2 EHF SATCOM Program

Technology Maturity

The B-2 EHF SATCOM program entered system development in February 2007 with all five of its critical technologies approaching maturity. However, the program office does not expect the technologies to be demonstrated in a realistic environment, and therefore fully mature, until after the design review. This increases the risk that the program could encounter further technology issues as it integrates those technologies into the B-2 aircraft. For example, the program is still developing the disk drive unit—a high-risk item that is essential to Increment 1 modernization efforts. If unable to mature this technology as expected, the program could face schedule delays and increased costs. The program currently does not have back-up technologies.

Design Stability

The program has released nearly 63 percent of its drawings, but plans all to be released by the Critical Design Review in June 2008. The program office considers the design to be stable since it incorporates hardware that is currently in use in another aircraft. However, the uncertainty with technology maturity could affect system integration and design stability. We have found some programs that underestimated the complexity of integrating hardware onto existing platforms and have experienced unanticipated cost growth and schedule delays.

Production Maturity

The program office does not plan to collect statistical process control data because it believes the production quantities are too small. A production readiness review is scheduled for January 2011, followed by a low-rate initial production decision in July 2011 and a full-rate production decision in April 2012.

Other Program Issues

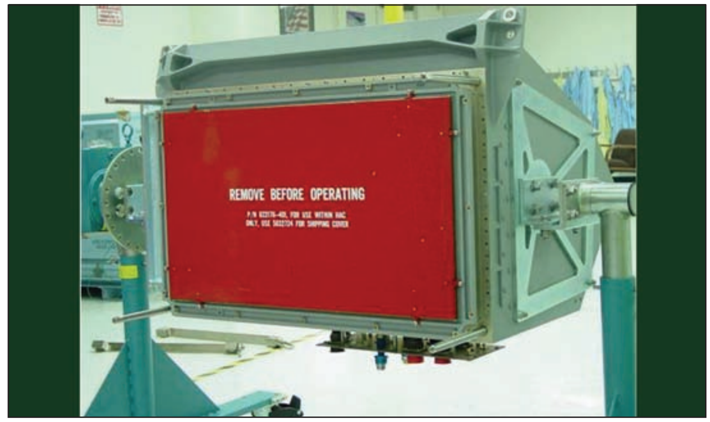
Increments 1 and 2 of the B-2 EHF SATCOM program are estimated to cost nearly $1.9 billion. While Increments 2 and 3 are not yet in development, areas of potential concern already exist. The program office expects Increment 2 to represent a major modification to the system. Specifically, Increment 2 requires physical changes that present additional risk to the low-observable nature of the aircraft because of the integration of large radomes and antenna. Increment 2 currently plans to incorporate six additional technologies, two of which are very immature. The program began a component advance development phase in November 2007 to define requirements and begin preliminary design activities. System development for Increment 2 is expected to begin in November 2010. Fielding the completed EHF capability in time to meet operational needs is currently at risk due to funding constraints and other program dependencies. For example, the Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) is a supporting program that could negatively affect B-2 EHF SATCOM development efforts, since it has already experienced significant delays. In addition to the risks identified for Increment 2, Increment 3 requirements are not yet defined or funded and its four critical technologies are immature.

Agency Comments

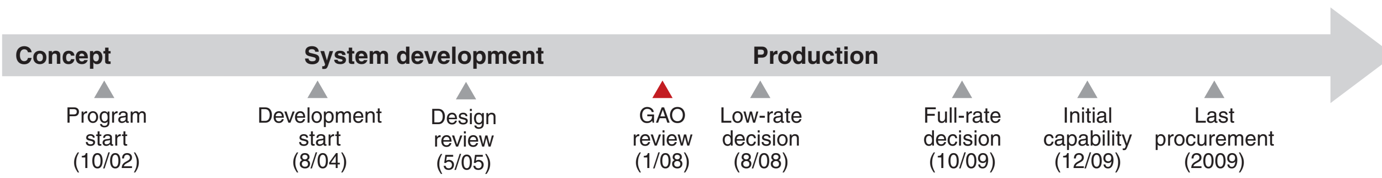
In commenting on a draft of this assessment, the Air Force noted that it expects the risks associated with the disk drive unit to be fully mitigated when hardware testing is complete in May 2009. At that time it believes all critical technologies will be demonstrated to be low or moderate risk. System integration is expected to be demonstrated with lab testing complete by September 2009, flight testing beginning in November 2009, and completion of an operational assessment prior to the low-rate initial production decision in July 2011. The Air Force also noted that the current FAB-T program plans support the B-2 EHF SATCOM schedule. The Air Force provided additional technical comments, which were incorporated as appropriate.

B-2 Radar Modernization Program (B-2 RMP)

The Air Force's B-2 RMP is designed to modify the current radar system to resolve potential conflicts in frequency band usage. Program officials told us that to comply with federal requirements, the frequency must be changed to a band where DOD has been designated as the primary user. The modified radar system is being designed to support the B-2 stealth bomber and its combination of stealth, range, payload, and near-precision weapons delivery capabilities.



Source: B-2 Program Office.



Program Essentials

Prime contractor: Northrop Grumman
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
- R&D: $81.9 million
- Procurement: $394.1 million
- Total funding: $475.9 million
- Procurement quantity: 10

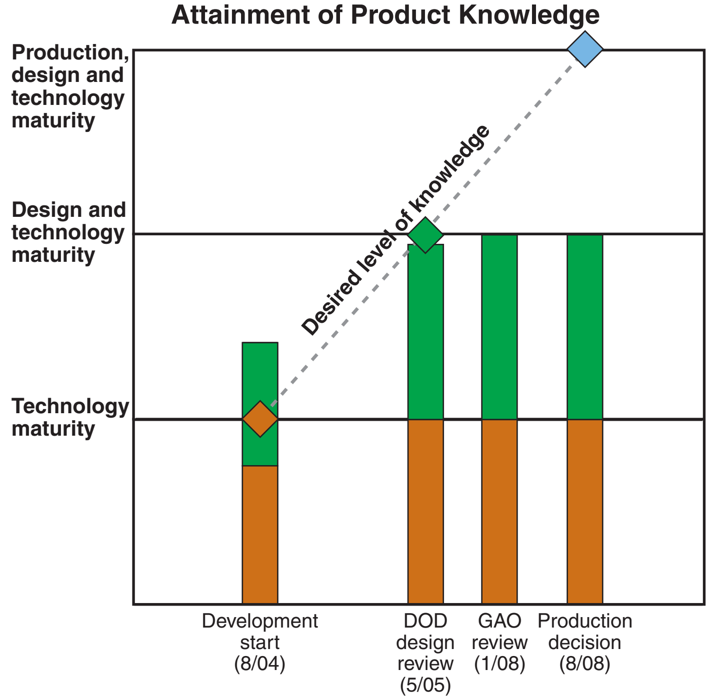
Program Performance (fiscal year 2008 dollars in millions)

	As of 08/2004	Latest 07/2007	Percent change
Research and development cost	$716.9	$579.9	-19.1
Procurement cost	$560.9	$552.9	-1.4
Total program cost	$1,277.6	$1,132.5	-11.3
Program unit cost	$60.836	$53.928	-11.3
Total quantities	21	21	NA
Acquisition cycle time (months)	63	65	3.2

The total quantity of 21 operational units includes 14 to be bought with procurement funds and 7 with R&D funds. Quantities and costs reflect the program of record but are expected to change after the program restructures its procurement profile.

The four B-2 RMP critical technologies were considered mature at the May 2005 design review. By 2006, the program had released 100 percent of its design drawings. However, in early 2007, the program experienced problems with the radar antenna. Due to an agressive development schedule, some important systems engineering and systems integration tasks were not completed. As a consequence, antenna performance deficiencies forced a delay in the development program, including flight test, in January 2007. These issues caused a 1 year delay in the start of production. Consequently, the Air Force reprogrammed fiscal year 2007 production funds to other priorities. Flight testing resumed in June 2007 to verify the problems have been fixed. The program is currently planning to enter production in August 2008.

Attainment of Product Knowledge



B-2 RMP Program

Technology Maturity

All 4 of B-2 RMP's critical technologies are currently mature.

Design Stability

Eighty-five percent of the expected drawings were released to manufacturing at the program design readiness review. Since then, all drawings have been released. However, in early 2007, the program experienced technical problems with the radar antenna. During flight testing, the radar had difficulties staying powered on and characterizing weather conditions. These difficulties delayed testing and production by at least a year.

Production Maturity

The program does not use manufacturing process control data because of the small number of production units. However, the program has identified one key process related to the assembly of the radar antenna array. The B-2 RMP is now approaching the point of conducting complete systems-level testing. This testing will establish whether or not the program is ready to enter production, which is currently scheduled for August 2008. Program officials noted that they are still monitoring and addressing test asset and equipment resource constraints.

Other Program Issues

In late January 2007, the development program, including flight testing, was delayed and replanning efforts were initiated because of radar antenna performance problems. The Air Force subsequently reprogrammed fiscal year 2007 funds for the first four production radar units. This delayed the start of production by 1 year. Program officials noted that pursuing an aggressive schedule to change the radar frequency caused significant execution problems. Specifically, certain important tasks were not completed, such as some aspects of systems engineering, integration and testing. This led to difficulty in understanding the causes of the radar antenna's technical problems encountered during flight testing.

After addressing the technical problems of the radar antenna, flight testing resumed in June 2007. The program is currently planning to enter production in August 2008.

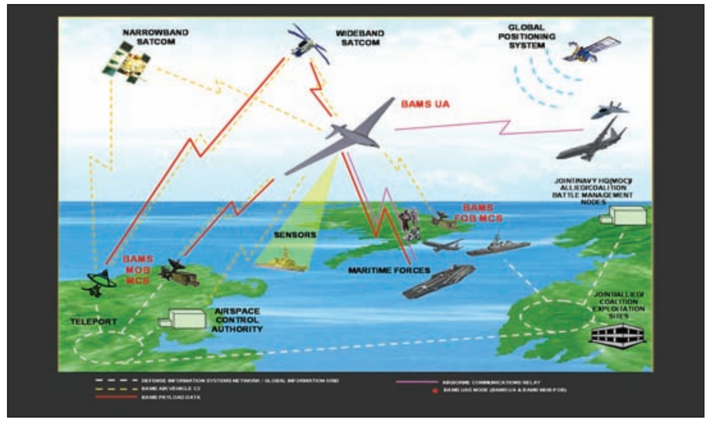
Although the Air Force intends to enter production in fiscal year 2008, important testing events, including the completion of development flight testing and operational testing, are not scheduled for completion until fiscal year 2009. Producing units before testing is able to demonstrate the design is mature and can work in its intended environment increases the risk of costly design changes in the future. The program office noted that it plans to mitigate concurrency between development and production by completing qualification tests, flight-testing for conventional combat capability, and an operational assessment prior to a production decision.

Program Office Comments

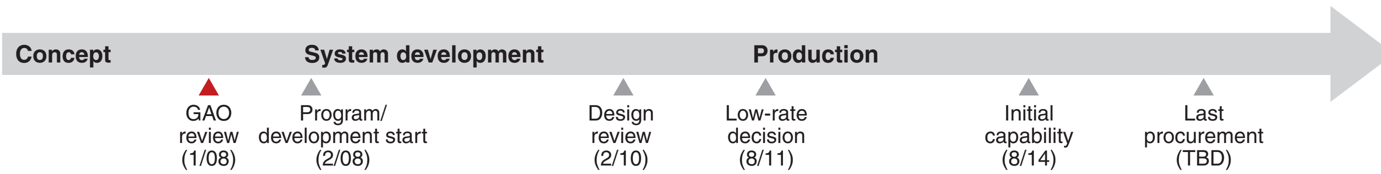
The program office concurred with this assessment and provided technical comments, which were incorporated where appropriate.

Broad Area Maritime Surveillance Unmanned Aircraft System

The Navy's Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS) is to provide a persistent maritime intelligence, surveillance, and reconnaissance (ISR) capability. Along with the Multi-mission Maritime Aircraft and the future EP-X electronic surveillance aircraft, BAMS UAS will be part of a maritime patrol and reconnaissance force family of systems integral to the Navy's recapitalization of its airborne ISR. Australia is participating in pre-system development activities with the program.



Source: BAMS Program Office.



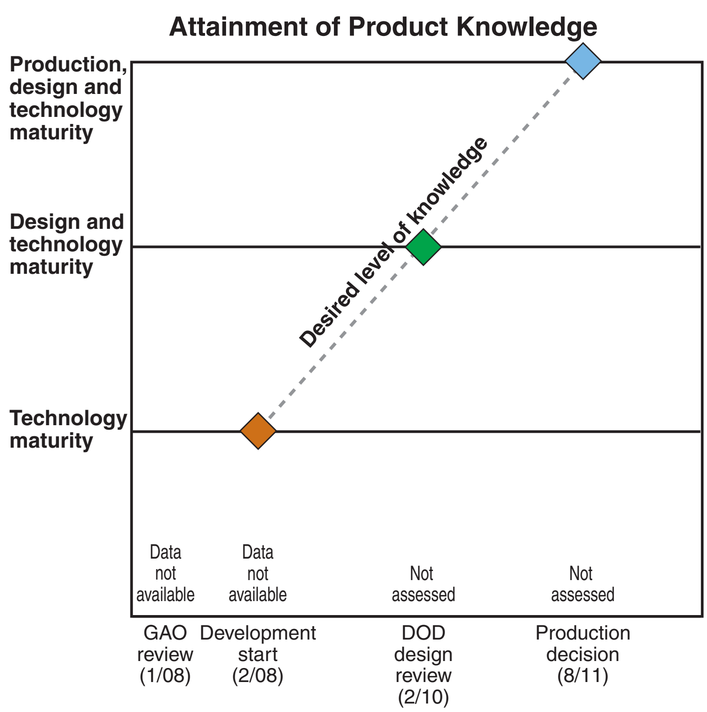
Program Essentials

Prime contractor: TBD
Program office: Patuxent River, Md.
Funding needed to complete:
R&D: $2,139.5 million
Procurement: $690.9 million
Total funding: $2,830.5 million
Procurement quantity: TBD

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$2,139.5	NA
Procurement cost	NA	$691.0	NA
Total program cost	NA	$2,830.5	NA
Program unit cost	NA	TBD	NA
Total quantities	NA	TBD	NA
Acquisition cycle time (months)	NA	NA	NA

The BAMS UAS program plans to begin system development during the second quarter of fiscal year 2008. The program is currently evaluating proposals for source selection and developing documents to meet formal design decision requirements. The program previously planned to start system development by October 2007, but according to a program official, additional time is needed to evaluate contractor proposals. Program officials indicated that the system development solicitation requires critical technologies to be demonstrated in a relevant environment prior to contract award. The program is conducting a technology readiness assessment in parallel with source selection. BAMS UAS initial operational capability has also been delayed from fiscal year 2013 to the last quarter of fiscal year 2014.



BAMS Program

Technology Maturity

BAMS UAS is working to evaluate technologies prior to the start of system development. As part of the previous Persistent Unmanned Maritime Airborne Surveillance effort, the program awarded contracts to develop mission performance metrics and determine capabilities necessary for optimal performance of the maritime intelligence, surveillance, and reconnaissance mission within a family of systems.

Program officials are requiring contractors to identify critical technologies in their proposals as part of source selection. According to program officials, critical technologies must be approaching maturity and demonstrated in a relevant environment prior to the start of system development.

Other Program Issues

BAMS UAS is intended to serve as an adjunct to the Multi-mission Maritime Aircraft (MMA). The Navy intends to position BAMS UAS mission crews with maritime patrol and reconnaissance forces personnel to allow operators to closely coordinate missions and utilize a common support infrastructure. If BAMS UAS does not develop as planned or continues to experience schedule delays, Navy officials state that additional MMA will be purchased as a fallback, increasing the overall cost of the MMA program.

The Navy's future EP-X electronic surveillance aircraft is also intended to be a part of the maritime patrol and reconnaissance forces family of systems as a replacement for the Navy's current airborne intelligence platform, the EP-3. The EP-X program replaced development efforts previously being conducted through the Army's Aerial Common Sensor program, which was terminated due to a significant weight increase. According to BAMS UAS officials, the EP-X schedule will not affect the BAMS UAS program.

DOD is continuing to exchange information and coordinate with allied and friendly nations that have common maritime surveillance goals and objectives. Program officials indicated that Australia is participating in BAMS UAS pre-system development activities and has provided specific requirements that were included in the BAMS UAS solicitation as an option. Australia has also expressed interest in participating in the system development and demonstration phase of the program.

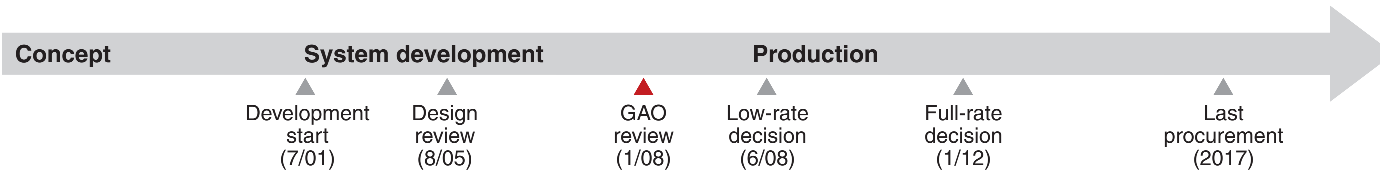
Program Office Comments

The BAMS UAS program office provided technical comments, which we incorporated as appropriate.

C-130 Avionics Modernization Program (AMP)

The Air Force's C-130 AMP standardizes the cockpit configurations and avionics for three combat delivery configurations of the C-130 fleet, which provides increased reliability, maintainability, and sustainability. The program is intended to ensure C-130 global access and deployability by satisfying navigation and safety requirements, installing upgrades to the cockpit systems, and replacing many systems no longer supportable due to diminishing manufacturing sources.

Source: C-130 Avionics Modernization Program, System Program Office.



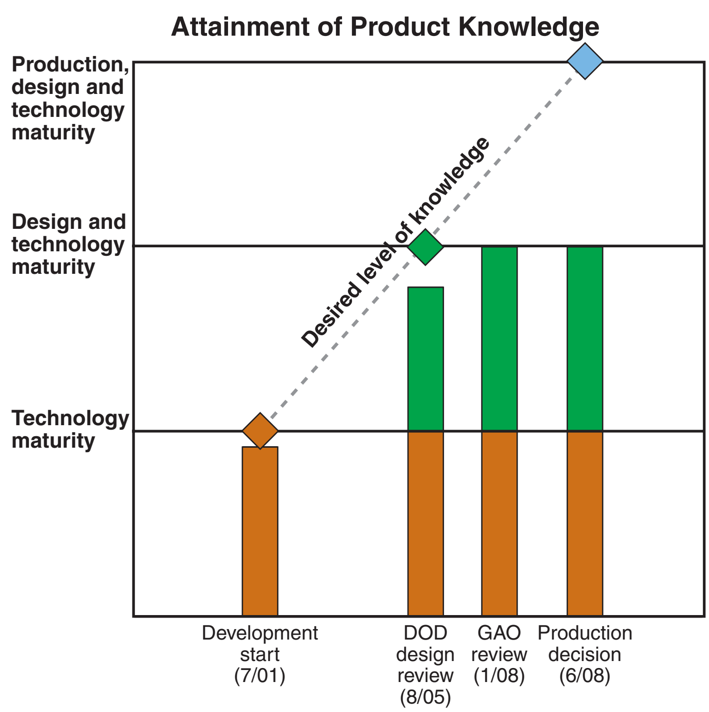
Program Essentials

Prime contractor: Boeing
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
- R&D: $589.9 million
- Procurement: $3,324.3 million
- Total funding: $3,914.1 million
- Procurement quantity: 219

Program Performance (fiscal year 2008 dollars in millions)

	As of 07/2001	Latest 08/2007	Percent change
Research and development cost	$736.4	$1,977.0	168.5
Procurement cost	$3,188.1	$3,371.4	5.7
Total program cost	$3,924.5	$5,348.4	36.3
Program unit cost	$7.562	$24.092	218.6
Total quantities	519	222	-57.2
Acquisition cycle time (months)	TBD	TBD	TBD

The C-130 AMP's technologies are currently mature and its design is stable. However, the program has had ongoing problems for more than 2 years. The program is presently being restructured to provide a better balance between requirements and resources. In the past year, the program reduced the number of aircraft and variants to be modified and increased estimated costs, which resulted in a critical Nunn-McCurdy breach concerning unit cost increases. The program acquisition unit costs have increased to over three times what was expected at development start. The program now plans to enter production in June 2008, over 3 years later than originally planned. However, production maturity will not be fully known at that time because the program does not plan to collect key manufacturing information.



C-130 AMP Program

Technology Maturity

The C-130 AMP critical technologies are fully mature. Removal of 11 of the 14 C-130 aircraft configurations previously included in the program is expected to stabilize the program through reduced requirements and led to the removal of three critical technologies during 2007. The three remaining critical technologies—global air traffic management, defensive systems, and combat delivery navigator removal—are specific to the combat delivery configurations of the C-130 fleet, which comprises the entire AMP following program restructuring in 2007.

Design Stability

The C-130 AMP combat delivery configuration is stable, with over 3,200 expected drawings released. However, at the critical design review held in 2005, the program had not proven that all subsystems and components could be successfully integrated into the aircraft. According to the program office, the complexity of the engineering efforts needed to modify the different configurations of the C-130 was misjudged. Specifically, upon integration of the new avionics into the test aircraft, the amount of wiring and the number of harnesses and brackets needed for the installation had been underestimated by 400 percent. As a result, the design had to be reworked, delaying the delivery of the test aircraft and increasing costs. The program believes it has addressed these integration issues.

Two of the three C-130 aircraft configurations included in the AMP have begun flight testing. However, several key development activities remain that may necessitate design changes if problems arise, including demonstration on the fully integrated test aircraft. Developmental flight testing is expected to conclude in June 2009. The first flight of a fully configured, integrated production representative prototype occurred for the initial C-130 aircraft configuration in September 2006, while the first flight for the final C-130 configuration is scheduled for February 2009.

Production Maturity

The program expects to begin production in June 2008 but will not have data that shows the total number of key product characteristics, the maturity of critical manufacturing processes, or capability indices. Program officials stated they will meet the approved exit criteria established by the milestone decision authority, which includes a Production Readiness Review scheduled for March 2008, before entering into low-rate initial production. Since the beginning of 2006, the low-rate initial production decision has been delayed 19 months due to program uncertainties related to program funding and changing customer requirements. However, changes in the program schedule should allow more testing before the program increases production rates.

Other Program Issues

The C-130 AMP has experienced uncertainty and restructuring for more than 2 years. In February 2007, the program announced it encountered a critical Nunn-McCurdy breach concerning unit cost increases that led to DOD certification, resulting in a formal replan effort to revise requirements. At the time of our review, the program was still finalizing the details of the replan, which included reallocating resources within the program and reducing requirements (fewer aircraft quantities and fewer configurations for the program). The program manager expects that the replan will better position the program to deliver the C-130 AMP within cost and schedule targets. However, the program does not have an updated acquisition strategy, test and evaluation master plan, or service cost position. This information is expected by the production decision in June 2008. The Air Force also must develop an investment strategy, as stipulated in the DOD certification, for 166 C-130 aircraft that are no longer part of the program.

Given the significant changes to the C-130 program, the Air Force is paying more to modernize the avionics for far fewer aircraft than originally planned. At the same time, the warfighter is waiting longer than originally planned for the new capability.

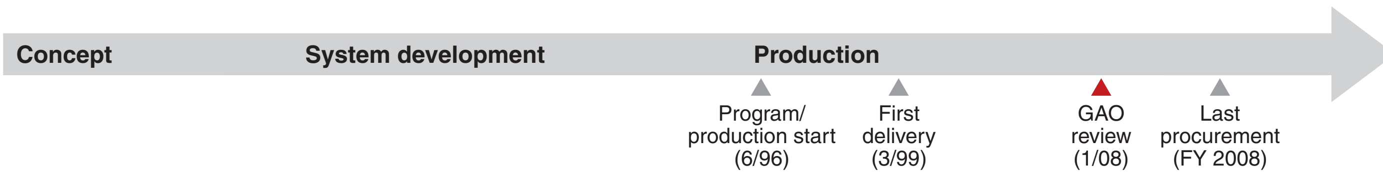
Air Force Comments

In commenting on a draft of this assessment, the Air Force stated the C-130 AMP is focused on restructuring the development effort and proceeding into low-rate initial production in June 2008. The program recently accomplished first flight without a serious software deficiency, incremental software was delivered on time, and flight testing is slightly ahead of schedule. The program has also addressed past issues and is committed to providing the warfighter a critically needed capability.

C-130J Hercules

The C-130J is a tactical airlift aircraft designed primarily for the transport of cargo and personnel within a theater of operation. It is the latest addition to DOD's fleet of C-130 aircraft, providing performance improvements over legacy aircraft in the series. Variants of the C-130J are being acquired by the Air Force, Marine Corps, Coast Guard, and several foreign militaries to perform their respective missions. We reviewed the baseline configuration of the Air Force's C-130J aircraft and related modernization efforts.

Source: C-130J Program Office (657th AESS), U.S. Air Force.



Program Essentials

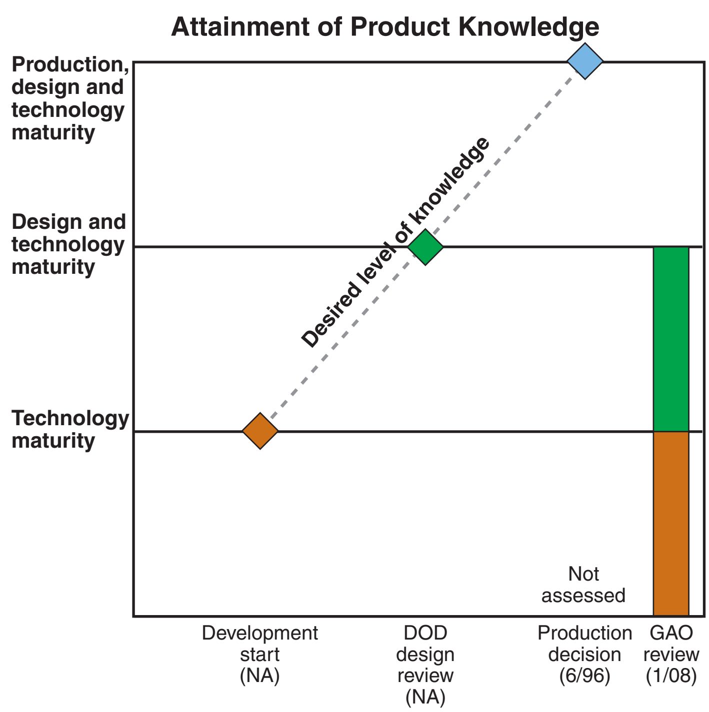
Prime contractor: Lockheed Martin Aeronautics Company - Marietta
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
R&D: $327.7 million
Procurement: $1,348.5 million
Total funding: $1,676.2 million
Procurement quantity: 9

Program Performance (fiscal year 2008 dollars in millions)

	As of 10/1996	Latest 11/2007	Percent change
Research and development cost	$10.9	$430.3	3,847.7
Procurement cost	$890.2	$8,375.1	840.8
Total program cost	$901.2	$8,929.5	890.8
Program unit cost	$81.928	$102.637	25.3
Total quantities	11	87	690.9
Acquisition cycle time (months)	16	33	106.3

These figures reflect only the Air Force's procurement of the C-130J.

We did not assess technology, design, or production maturity for the baseline aircraft because the Air Force did not maintain visibility into this information as part of the C-130J's original commercial acquisition strategy. Program officials stated they evaluated these areas to their satisfaction in other ways. The Air Force is funding modernization efforts to correct deficiencies and provide improvements to fielded C-130Js. Program officials stated there are no issues with technology, design, or production maturity for the modernization efforts now under way. Both the modernization efforts and remaining procurement are being executed under noncommercial negotiated contracts, completing the move from the original commercial item acquisition strategy. This transition provided insight into the cost and pricing of the remaining aircraft buy and data rights for all modernization efforts.



C-130J Hercules Program

Technology Maturity

We did not assess the critical technologies of the baseline aircraft, since the contractor initiated development of the C-130J at its own expense in the early 1990s and DOD took no responsibility for its technology maturity. Program officials also reported no issues with the technology maturity of modernization efforts currently under way.

Design Stability

We did not assess the design of the baseline aircraft because the Air Force does not maintain visibility into design drawing information that GAO would normally utilize to measure design maturity. Because the C-130J was originally procured as a commercial item, rights to this information were not included as part of the acquisition. While program officials believed the intial C-130J design was stable, deficiencies were discovered that had to be corrected in order to meet minimum warfighter requirements, which resulted in the current baseline aircraft. Other design shortfalls to the baseline aircraft have recently been discovered that affect the C-130J's ability to complete certain airdrop operations. Program officials stated that options to address these shortfalls are being developed and should result in aircraft testing in the summer of 2008. Air navigation improvements must also be made so the C-130J can continue to successfully operate in international airspace. These improvements and others will be added to the aircraft through modernization efforts, resulting in a significant development cost increase. Program officials reported no issues with the design maturity of modernization efforts currently under way.

Production Maturity

We did not assess the production maturity of the baseline aircraft because the C-130J was originally procured as a commercial item and DOD has limited access to the full range of contractor manufacturing process and quality control information. Instead, the program relies on oversight by the Defense Contract Management Agency (DCMA) at the contractor's facility to ensure that the C-130J aircraft is manufactured in accordance with applicable quality standards. DCMA officials informed us that their oversight into the contractor's manufacturing processes has improved as a result of the recently completed transition from a commercial item acquisition to a noncommercial negotiated acquisition. Furthermore, production schedules were not affected by the transition and aircraft continue to be delivered on time.

Other Program Issues

In April 2006, test officials deemed the C-130J to be effective in only a low to medium threat environment. The ongoing modernization efforts are expected to correct known deficiencies and address future needs such as communication, navigation, and safety improvements so that the aircraft can accomplish its intended missions. The first of four planned modernization efforts to upgrade the baseline aircraft were tested during 2007, and installation on fielded aircraft will begin in 2008. The second modernization effort, a collaborative endeavor funded by both the Air Force and foreign military customers, is in the initial planning stages, with developmental testing scheduled to begin in fiscal year 2010. The other two modernization efforts are in a preliminary planning stage, with upgrade activities expected to continue through 2015. The Air Force has budgeted approximately $400 million in development funding to pursue the four modernization efforts that does not include the additional costs to install these upgrades on fielded C-130Js in the future.

In October 2006, the Air Force finalized the program's transition from a commercial item acquisition to a noncommercial negotiated acquisition for the remaining procurement. The Air Force now has data rights related to development efforts under the modernization program and full insight into cost and pricing of the C-130J, which resulted in a downward price adjustment of $364 million. However, according to the DOD Inspector General, DOD has assumed responsibility for costs related to shutting down production of the C-130J that were previously factored into the commercial item price for the aircraft. In the future, these potential cost increases may reduce the estimated savings of the transition.

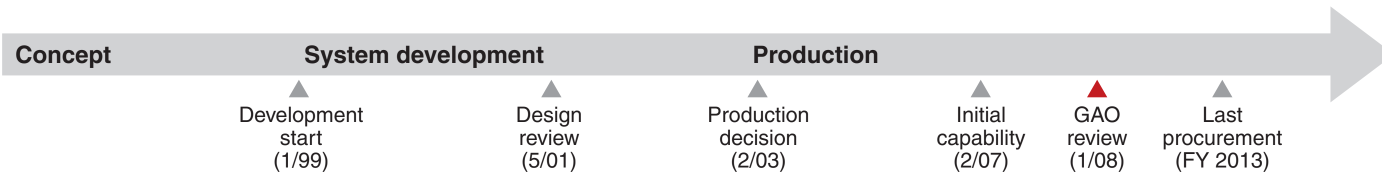
Agency Comments

In commenting on a draft of this assessment, the Air Force provided technical comments, which were incorporated as appropriate.

C-5 Avionics Modernization Program (C-5 AMP)

The Air Force's C-5 AMP is the first of two major upgrades for the C-5 to improve mission capability rate and transport capabilities and to reduce ownership costs. The AMP incorporates Global Air Traffic Management, navigation and safety equipment, modern digital equipment, and an all-weather flight control system. The second major upgrade, the C-5 Reliability Enhancement and Reengining Program (RERP), replaces the engines and modifies the electrical, fuel, and hydraulic systems. We assessed the C-5 AMP.

Source: Edwards AFB, CA. Photo taken by Air Force.



Program Essentials

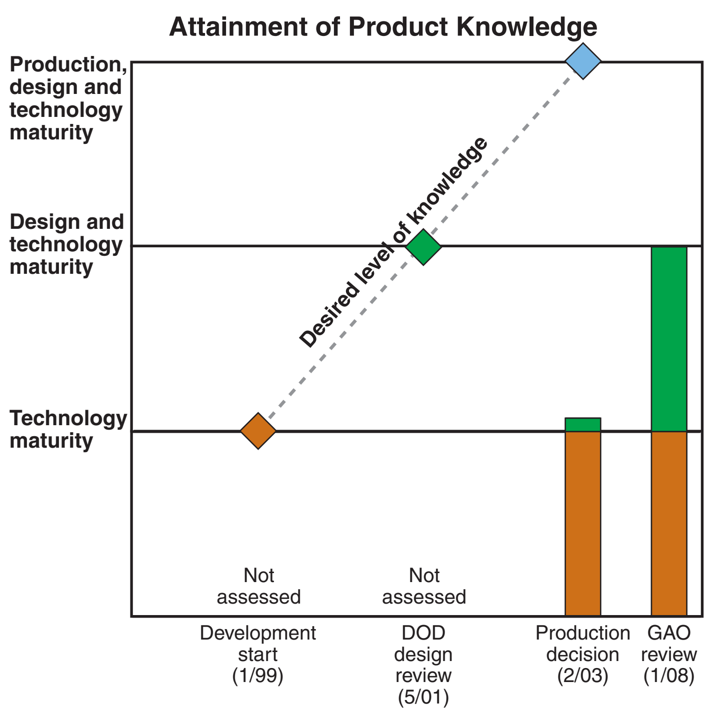
Prime contractor: Lockheed Martin
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
R&D: $14.3 million
Procurement: $519.9 million
Total funding: $534.1 million
Procurement quantity: 52

Program Performance (fiscal year 2008 dollars in millions)

	As of 11/1998	Latest 08/2007	Percent change
Research and development cost	$381.0	$460.9	20.9
Procurement cost	$666.5	$989.8	48.5
Total program cost	$1,047.6	$1,450.5	38.5
Program unit cost	$8.314	$12.951	55.9
Total quantities	126	112	-11.1
Acquisition cycle time (months)	83	97	16.9

The C-5 AMP technologies and design are used in other aircraft and are considered mature. We did not assess production maturity as the components are commercial off-the-shelf items. While the program is currently in production, 250 deficiencies were identified by the end of Operational Test and Evaluation. These deficiencies are reviewed and prioritized by the Air Force annually, and the top priority deficiencies will be included in the software maintenance builds released in the fourth quarter of every year. Further, 14 operational requirements have been waived; four will be addressed by the C-5 RERP and others may be included in a possible block upgrade for fiscal year 2010. At the time of our review, DOD was studying options to meet its airlift requirements, due to cost increases in the C-5 RERP. This could result in a smaller number of C-5 aircraft receiving the modernization upgrades.

Attainment of Product Knowledge



C-5 AMP Program

Technology Maturity

We did not assess the C-5 AMP's critical technologies because the program uses commercial technologies that are considered mature.

Design Stability

The program reports that the contractor has now released all of the drawings for the AMP.

Production Maturity

We could not assess the production maturity because most components are readily available as commercial off-the-shelf items. This equipment is being used on other military and commercial aircraft. To ensure production maturity, the contractor annually surveys its suppliers to assess future availability of AMP modification kits and works with the program office and end user to ensure that installations can be completed according to the installation schedule.

According to the Director of Operational Test and Evaluation, the program is not operationally suitable. According to program officials, 250 deficiencies, including software issues related to autopilot disconnects, currently exist, and 14 operational requirements have been waived. Program officials expect that 44 of the deficiencies will be corrected as part of a sustainment contract software build in August 2008. The corrections to 24 of these 44 deficiencies will also be included in the C-5 RERP. The C-5 RERP program is also expected to address 4 of the 14 previously waived operational requirements, such as the Auto Take Off and Go Around functionality and memory improvement for the Flight Management System database. Air Force officials are considering a block upgrade program beginning in 2010 to correct the remaining deficiencies and the 10 unmet operational requirements.

Other Program Issues

Program unit costs have increased approximately 56 percent since the original estimate because of a reduction in the total number of aircraft scheduled to receive the AMP upgrade, as well as increases in development and procurement estimates related to software reliability problems.

Last year we reported that the program did not have enough funding to implement an Air Force mobility study recommendation to modify all C-5 aircraft. At that time, there was only funding for 59 aircraft. The Air Force requested funding in fiscal year 2008 to complete the AMP upgrade for all aircraft in the C-5 fleet. However, officials continue to study options to meet its airlift requirements because of cost increases associated with the C-5 RERP. This could result in a smaller number of C-5 aircraft receiving the modernization upgrade.

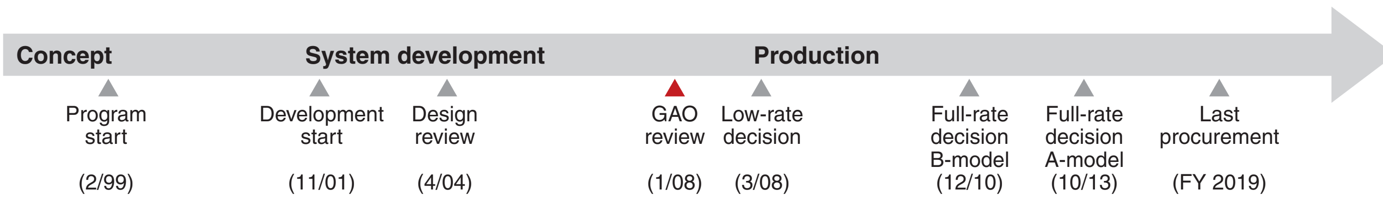
Agency Comments

The Air Force provided technical comments to a draft of this assessment, which were incorporated as appropriate.

C-5 Reliability Enhancement and Reengining Program (C-5 RERP)

The Air Force's C-5 RERP is one of two major upgrades for the C-5. The RERP is designed to enhance the reliability, maintainability, and availability of the C-5 by replacing the propulsion system and modifying the mechanical, hydraulic, avionics, fuel, and landing gear systems as well as other structural modifications. Together with the C-5 Avionics Modernization Program (AMP), these upgrades are intended to improve the mission capability rates and reduce total ownership costs. We assessed the C-5 RERP.

Source: Edwards AFB, CA. Photo taken by Air Force.



Program Essentials

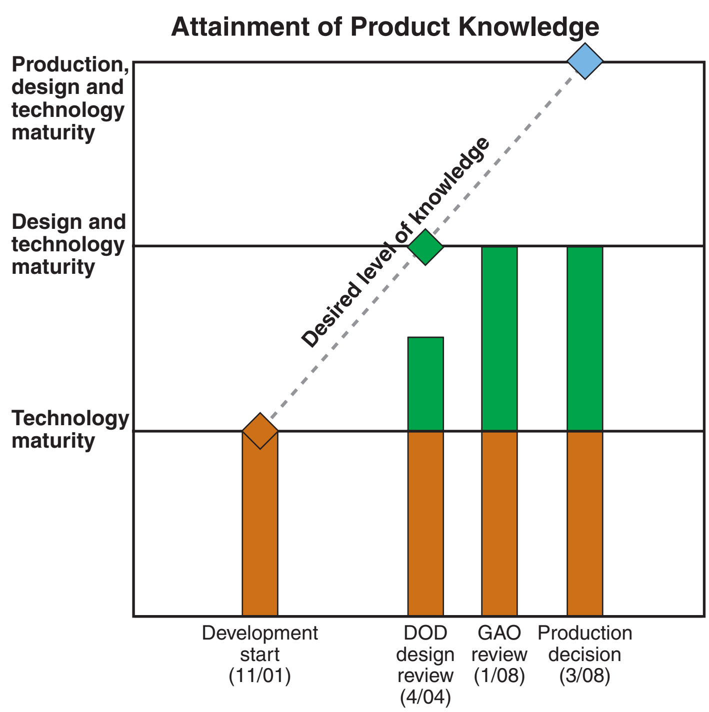
Prime contractor: Lockheed Martin
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
- R&D: $403.6 million
- Procurement: $13,501.4 million
- Total funding: $13,905.0 million
- Procurement quantity: 108

Program Performance (fiscal year 2008 dollars in millions)

	As of 11/2001	Latest 09/2007	Percent change
Research and development cost	$1,664.4	$1,744.4	4.8
Procurement cost	$8,688.6	$13,531.6	55.7
Total program cost	$10,356.7	$15,283.9	47.9
Program unit cost	$82.196	$137.693	67.5
Total quantities	126	111	-11.9
Acquisition cycle time (months)	100	139	39.0

These numbers are expected to change after DOD completes its Nunn-McCurdy certification.

The C-5 RERP technologies are mature and the design is stable. We did not assess production maturity because the Air Force is buying commercially available items. Despite the high degree of product knowledge, the program has faced a series of development and production issues over the past year. The RERP experienced a 1-year delay in starting low-rate intial production because of rising production costs. The program resolved complications related to a requirement that certain specialty metals be bought only from American sources. The Air Force notified Congress that program unit costs have increased over 50 percent, triggering a Nunn-McCurdy unit cost increase over the critical cost growth threshold. At the time of our review, DOD was examing options to meet its airlift requirements. There are also concerns about the contractor's ability to track costs and the funding needed to fix some C-5 AMP problems.



C-5 RERP Program

Technology Maturity

The C-5 RERP's technologies are mature based on an independent technology readiness assessment conducted in October 2001.

Design Stability

The basic design of the C-5 RERP is now complete with over 90 percent of the drawings released. At the critical design review, program officials believed that about 80 percent of the drawings had been released. However, since then, a redesign of the pylon/thrust reverser was needed to address weight requirements and safety concerns for the engine mount area as well as control of asymmetric thrust reverser conditions in flight. According to program officials, the now completed redesign effort contributed to a 4-month modification program delay.

Production Maturity

We did not assess the C-5 RERP's production maturity because the Air Force is buying commercially available items.

The program awarded a long-lead contract for Lot 1, which comprises one aircraft, in April 2007, 14 months later than planned. The primary causes of the delay were increased costs in producing engines and pylons and estimate revisions associated with the automation of production processes and material installation touch labor. During this delay, the Air Force granted a permanent waiver from the speciality metal provisions of the Berry Amendment, permitting the use of non-U.S. sources for certain specialty materials.

According to program officials, the program office and prime contractor have expended considerable effort in preparing the RERP for production. For example, a production readiness review has been conducted, three test aircraft were produced in the system development and demonstration phase, and the lessons learned are being applied to production plans. The program office is reviewing the contractor's proposal for low-rate initial production in preparation for award of Lot 1, with options for Lots 2 and 3, in April 2008. Final work to be accomplished includes about 30 percent of flight test verification points, flight test completion, a software verification review, and operational test and evaluation preparatory work.

However, the production program continues to be a major issue for the RERP as the costs to fund first-unit production and related expenses have increased by about 108 percent since last year. According to program officials, the prime contractor did not maintain long-term contracts with key suppliers that could have kept costs down and significantly underestimated the amount of touch labor needed to complete each aircraft. In addition, the C-5 RERP program will pay up to an additional $16 million to the prime contractor to address 4 deviation waivers and 24 deficiencies from the C-5 AMP.

Flight testing has been extended to August 2008, an increase of 8 months, to allow sufficient time for additional test points, reflights, weather, maintenance, and other factors. The low-rate initial production decision has now been scheduled for March 2008. Producing units before testing is able to demonstrate the design is mature and works in its intended environment increases the likelihood of future costly design changes during production.

Other Program Issues

The Air Force recently reported a Nunn-McCurdy unit cost increase over the critical cost growth threshold because program costs have increased more than 50 percent. Air Force leadership is currently working with DOD and Congress to determine the most prudent course for the U.S. strategic airlift fleet. Options could include reducing the number of C-5 aircraft that will receive the RERP modification and procuring additional C-17 aircraft to fulfill the airlift mission.

The Defense Contract Audit Agency has identified significant deficiencies with the prime contractors' earned value management system that affects the Air Force's ability to oversee the cost aspects of the program.

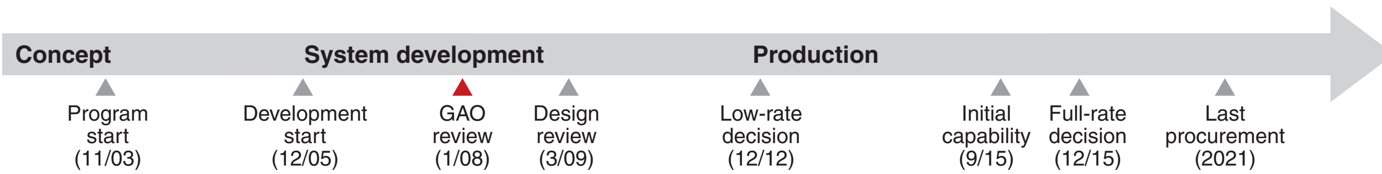
Agency Comments

The program office provided technical comments, which were incorporated as appropriate.

CH-53K Heavy Lift Replacement (HLR)

The Marine Corps' CH-53K helicopter will perform the marine expeditionary heavy-lift assault transport of armored vehicles, equipment, and personnel to support distributed operations deep inland from a sea-based center of operations. The CH-53K program is expected to replace the current CH-53E helicopter with a new design to improve range and payload, survivability and force protection, reliability and maintainability, coordination with other assets, and overall cost of ownership.

Source: Sikorsky Aircraft Company, © 2003 Sikorsky Aircraft Company.



Program Essentials

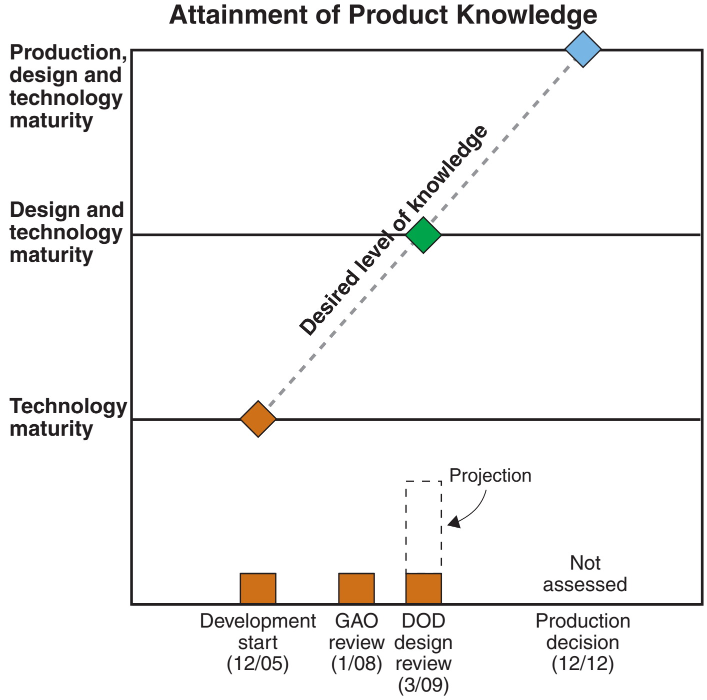
Prime contractor: Sikorsky Aircraft
Program office: Patuxent River, Md.
Funding needed to complete:
- R&D: $3,429.8 million
- Procurement: $11,664.2 million
- Total funding: $15,094.0 million
- Procurement quantity: 152

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2005	Latest 12/2006	Percent change
Research and development cost	$4,158.7	$4,159.5	0
Procurement cost	$11,565.9	$11,664.2	0.8
Total program cost	$15,724.7	$15,823.8	0.6
Program unit cost	$100.799	$101.434	0.6
Total quantities	156	156	0
Acquisition cycle time (months)	119	117	-1.3

The CH-53K program entered system development in December 2005 without demonstrating that its three critical technologies had reached full maturity. The program has decided to use an alternative technology for one of these technologies and expects the remaining two technologies to be mature by 2012, three years after the program's design review. Elements of other technology areas are not considered critical, although they may still present challenges to the program as many of them are currently being developed or used by other programs and will be integrated later into the CH-53K. Due to attrition in the fleet of CH-53Es, the program has recognized the need for fielding the CH-53Ks as soon as possible. To address these challenges, it plans to manufacture a large portion of aircraft during low rate initial production and concurrent with operational testing.

Attainment of Product Knowledge



CH-53K Program

Technology Maturity

Two critical technologies for the CH-53K program—the main rotor blade and the main gearbox—are not expected to be fully mature until 2012, three years after the program's design review. The main rotor blade will be the same diameter (79 feet) and 11 percent wider than that of the CH-53E design. The CH-53K main rotor blade has demonstrated improved performance to meet new vertical lift requirements. Program officials stated that smaller-scale models of the main rotor blade performed well in tests and the actual-sized rotor blade is expected to achieve full maturity by 2012. The main gearbox has not achieved full maturity, which is expected by fiscal year 2012. While other helicopters have utilized similar technology, their intended payload was less than that of the CH-53K. Program officials stated that through testing to date, the main gearbox has achieved greater than 100 percent of its torque requirement.

The viscoelastic lag damper, which serves to control the lead-lag motion of the blade, was originally considered a critical technology and expected to be fully mature by 2009. However, program officials told us that the program has now decided to use a linear hydraulic damper as an alternative. While this may result in a reduction of planned CH-53K reliability, program officials stated that modifications have doubled the reliability of the current damper used on the CH-53E.

An assessment conducted in September 2004 reduced 10 original critical technologies to the 3 above. Of the 7 technologies that were determined to not be critical, 2 are being developed by the CH-53K program, including the engine for which a supplier was selected in December 2006. The other 5 are being developed by or used on other programs, and 4 of them will be integrated onto the CH-53K platform. While the program does not anticipate problems with the 4 technologies, they are dependent on the development and maturity schedules of the other programs.

Design Stability

CH-53K design stability is being assessed through reviews and approvals of relevant design baselines at the system engineering technical reviews. The program has completed a review and approved the systems requirements baseline and has also conducted a systems-level review and approved the system functional baseline. A critical design review is scheduled for March 2009.

Other Program Issues

Due to unexpected attrition of CH-53E aircraft, the need for the deployment of the CH-53K as a replacement has increased, resulting in the return of decommissioned CH-53E helicopters to operational status. According to program officials, all available aircraft have been reclaimed while the program continues to review the condition of other usable aircraft for potential spare parts.

Currently deployed CH-53E aircraft have flown at three times the planned utilization rate. This operational pace is expected to result in higher airframe and component repair costs, including short-term fatigue repairs necessary to minimize CH-53E inventory reductions until CH-53K deliveries reach meaningful levels.

Program officials stated that to address the challenges that have led to this attrition, the requirements of the CH-53K have expanded the CH-53E's thresholds for heat, distance, and load capacity. The program also intends to manufacture 29 of the 156 total helicopters (19 percent) during low-rate initial production and concurrent with initial operational testing. While concurrent production may help to field the systems sooner, it could also result in greater retrofit costs if unexpected design changes are required.

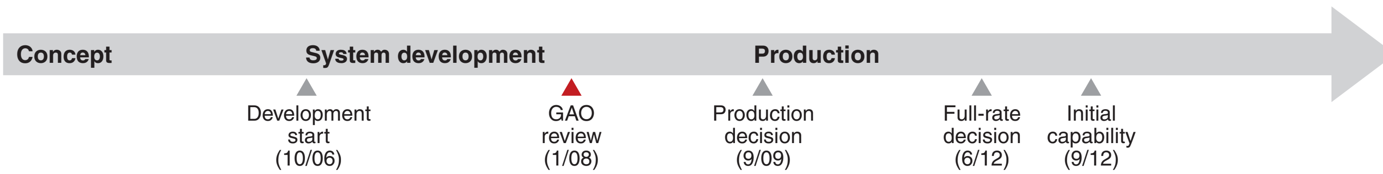
Agency Comments

In commenting on a draft of this assessment, the Navy provided technical comments, which were incorporated as appropriate.

Combat Search and Rescue Replacement Vehicle (CSAR-X)

The Combat Search and Rescue Replacement Vehicle (CSAR-X) is planned to provide the United States Air Force with a vertical take-off and landing aircraft that is quickly deployable and capable of main base and austere location operations for worldwide CSAR and personnel recovery missions. The CSAR-X will be developed in two blocks and will replace the aging HH-60G Pave Hawk helicopter fleet. We assessed CSAR-X Block 0, the first block to be developed.

Source: 669 AESS/TH CSAR-X Program Office.
Note: Photo is of the HH-60 Pavehawk, the aircraft the CSAR-X will replace.



Program Essentials

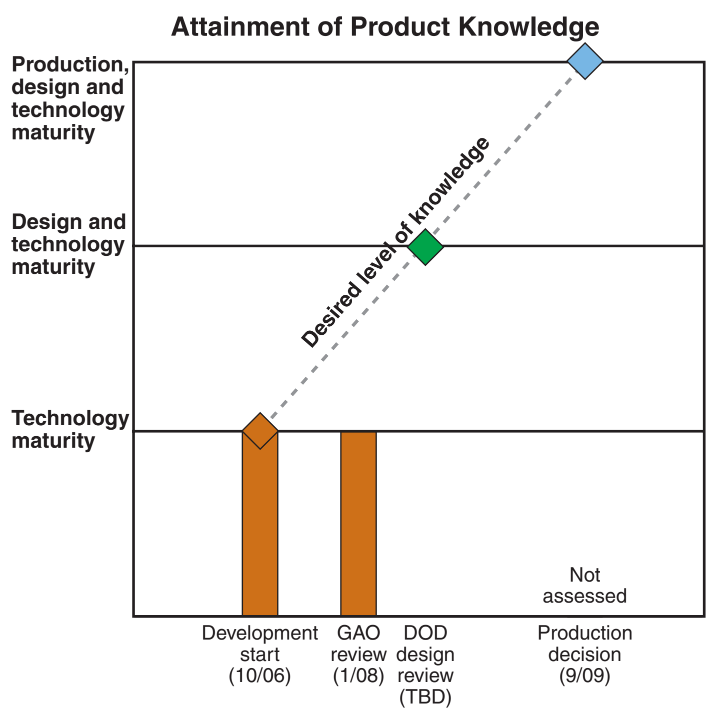
Prime contractor: TBD
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
R&D: $491.9 million
Procurement: $7,271.9 million
Total funding: $7,874.5 million
Procurement quantity: 141

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$836.5	NA
Procurement cost	NA	$7,271.9	NA
Total program cost	NA	$8,219.1	NA
Program unit cost	NA	$57.077	NA
Total quantities	NA	144	NA
Acquisition cycle time (months)	NA	70	NA

Cost and schedule data are based on estimates developed prior to legal rulings and are subject to change pending contract award in spring 2008.

The CSAR-X program received approval to begin product development in October 2006, and program officials reported that all critical technologies were mature at that time. However, two related consecutive bid protests filed by competitors required the program to suspend development activities. GAO sustained both protests, and currently, the Air Force is amending the request for proposals to address GAO's recommendations. As a result, information regarding technology maturity is subject to change pending the contract award, which is not expected to occur before spring 2008. Design stability and production maturity information was not available at the time of this review.



CSAR-X Program

Technology Maturity

CSAR-X program officials identified eight critical technologies for Block 0 and reported that all eight were mature based on a program office assessment of industry standards and market research. However, since that assessment was completed, two separate but related bid protests were filed by competing contractors and sustained by GAO. In response to GAO's concerns, the Air Force is currently amending the request for proposals and does not anticipate awarding a development contract before spring of 2008. As such, it is possible that the technology readiness information could change upon contract award. The Air Force also identified a number of other critical technologies expected to support the next segment of CSAR-X vehicles (Block 10), but did not provide related maturity information. These additional technologies will be assessed prior to the start of Block 10 development.

Program Issues

CSAR-X is being managed as an incremental development program. Block 0, the block assessed in this review, and Block 10 will be managed as separate programs, each with its own requirements, program baselines, and milestone reviews.

The initiation of CSAR-X Block 0 development has been delayed several times, in part due to two bid protests. The Air Force awarded the CSAR-X Block 0 development contract to Boeing in November 2006, but a bid protest by competing contractors filed with GAO required the Air Force to suspend the beginning of product development activities. In February 2007 GAO sustained the protest. In response, the Air Force amended its request for proposals. However, the competitors filed another bid protest in response to the Air Force's amended request. This second protest was also sustained by GAO in August 2007. As a result, the Air Force is again amending the request for proposals to respond to GAO's latest recommendations.

These schedule delays in Block 0 development will likely affect the entire CSAR-X acquisition strategy including the development of Block 10, which is currently scheduled to start in 2009. Program officials do not expect to award a Block 0 development contract before spring 2008. According to program officials, the Air Force still desires to have the first unit of CSAR-X helicopters in the field by 2012, but due to the delayed start of product development they acknowledge that initial operational capability could occur as late as 2014.

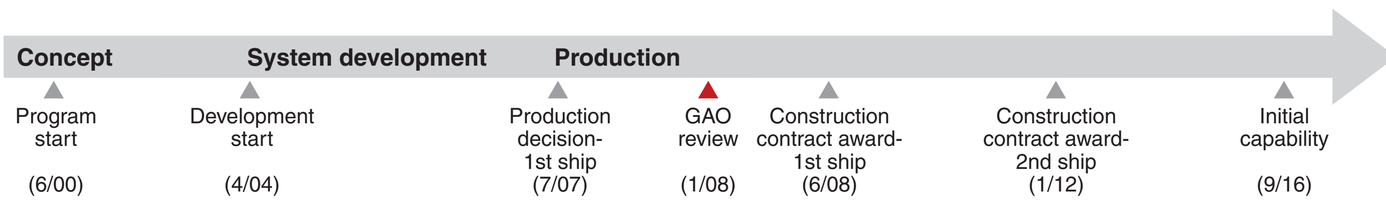
Agency Comments

In commenting on a draft of this assessment, program officials provided technical comments that were incorporated as appropriate.

CVN 21 Nuclear Aircraft Class Carrier

The Navy's CVN 21 program is developing a new class of nuclear-powered aircraft carriers that will replace USS Enterprise and the Nimitz-class as the centerpiece of the carrier strike group. The new carriers are to include advanced technologies in propulsion, weapons handling, aircraft launch and recovery, and survivability designed to improve operational efficiency and enable higher sortie rates while reducing required manpower. The Navy expects to award a contract for construction of the lead ship, CVN 78, in June 2008.

Source: CVN-21 Program Office.



Program Essentials

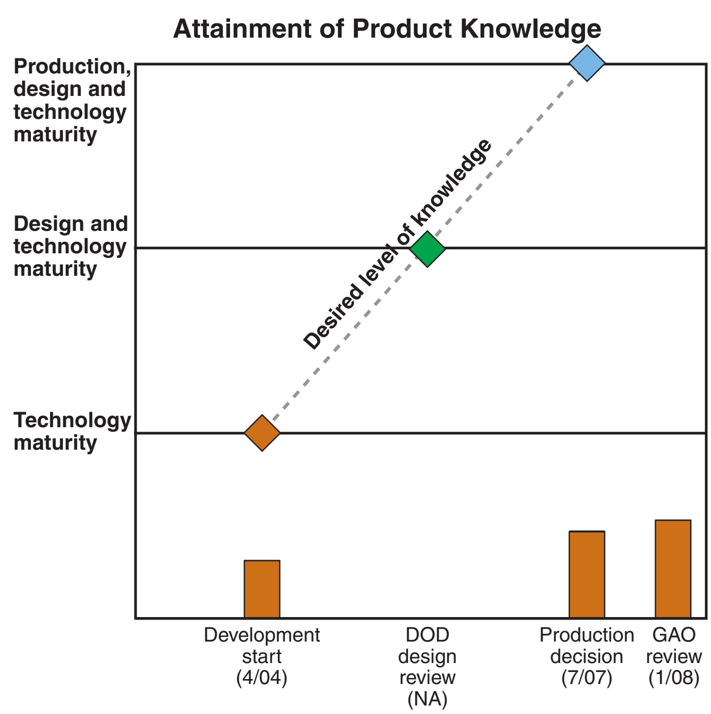
Prime contractor: Northrop Grumman Shipbuilding
Program office: Washington, D.C.
Funding needed to complete:
- R&D: $1,450.9 million
- Procurement: $22,059.9 million
- Total funding: $23,510.5 million
- Procurement quantity: 3

Program Performance (fiscal year 2008 dollars in millions)

	As of 04/2004	Latest 12/2006	Percent change
Research and development cost	$4,561.9	$4,083.2	-10.4
Procurement cost	$29,224.1	$25,652.6	-12.2
Total program cost	$33,786.0	$29,735.8	-11.9
Program unit cost	$11,261.997	$9,911.948	-11.9
Total quantities	3	3	0
Acquisition cycle time (months)	137	149	8.9

Program costs decreased due to changes in the estimated costs for the second and third ships and the application of new outyear inflation indices.

Five of 15 current critical technologies are fully mature, including the nuclear propulsion and electric plant. Six technologies are expected to approach maturity, while four others will remain at lower maturity by construction contract award. Since last year, the Navy has eliminated an armor protection system from CVN 78, but is evaluating use on follow-on ships, and the air conditioning plant and automated weapons information system are no longer considered developmental. Of CVN 21's technologies, the electromagnetic aircraft launch system (EMALS), the advanced arresting gear, and the dual band radar (composed of the volume search and multifunction radars) present the greatest risk to the ship's cost and schedule. By January 2008, 76 percent of the design was complete. Challenges in technology development could lead to delays in maintaining the design schedule needed for construction.



CVN 21 Program

Technology Maturity

EMALS will not be tested at sea, but a production model is now scheduled to begin land-based testing in 2009. Difficulties developing the generator and meeting detailed Navy requirements have already led to a 15-month schedule delay. Problems manufacturing the generator recently delayed testing scheduled to begin by February 2008. The Navy is considering authorizing production of the generators prior to completing initial testing in order to ensure delivery to support CVN 78's construction schedule. As a consequence, production may begin prior to demonstrating that the generators work as intended. Timely delivery of EMALS remains at risk. Problems that occur in testing or production will likely prevent EMALS from being delivered to the shipyard to meet the construction schedule.

The dual band radar is being developed as part of the DDG 1000 program. In 2007 DOD reassessed the multifunction radar's readiness. Since modes critical to CVN 21 have not yet been tested, including electronic protection and air traffic control, the radar could not be considered fully mature. While the multifunction radar has been tested at sea, considerable testing remains for the volume search radar. Due to problems with a critical circuit technology, the volume search radar will not demonstrate the power output needed to meet requirements during upcoming testing. Full power output will not be tested on a complete system until the first production unit in 2010, and the radar will not be fully demonstrated until operational testing on DDG 1000 in 2013. Problems discovered during testing may affect installation on the carrier scheduled to begin in 2012.

The advanced arresting gear completed early verification tests that proved the system's concept and tested components. Integrated testing with simulated and live aircraft is scheduled to begin in 2009. Delays have led the Navy to consolidate test events in order to maintain the shipyard delivery date, leaving little time to address any problems prior to production. Late delivery will require the shipbuilder to install this system after the flight deck has been laid, disrupting the optimal build sequence and increasing cost.

Other technologies will not be fully matured by construction contract award, but present less risk to ship construction. The advanced weapons elevator cannot be tested at sea until ship delivery but will complete full-scale testing in 2008. A shipboard replenishment system is a modification of current technology and full-scale testing concluded this year. The shipboard weapons loader is critical for achieving manpower reductions, but will be stored on the flight deck and not required until ship delivery. A GPS-based landing system (JPALS) is still in development, but the carrier will use a backup to land aircraft that are not JPALS-capable. A missile uplink will not be operationally tested until 2013, but CVN 78 can achieve its key performance parameters without this improvement.

Design Stability

By January 2008, 76 percent of the design was complete. Rather than conducting discrete design reviews, the Navy reviews each design zone (or separate units that make up the ship's design) as it completes an interim phase of the product model and measures design progress by the number of zones completed. According to the Navy, the design is on track to support construction. However, the program may face challenges in maintaining its design schedule due to delays in the receipt of technical information on some key technologies. In particular, late delivery of information on EMALS is driving inefficiencies in design development and must be resolved to prevent late delivery of design products needed for construction.

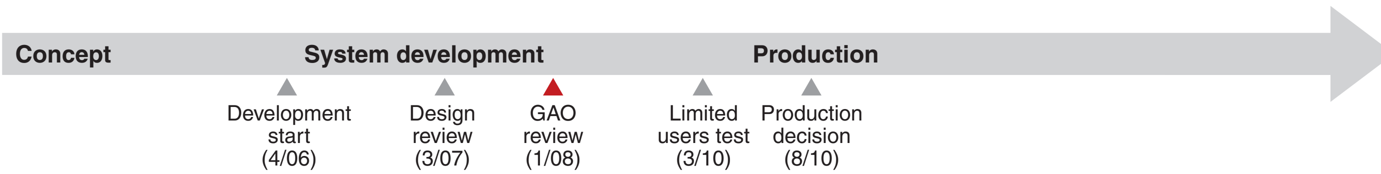
Agency Comments

The Navy generally concurred with our assessment that concurrent technology development, particularly regarding EMALS, the advanced arresting gear, and the dual-band radar system, presents the highest programmatic risk, but stated that all critical technologies are being managed through established processes to mitigate cost, schedule, and development risk. Additionally, a lengthy construction period allows technologies to mature and helps ensure technologies do not become obsolete by ship delivery. The Navy noted that the program has maintained key performance parameters through product modeling, which indicates design stability. Production risk is being mitigated by the advanced construction of structural units low in the ship. As of December 2007, 25 percent of the ship's units were under construction.

Distributed Common Ground System—Army (DCGS-A)

The Army's DCGS-A is an automated information system providing commanders at various echelons with access to a variety of intelligence, surveillance, and reconnaissance (ISR) data. DCGS-A allows commanders to visualize and understand threats, execute targeting, conduct ISR integration, and support information operations. The Army plans ongoing enhancement of DCGS-A by incrementally fielding more capable versions of the system over time. We assessed Version 4, which is intended to provide commanders with a mobile capability.

Source: PM DCGS-A, U.S. Army.



Program Essentials

Prime contractor: Northrop Grumman
Program office: Fort Monmouth, N.J.
Funding FY08-FY13:
- R&D: $204.1 million
- Procurement: $1,012.3 million
- Total funding: $1,216.4 million
- Procurement quantity: 0

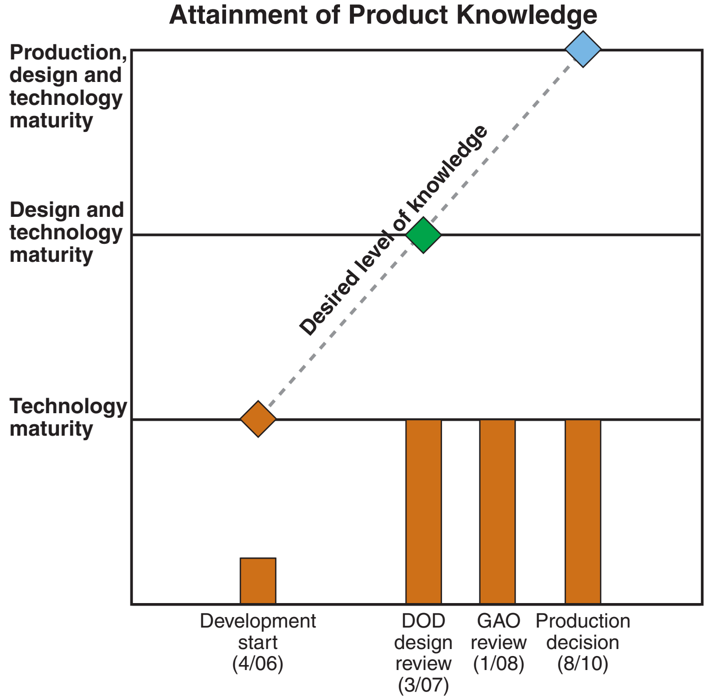
Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$637.5	NA
Procurement cost	NA	$1,206.8	NA
Total program cost	NA	$1,844.3	NA
Program unit cost	NA	NA	NA
Total quantities	NA	0	NA
Acquisition cycle time (months)	NA	NA	NA

Northrop Grumman is the development contractor; the production contractor is to be determined. Funding needed to complete includes appropriations through fiscal year 2013, future funding needed is to be determined.

DCGS-A Version 4 began system development in April 2006. Currently, all three Version 4 critical technologies are mature. DCGS-A is scheduled to undergo a limited users test in March 2010 to support a Version 4 production decision in August 2010. We were unable to assess design stability because the program does not use drawings to assess design stability. Additionally, we did not assess production maturity because the production phase does not involve any critical manufacturing processes.

Attainment of Product Knowledge



DCGS-A Program

Technology Maturity

Currently, all critical technologies are mature and were demonstrated in the 2007 Empire Challenge ISR demonstration. A program official noted that all critical technologies will be tested through a series of Software Blocking Operational Evaluations culminating in a Limited Users Test in March 2010.

Design Stability

We were unable to assess design stability because the program does not use drawings to assess design stability. A program official stated that design stability was demonstrated during the critical design review in March 2007 and through the delivery of the first test article in September 2007.

Production Maturity

DCGS-A has no critical manufacturing processes, as it integrates existing ISR capabilities through the use of hardware and software. DCGS-A is an integration of commercial off-the-shelf and government off-the-shelf hardware and software with additional software functionality being added to meet the requirements of the Army's capabilities development document. Program officials expect that the Version 4 production decision to occur in August 2010.

Other Program Issues

DCGS-A is composed of multiple versions split into three capability development increments: Versions 2 and 3 are in Increment 1, Version 4 is in Increment 2, and Version 5 is in Increment 3. Version 4 will meet about 85 percent of the DCGS-A operational requirements and be further modified to achieve the system's full objective capability in Version 5. Version 4 upgrades current software, increases system mobility, and consolidates existing ISR capabilities, including the Common Ground Station, All Source Analysis System family of systems, Digital Topographic Support System, Integrated Meteorological System, Counter Intelligence and Interrogation Operations Workstation, and Prophet Control. Version 5 will consist primarily of software upgrades to the Version 4 configuration to provide advanced fusion capabilities and the ability to receive and process data from emerging and developing sensors.

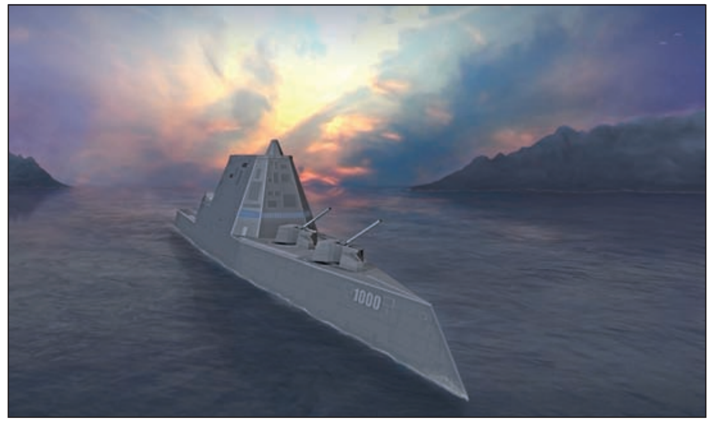
Each military service has a DCGS system and all are highly dependent on the DCGS Integration Backbone (DIB); without this they cannot work together. The DIB is a common set of enterprise services and standards that serves as the foundation for interoperability and data sharing across the DCGS enterprise. The DIB program is pursuing an evolutionary acquisition strategy and has delivered early versions of the product. To date, the DIB has achieved successful connectivity and data sharing in a demonstration with Army, Air Force, and Navy laboratories. According to a DIB program official, the next major milestone for the DIB is the planned delivery of a new version that will focus on interoperability testing and certification. The delivery of the new DIB software is scheduled for the first quarter of fiscal year 2009 to support the DCGS-A Version 4.

Agency Comments

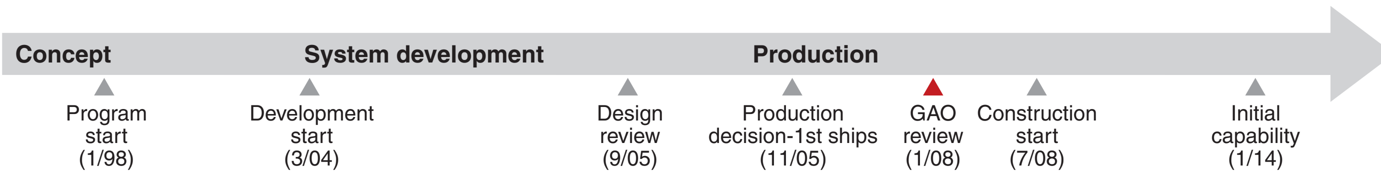
In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

DDG 1000 Destroyer

The Navy's DDG 1000 destroyer (formerly known as DD(X)) is a multimission surface ship designed to provide advanced land attack capability in support of forces ashore and contribute to U.S. military dominance in littoral operations. The program awarded contracts for detail design in August 2006 and negotiated contract modifications for construction of two lead ships in February 2008. The program will continue to mature its technologies and design as it approaches construction start, currently planned for July 2008.



Source: PEO Ships (PMS 500).



Program Essentials

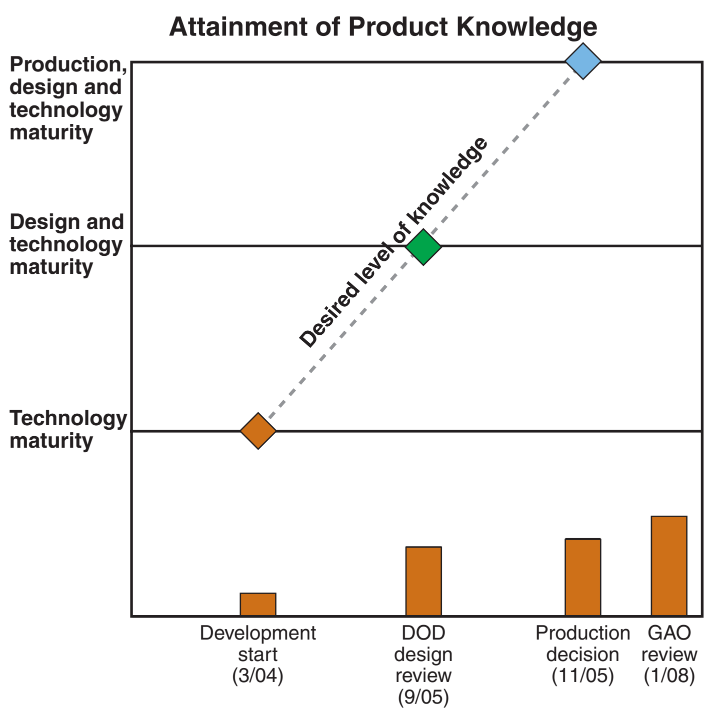
Prime contractor: BAE Systems, Bath Iron Works, Northrop Grumman Shipbuilding, Raytheon
Program office: Washington, D.C.
Funding needed to complete:
R&D: $2,336.4 million
Procurement: $20,291.3 million
Total funding: $22,627.7 million
Procurement quantity: 10

Program Performance (fiscal year 2008 dollars in millions)

	As of 01/1998	Latest 12/2006	Percent change
Research and development cost	$2,163.3	$9,342.4	331.9
Procurement cost	NA	$23,734.9	NA
Total program cost	NA	$33,076.9	NA
Program unit cost	NA	$3,307.694	NA
Total quantities	0	10	NA
Acquisition cycle time (months)	128	192	50

Quantity based on the approved program estimate, the Navy's shipbuilding plan estimates 7 ships. Costs increased due to changes in quantities, technology development, and program restructuring.

Three of 12 DDG 1000 critical technologies are fully mature, having been demonstrated in a sea environment. While 7 other technologies are approaching full maturity, 5 of them will not demonstrate full maturity until after installation on the ship. Two technologies remain at lower levels of maturity—the volume search radar and total ship computing environment. Land-based testing of a volume search radar prototype is expected to begin in May 2008—a delay of over 12 months since last year's assessment. Software development for the total ship computing environment has been replanned, shifting functionality to later software blocks. The Navy plans on completing 85 percent of the ship's detail design prior to the start of construction.



DDG 1000 Program

Technology Maturity

The volume search and multifunction radars constitute the dual band radar system. While the multifunction radar has been tested at sea, the volume search radar continues to experience delays. Problems in developing the prototype and constructing the test facility have delayed land-based testing of the volume search radar by over a year. In order to support the ship construction schedule, the Navy has begun initial testing at an alternate test site. Because of issues with a critical circuit technology, the volume search radar will not demonstrate full power output until at least 2010—after production of the dual band radar is well under way. Problems or delays discovered during testing will likely affect radar production and installation.

The total ship computing environment includes hardware and six blocks of software code. Current software development is focused on the fourth block. The Navy has reduced its software development efforts in order to accommodate available funding. As a consequence, some functionality has been deferred to blocks five and six. The Navy believes that cost and schedule parameters will still be achieved by leveraging non-development items and existing software code. However, full maturity will not occur until after the start of ship construction.

Of the seven technologies approaching full maturity, the Navy expects to demonstrate full maturity of the integrated deckhouse and peripheral vertical launch system by the start of ship construction in July 2008. Production of a large-scale deckhouse test unit is under way and final validation of the vertical launching system will occur in spring 2008. Practical limitations prevent the Navy from fully demonstrating all critical technologies at sea prior to ship installation. Testing of other technologies continues through ship construction start.

Due to scheduling issues for the lead ships, the Navy did not have time to fully test the integrated power system prior to shipyard delivery and instead requested funds in fiscal year 2008 to procure an additional unit. The Navy will conduct integrated power system testing in 2010 using this unit at a land-based test site. Considerable software development remains and land-based testing will mark the first integrated testing between the power generation and distribution system and the control system. If problems are discovered during testing, construction plans and costs could be at risk because the power systems needed for the first two ships will already have been delivered to the shipyards.

The Navy continues to test prototypes of the ship's hull form to demonstrate stability in extreme sea conditions at higher speeds. According to Navy officials, existing computer simulation tools over-predicted the ship's tendency to capsize. The Navy is now relying on testing of scale models in tanks and on the Chesapeake Bay, and is updating its computer simulation tool. Ongoing testing is aimed at developing guidance for operating the ship safely under different sea conditions.

Design Stability

The Navy estimates that it will complete 85 percent of the detail design prior to the start of lead ship construction. While design progress is being made, the program faced initial technical difficulties in sharing the design tool between shipbuilders. Processing changes between shipyards and contractors resulted in some delays. According to the Navy, the program is on track to reach its design targets. Successfully meeting its target requires that DDG 1000 technologies develop according to plan.

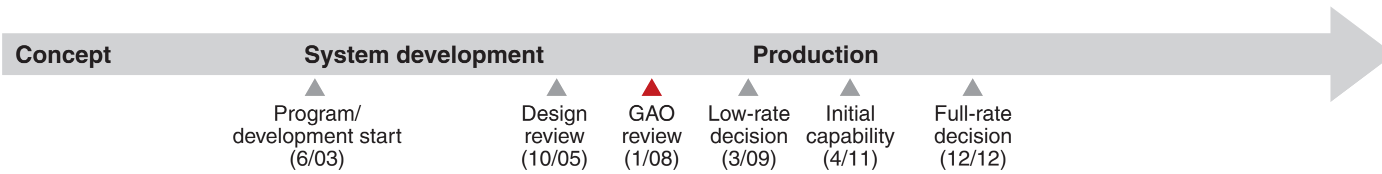
Agency Comments

The Navy stated that DDG 1000 will have the most mature design of any surface combatant at the start of fabrication, resulting in a more affordable construction, with fewer changes. According to the Navy, successful completion of its design review in 2005 certifies that its critical technologies are capable of performing at planned levels and sufficiently mature to remain in the ship baseline, continuing into detail design and construction. Due to the long timeline required to design, develop, and deliver a Navy ship, the Navy stated that some concurrency is unavoidable to prevent the immediate obsolescence of technologies and preclude additional costs associated with stretching the timeline to allow all technologies to reach readiness levels meeting GAO best practice criteria prior to the start of ship construction. The Navy concluded that DDG 1000 strikes the best balance between management risk and delivering required capability within cost and schedule.

E-2D Advanced Hawkeye (E-2D AHE)

The Navy's E-2D AHE is an all-weather, twin-engine, carrier-based, aircraft designed to extend early warning surveillance capabilities. It is the next in a series of upgrades the Navy has made to the E-2C Hawkeye platform since its first flight in 1971. The E-2D AHE is designed to improve battle space target detection and situational awareness, especially in littoral areas; support Theater Air and Missile Defense operations; and improve operational availability.

Source: Program Executive Officer, Tactical Aircraft Programs (PEO(T)).



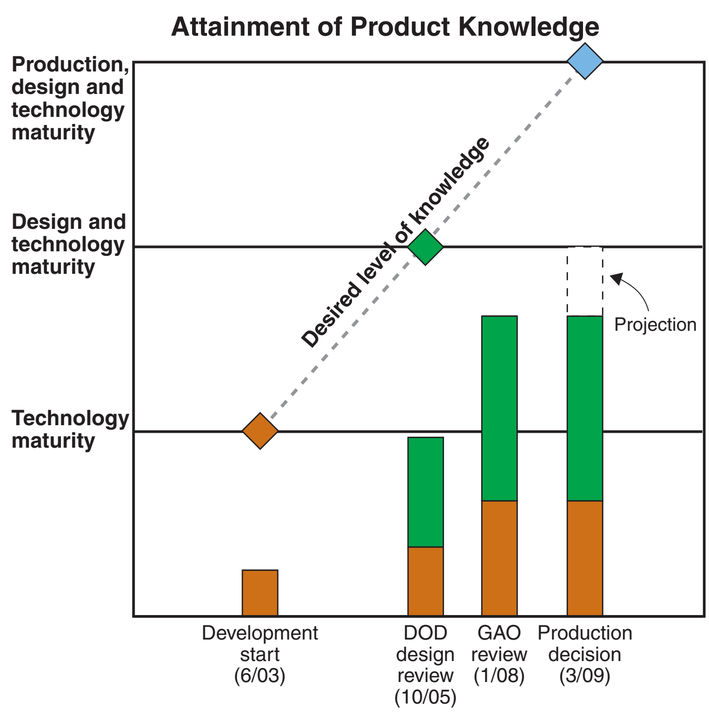
Program Essentials

Prime contractor: Northrop-Grumman
Program office: Patuxent River, Md.
Funding needed to complete:
- R&D: $1,650.8 million
- Procurement: $11,414.7 million
- Total funding: $13,065.9 million
- Procurement quantity: 70

Program Performance (fiscal year 2008 dollars in millions)

	As of 06/2003	Latest 12/2006	Percent change
Research and development cost	$3647.7	$3,902.9	6.9
Procurement cost	$10,362.1	$11,414.7	10.2
Total program cost	$14,009.9	$15,317.7	9.3
Program unit cost	$186.798	$204.236	9.3
Total quantities	75	75	0.0
Acquisition cycle time (months)	95	94	-1.0

Since our assessment of the E-2D AHE last year, the program reported an increase in its baseline procurement cost due to, among other factors, the addition of one aircraft to the program's procurement budget and an increase in the program's material cost estimate. One of the E-2D AHE's four critical technologies is mature. Since our last assessment, two of these technologies have continued to mature as the program has completed high-fidelity laboratory testing. Although the design met best practice standards at the time of the October 2005 design review, continued increases in the number of required drawings indicated that the design may not be stable. The program office reports that the design is currently 93 percent complete, but system integration activities may result in additional design changes.



E-2D AHE Program

Technology Maturity

One of the E-2D AHE's four critical technologies—the space time adaptive processing algorithms—is mature. Since the last assessment, two additional technologies—the rotodome antenna and the power amplifier module UHF transistor—are currently approaching maturity as the program completed high-fidelity laboratory testing. The program office anticipates that all four critical technologies will be fully mature through mission system flight testing, which is scheduled to begin at the end of 2007. The program plans to complete a Technology Readiness Assessment in late fiscal year 2008 in support of the low-rate initial production decision.

Design Stability

The program office reports that 93 percent of total drawings are complete. However, continued growth in the number of required drawings indicates that the design may not be stable. While the program had completed 90 percent of planned drawings at the time of its October 2005 design review, the number of total drawings has continued to increase. Since the last assessment, the number of required drawings has increased by 39 percent. The program attributes the increase in drawings to, among other things, releases of wiring diagrams, wiring adjustments due to system maturation, and engineering changes that apply to multiple aircraft platforms including the E-2D AHE. This increase in drawings means that the program had completed only 53 percent of planned drawings prior to the design review. The program office anticipates that 100 percent of the drawings will be complete by the planned start of production in March 2009.

The program office reported that all components were operational in the system integration laboratory in September 2007, and that the first development test of a fully integrated prototype will take place in early 2008. Without the benefit of a systems integration laboratory or a fully integrated prototype prior to entering the systems demonstration phase, the program increases the likelihood of additional design changes and that problems may be discovered late in development when they are more costly to address.

Production Maturity

The program expects a low-rate initial production decision in March 2009, but does not require the contractor's major assembly site to use statistical process controls to ensure its critical processes are producing high-quality and reliable products. The program initiated a series of production assessment reviews in February 2008 and plans a production readiness review in August 2008 to assess the contractor's readiness for low-rate initial production.

Other Program Issues

The program reported a procurement cost increase in its December 2006 Selected Acquisition Report. Reasons for the cost increase include the addition of one aircraft to the program's procurement budget and an increase in the program's material cost estimate. The program has initiated its developmental flight test program, but to date has completed fewer test points than planned due to weather delays and issues with the aircraft's hydraulic lines. The program is developing options to make up for the delays, but any additional testing delays may complicate the program's ability to complete its flight test program as planned.

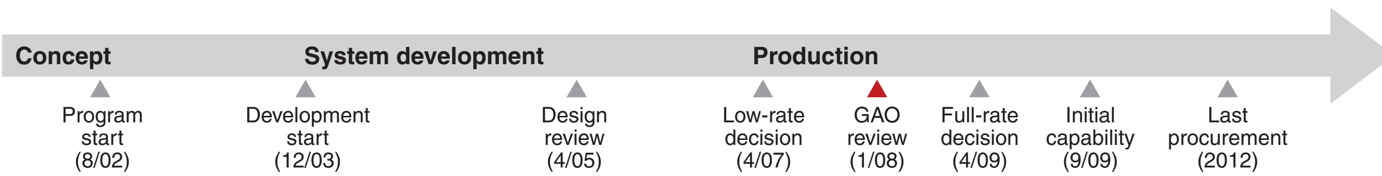
Agency Comments

The Navy stated that the E-2D program is executing to the approved acquisition program baseline plan, has met all major program events on schedule, and is on track to meet future major program schedule events including the operational assessment in fiscal year 2008 and the low-rate initial production decision in fiscal year 2009. Regarding design stability, the growth for E-2D unique drawings is 13 percent. The additional 26 percent of drawing growth includes global engineering orders common to the E-2C and C-2A. The E-2D System Integration Laboratory was stood up between critical design review and aircraft test activities as per NAVAIR system engineering best practices and has been an invaluable resource to the program to date. The Navy has chosen not to fund integration of aircraft manufacturing statistical process controls due to the maturity of the 30-plus years of E-2 production history.

EA-18G

The Navy's EA-18G Growler will replace the carrier-based EA-6B and provide electronic warfare capability beginning in 2009. The EA-18G is designed to support friendly air, ground, and sea operations by suppressing enemy radar and communications. The aircraft is a combination of the new, more capable Improved Capability (ICAP) III electronic suite and the F/A-18F airframe. The Navy accepted the first production configuration EA-18G in September 2007 and expects to begin operational testing by September 2008.

Source: U.S. Navy.



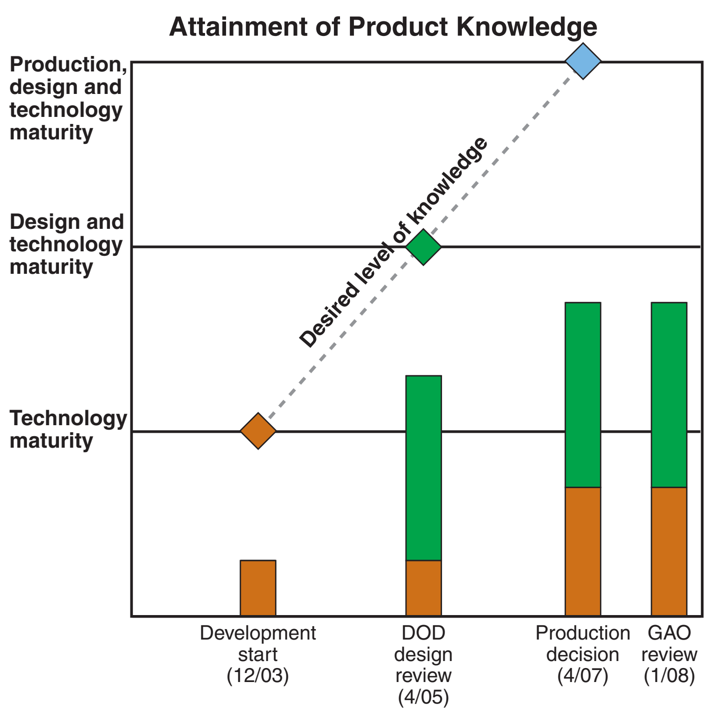
Program Essentials

Prime contractor: Boeing
Program office: Patuxent River, Md.
Funding needed to complete:
R&D: $567.9 million
Procurement: $5,084.4 million
Total funding: $5,675.3 million
Procurement quantity: 68

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2003	Latest 12/2006	Percent change
Research and development cost	$1,815.9	$1,952.7	7.5
Procurement cost	$6,708.9	$6,151.9	-8.3
Total program cost	$8,524.4	$8,127.9	-4.3
Program unit cost	$94.716	$101.599	7.3
Total quantities	90	80	-11.1
Acquisition cycle time (months)	70	69	-1.4

The EA-18G began system development without demonstrating that its five critical technologies had reached full maturity, but all have since made progress. However, the software needed to demonstrate full functionality for three of these technologies, while having been delivered, has not yet demonstrated full functionality in a realistic environment. The design appears stable, with almost all drawings complete. However, until all technologies are demonstrated using fully matured software, the potential for redesign remains. The first production configuration aircraft has been delivered with 3 more in production. There are an additional 26 low-rate initial production aircraft planned. During development testing the Navy identified six deficiencies that needed correction prior to the start of operational testing. Fixes for some of these deficiencies have yet to be identified.



EA-18G Program

Technology Maturity

According to the program office, all five of the EA-18G's critical technologies are mature. While the 2.0 software build, needed to demonstrate full functionality for three of the technologies—the ALQ-218 Receiver System, the Communications Countermeasures Set, and the Multimission Advanced Tactical Terminal system—has been delivered, tests to demonstate full functionality in a multithreat environment will not start until late this summer. However, the program expects that ongoing development and operational tests will demonstrate full functionally of these technologies before then.

The effect of noise and vibration on the aircraft is being done in two phases. Phase I, which investigates noise and vibration with no external stores except for the ALQ-218 reciever pod, has been completed on two aircraft. Phase II is conducted with external stores, specifically the ALQ-99 jamming pods on the aircraft. This test started in the fall of 2007 and was approximately 25 percent complete at that time.

Design Stability

The design of the EA-18G appears stable, with 97 percent of drawings released. According to program officials, more of the ALQ-218 receiver software from the ICAP III on the EA-6B can be reused than was previously estimated--almost 80 percent versus 60 percent. However, the potential for redesign remains until all technologies are demonstrated with fully mature software.

Production Maturity

We could not assess production maturity because the program does not collect statistical process control data. In April 2007, the Navy approved the program's low-rate initial production decision and by September 2007, the first production configuration EA-18G aircraft was delivered. The Navy has a total of 8 low-rate initial production aircraft on contract, plus the conference report accompanying the 2007 Supplemental Appropriation indicates the conferee's intent to fund 1 additional aircraft. Congress has not yet authorized or appropriated funds for an additional 18 aircraft planned for procurement in the second low-rate initial production lot.

The F/A-18E/F and EA-18G share a production line. The two-seat Growler airframe has about 90 percent parts commonality with the F/A-18F airframe.

The Navy is planning to buy about one-third of the total production quantity, 26 of 80 aircraft, during low-rate initial production prior to the completion of development and operational tests. Concurrency in testing and production could result in significant additional costs should later tests determine that changes are needed to already produced aircraft.

Other Program Issues

Development tests of the EA-18G revealed 28 deficiencies, six of which need to be corrected before beginning operational testing. Operational testing is expected to begin in September 2008 and will not be completed until December 2008. According to the program office, it has fully addressed two of the six problems–a failure to detect a threat without operator indicator and the assignment of jammers to incorrect emitters–and is working to correct the remaining deficiencies. These additional deficiencies include airborne electronic attack system lockups, the lack of adequate threat warning information about pop-up weapon system emitters, and addressing the excessively time-consuming and cumbersome process to build the mission planning system and database.

In addition, the DOD Director, Operational Test and Evaluation, identified operator workload of the two-man EA-18G crew in electronic attack and electronic support missions--currently performed by the four-man EA-6B crew--as a program risk.

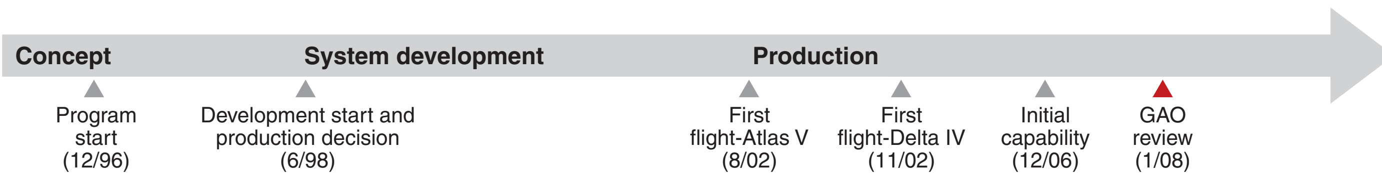
Agency Comments

In commenting on a draft of this assessment, the Navy provided technical comments which were incorporated as appropriate. Additionally, the Navy stated that the program continues to progress on schedule and within cost while meeting or exceeding all performance requirements. According to the Navy, there are currently no high-level risks associated with program completion, and identified deficiencies are being addressed to stay on schedule for the September 2008 Initial Operational Test and Evaluation.

Evolved Expendable Launch Vehicle (EELV)—Atlas V, Delta IV

The Air Force EELV program acquires satellite launch services for military, intelligence, and civil missions from two families of launch vehicles---Atlas V and Delta IV. The program's goal is to preserve the space launch industrial base, sustain assured access to space, and reduce life cycle costs of space launches by at least 25 percent over previous systems. A number of vehicle configurations are available, depending on satellite vehicle weight and mission specifications. We assessed both the Atlas V and Delta IV.

Source: United Launch Alliance, © 2007 United Launch Alliance, LLC. All Rights Reserved.



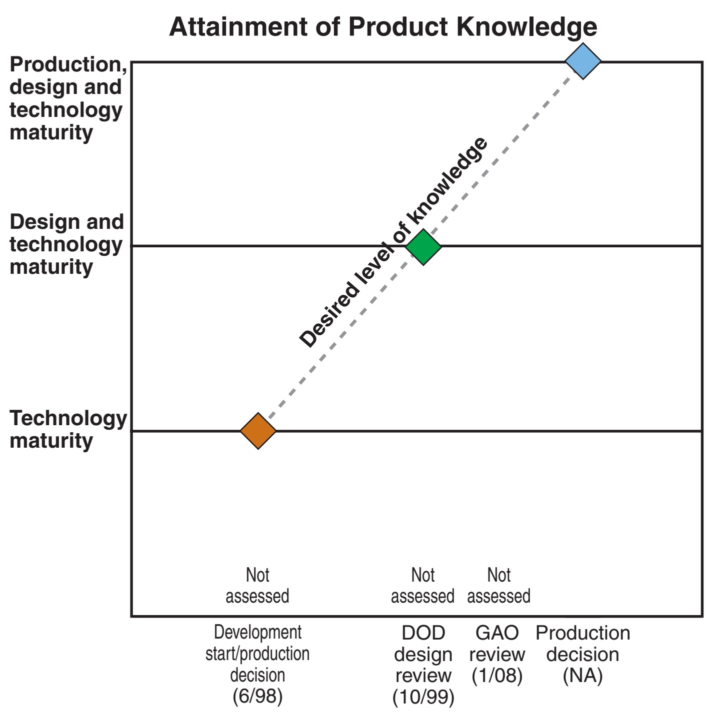
Program Essentials

Prime contractor: Boeing Launch Services, Lockheed Martin Space Systems
Program office: El Segundo, Calif.
Funding needed to complete:
- R&D: $0.0 million
- Procurement: $25,155.1 million
- Total funding: $25,155.1 million
- Procurement quantity: 109

Program Performance (fiscal year 2008 dollars in millions)

	As of 10/1998	Latest 08/2007	Percent change
Research and development cost	$1,690.9	$1,837.2	8.9
Procurement cost	$14,810.2	$30,443.9	105.9
Total program cost	$16,500.9	$32,281.2	95.6
Program unit cost	$91.165	$233.922	156.9
Total quantities	181	138	-23.5
Acquisition cycle time (months)	NA	120	NA

We did not assess technology, design, and production maturity information. The EELV contracts do not include requirements for delivery of such data from the contractors. The EELV program completed production and transitioned into the sustainment phase in August 2007. However, only 9 of 15 possible configurations of launch vehicles have been launched. As of November 1, 2007, all 18 EELV launches (8 government, 3 NASA, and 7 commercial) have been successful. Twelve additional launches are scheduled through the end of fiscal year 2008. The United Launch Alliance (ULA), a joint venture between Boeing Launch Services and Lockheed Martin Space Systems, was established on December 1, 2006. Over about a 4-year period from establishment, the joint venture is to combine production, engineering, test, and launch operations associated with U.S. government launches of Atlas and Delta vehicles.



EELV Program

Technology Maturity

We did not assess technology maturity because, according to the program office, the EELV contracts do not require the delivery of information needed to conduct this assessment.

Design Stability

We did not assess design stability because the EELV contracts do not require the delivery of information needed to conduct this assessment.

Production Maturity

We did not assess production maturity because the EELV contracts do not require the delivery of information needed to conduct this assessment.

Other Program Issues

Efforts to complete the ULA merger are currently under way. The intention of the joint venture is to combine and centralize the production of launch vehicles into one plant location and all management and engineering activities into another facility. Nearly all transition efforts are expected to be completed by the end of 2010. The current challenge is the consolidation of Atlas and Delta facilities and personnel while maintaining mission success.

As part of the revised acquisition strategy, the EELV program awarded cost-plus-award-fee contracts for launch capabilities to Lockheed Martin and Boeing in 2006. A firm fixed price contract for launch services was awarded to Lockheed Martin in February 2007 and to Boeing in January 2008. According to DOD officials, contract awards for launch services have been delayed because the EELV program is understaffed. Further, under the revised contracting strategy, the program office will assume greater responsibilities with regard to program oversight and financial execution and will continue to monitor every aspect of booster procurement and production. However, program officials are concerned about a shortage of skilled program office staff to effectively carry out its increased oversight responsibilities.

In August 2007, a revised acquisition program baseline transitioned the EELV program to the sustainment phase. However, only 9 of 15 possible configurations of launch vehicles have been launched. Additionally, the program office has yet to revise the life cycle cost estimate to reflect this transition and is awaiting further guidance on changes to program reporting requirements.

According to EELV officials, the program is close to resolving issues related to the RL-10 upper stage engine and the Russian-built RD-180 Atlas V engine. Program officials explained that a technical review held in September 2007 approved a "return-to-flight" plan for the RL-10 that includes improvements to the fuel inlet valve, the direct cause of an early shut off during a June 2007 Atlas V launch. During the same month, the Air Force also received approval to maintain a sufficient inventory of RD-180 engines in lieu of implementing a domestic RD-180 co-production capability. Furthermore, the Air Force is investigating the costs and benefits of implementing a single RS-68 Delta IV upgrade. This upgrade is intended to support future launch needs of the Air Force, National Reconnaissance Office, and National Aeronautics and Space Administration.

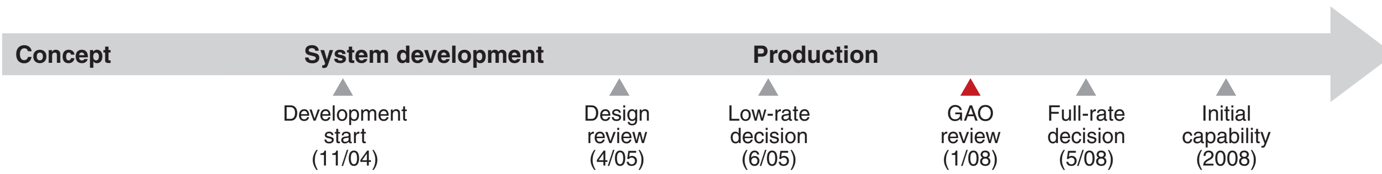
Agency Comments

The Air Force was provided an opportunity to comment on a draft of this assessment, but did not have any comments.

Expeditionary Fire Support System (EFSS)

The Marine Corps' EFSS is an indirect fire support system used for the Marines' vertical assault operations and is designed for internal transport on the MV-22 and CH-53E aircraft. The EFSS consists of two vehicles: a rifled mortar that fires 120 millimeter shells and an ammunition trailer. The program conducted operational testing in July 2007. In response to a letter from a member of the Senate Armed Services Committe, the full-rate production decision was delayed; it is now scheduled for May 2008.

Source: EFSS Program Office.



Program Essentials

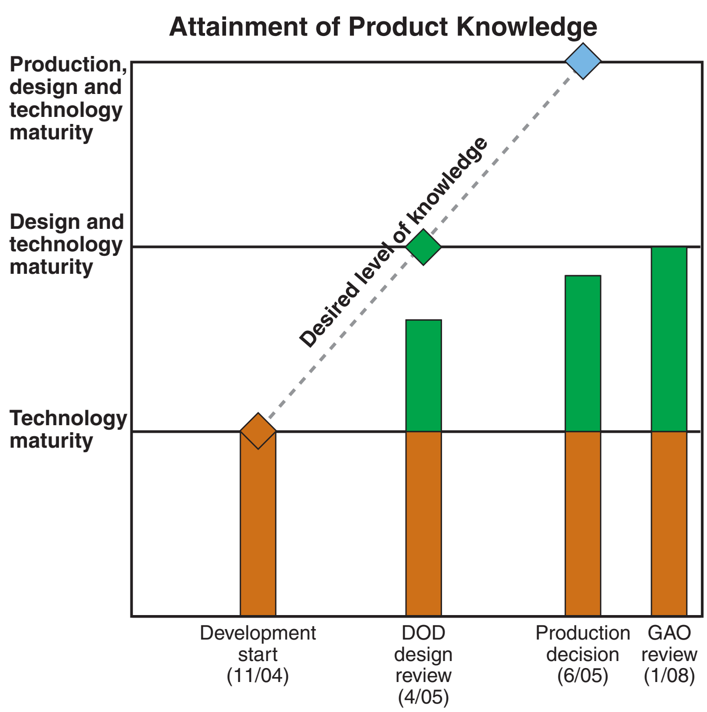
Prime contractor: General Dynamics
Program office: Quantico, Va.
Funding needed to complete:
- R&D: $24.8 million
- Procurement: $128.9 million
- Total funding: $170.3 million
- Procurement quantity: 54

Program Performance (fiscal year 2008 dollars in millions)

	As of 11/2004	Latest 01/2008	Percent change
Research and development cost	$52.8	$78.5	48.9
Procurement cost	$600.0	$174.6	-70.9
Total program cost	$751.8	$272.7	-63.7
Program unit cost	$10.895	$3.895	-64.2
Total quantities	69	70	1.4
Acquisition cycle time (months)	52	71	36.5

Latest estimate excludes ammunition procurement from 2014 through 2025, which was included in the 2004 estimate.

Since our assessment last year, the EFSS program has completed operational testing. However, the aggressive test schedule allowed no time to implement corrective actions for problems previously discovered during developmental testing. As a result, the EFSS was determined to be operationally effective and suitable with safety, reliability, and performance limitations. In response to congressional concerns, the program subsequently rescheduled the full-rate production decision until after an expanded follow-on test and evaluation effort assesses progress in fixing these limitations. The follow-on testing is expected to be conducted in early calendar year 2008. In the past year, the program has obtained its internal and external flight certification for use on the MV-22 and CH-53 aircraft. Naval concurrence regarding the ammunition's compliance with safety standards is pending.



EFSS Program

Technology Maturity

EFSS is approaching full-rate production. According to the program office, no critical technologies have been identified because EFSS is relying on existing technologies.

Design Stability

At the program design review, less than 50 percent of the total system level drawings were complete. Now, the design appears stable because the program office set the EFSS baseline design, and ordered the first production vehicles. However, design changes to address safety, reliability, and performance issues discovered during testing have not yet been fully validated, so the potential for redesign remains.

The EFSS program faces unique design challenges due, in part, to the internal MV-22 Osprey transportability key performance parameter requirement. The EFSS design must fit within the MV-22 cabin size and meet its weight restrictions. The program office initially planned to meet EFSS requirements by using a mostly commercial off-the-shelf system. However, EFSS needed more development than originally anticipated. Many changes were incorporated into the design due to the internal MV-22 transportability requirement and due to issues that arose with the vehicle's axle, hub assembly, driveshaft, chassis, and electrical system. The aggressive test schedule allowed no time to incorporate corrections identified during developmental testing into assets for use in operational testing. In addition, a design issue with the tail charge of the mortar round was recently discovered and must be fixed prior to starting cold weather testing, currently scheduled for early calendar year 2008.

Production Maturity

We did not assess the production maturity because the program office does not collect statistical control data. The design changes and aggressive test schedule led program officials to make a production decision in June 2005 before the development scope was fully recognized. This contributed to a year long delay between the production decision and the actual award of the low-rate initial production contract. In August 2007, the program office completed the production readiness review and accepted delivery of the first production vehicles in November 2007.

Other Program Issues

Operational testing revealed several safety, reliability, and performance issues. For example, there were safety concerns regarding instability with the ammunition trailer (which could cause harm to personnel riding in the rear seat). In addition, the EFSS vehicle could not carry the recommended combat load; the radiator was unable to sufficiently cool the engine and transmission during operations; the compressor was not robust enough to support the air ride system and central tire inflation system; and the vehicle had problems starting at higher altitudes. These issues led the operational testers to determine that EFSS was operationally effective with limitations and suitable with limitations. The testers characterize the EFSS as a "niche capability," which must operate within a small performance envelope.

The Chairman of the Senate Armed Services Committee requested that the Marine Corps delay the EFSS full-rate production decision that had been scheduled for September 2007. This decision is now planned for May 2008 and the program office is revising the test plan to support validation of the corrections required for the identified limitations.

Finally, the program office recently authorized additional limited production before reaching agreement on the scope and price of the work. Under this undefinitized contract action, the contactor is authorized to begin work before reaching a final agreement on contract terms. We have previously reported that these types of arrangements provide little incentive to the contractor to control cost until the terms of the work are finalized. The program office expected to reach agreement on the terms of work between the end of 2007 and January 2008.

Agency Comments

In commenting on a draft of this assessment, the program office provided technical comments, which were incorporated as appropriate.

Expeditionary Fighting Vehicle (EFV)

The Marine Corps' EFV is designed to transport troops from ships offshore to inland destinations at higher speeds and from longer distances than the system it is designed to replace, the Assault Amphibious Vehicle 7A1 (AAV-7A1). The EFV will have two variants---a troop carrier for 17 combat equipped Marines and 3 crew members and a command vehicle to manage combat operations in the field. We assessed both variants.

Source: EFV Program Office.

Concept — **System development** — **Production**

- Program start (3/95)
- Development start (12/00)
- Design review (1/01)
- GAO review (1/08)
- 2nd design review (9/08)
- Low-rate decision (9/11)
- Initial capability (8/15)

Program Essentials

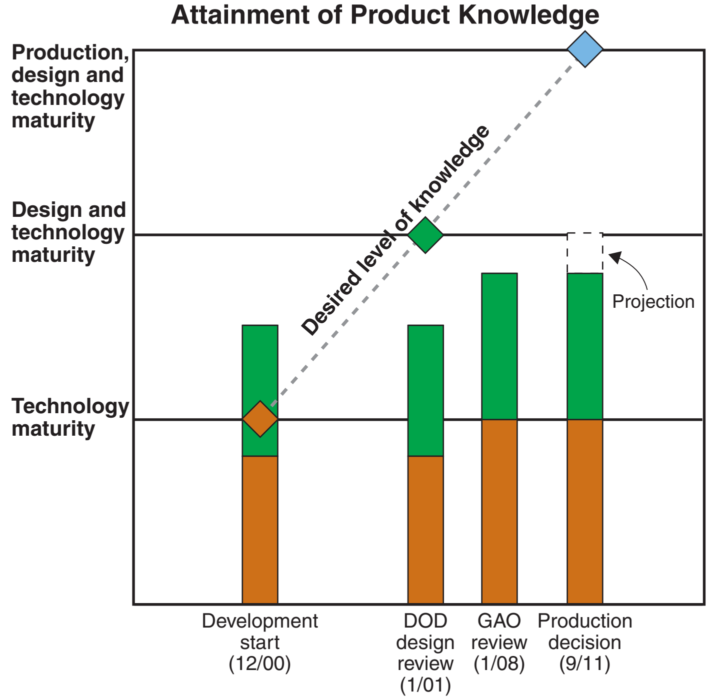
Prime contractor: General Dynamics
Program office: Woodbridge, Va.
Funding needed to complete:
R&D: $1,279.5 million
Procurement: $9,632.3 million
Total funding: $10,978.7 million
Procurement quantity: 573

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2000	Latest 08/2007	Percent change
Research and development cost	$1,569.1	$3,565.0	127.2
Procurement cost	$7,037.3	$9,846.9	39.9
Total program cost	$8,696.7	$13,504.4	55.3
Program unit cost	$8.485	$22.773	168.4
Total quantities	1025	593	-42.1
Acquisition cycle time (months)	138	245	77.5

The EFV's technologies are mature. However, the system design proved unstable following the original design review. After reliability shortfalls were discovered, the program was restructured to extend development, initiate a design-for-reliability process, and to enhance program oversight and monitoring. The EFV is scheduled to have a second design review in September 2008, and projected initial capability has been delayed by almost 5 years, to 2015. Program officials said that the redesign of key systems should enable the program to meet reliability metrics. The program has currently identified 12 critical manufacturing processes, but does not require the contractor to use statistical process controls. The Navy reported a Nunn-McCurdy unit cost increase over the critical cost threshold in part because of reliability issues and quantity reductions.

Attainment of Product Knowledge



EFV Program

Technology Maturity

All four of the EFV system's critical technologies are mature and have been demonstrated in a full-up system prototype. According to program officials, the current redesign effort will not affect the maturity of any of the existing critical technologies.

Design Stability

The EFV design was thought to be approaching stability at the time of the original design review. However, reliability shortfalls were discovered during an operational assessment in 2006 when the EFV achieved only a fraction of the required operational goal of 43.5 hours of operations before maintenance was required. Given the discovery of problems with reliability, the program was restructured to extend development efforts and build a second set of prototypes. The program is redesigning various systems, such as the drivetrain, and plans to monitor their predicted and demonstrated reliability. The program reports that 70 percent of its design drawings have been released to manufacturing and expects to release all drawings by the newly established design review in September 2008. This schedule may be ambitious given the design instability related to ongoing redesign and testing efforts to resolve reliability issues.

The EFV design currently has a flat hull, which enables the vehicle to move very quickly over the water. Program officials said they recently completed a review of using a "v-shaped" hull, and found that such a hull would reduce the vehicle's vulnerability to ground-based explosive devices, but would make it impossible to meet its key performance parameters. In order to provide additional blast protection, officials said additional hull belly armor could be added to the vehicle for land operations.

Production Maturity

The program office currently does not require the contractor to use statistical process controls to ensure critical processes will produce products within cost, schedule, performance, and quality targets. Instead, the program is using production representative processes for the manufacture of prototype vehicles during development. Twelve critical processes have been identified so far and will be used to manufacture the next seven prototype vehicles. The program expects to continue to evolve these processes.

Other Program Issues

In February 2007, the Navy reported a Nunn-McCurdy unit cost increase over the critical cost growth threshold. Various factors contributed to cost increases, including reliability challenges, optimistic estimating assumptions, and reduced procurement quantities because of changes in the Marine Corps ground mobility strategy. After a comprehensive review, the program was restructured in June 2007 to extend system development. This will delay initial production to 2011 to allow for development of a second set of prototypes to resolve reliability issues. Furthermore, the Under Secretary of Defense for Acquisition, Technology and Logistics has established a set of oversight, monitoring, and reporting mechanisms to ensure successful management of the program.

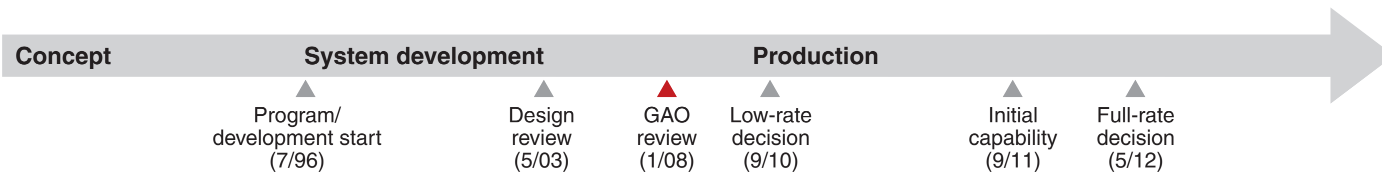
Agency Comments

The program office provided technical comments to a draft of this assessment, which were incorporated as appropriate.

Extended Range Munition (ERM)

The Navy's ERM is a 5-inch, rocket-assisted projectile that will provide fire support to expeditionary forces operating near coastal waters. ERM is being designed to fire to an objective range of 63 nautical miles using modified 5-inch guns onboard 32 Arleigh Burke-class destroyers. ERM represents a continuation of the Navy's Extended Range Guided Munition program, which entered system development and demonstration in 1996. The Navy is currently restructuring the program, and the planned initial fielding date of 2011 is under review.

Source: Naval Gunnery Project Office, PEO IWS3C/Raytheon, ©2006 Raytheon.



Program Essentials

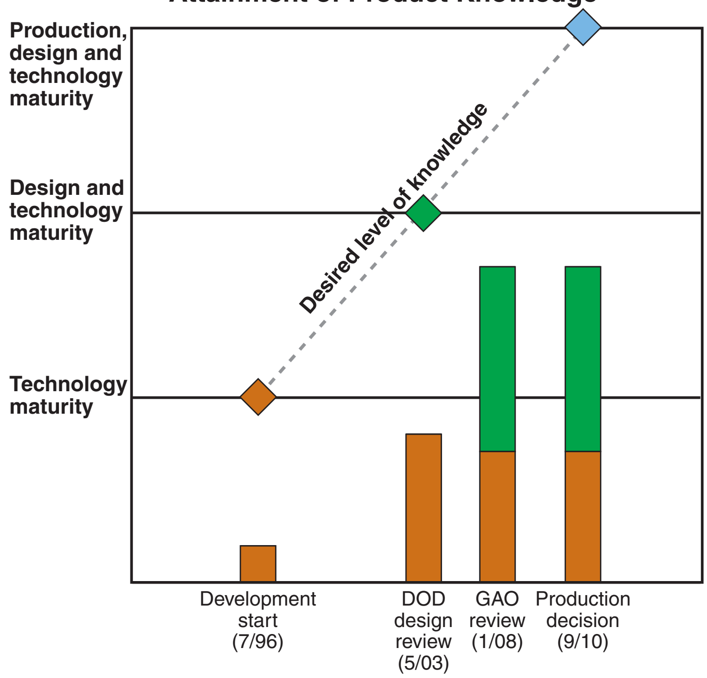
Prime contractor: Raytheon Missile Systems
Program office: Washington, D.C.
Funding needed to complete:
- R&D: $108.6 million
- Procurement: $858.9 million
- Total funding: $967.6 million
- Procurement quantity: 15,000

Program Performance (fiscal year 2008 dollars in millions)

	As of 04/1997	Latest 08/2007	Percent change
Research and development cost	$86.9	$500.1	475.5
Procurement cost	$343.5	$858.9	150.0
Total program cost	$430.4	$1,359.1	215.7
Program unit cost	$.050	$.090	79.2
Total quantities	8,570	15,100	76.2
Acquisition cycle time (months)	50	182	264.0

Of ERM's 17 critical technologies, 8 have reached maturity. Obsolescence issues facing ERM have prompted the Navy to replace components for a number of critical technologies. Testing of these new components inside gun-fired canisters has revealed a number of structural weaknesses. While analysis of recent test results continues, program officials have begun to question the validity of these tests and are focused on moving forward with flight testing. Also, while all of ERM's design drawings have been released, continuing component test failures may necessitate design changes. Further, program officials report that DOD continues to evaluate plans for completing development of ERM. Until these plans are approved and performance of new components is validated in testing, it is uncertain whether the Navy's goal to begin fielding ERM in 2011 is realistic.

Attainment of Product Knowledge



ERM Program

Technology Maturity

Currently, 8 of ERM's 17 critical technologies are mature. Another 8 technologies are approaching maturity. Recent engineering changes to the munition prompted the Navy to reduce its assessment for ERM's rocket motor, rocket motor igniter, and height-of-burst fuze technologies from mature to approaching maturity. Engineering changes also affected the control actuation system, and the Navy now assesses this technology as immature.

The Navy recently replaced components for a number of ERM technologies due to obsolescence and is testing these new components inside 8-inch canisters fired from guns. This canister testing is intended to help the Navy evaluate ERM reliability by exposing components to representative gun pressure and acceleration environments. Although the Navy initially outlined a robust plan for testing the new ERM components, hardware fabrication errors and delays as well as supplier cost growth have prompted the Navy to scale back these plans. Component testing completed to date has identified a number of structural weaknesses with ERM components. For instance, in a July 2007 canister test, ERM's radome separated from the guidance section, the canard covers buckled, and subassemblies of the control actuation system fractured and deformed. Program officials report that although they continue to analyze test results, they have begun to question the validity of canister testing for ERM. Specifically, there is concern that the gun pressure loads placed upon the canisters in testing far exceed those induced in a normal 5-inch gun. Alternatively, the program has begun testing the structural integrity of new components using centrifuge and air gun assets and is moving forward with engineering flight testing in advance of a 20-round reliability demonstration test phase planned for the fourth quarter of fiscal year 2008.

Design Stability

The program has released 100 percent of ERM's anticipated 143 production representative engineering drawings. None of these drawings were released in time for the munition's May 2003 design review. Instead, the Navy conducted this review with less mature drawings and used them to validate the design of the developmental test rounds. According to program officials, recent changes to ERM components to address obsolescence and reliability issues have required significant redesign of the munition. If the munition does not perform as expected in remaining component and flight tests or technologies do not mature as planned, additional design changes may be needed. Program officials stated they are concerned that ERM's development schedule may not allow sufficient time to fix technical problems should they occur during engineering flight testing planned for the second quarter of fiscal year 2008.

Production Maturity

The Navy plans to collect statistical process control data for ERM once production begins. According to Navy officials, 100 ERM units will be built during system development using lessons learned and process control methods developed in the Excalibur program. The Navy anticipates that this strategy will result in mature production processes for ERM at the beginning of low-rate initial production.

Other Program Issues

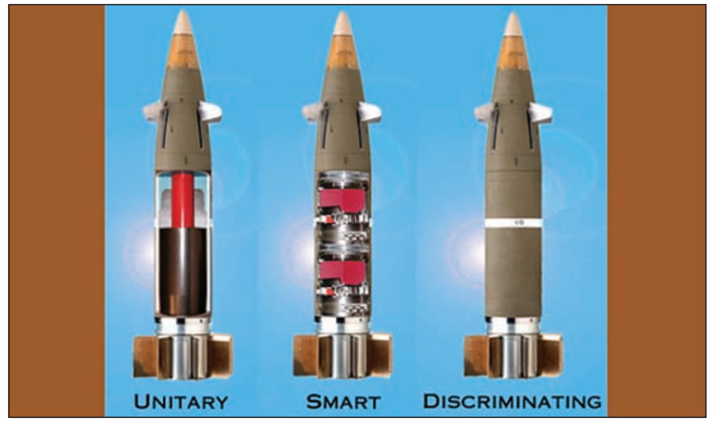
The Navy has proposed a restructuring of the ERM program following cost growth that led to an elevation in oversight responsibility for the program. According to program officials, the Under Secretary of Defense for Acquisition, Technology, and Logistics has approved a new acquisition strategy for the program and is reviewing a new acquisition program baseline and systems engineering plan for ERM. In addition, program officials stated that a new test and evaluation master plan for ERM is under review and anticipate it will be completed in spring 2008.

Agency Comments

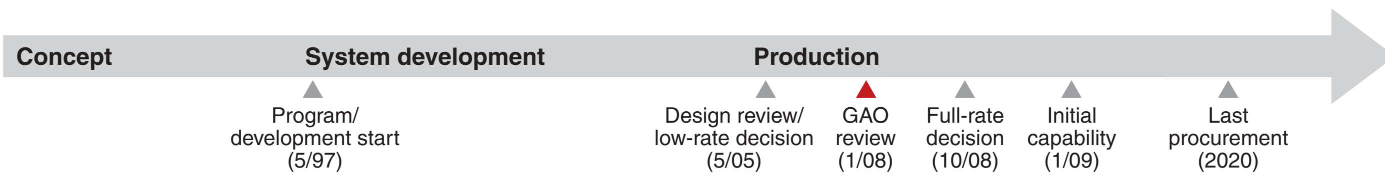
In commenting on a draft of this assessment, the Navy provided technical comments, which were incorporated as appropriate.

Excalibur Precision Guided Extended Range Artillery Projectile

The Army's Excalibur is a family of global positioning system-based, fire-and-forget, 155 mm cannon artillery precision munitions intended to provide improved range and accuracy. The Excalibur's near-vertical angle of fall is intended to reduce collateral damage around the intended target, making it more effective in urban environments than current projectiles. The Future Combat System's Non-Line-of-Sight Cannon requires the Excalibur to meet its required range. Only the unitary variant is currently being developed.



Source: PM Excalibur.



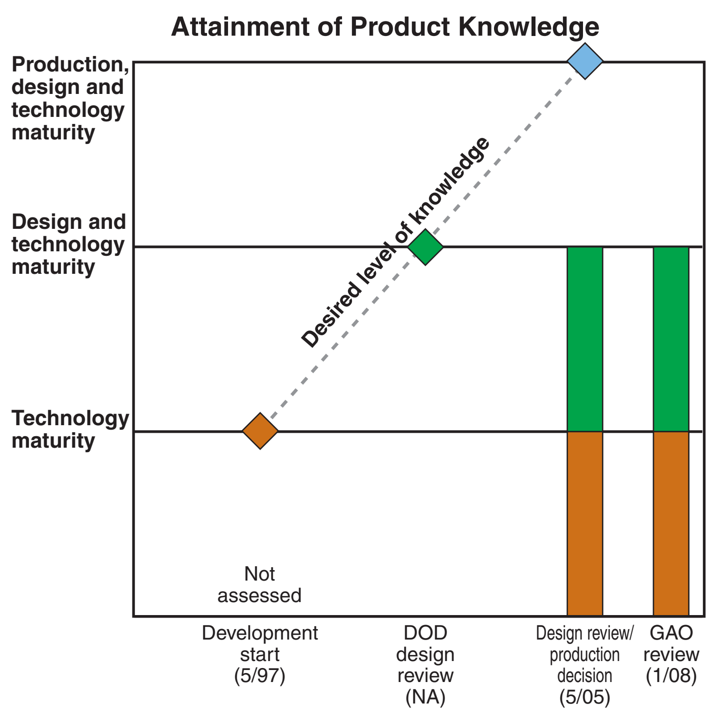
Program Essentials

Prime contractor: Raytheon
Program office: Picatinny Arsenal, N.J.
Funding needed to complete:
R&D: $184.4 million
Procurement: $1,119.9 million
Total funding: $1,303.9 million
Procurement quantity: 29,301

Program Performance (fiscal year 2008 dollars in millions)

	As of 02/2003	Latest 07/2007	Percent change
Research and development cost	$726.9	$954.8	31.4
Procurement cost	$3,809.1	$1,364.0	-64.1
Total program cost	$4,536.1	$2,358.7	-48.0
Program unit cost	$.059	$.078	31.2
Total quantities	76,677	30,388	-60.3
Acquisition cycle time (months)	136	140	2.9

The Excalibur program has begun early production to support an urgent early fielding requirement in Iraq for more accurate artillery that will reduce collateral damage. According to program officials, this early production run of the Excalibur's first increment has completed testing necessary to field the projectile for use in combat operations. They also noted that Excalibur's critical technologies reached full maturity in May 2005, and all of its 790 drawings were completed in July 2005. The Excalibur unitary variant will be developed in three incremental blocks, which will incorporate increased capabilities and accuracy over time. Since development began in 1997, the program has encountered a number of significant changes, including four major restructures, reduced initial production quantities, and increased unit costs.



Excalibur Program

Technology Maturity

All three of the unitary variant's critical technologies reached full technology maturity in May 2005 at the time of the Excalibur's design review. These technologies were the airframe, guidance system, and warhead.

Design Stability

Excalibur's design appears to be stable. In May 2005, Excalibur held its design review and concurrently entered production to support an urgent fielding requirement in Iraq. At the time of the design review, 750 of 790 design drawings were released. All 790 were complete for the first Excalibur block in July 2005. By August 2006, the number of drawings had increased by almost 20 percent to 943, all of which have been released.

Production Maturity

We could not assess Excalibur's production maturity. The program is taking steps to utilize statistical process control at subsystem and component levels, but the production processes remain inconsistent at this point.

Other Program Issues

Excalibur started as a combination of three smaller artillery programs with the intent to extend the range of artillery projectiles with an integrated rocket motor. It is expected to enable three different Army howitzers and the Swedish Archer howitzer to fire farther away and defeat threats more quickly while lowering collateral damage and reducing the logistics support burden. The program has encountered a number of changes and issues since development began in 1997, including a decrease in planned quantities, a relocation of the contractor's plant, early limited funding, technical problems, and changes in program requirements. Since 1997, it has been restructured four times. In 2002, the program was directed to include the development of the Excalibur for the Army's Future Combat System's Non-Line-of-Sight Cannon (NLOS-C). The net effect of these changes has been to lengthen the program's schedule, substantially decrease planned procurement quantities, and dramatically increase unit costs.

The Excalibur acquisition plan currently focuses on developing its unitary version in three incremental blocks. In the first block, which has been made available for early fielding, the projectile would meet its requirements for lethality and accuracy in a non-jammed environment. In the second block, the projectile would be improved to meet its requirements for accuracy in a jammed environment, with extended range and increased reliability, and would be fielded with the NLOS-C when the cannon is available. Finally, in the third block, the projectile would be improved to further increase reliability, lower unit costs, and would be available for fielding to all systems in late fiscal year 2011. The other two Excalibur variant blocks—smart and discriminating—are expected to enter system development in fiscal year 2010, although both variants are unfunded.

In 2002, an early fielding plan for the unitary version was approved. According to the program office, a limited user test was completed in fiscal year 2007, almost 2 years after entering production, with results that exceeded the objective requirements for accuracy and reliability. Excalibur was fielded in Iraq with its first use in combat in the third quarter of fiscal year 2007. The program office reported the munition performed well in combat operations.

According to program officials, compatibility with NLOS-C has been identified as one of its top program risks because the muzzle brake on that platform is different than that on a standard howitzer. An engineering study was completed in May 2007 that identified modifications to both the Excalibur projectile and the NLOS-C. Testing of the new designs is scheduled to begin in December 2007, with firing of the projectile from the redesigned NLOS-C in the third quarter of fiscal year 2008. If the redesigned projectile is successfully fired from the NLOS-C, the projectile will then have to be retested in the Paladin and lightweight 155 mm howitzer platforms.

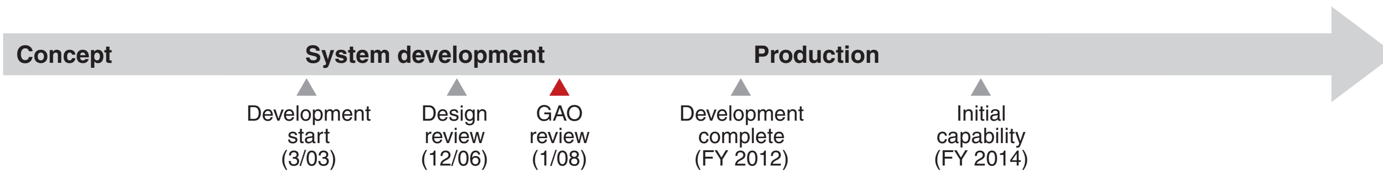
Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

F-22A Modernization Program

The Air Force's F-22A, originally planned to be an air superiority fighter, will now also have air-to-ground attack capability. It was designed with advanced features, such as stealth characteristics, to make it less detectable to adversaries and capable of high speeds for long ranges. The Air Force established the F-22A modernization and improvement program in 2003 to add enhanced air-to-ground, information warfare, counter air, reconnaissance, and other capabilities and to improve the reliability and maintainability of the aircraft.


Source: F-22A System Program Office.



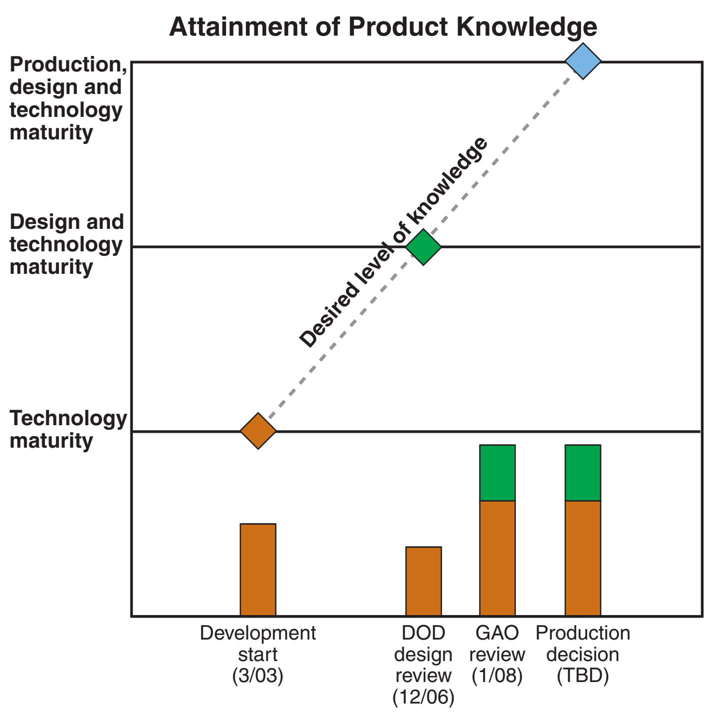
Program Essentials

Prime contractor: Lockheed Martin
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
R&D: $3,064.8 million
Procurement: $1,606.6 million
Total funding: $4,671.4 million
Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of 03/2003	Latest 08/2007	Percent change
Research and development cost	$3,055.5	$4,127.7	35.1
Procurement cost	$529.4	$1,779.9	236.2
Total program cost	$3,584.9	$5,907.6	64.9
Program unit cost	$13.131	$34.148	160.0
Total quantities	273	173	-36.6
Acquisition cycle time (months)	133	133	0.0

The Air Force originally planned to field the enhanced F-22A capabilities in three development increments to be completed in 2010. However, due to numerous funding decreases, schedule slips, and changes in requirements and work content in each increment, the last increment will not be integrated on the F-22A until 2013, 3 years later than planned. The program has achieved less than 30 percent design maturity for its first major increment. The Air Force also plans to integrate additional capabilities beyond the current three planned increments in a separate Acquisition Category I program.



F-22A Program

Technology Maturity

One of four critical technologies—processing memory—is mature and has been demonstrated in a realistic environment. The three remaining technologies—stores management system, cryptography, and radio frequency—are approaching maturity, having been tested in a relevant environment. According to program office officials the current F-22 production and modernization plans do not commit to incorporating new technology into developmental increments until the underlying technologies have been tested in a relevant environment, and also do not commit to fielding these technologies until they have been proven in a developmental and operational environment. The number and mix of technologies identified by program officials has changed somewhat over the years, reflecting the changes in program direction, priorities, and work content. Two critical technologies associated with the program last year (larger bandwidth and low observables) were removed from the current funded modernization program to be addressed in future increments, which will be implemented as a separate Acquisition Category I program.

Design Stability

The design for the first major increment of enhanced capabilities of the F-22A Modernization Program is not mature and, as of October 2007, less than one-third of the planned engineering drawings had been released. The program office had released no engineering drawings when critical design review (CDR) was held and approved in December 2006. According to program officials, they did not plan to release drawings at CDR because most of the design consisted of software changes or modifications of existing hardware to enable the aircraft to carry and deliver the Small Diameter Bomb (SDB) on preplanned missions as well as to use an air-to-ground radar mode to permit attack of emerging targets using SDBs, and to save radar imagery for post-mission analysis. Program officials further mentioned final instrumentation that is planned for installation—such as radio frequency data links and other items—will not be installed in test aircraft until fiscal year 2011. Consequently, there are a significant number of engineering drawings that have to be released before the design is mature.

Other Program Issues

The F-22A modernization program has experienced numerous budget decreases and program restructurings that have resulted in delaying the planned implementation of the development increments by 3 years. Since fiscal year 2002, the F-22A's modernization budget has been decreased by nearly $330 million. Some of these decreases were the result of congressional budget cuts. However, more than 50 percent of the decreases can be attributed to program restructuring by the Air Force and the Office of the Secretary of Defense. In its fiscal year 2008 budget submission to Congress, the Air Force requested $743 million in development funding for F-22A modernization. The conference reports accompanying the 2008 National Department of Defense Authorization Act, and Defense Appropriations Act both recommended providing the F-22A modernization program with $611 million, about $132 million less than requested. Program officials indicated that this decrease in funding required changes to minimize the impact on the planned modernization program.

The Air Force also budgeted $132 million in fiscal years 2007 and 2008 for reliability and maintainability upgrades, $28 million more than the amount budgeted for fiscal years 2006 and 2007. Despite these efforts, the F-22A continues to operate below its expected reliability rates. A key reliability requirement for the F-22A is a 3-hour mean time between maintenance intervals, which is required by the time the program achieves 100,000 operational flying hours, now projected for fiscal year 2010. Mean time between maintenance is defined as the number of operating hours divided by the number of maintenance actions. Currently, the mean time between maintenance is less than 1 hour, or about half of what was expected by the end of system development in December 2005. There has been no significant change reported regarding the current mean time between maintenance since last year's review.

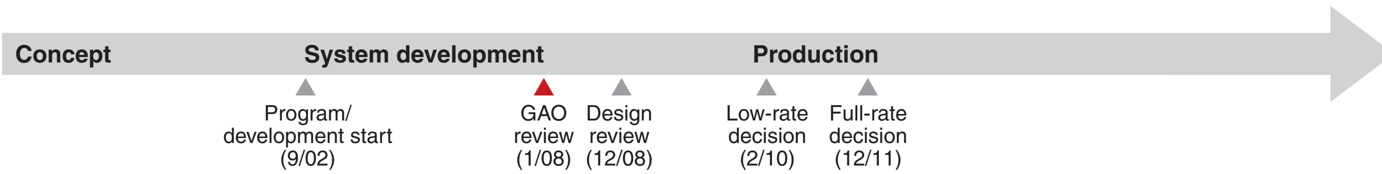
Agency Comments

The Air Force provided technical comments, which were incorporated as appropriate.

Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)

The Air Force's FAB-T will provide a family of satellite communications terminals for airborne and ground-based users. FAB-T will address current and future communications capabilities and technologies, replacing many program-unique terminals. FAB-T is being developed incrementally; the first increment will provide voice and data military satellite communications for nuclear and conventional forces as well as airborne and ground command posts, including the B-2, B-52, RC-135, E-6, and E-4 aircraft. We assessed the first increment.

Source: Boeing Corp., Anaheim, CA.



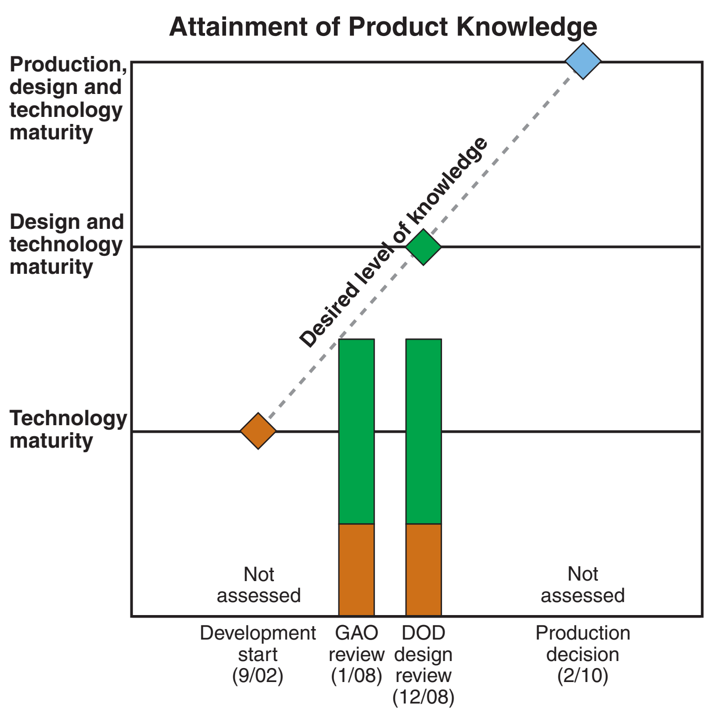
Program Essentials

Prime contractor: Boeing
Program office: Hanscom AFB, Mass.
Funding needed to complete:
R&D: $668.9 million
Procurement: $1,916.2 million
Total funding: $2,585.1 million
Procurement quantity: 197

Program Performance (fiscal year 2008 dollars in millions)

	As of 09/2002	Latest 04/2007	Percent change
Research and development cost	$1,459.9	$1,468.9	0.6
Procurement cost	$1,568.3	$1,886.1	20.3
Total program cost	$3,028.1	$3,354.7	10.9
Program unit cost	$14.019	$15.111	7.9
Total quantities	216	222	2.9
Acquisition cycle time (months)	129	129	0

Although FAB-T entered system development in 2002, its critical technologies were not assessed until January 2007, after being designated an Acquisition Category (ACAT) 1 program. Currently, the seven critical technologies are approaching maturity and the program office expects that all will reach full maturity by the low-rate initial production decision in February 2010. While the program reports that the FAB-T design is nearly stable, it expects further minor design changes, including those to address vibration issues in the modem processor group. In 2006, the program was restructured to address design changes caused by the concurrent development of the Advanced Extremely High Frequency satellite and cryptological devices, as well as issues with contractor performance.



FAB-T Program

Technology Maturity

All seven critical technologies are approaching maturity, and program officials expect they will be fully mature by the end of the first quarter of fiscal year 2010, well before the scheduled development and operational tests in the third quarter of fiscal year 2011. According to program officials, when FAB-T began system development in 2002, a technology readiness assessment was not required. Critical technologies were not assessed until after it was designated an ACAT 1D program in August 2006. In January 2007, the program office initially identified and assessed 9 critical technologies.

In June 2007, the milestone decision authority requested an independent technology readiness assessment for FAB-T. While the program office estimated that most critical technologies were mature, the independent panel determined that they were not, in part because some of them had not been flight tested in a realistic environment. The review team also added an additional critical technology that had not previously been identified by the program. In addition, four technologies identified by the program office as critical were removed because the review concluded that they were more appropriately categorized as engineering, integration and/or interoperability issues. The Deputy Under Secretary for Science and Technology did not agree with the removal of one of these technologies, redesignated it as critical, and assessed it as approaching maturity based on additional information provided by the program office.

Because FAB-T is a software-defined radio, another risk facing the program is the large amount of new software code. Since the start of program development, the total lines of code expected in the final system has increased by 40 percent, with 69 percent of the total lines of code to be newly developed. Program officials noted that the software growth was necessary to accommodate the design and interface requirement changes with the Advanced Extremely High Frequency satellite and cryptological devices. The software budget has increased significantly, and program officials explained that this was due to the additional lines of code and to lower than expected levels of productivity.

Design Stability

Program officials reported that 98 percent of design drawings have been released to manufacturing. Prior to system-critical design review, scheduled for early in fiscal year 2009, there have been a number of line replaceable unit critical design reviews. Each of the line replaceable unit critical design reviews was completed successfully, and there were no significant design issues identified. Testing to date has been conducted at the component, shop replaceable unit, and line replaceable unit levels. Program officials noted that testing revealed vibration issues with two cards within the modem processor group; these cards are being modified and will undergo retest. As of February 2008, over 70 percent of the software lines of code had been coded, tested and integrated.

The program has allowed 4 months to execute initial operational testing. Program officials said that this is sufficient, but noted it will allow only minimal time for retesting any required design changes.

Other Program Issues

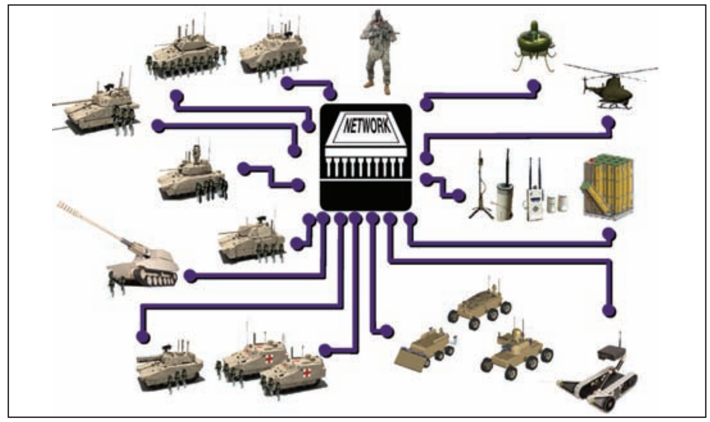
Increment 1 of the program was restructured in 2006 because concurrent development of the terminal and the Advanced Extremely High Frequency satellite and cryptologic devices resulted in a need to revise the terminal requirements. In addition, contractor design teams were restructured to improve performance and efficiency. Program officials said that costs for development have more than tripled since the contract was awarded due to design changes and contractor cost growth. Program officials also said the concurrent development and contractor performance issues resulted in a delay to the start of low-rate initial production from fiscal year 2007 to fiscal year 2010.

Agency Comments

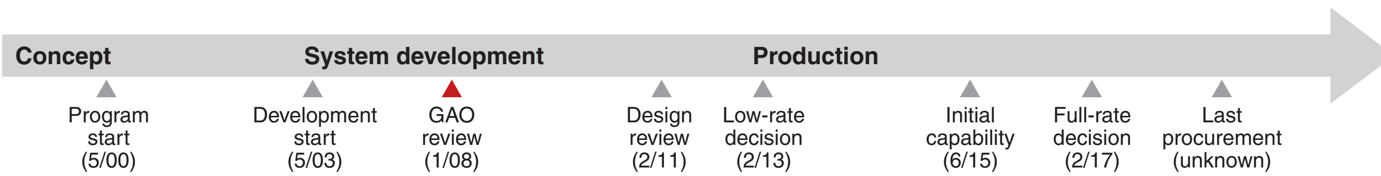
In commenting on a draft of this assessment, the FAB-T program office provided additional background information and technical comments, which were incorporated as appropriate. As part of the background information, the program office noted that, as of 2006, FAB-T is being managed in accordance with National Security Space Acquisition Policy 03-01. This includes program milestones that are different than those for a DOD 5000 program. The program office established a new program baseline under these guidelines in calendar year 2007.

Future Combat Systems (FCS)

The FCS program consists of an integrated family of advanced, networked combat and sustainment systems; unmanned ground and air vehicles; and unattended sensors and munitions intended to equip the Army's new transformational modular combat brigades. Within a system-of-systems architecture, FCS features 14 major systems and other enabling systems along with an overarching network for information superiority and survivability. This assessment focuses on the full FCS program.



Source: U.S. Army.



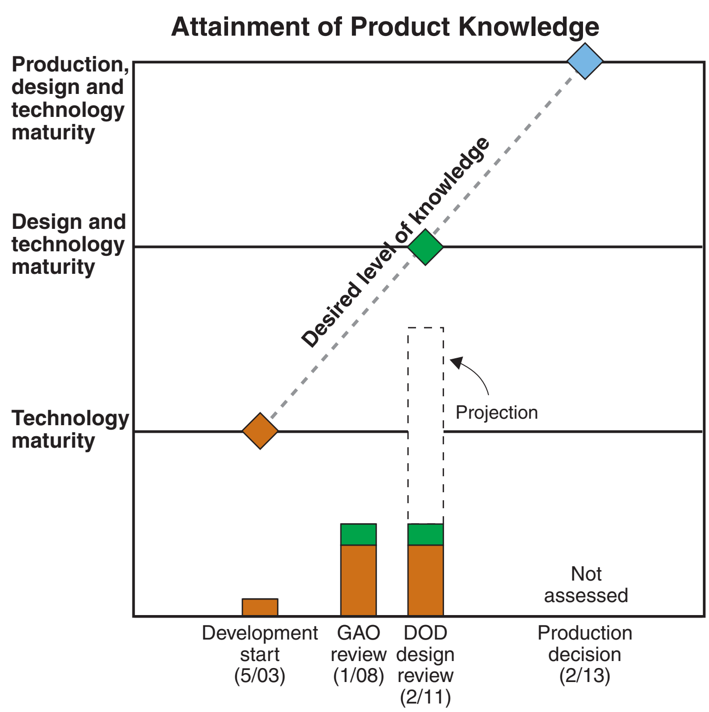
Program Essentials

Prime contractor: Boeing
Program office: Hazelwood, Mo.
Funding needed to complete:
R&D: $16,651.9 million
Procurement: $99,275.0 million
Total funding: $116,657.9 million
Procurement quantity: 15

Program Performance (fiscal year 2008 dollars in millions)

	As of 05/2003	Latest 12/2006	Percent change
Research and development cost	$20,537.8	$28,478.2	38.9
Procurement cost	$67,060.0	$99,275.0	48.0
Total program cost	$88,278.7	$128,483.8	45.5
Program unit cost	$5,885.245	$8,565.589	45.5
Total quantities	15	15	0
Acquisition cycle time (months)	91	145	59.3

Since last year's assessment, the Army has made progress maturing six technologies, but three other critical technologies are now assessed as less mature. The Army continues to define the requirements for core FCS systems, and contractors continue to refine their initial designs. Testing of the initial FCS items to be delivered to current Army forces is expected to begin in fiscal year 2008. The Army also plans to begin initial production of both the Non-Line-of-Sight Cannon and a few other related systems in fiscal year 2009. The Army has eliminated four of the core FCS systems due to budget considerations. The Army's development cost estimate for FCS is much lower than two independent estimates and is based on less demonstrated knowledge than would normally be expected near the midpoint of development.



FCS Program

Technology Maturity

Only 2 of the program's 44 technologies are fully mature and 30 are nearing full maturity. Based on the Army's assessment, 6 technologies have demonstrated higher maturity since last year, but 3 are now assessed as less mature. All critical technologies may not be fully mature until the Army's production decision in February 2013. The next independent verification of FCS critical technologies should be available in early 2009 for the preliminary design review.

The Army is using a phased approach to "spin out" mature FCS equipment to current forces, provided the equipment demonstrates military utility during testing. Testing of the initial spinout items should begin in fiscal year 2008. Because technical issues have delayed development of new radios, the Army will be testing spinout hardware using surrogate radios. As currently scheduled, production-representative radios will not be available for testing until at least 2009, which is after the production decision for spinout items.

Design Stability

The Army plans to conduct a preliminary design review in February 2009 and a critical design review in February 2011. At the critical design review, the Army expects to have completed 90 percent of FCS design drawings. FCS contractors have released some design drawings for a small number of systems that are candidates for near-term spinout fielding including unattended sensors, the Non-Line-of-Sight Launch System, and various communications equipment. Contractors have also released some design drawings for an early production version of the Non-Line-of-Sight Cannon. The vehicles are being built to satisfy a congressional mandate for the early fielding of cannon vehicles.

Production Maturity

Since the low-rate production decision for the core FCS systems is not scheduled until February 2013, we did not assess production maturity. However, the Army plans to spend more than $5 billion to begin initial production of both the Non-Line-of-Sight Cannon and a few spinout systems in 2009—4 years before the program's system-of-systems production decision and before any of the other manned ground vehicles are subject to any developmental, live fire, or operational testing. The Army intends to use a sole source contract with the current lead system integrator for all FCS low-rate production.

Other Program Issues

Since last year's assessment, the Army deleted four systems and made several other adjustments to the FCS development program based largely on budgetary constraints. The Army also reduced the annual FCS production rate and stretched out the production phase by about 5 years, also due to budgetary limitations. As a result, total cost estimates for the program were slightly reduced.

The Army's FCS development cost estimate depends on a number of assumptions. Historically, programs using such assumptions tend to underestimate costs. Program officials stated they will not spend more in development than the current value of the FCS development contract. Any projected cost overruns would be eliminated by deleting requirements, forcing the user to forego certain capabilities.

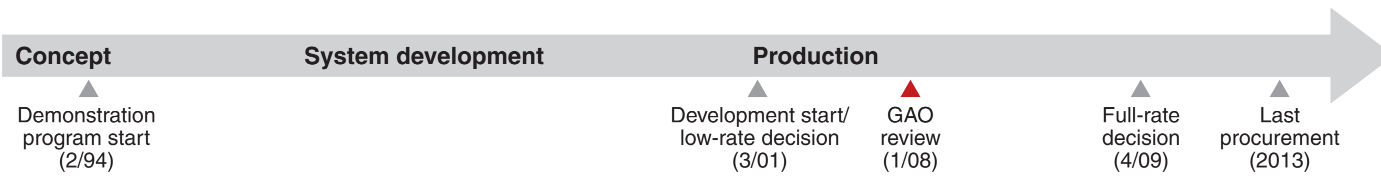
Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

Global Hawk Unmanned Aircraft System

The Air Force's Global Hawk system is a high-altitude, long-endurance unmanned aircraft with integrated sensors and ground stations providing intelligence, surveillance, and reconnaissance capabilities. After a successful technology demonstration, the system entered development and limited production in March 2001. The acquisition program has been restructured several times. The current plan acquires 7 aircraft similar to the original demonstrators (the RQ-4A) and 47 of a larger and more capable model (the RQ-4B).

Source: Northrop Grumman Corporation.



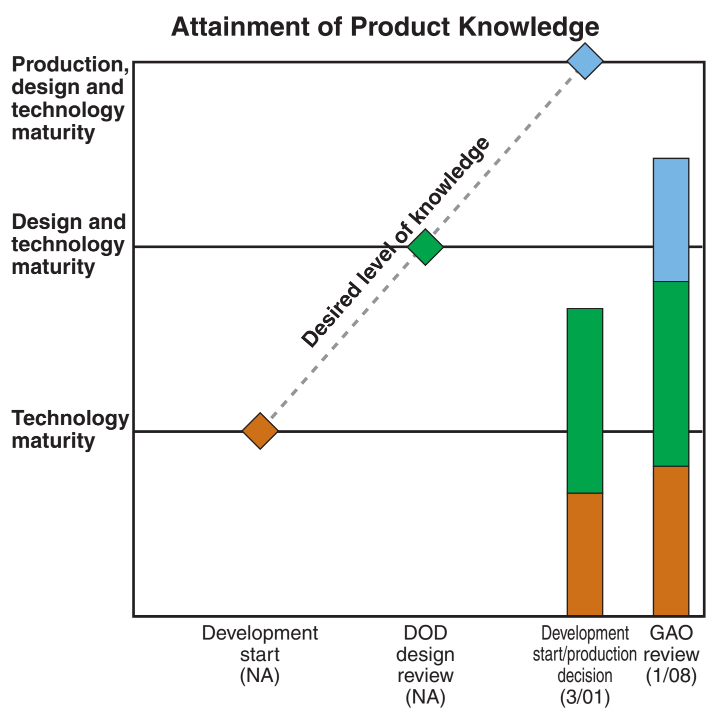
Program Essentials

Prime contractor: Northrop Grumman
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
R&D: $1,603.1 million
Procurement: $3,894.9 million
Total funding: $5,500.9 million
Procurement quantity: 30

Program Performance (fiscal year 2008 dollars in millions)

	As of 03/2001	Latest 09/2007	Percent change
Research and development cost	$989.3	$3,682.4	272.2
Procurement cost	$4,101.7	$5,773.9	40.9
Total program cost	$5,121.0	$9,599.8	87.5
Program unit cost	$81.286	$177.773	118.7
Total quantities	63	54	-14.2
Acquisition cycle time (months)	55	TBD	TBD

RQ-4A production is complete and RQ-4B aircraft are currently in production. Key technologies are mostly mature. The program is collecting manufacturing process control data and bringing them into control, but test delays constrain these efforts. The first RQ-4B had its first flight in March 2007 but encountered problems. Flight testing is ongoing but proceeding slowly. Representative prototypes of the two sensors driving the requirement for the larger aircraft are in flight test on surrogate platforms. However, critical imaging sensors are not yet fully mature. Airframe design appears stable, but differences between the two models were much more extensive and complex than anticipated; these differences resulted in extended development times, frequent engineering changes, and significant cost increases. The program was rebaselined for the third time since its 2001 inception.



Global Hawk Program

Technology Maturity

Critical technologies on the RQ-4B are mature or approaching maturity. This includes the advanced signals intelligence and improved radar sensors, two key capabilities that are critical for developing and acquiring the larger aircraft. Representative prototypes of both sensors are in flight tests on surrogate aircraft. However, critical imaging sensors are not yet fully mature.

Design Stability

The RQ-4B basic airframe design is now stable with all its engineering drawings released. During the first year of production, however, frequent and substantive engineering changes increased development and airframe costs and delayed delivery and testing schedules. Differences between the two aircraft models were much more extensive and complex than anticipated.

Production Maturity

The contractor has built all seven RQ-4A aircraft and production efforts are now focused on the larger, more advanced RQ-4B aircraft. The first block of RQ-4B's (six aircraft, which do not include the advanced radar or signal intelligence capabilities) have all been produced. The program office is collecting statistical process control data for several of its critical manufacturing processes, and many of these are in control. Other performance indicators, such as defects and rework rates, are also being used to monitor quality.

The first RQ-4B aircraft completed production in August 2006 and had its first flight in March 2007. This aircraft is more than 1 year behind schedule. The first flight had been delayed, in part, due to problems identified during testing. Developmental testing is ongoing but has proceeded slowly. Continued test delays may affect efforts to further mature production processes. Performance and flight issues identified during tests could result in design changes, revised production processes, and rework. Operational tests to verify that the basic RQ-4B design works as intended are planned to be completed in February 2009, a delay of more than 2 years. By that time the Air Force expects to have bought about one-half of the total quantities. Schedules for integrating, testing, and fielding the new advanced sensors have had delays, raising risks that these capabilities may not meet the warfigther's requirements.

An operational assessment was completed in March 2007 on the RQ-4A, over 2 years later than originally estimated. Performance problems were identified in communications, imagery processing, and engines. These issues have not yet been completely resolved.

Other Program Issues

We have previously reported significant cost, schedule, and performance problems for the Global Hawk program. Soon after its March 2001 start, DOD restructured the program from a low-risk incremental approach to a high-risk, highly concurrent strategy. Specifically, the restructuring aimed to develop and acquire the larger RQ-4B aircraft with advanced but immature technologies on an accelerated production schedule. The program has been rebaselined three times, and aircraft unit costs have more than doubled since program start. Significant cost increases between 2002 and 2005 culminated in a Nunn-McCurdy unit cost breach of the critcal cost growth threshold, which led to certification to Congress. The program still faces risks, as the most advanced aircraft variant will not be fully tested until mid-fiscal year 2010. By this point, the program plans to have purchased over 60 percent of the total aircraft quantity. Also, software and subcontractor management continue to be risk areas for the program.

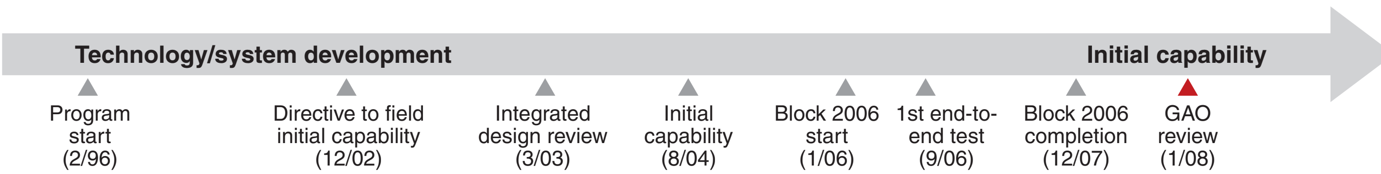
Agency Comments

In commenting on an assessment draft, the Air Force stated that the Global Hawk program made progress in the last year and continues to execute what it calls a challenging acquisition program. Three deployed RQ-4A aircraft supported military operations, amassing 5,700 combat hours in 2007. Two advanced technology sensors, which were once a technology maturity concern, are being successfully tested on surrogate aircraft: a risk management initiative. The RQ-4B aircraft entered a rigorous development test phase. The methodical collection of test data paces this testing, not the test schedule. Integration of the two advanced technology sensors into the RQ-4B aircraft is beginning or in planning. Current program challenges include: software production, RQ-4B (Block 20) testing, and normalization of sustainment and operations.

Ground-Based Midcourse Defense (GMD)

MDA's GMD element is being developed in incremental, capability-based blocks to defend against limited long-range ballistic missile attacks during the midcourse phase of the missile's flight. GMD is an integrated system consisting of radars, an interceptor (a booster and an exoatmospheric kill vehicle) and a fire control system that formulates battle plans and directs components. We assessed the maturity of technologies critical to the Block 2006 GMD element, but we assessed design and production maturity for the interceptor only.

Source: Department of Defense.



Program Essentials

Prime contractor: Boeing
Program office: Arlington, Va.
Funding FY08-FY13:
R&D: $10,422.4 million
Procurement: NA
Total funding: $10,422.4 million
Procurement quantity: NA

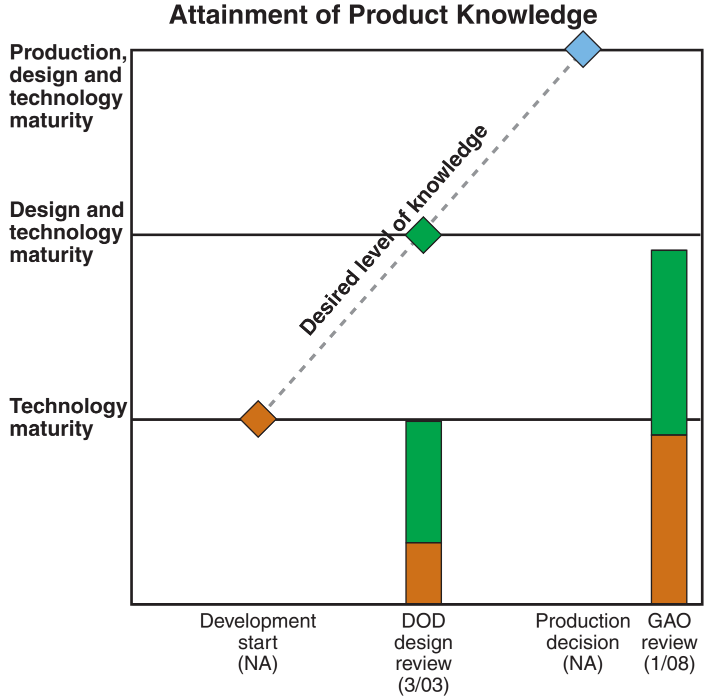
Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 09/2007	Percent change
Research and development cost	NA	$37,334.2	NA
Procurement cost	NA	0	NA
Total program cost	NA	$37,334.2	NA
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Columns include known costs and quantities from the program's inception through fiscal year 2013.

Block 2006 enhances GMD's Block 2004 design by adding two new technologies that are expected to improve the performance of the interceptor. All Block 2004 technologies are mature, but the Block 2006 technologies have not been demonstrated in an operational environment. MDA has released all drawings related to the Block 2004 interceptor to manufacturing and has emplaced 24 interceptors for operational use. However, technical problems with the 2004 design and efforts to mature new technologies may lead to design changes. Although MDA is producing hardware for operational use, it has not made a formal production decision, and we could not assess the stability of production processes because the program is not collecting statistical data.

Attainment of Product Knowledge



GMD Program

Technology Maturity

All nine Block 2004 technologies are mature. Block 2006 adds two new technologies—an upgraded infrared seeker and onboard discrimination—to the interceptor's exoatmospheric kill vehicle. These two technologies are approaching maturity but have not yet been demonstrated in an operational environment. The GMD program expects to integrate these technologies into the interceptor's design and field the enhanced interceptor in 2008.

One critical technology was removed since last year's assessment. Lockheed Martin's Boost Vehicle Plus program, including its guidance navigation and control subsystem, was canceled in 2006 because of fiscal constraints and the program's success with the Orbital Booster Vehicle.

Design Stability

The design of the Block 2004 ground-based interceptor appears stable, with 100 percent of its drawings released to manufacturing. However, the number of drawings may increase if ongoing tests of the Block 2004 interceptor identify needed design changes. Additionally, the design of the Block 2006 configuration is incomplete, as the program is still maturing the kill vehicle's infrared seeker and onboard discrimination.

Production Maturity

Officials do not plan to make an official production decision, and the program intends to keep production quantities low. Because production quantities are small, the program does not collect statistical control data, and we could not assess the maturity of the production processes. Instead, the GMD program measures production capability and maturity with a monthly evaluation process called a manufacturing capability assessment that evaluates critical manufacturing indicators for readiness and execution.

Other Program Issues

GMD's flight test program continues to experience delays. GMD planned three flight tests in 2007, including two intercept attempts and one radar characterization test. The program successfully accomplished one intercept attempt and the radar characterization flight. The first intercept attempt was originally declared a "no test" when the target malfunctioned. To make-up for the no test, the program held another test with the same objectives. This test was successfully completed in September 2007.

Quality control procedures have allowed less reliable or inappropriate parts to be incorporated into the manufacture of the booster and the kill vehicle. The program has corrected some reliability problems by incorporating new parts into the manufacturing line. However, numerous emplaced interceptors include unproven parts because they were manufactured before the improved parts were introduced into the production line. The program expects to remedy this problem by retrofitting the emplaced interceptors, but this is not scheduled to begin until fiscal year 2008.

As reported in our last assessment, we estimate that at the contract's completion, the GMD prime contractor, Boeing, could experience a cost overrun between $1.0 billion and $1.4 billion. As of September 2007, the GMD program was overrunning its fiscal year 2007 cost budget by $22 million.

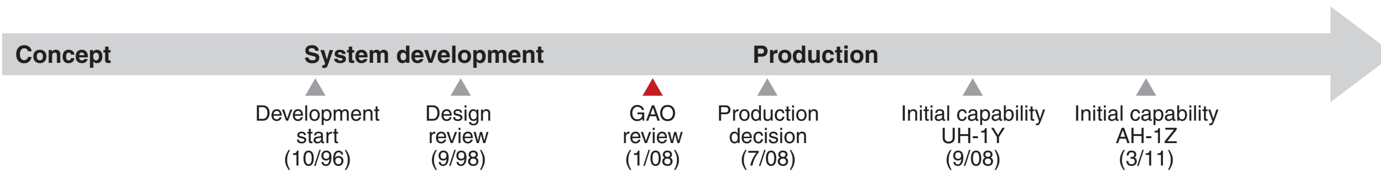
Agency Comments

MDA provided technical comments, which were incoporated where appropriate.

H-1 Upgrades

The Navy's H-1 Upgrades Program converts the AH-1W attack helicopter and the UH-1N utility helicopter to the AH-1Z and UH-1Y configurations, respectively. The mission of the AH-1Z attack helicopter is to provide rotary wing fire support and reconnaissance capabilities in day/night and adverse weather conditions. The mission of the UH-1Y utility helicopter is to provide command, control, and assault support under the same conditions.

Source: Bell Helicopter, © 2007 Bell Helicopter.



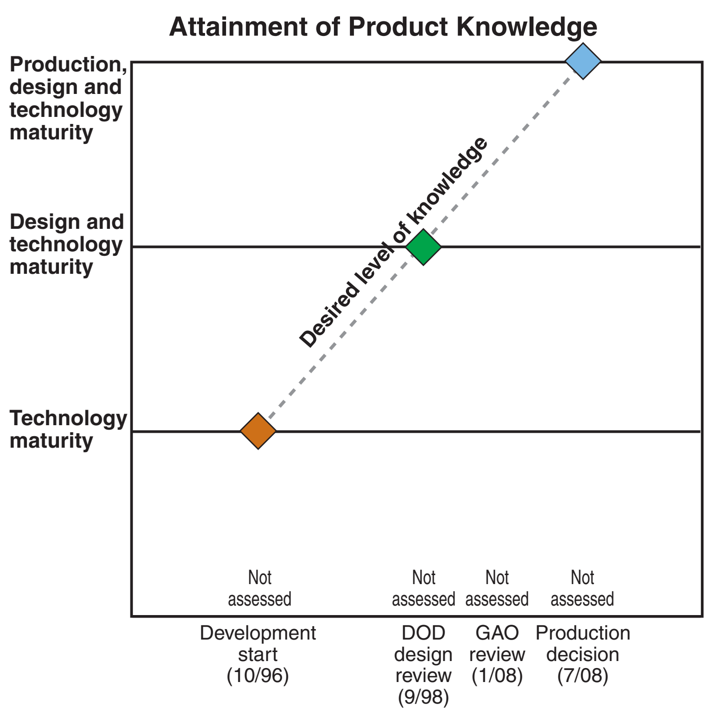
Program Essentials

Prime contractor: Bell Helicopter Textron
Program office: Patuxent River, Md.
Funding needed to complete:
- R&D: $21.7 million
- Procurement: $5,282.1 million
- Total funding: $5,303.8 million
- Procurement quantity: 246

Program Performance (fiscal year 2008 dollars in millions)

	As of 10/1996	Latest 09/2007	Percent change
Research and development cost	$663.3	$1,521.7	129.4
Procurement cost	$2,780.8	$6,734.9	142.2
Total program cost	$3,444.1	$8,256.7	139.7
Program unit cost	$12.127	$29.073	139.7
Total quantities	284	284	0
Acquisition cycle time (months)	105	143	36.2

The H-1 Upgrades Program did not assess technology maturity at program start, but faces challenges with key technologies, including the target sight system and helmet-mounted sight display. The program office reported that it currently has 2,611 AH-1Z drawings and 3,169 UH-1Y drawings. The program does not track data for critical process control in manufacturing, but utilizes postproduction quality metrics. The H-1 upgrades program was approved for Low-Rate Initial Production Lot 4 in July 2007 and currently has 34 aircraft on contract. The program reported that three AH-1Z and five UH-1Y have been delivered to date. The program is currently undergoing its fourth major restructuring, which has delayed the expected full-rate production decision by 18 months, now expected for July 2008.



H-1 Upgrades Program

Technology Maturity

Program officials reported that technologies and related maturity were not assessed at program start, but that all technologies are currently considered mature.

Design Stability

The program reported there are currently 2,611 AH-1Z drawings, 475 of which are legacy, and 3,169 UH-1Y drawings, 765 of which are legacy.

Production Maturity

Program officials reported they do not collect critical process control data. However, postproduction quality metrics and engineering change metrics are used to assess product maturity.

A recent operational test report identified performance issues with key technologies that will need to be resolved prior to initial operational capability. For example, the program's target sight system continues to experience a high failure rate, which could affect the AH-1Z's readiness for fielding. Further, flight restrictions are in effect for both the AH-1Z and UH-1Y during operational test and evaluation due to the poor performance of the helmet-mounted sight displays (HMSD), a key weapon system upgrade. The visual sharpness of the HMSD does not support shipboard landings at night, depth perception cues are misleading, and HMSD components are not reliable. The program reported designed improvements are currently being tested to address these challenges. Upon implementation of these improvements, the aircraft will go through a second phase of operational evaluation. However, if deficiencies in the HMSD are not corrected, or if the upgrade is not delivered on time, initial operational capability cannot be supported for the UH-1Y.

The program was approved for Low-Rate Initial Production Lot 4 in July 2007. To date, the program has 34 aircraft on contract, consisting of eight AH-1Z and 26 UH-1Y. Program officials reported that the third AH-1Z and fifth UH-1Y were delivered in October and November 2007, respectively.

Other Program Issues

In an effort to minimize the time aircraft are out of service for remanufacturing, the UH-1Y acquisition strategy was adjusted to a new build airframe in fiscal year 2006. Additionally, the program office is using fiscal year 2007 funding for preliminary engineering for new AH-1Z airframes. The program has experienced significant delays and cost growth in the manufacturing of initial production aircraft, leading to 140 percent cost growth and 36 percent schedule growth. The cost growth experienced by the program is due primarily to revised estimates for labor, material, and tooling based on manufacturing performance data from development and initial production aircraft. The program reported that requirements changes in previous years have also contributed to cost growth.

In May 2006, the Navy initiated the program's fourth major restructuring effort, resulting in an approximate 18-month delay in the full-rate production decision (now expected for July 2008), a reduction in production quantities from 47 to 38 in fiscal years 2006 to 2008, and the extension of low-rate production. At the same time, the contractor has failed to meet the commitments of an increased production rate. Program officials stated that the prime contractor's delivery schedule is a key risk that could affect the UH-1Y initial operational capability. The prime contractor has experienced challenges with supply chain management, manufacturing standards, and built-in quality, affecting program schedule and resulting in aggressive training timelines with little margin. If the planned September 2008 initial operational capability is not met, the program may face an acquisition program baseline breach and risk undergoing a fifth restructuring. Additionally, the contractor's earned value management system was decertified. The program expects recertification during spring 2008.

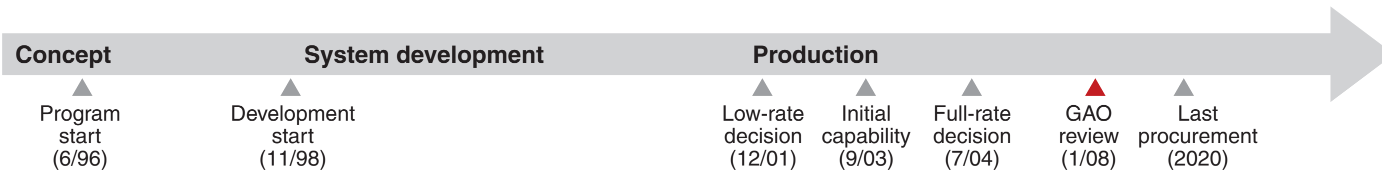
Agency Comments

In commenting on a draft of this assessment, the Navy provided technical comments, which were incorporated as appropriate.

Joint Air-to-Surface Standoff Missile (JASSM)

JASSM is a long-range Air Force air-to-ground precision missile that is able to strike targets from a variety of aircraft, including the B-1, B-2, and F-16. The Air Force plans for the JASSM Extended Range (ER) variant to add greater range capability to the baseline missile. According to the program office, the baseline JASSM and the ER variant share approximately 70 percent commonality in components. We assessed both variants.

Source: JASSM Program Office.



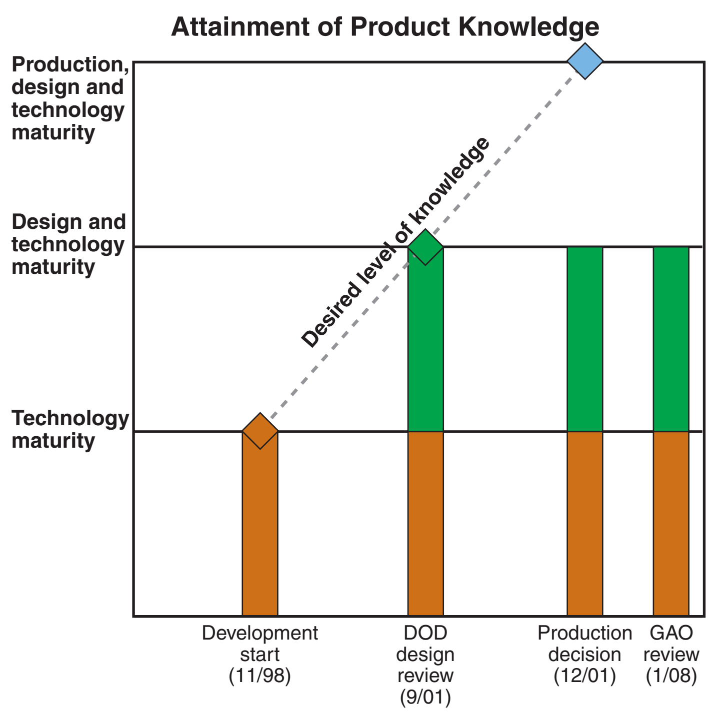
Program Essentials

Prime contractor: Lockheed Martin
Program office: Eglin AFB, Fla.
Funding needed to complete:
- R&D: $138.1 million
- Procurement: $3,375.3 million
- Total funding: $3,513.4 million
- Procurement quantity: 3,958

Program Performance (fiscal year 2008 dollars in millions)

	As of 11/1998	Latest 08/2007	Percent change
Research and development cost	$970.1	$1,407.3	45.1
Procurement cost	$1,207.9	$3,998.5	231.0
Total program cost	$2,200.9	$5,670.1	157.6
Program unit cost	$0.891	$1.133	27.1
Total quantities	2,469	5,006	102.9
Acquisition cycle time (months)	75	87	16.0

The baseline JASSM entered production in 2001. Both variants have the same three critical technologies, and the program office indicates that all three are mature. However, the JASSM design is still not stable. In test flights during April and May 2007, the program experienced four of four test failures, producing an overall missile reliability rate of less than 60 percent. The program office has planned reliability improvements, and it expects to demonstrate those in ground and flight tests during the December 2007 through March 2008 time frame. No additional procurement will occur until the reliability improvements have been demonstrated. The program also experienced a Nunn-McCurdy unit cost breach of the critical cost growth threshold that may require a certification by the Under Secretary of Defense for Acquisition, Technology, and Logistics.



JASSM Program

Technology Maturity

The JASSM program identified the same three critical technologies for both variants—composite materials, global positioning system anti-spoofing receiver module, and stealth/signature reduction—and indicated all three are mature.

Design Stability

Test results show that the JASSM design is not stable. The program office is not acquiring drawings because the contractor has Total System Performance Responsibility wherein, according to program officials, the contractor guarantees the missile performance.

In test flights during April and May 2007, the program experienced four of four test failures, producing an overall missile reliability rate of less than 60 percent. Of the four test failures, three were related to the global-positioning system and one was a repeat of a previously-experienced fuze failure.

The program office has developed a plan to solve the reliability problems by: (1) implementing a software change to the GPS receiver, (2) correcting a design flaw by moving a cable associated with the weapon's anti-spoofing capability farther away from the engine, and (3) reworking the software code for a key data processor.

The program office plans a minimum of nine ground tests in late 2007 and early 2008 as well as a 16-shot test-flight program in the February through mid-March 2008 time frame. These tests are expected to verify the planned improvements to JASSM's reliability. The Under Secretary of Defense for Acquisition, Technology, and Logistics will evaluate the test results.

Production Maturity

Production maturity could not be assessed because the program does not collect production process control data. The program office stated that the contractor collects limited production process control data from its vendors, but it does not formally report the data to the Government under JASSM's contract terms. However, program office personnel review production control data during monthly program management reviews. Additionally, program officials believe that none of the manufacturing processes that affect critical system characteristics are a problem, although there are key production processes that have cost implications, such as the bonding for various subassemblies within the missile body.

Other Program Issues

Following the test failures, the Air Force officially halted procurement of JASSM missiles in July 2007. Of the 942 missiles currently on contract (Lots 1-6) from the total planned buy of 4,900 baseline and ER variants, 611 have been delivered. According to program officials, if the planned tests validate JASSM's reliability, the Air Force expects to restart procurement by renegotiating the Lot 7 buy.

The program has also experienced a cost increase of over 60 percent. This cost increase resulted in a Nunn-McCurdy unit cost breach of the critical cost growth threshold. The primary drivers for the cost breach were the addition of 2,500 of the more expensive Extended Range variant (increasing total missile quantity from 2,400 to 4,900) and a reliability improvement program. As a result, even if JASSM performs successfully in its ground and flight tests, the program cannot continue unless the Under Secretary of Defense for Acquisition, Technology, and Logistics certifies that it is essential to national security, no feasible alternatives exist, cost estimates are reasonable, and the program's management structure is adequate. The Under Secretary has delayed certification pending the test results.

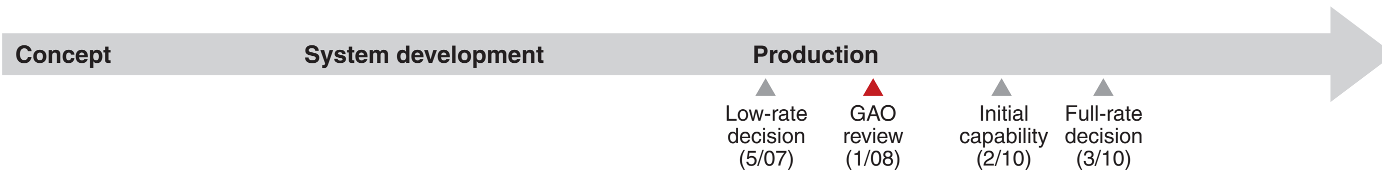
Agency Comments

In commenting on a draft of this assessment, the Air Force reiterated that JASSM remains in the Nunn-McCurdy certification process. The Air Force added that previous independent reviews found reliability issues primarily driven by supplier quality control problems. It was further stated that significant progress has been made towards the resolution of the GPS issue and once corrective actions are validated and verified through continued testing they will be incorporated into additional JASSM test missiles. The Air Force also provided technical comments which were incorporated where appropriate.

Joint Cargo Aircraft

Joint Cargo Aircraft (JCA) is a joint acquisition by the Army and the Air Force for a medium lift, fixed-wing aircraft which will move mission-critical and time-sensitive cargo to tactical units in remote and austere locations. The six JCA missions are (1) critical resupply, (2) casualty evacuation, (3) air drop (personnel/supplies), (4) aerial sustainment, (5) troop transport, and (6) homeland security. This is a fully-developed commercial-off-the-shelf aircraft that is currently being delivered to multiple military customers worldwide.

Source: C-27J Spartan www.c-27j.com, ©2006 C-27J Team.



Program Essentials

Prime contractor: L-3 Communications
Program office: Huntsville, Ala.
Funding needed to complete:
- R&D: $98.7 million
- Procurement: $3,590.7 million
- Total funding: $3,689.4 million
- Procurement quantity: 76

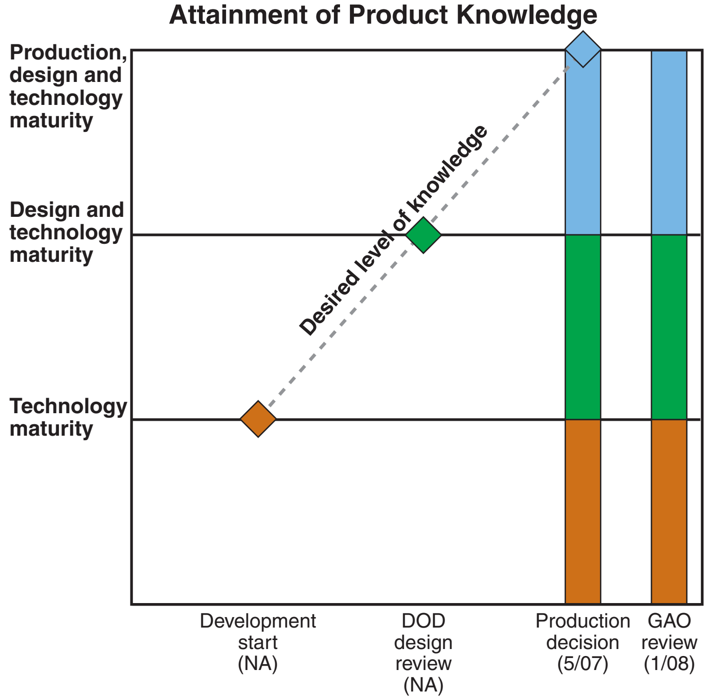
Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$113.9	NA
Procurement cost	NA	$3,669.5	NA
Total program cost	NA	$3,783.1	NA
Program unit cost	NA	$48.502	NA
Total quantities	NA	78	NA
Acquisition cycle time (months)	NA	32	NA

Costs reflect Army's and Air Force's dollars through fiscal year 2013. Total program cost beyond fiscal year 2013 is to be determined.

The JCA is a commercial off-the-shelf procurement. No developmental efforts are planned, and the system's technology and design are mature. Production maturity is high since this aircraft is currently in use commercially. On June 13, 2007, the Army awarded a $2.04 billion contract with L-3 Communications for an initial quantity of 78 aircraft by 2013, along with training and support. The delivery date for the first aircraft is September 2008. The system is scheduled to undergo initial operational test and evaluation from September to November 2009 and its initial operational capability is planned for February 2010.

Attainment of Product Knowledge



JCA Program

Technology Maturity

The JCA is an off-the-shelf procurement of a fully developed commercial aircraft that is currently produced and delivered to multiple military customers worldwide. As such, the JCA program office states that the system's technologies are mature. The Army submitted a technology readiness assessment for JCA in support of program entry at Milestone C. This assessment concluded that nondevelopmental capabilities presently embodied in both military and commercially available aircraft are sufficient to meet the JCA mission requirements without further technology development. The assessment also determined that there are no technology elements associated with the JCA's performance, manufacturing process, material, or tooling/manufacturing infrastructure that are new or novel or are being used in a new or novel way. The Office of the Director of Defense Research and Engineering concurred with this conclusion in a memorandum on May 30, 2007, and noted that the aircraft has been demonstrated in a relevant environment. It was also noted that if any future technology insertions are included in the JCA program, a technology certification should be revisited for those technologies.

Design Stability

We did not assess the JCA's design stability because program officials said that the design of the JCA is stable, since the aircraft is already a fully developed commercial aircraft.

Production Maturity

Program officials state that the production maturity is at a high level because the aircraft is commercially available, and production lines are already established. The delivery date for the first aircraft to the JCA program is September 2008. The system will undergo initial operational tests from September to November 2009 and be fielded shortly thereafter, in February 2010.

Other Program Issues

The Army awarded a low-rate initial production contract for 13 aircraft on June 13, 2007, with full-rate production decision scheduled for March 2010. A bid protest that was filed shortly after the contract award was resolved, but program officials stated that this had a 3 month impact on the JCA's schedule.

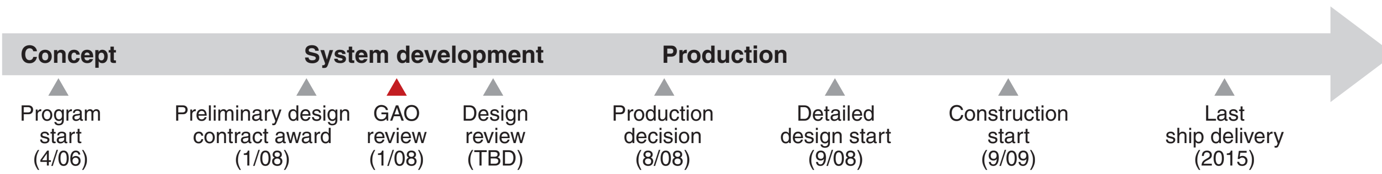
Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

Joint High Speed Vessel (JHSV)

The Joint High Speed Vessel (JHSV) is a cooperative Army and Navy effort to acquire a high-speed, shallow-draft vessel capable of operating without existing ports for rapid intratheater transport of personnel and cargo. The program awarded three preliminary design contracts in January 2008 and intends to award a detailed design and construction contract in the fourth quarter of fiscal year 2008. The program expects to mature its design as it approaches construction, currently scheduled for the fourth quarter of fiscal year 2009.

Source: U.S. Navy.



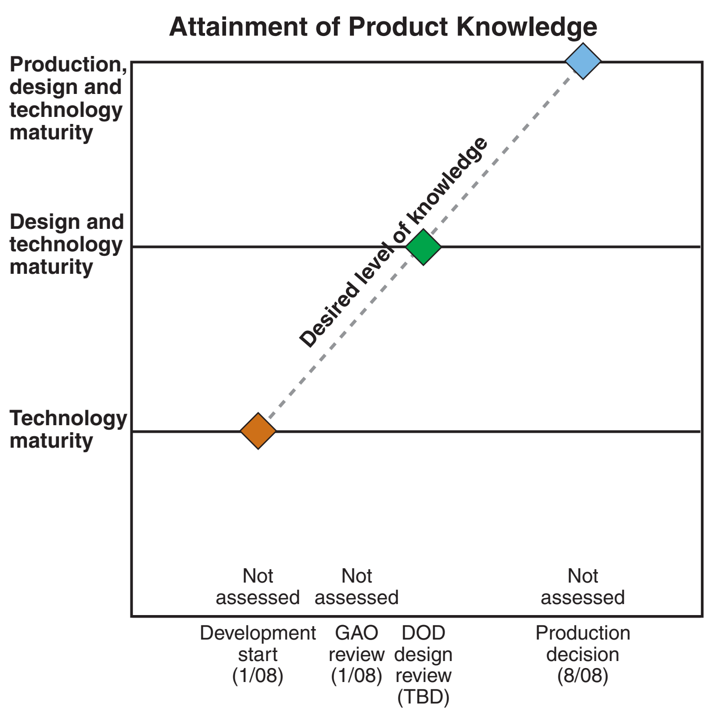
Program Essentials

Prime contractor: TBD
Program office: Washington, D.C.
Funding needed to complete:
R&D: $58.0 million
Procurement: $1,421.0 million
Total funding: $1,479.0 million
Procurement quantity: 8

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$112.0	NA
Procurement cost	NA	$1,421.0	NA
Total program cost	NA	$1,533.0	NA
Program unit cost	NA	$191.625	NA
Total quantities	NA	8	NA
Acquisition cycle time (months)	NA	NA	NA

In 2007, DOD and the Navy determined that the JHSV program had no critical technologies because all of the technologies have been previously demonstrated on ships leased by DOD. However, a number of existing designs and technologies, such as at-sea tension refueling, hull design, the fire suppression system, and the engines, may need to be modified to support additional performance requirements. These performance requirements may be amended if the associated technologies do not mature on time. The JHSV is designated as part of the Capital Budget Account (CBA), a DOD pilot program designed to keep shipbuilding programs on budget.



JHSV Program

Technology Maturity

The JHSV program intends to modify existing commercial fast ferry technologies and designs in order to produce a ship that meets its key performance parameters. According to the program office, the three most important key performance parameters are payload, speed, and un-refueled range. The ship design will include a helicopter flight deck and a ramp capable of supporting an Abrams main battle tank.

According to the program office, all of the ship's key performance parameters have been demonstrated on ships leased by the government and used in military operations. On the basis of the results of these operations, program officials estimate that there is only a low risk that a new high-speed vessel derived from commercial designs would fail to meet JHSV key performance parameters.

In addition to the key performance parameters, other requirements have been established for the ship. These additional requirements may require the use of existing technologies that have not been proven on similar vessels and are in development in other programs. For example, one requirement is the installation of a fire suppression system that uses high-expansion foam. While high-expansion foam fire suppression systems are in use, they have never been used in an open cargo bay of a moving ship. There is also a requirement for at-sea tensioned refueling, a technology that has not been demonstrated on lightweight vessels that rely on waterjet propulsion. This technology is scheduled for testing on the Littoral Combat Ship. Another JHSV requirement includes engine reliability specifications that have not been demonstrated by existing commercial engines. JHSV may be able to leverage other shipbuilding programs, such as the Littoral Combat Ship, that are currently testing engines with similar requirements. According to program officials the additional requirements for JHSV can be amended or removed from the ship if associated technologies do not mature on time or fail to meet basic performance specifications.

Design Stability

The program is pursuing a phased approach to designing the ship. In phase I the program office selected three contractors to develop competing preliminary designs based on JHSV requirements. The contracts for preliminary design were awarded in January 2008. In phase II the program office will select a single contractor and award a contract for detailed design and construction sometime in the summer of 2008. Follow-on ships will be modified versions of this contractor's design.

Modifications to existing commercial designs may be necessary to meet JHSV specifications. For example, existing high-speed structural designs may not be adequate to meet the required open ocean transit capability. The program office believes that all of the key performance parameters have been sufficiently demonstrated on the four leased ships and that any necessary modifications are not significant.

Other Program Issues

The Office of the Secretary of Defense designated the JHSV program for the CBA. CBA is a program that establishes metrics used to measure a program's progress against an established budget. According to officials, the metrics against which the JHSV program will be measured have not yet been established. Even when established, CBA metrics will not be applied to the program until after the program enters development- currently planned for August 2008- when the program's budget and requirements will be set.

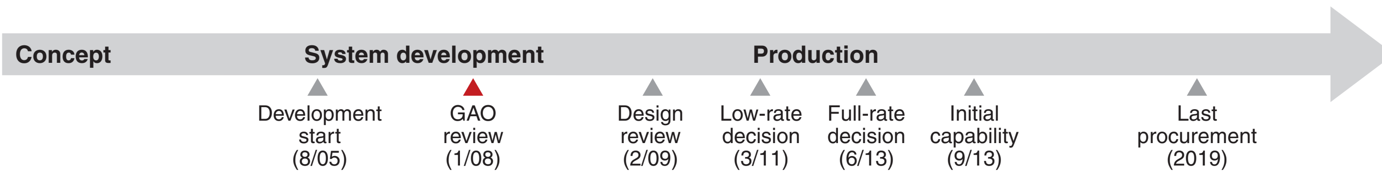
Agency Comments

The Navy provided technical comments, which were incorporated as appropriate.

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)

The Army's JLENS is designed to provide over-the-horizon detection and tracking of land attack cruise missiles and other targets. The Army is developing JLENS in two spirals. Spiral 1 is complete and served as a test bed to demonstrate initial capability. Spiral 2 will utilize two aerostats with advanced sensors for surveillance and tracking as well as mobile mooring stations, communication payloads, and processing stations. JLENS provides surveillance and engagement support to other systems, such as PAC-3 and MEADS. We assessed Spiral 2.

Source: JLENS Product Office.



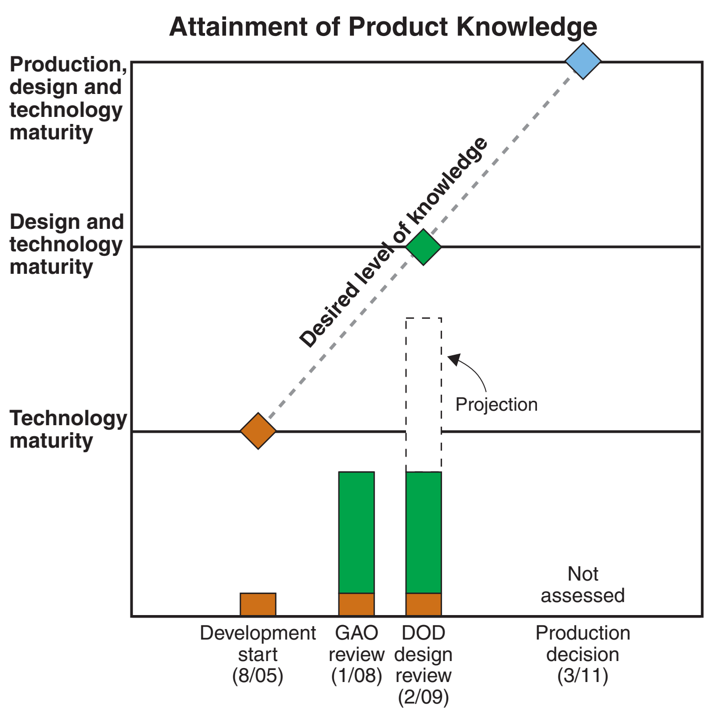
Program Essentials

Prime contractor: Raytheon
Program office: Huntsville, Ala.
Funding needed to complete:
R&D: $1,586.5 million
Procurement: $4,411.1 million
Total funding: $6,070.4 million
Procurement quantity: 14

Program Performance (fiscal year 2008 dollars in millions)

	As of 08/2005	Latest 12/2006	Percent change
Research and development cost	$1,904.9	$1,932.9	1.5
Procurement cost	$4,357.9	$4,411.1	1.2
Total program cost	$6,330.5	$6,416.8	1.4
Program unit cost	$395.655	$401.052	1.4
Total quantities	16	16	0
Acquisition cycle time (months)	97	97	0

The program began development in August 2005 with one of its five critical technologies mature. The program has reduced the number of technologies from five to four, and of those, one is approaching maturity, while three are not yet mature. All technologies are expected to be mature in late 2010. Although the program plans to release nearly 90 percent of engineering drawings by the design review in February 2009, risks for redesign remain until technologies demonstrate full maturity. The synchronization of JLENS development with the Army's effort to integrate its air and missile defense systems also poses a risk to the program's schedule.



JLENS Program

Technology Maturity

JLENS entered system development in August 2005 with only one of its five critical technologies mature. Since that time, the program has combined the communications payload and the processing station into the communications processing group. The communications processing group, which includes radios and fiber optic equipment and also serves as the JLENS operations center, is approaching full maturity. Both sensors—the fire control radar and the surveillance radar—along with the platform, have not yet reached maturity. The program expects to demonstrate these technologies by late 2010.

According to program officials, JLENS development predominately requires integration of existing technologies, and therefore all have been demonstrated as mature. However, components of the JLENS platform and the two sensors will require modification to their form and fit before demonstration in the JLENS operational environment.

While many of the JLENS sensor technologies have legacy components, key hardware that proves functionality, such as the surveillance radar's element measurement system that provides data for signal processing, have yet to be demonstrated in the size and weight needed for integration on the aerostat. Tests to characterize and integrate fire control radar and surveillance radar components are currently being conducted in the program's system integration laboratory. Furthermore, sensor software items related to signal processing, timing, and control, as well as element measurement, are not yet mature.

Design Stability

The program estimates that 88 percent of its 17,000 drawings will be released by the design review in February 2009. The program will hold a number of preliminary design reviews and subsystem design reviews over the next year in preparation for this event. However, until the maturity of the JLEN'S critical technologies has been demonstrated, the potential for design changes remains.

The platform consists of the aerostat, mobile mooring station, power and fiber optic data transfer tethers, and ground support equipment. The mobile mooring station—used to anchor the aerostat during operations—is the least defined component of the JLENS system and is based on a fixed mooring station design. The program has yet to demonstrate the mobility of the mooring station, as the design parameters associated with modifying it from a fixed to a mobile asset have not yet been identified. Consequently, the weight of the mobile mooring station may affect its ability to meet transportability requirements.

Other Program Issues

JLENS will be a crucial part of the Army's Integrated Air and Missile Defense (IAMD) program expected to start development in fiscal year 2009. IAMD will develop a standard set of interfaces between systems such as JLENS and other sensors, weapons, and the battle management, command, control, communications, computers, and intelligence components to provide a common air picture. According to program officials, the impact of synchronizing the IAMD schedule with JLENS development and test schedule is currently unknown.

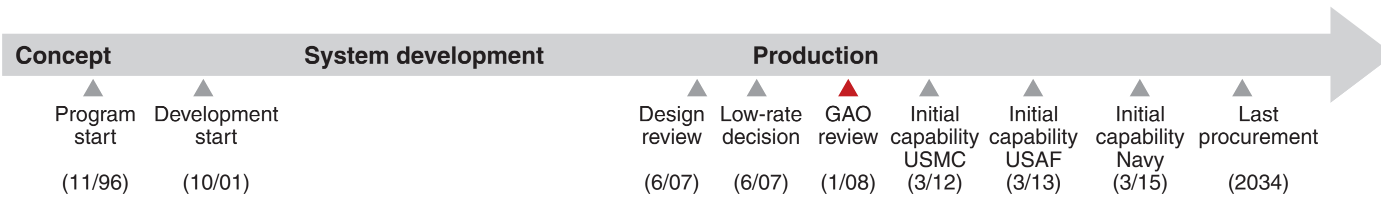
Agency Comments

In commenting on a draft of this assessment, the Army concurred with the information provided in this report.

Joint Strike Fighter (JSF)

The JSF program goals are to develop and field a family of stealthy strike fighter aircraft for the Navy, Air Force, Marine Corps, and U.S. allies, with maximum commonality to minimize costs. The carrier-suitable variant will complement the Navy's F/A-18 E/F. The conventional takeoff and landing variant will primarily be an air-to-ground replacement for the Air Force's F-16 and the A-10 aircraft, and will complement the F-22A. The short takeoff and vertical landing variant will replace the Marine Corps' F/A-18 and AV-8B aircraft.

Source: JSF Program Office.



Program Essentials

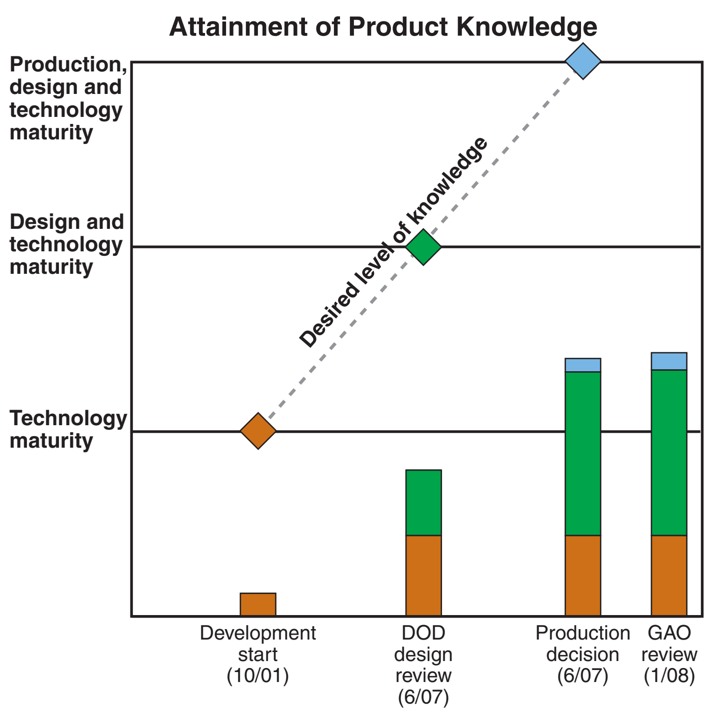
Prime contractor: Lockheed Martin
Program office: Arlington, Va.
Funding needed to complete:
- R&D: $13,976.3 million
- Procurement: $192,764.7 million
- Total funding: $207,178.9 million
- Procurement quantity: 2,441

Program Performance (fiscal year 2008 dollars in millions)

	As of 10/2001	Latest 12/2006	Percent change
Research and development cost	$37,015.8	$45,826.0	23.8
Procurement cost	$164,221.9	$193,652.1	17.9
Total program cost	$202,956.7	$239,974.3	18.2
Program unit cost	$70.815	$97.630	37.9
Total quantities	2,866	2,458	-14.2
Acquisition cycle time (months)	175	196	12.0

Cycle time calculations are based on the Air Force's inital capability because they represent over 70 percent of the procurement quantities.

Two of the eight JSF critical technologies are mature, three are nearing maturity, and three (mission systems integration, prognostics and health management, and manufacturing technologies) are still immature 6 years past the start of development. None of the variants demonstrated design stability at their design review, though two have now met the standard. The program collects data to manage manufacturing maturity, but currently unproven processes and a lack of flight testing could mean costly future changes to design and manufacturing processes. Program costs have continued to increase and the schedule has slipped since the 2004 rebaseline. Very little flight testing has occurred to date and the first fully integrated aircraft will not begin flight testing for at least 4 years. In 2007 DOD cut the number of test aircraft and flight test hours to maintain cost and schedule plans.



JSF Program

Technology Maturity

Two of the JSF's eight critical technologies are fully mature and three are approaching maturity, but three (mission systems integration, prognostics and health management, and manufacturing technologies) are immature despite being past the design review. Maturing critical technologies during development has led to cost growth, with the electric-hydraulic actuation and power thermal management systems costs increasing by 195 and 93 percent respectively since 2003.

Design Stability

As of August 2007, the contractor said it had released 99 percent of planned engineering drawings for the short takeoff and vertical landing variant, 91 percent for the conventional takeoff and landing variant, and 46 percent for the carrier variant. All three variants fell significantly short of meeting the best practices standard of 90 percent of drawings released by the critical design reviews—46 percent for the short takeoff and landing variant, 43 percent for the carrier variant, and 3 percent for the conventional takeoff and landing variant. The late release of drawings led to late parts deliveries, delaying the program schedule and forcing inefficient manufacturing processes. The program began production before delivering an aircraft representing the expected design.

Production Maturity

The program is collecting information on production maturity and reports that about 10 percent of its critical manufacturing processes are in statistical control. While we credit the program for collecting this information, efforts to mature production are constrained because the designs are not fully proven and tested, and manufacturing processes are not demonstrated. The first test aircraft completed needed 35 percent more labor hours than planned, and follow-on aircraft are not meeting a revised schedule put in place in 2007. Because of parts shortages and schedule delays, the test aircraft are being built differently from the process expected for the production aircraft. Flight testing, began in late 2006, is still in its infancy, with only 19 of some 5,500 planned flights completed as of November 2007. A fully integrated, capable aircraft is not expected to enter flight testing until 2012, increasing risks that problems found may require design and production changes, as well as retrofit expenses for aircraft already built.

Other Program Issues

Since the program rebaseline in fiscal year 2004, estimated acquisition costs have increased by about $55 billion (then-year dollars). Estimated procurement costs rose due to greater material costs, labor costs, and labor hours, a 7-year extension of the procurement schedule from fiscal year 2027 to 2034, and a reduction in annual production rates. Development costs since the rebaseline have been stable largely because the program removed about $2.8 billion for risk reduction and an alternate engine program. The program recently restructured development efforts to meet schedule and budget requirements. DOD cut the number of flight test aircraft and flight test sorties, putting greater reliance on the remaining flight test aircraft as well as ground tests to free up funds to replace dwindling management reserves.

Agency Comments

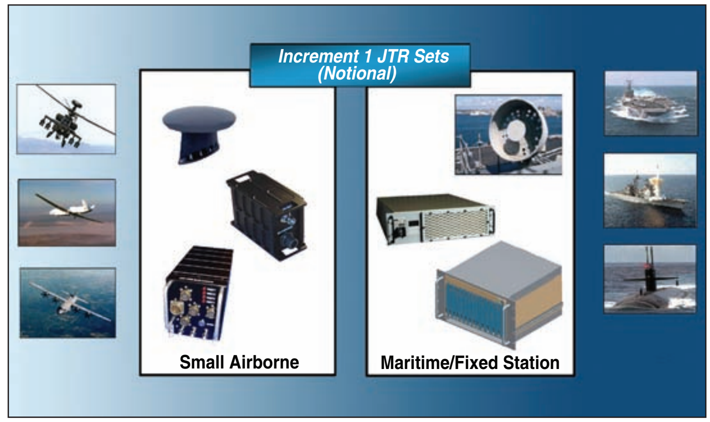
In commenting on a draft of this assessment, program officials challenged its balance, use of best practices, and depiction of program status. They noted the first aircraft is in flight test, includes all major subsystems, and along with other aircraft in work is showing unprecedented assembly fit and quality improvements with each aircraft. They stated the flying test bed is flying mission systems software and reducing risk prior to their first flight on a JSF in early 2009, and all mission systems are maturing as planned. The final software block enters testing in 2011, and later blocks mainly incorporate sensor and weapons updates after lab testing. Officials asserted that data on design maturity and drawing release at critical design reviews are not accurately presented, saying drawing changes are very low compared to legacy systems. They said their plan for spiral blocks of capability balances cost, schedule and risk, while GAO's approach would increase costs by billions and delay delivery of capability to warfighters.

GAO Response

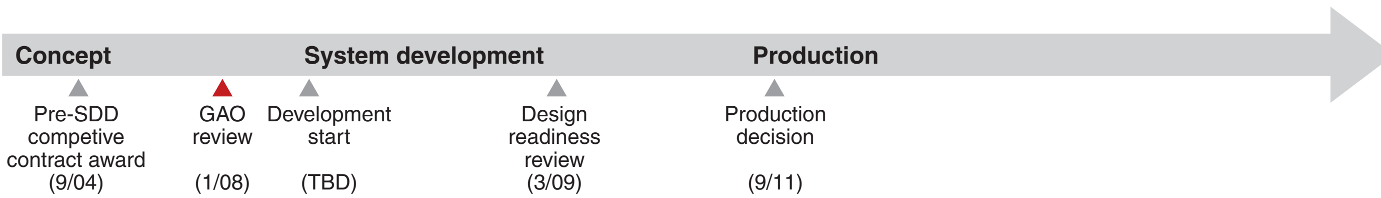
JSF cost increases and schedule delays are indicative of a program that consistently proceeds through critical junctures with knowledge gaps that expose the program to significant risks. The new plan to cut test assets and test activities is another example of adding risk.

Joint Tactical Radio System Airborne, Maritime, Fixed-Station (JTRS AMF)

The JTRS program is developing software-defined radios that will interoperate with existing radios and increase communications and networking capabilities. A Joint Program Executive Office provides a central acquisition authority and balances acquisition actions across the services. Program/product offices develop hardware and software for users with similar requirements. The AMF program will develop radios and associated equipment for integration into nearly 100 different types of aircraft, ships, and fixed stations for all the services.



Source: JTRS JPEO.



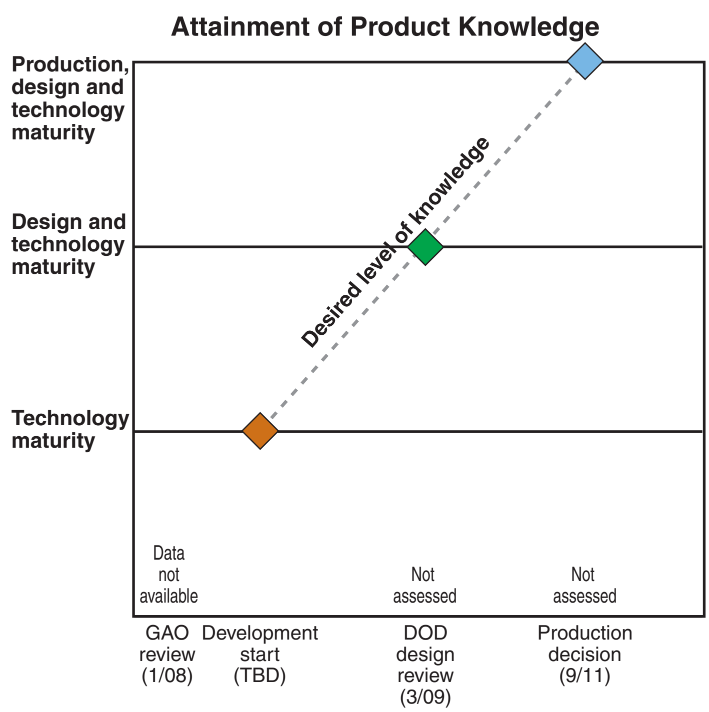
Program Essentials

Prime contractor: TBD
Program office: Hanscom AFB, Mass.
Funding needed to complete:
R&D: $1,478.0 million
Procurement: TBD
Total funding: TBD
Procurement quantity: TBD

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 12/2007	Percent change
Research and development cost	NA	$1,850.71	NA
Procurement cost	NA	TBD	NA
Total program cost	NA	TBD	NA
Program unit cost	NA	TBD	NA
Total quantities	NA	TBD	NA
Acquisition cycle time (months)	NA	NA	NA

The JTRS AMF program has taken steps to mature technologies prior to the start of system development, scheduled for early 2008. A presystem development phase started in 2004 with the award of competitive system design contracts to two industry teams. During 2006 and 2007, an independent technology readiness assessment found that all critical technologies had been demonstrated in a relevant environment and were approaching full maturity. However, there are concerns about four critical technologies needed by JTRS AMF; the program is dependent on another JTRS domain for the development of those technologies. In addition, JTRS AMF may experience cost, schedule, or performance problems if other related program capabilities are delivered late.



JTRS AMF Program

Technology Maturity

To help mitigate technical risks and address key integration challenges, the JTRS AMF program awarded competitive predevelopment contracts to two industry teams led by Boeing and Lockheed Martin. In early 2008, after a full and open competition, a contracting team is expected to be selected for the JTRS AMF system development.

During 2006 and 2007, an independent technology readiness assessment was completed by the Army in support of the start of system development. This assessment found that all critical technologies have been demonstrated in a relevant environment. An independent review team representing the Deputy Under Secretary of Defense for Science and Technology concurred with that assessment. As a result, the JTRS AMF program is expected to enter system development with all critical technologies approaching full maturity.

While noting the maturity of the JTRS AMF technologies, the Deputy Under Secretary of Defense for Science and Technology also expressed concern about four critical technologies on which JTRS AMF is dependent, including waveforms and network management services. These technologies are being developed by the JTRS Network Enterprise Domain—a separate domain under the Joint Program Executive Office. To address the concern, the Deputy Under Secretary recommended that the Joint Program Executive Office conduct an independent technical assessment of the Network Enterprise Domain's waveforms, networking, and network management approaches. In addition, the Deputy Under Secretary recommended that a technology readiness assessment be conducted on the networking and Mobile User Objective System (MUOS) waveforms, as well as network management software, to show that they are mature before being inserted into the JTRS AMF program.

Other Program Issues

Differences among the program's estimated costs and approved budget were resolved at the November 2007 JTRS Board of Directors meeting. The effort to reach a joint consensus caused a delay in the program schedule but resulted in a full funding decision for system development. However, production funding and quantities have not yet been finalized.

The disparity between the cost estimates and approved budget was attributable to a number of factors. For example, program office cost estimates were influenced by assumptions about the number of JTRS AMF variants and waveforms, the number of engineering development models, test costs, and contract costs for award fees and engineering change orders. The Cost Analysis Improvement Group estimate was derived, in part, from the F-35 Joint Strike Fighter communication, navigation and identification friend or foe cost history and cost performance reports. The approved budget included the effects of prior congressional adjustments and reductions to the overall JTRS budget, the overall restructuring of the JTRS program, and transfers to the Multifunctional Information Distribution System part of the JTRS program. Exacerbating the concerns about the difference between cost and budget was that estimates of overall program risk for the JTRS AMF program ranged from moderate to high.

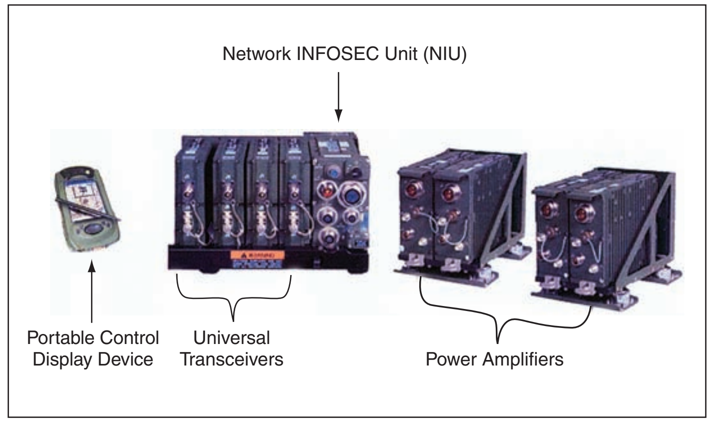
The restructuring of the JTRS program has resulted in an Increment 1 requirement for JTRS AMF to develop (1) a small radio variant for airborne platforms that will support the Wideband Networking Waveform, the Soldier Radio Waveform, the NATO Link 16/Tactical Digital Information Link J waveform, and the MUOS waveform and (2) a large radio variant for ships and fixed stations that will support MUOS and legacy UHF satellite communications. Currently, the JTRS AMF program office assesses the delivery of the MUOS waveform to the program as high risk. If the final development documentation and software for the MUOS waveform are delivered late, then the design and development of JTRS AMF will likely experience cost growth (estimated at $10 million to 25 million), schedule delays (estimated at 4-7 months), and performance problems (a significant loss of required functionality and/or required operational performance).

Agency Comments

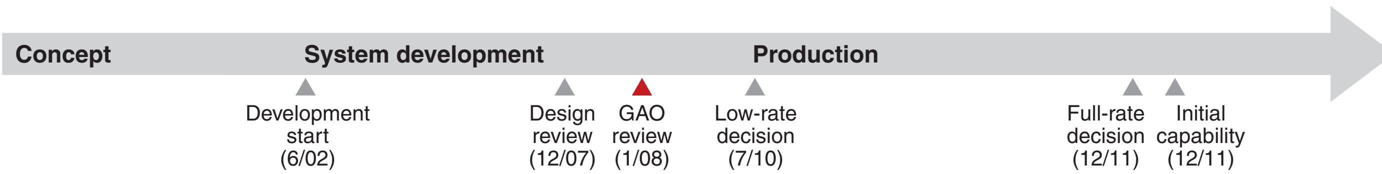
In commenting on a draft of this assessment, the JTRS Joint Program Executive Office provided technical comments which were incorporated as appropriate.

Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)

The JTRS program is developing software-defined radios that will interoperate with select radios and also increase communications and networking capabilities. A Joint Program Executive Office provides a central acquisition authority and balances acquisition actions across the services, while product offices are developing radio hardware and software for users with similar requirements. The JTRS Ground Mobile Radio (formerly Cluster 1) product office, within the JTRS Ground Domain program office, is developing radios for ground vehicles.



Source: JTRS JPEO.



Program Essentials

Prime contractor: Boeing
Program office: San Diego, Calif.
Funding needed to complete:
- R&D: $588.6 million
- Procurement: $13,895.6 million
- Total funding: $14,484.2 million
- Procurement quantity: 104,285

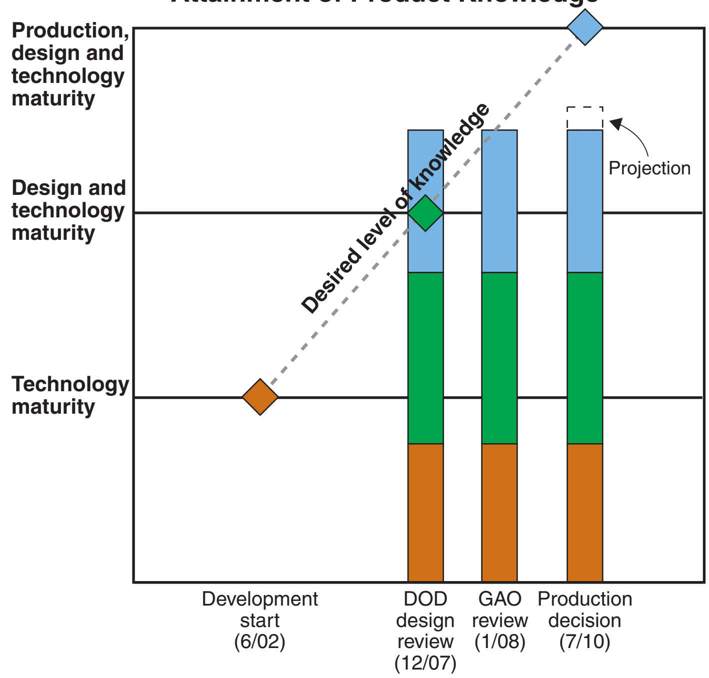
Program Performance (fiscal year 2008 dollars in millions)

	As of 06/2002	Latest 12/2006	Percent change
Research and development cost	$968.5	$1,586.5	63.8
Procurement cost	$15,576.6	$13,897.2	-10.5
Total program cost	$16,545.0	$15,483.7	-6.4
Program unit cost	$.153	$.148	-2.7
Total quantities	108,388	104,425	-3.3
Acquisition cycle time (months)	55	114	107.3

Costs and quantities reflect the program of record. Both are expected to change as part of the program's restructuring.

Twelve of JTRS GMR's 20 critical technologies are mature. While 5 other technologies are approaching maturity, 3 are not expected to mature until the production qualification test in early 2009. This includes 2 technologies—security architecture and the modem hardware and software—that were recently downgraded because early prototypes did not meet performance requirements. In addition, the program is still working to obtain security certification from the National Security Agency and has only demonstrated limited networking capabilities. The program reports a nearly stable design and expects to have fully functioning prototypes in early fiscal year 2009. The program's restructuring received final approval by the milestone decision authority in November 2007.

Attainment of Product Knowledge



JTRS GMR Program

Technology Maturity

The JTRS GMR program started system development in 2002 with none of its 20 critical technologies mature by best practice standards or even DOD policy. Currently, 12 critical technologies are mature, 5 are approaching maturity, and 3 critical technologies—the bridging retransmission software, modem hardware and software, and the security architecture—are immature. The maturity of the modem hardware and software and the security architecture was downgraded because early prototypes did not meet performance requirements. The program expects to demonstrate the maturity of all critical technologies during a production qualification test scheduled for early 2009.

Developing multiple levels of security and obtaining security certification from the National Security Agency continues to be a challenge for JTRS GMR. Security challenges persist, in part because waveform software is being developed while security requirements are still evolving. Nonetheless, the program office said that it is on track to obtain security certification in fiscal year 2010, as scheduled, in time for its low-rate production decision later that year.

A central feature of JTRS GMR's networking capabilities is the Wideband Networking Waveform being developed under the JTRS Network Enterprise Domain, a separate domain under the JTRS Joint Program Executive Office. Progress has been made in developing the waveform but testing and demonstrations on the JTRS GMR have been limited. The radio's closing range and throughput performance have both exceeded requirements in field tests. However, the tests were completed using a network of only two to six nodes, and key networking functions have yet to be demonstrated. Program office officials expect to demonstrate progressively greater Wideband Networking Waveform functionality—including mobile ad hoc networking, subnetting, and throughput tests—in field experiments leading up to the Limited User Test scheduled to begin in the first quarter of fiscal year 2010, when 35 nodes will be tested. More extensive functionality will be demonstrated in the Multi-Service Operational Test and Evaluation scheduled for early fiscal year 2012. This test is expected to include 60 nodes and may be augmented with additional assets from the Future Combat Systems program. The program is also in discussion with the testing community regarding the possibility of using complex modeling to test up to 150 nodes.

Design Stability

The program has released approximately 83 percent of its planned 1,575 drawings. According to the program office, most size, weight, and power issues have been addressed, although the program is still working to integrate the radios onto legacy platforms. The program has delivered 71 early prototypes to the Army's Future Combat Systems. While the program expects to have fully functioning prototypes available in early fiscal year 2009, the immature technologies related to the security requirements raise concerns about the program's design stability.

Production Maturity

The program expects that approximately 77 percent of its key manufacturing processes will be in statistical control when the program makes its low rate production decision in 2010. By not having all processes in statistical control, there is a greater risk that the radio will not be produced within cost, schedule, and quality targets.

Other Program Issues

The JTRS program was restructured in 2006 due to significant cost and schedule problems. While significant technical issues remain, the restructuring appears to put the program in better position to succeed by emphasizing an incremental, more moderate risk approach to developing and fielding capabilities. The restructuring—including program costs—received final approval by the Milestone Decision Authority in late November 2007, and was completed with the report to Congress on the significant Nunn-McCurdy unit cost breaches in late January 2008.

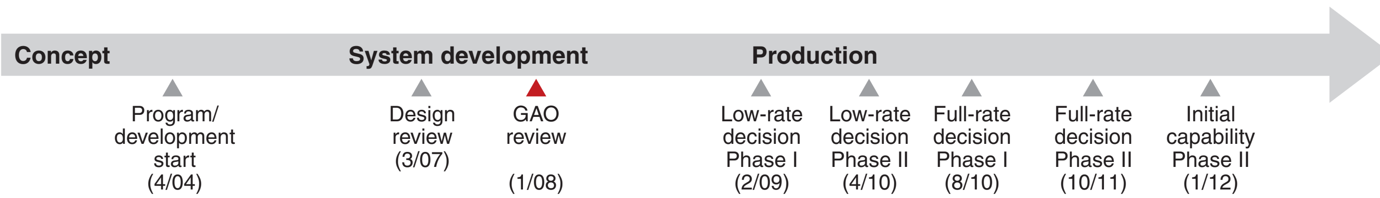
Agency Comments

In commenting on a draft of this assessment, the JTRS Joint Program Executive Office provided technical comments, which were incorporated as appropriate.

JTRS Handheld, Manpack, Small Form Fit (JTRS HMS)

The JTRS program is developing software-defined radios that will interoperate with select radios and increase communications and networking capabilities. The JTRS HMS product office, within the JTRS Ground Domain program office, is developing handheld, manpack, and small form radios. The program includes two concurrent phases of development. Phase I includes select small form variants, while Phase II includes small form radios with enhanced security as well as handheld and manpack variants. This report assesses both phases.

Source: JTRS JPEO.



Program Essentials

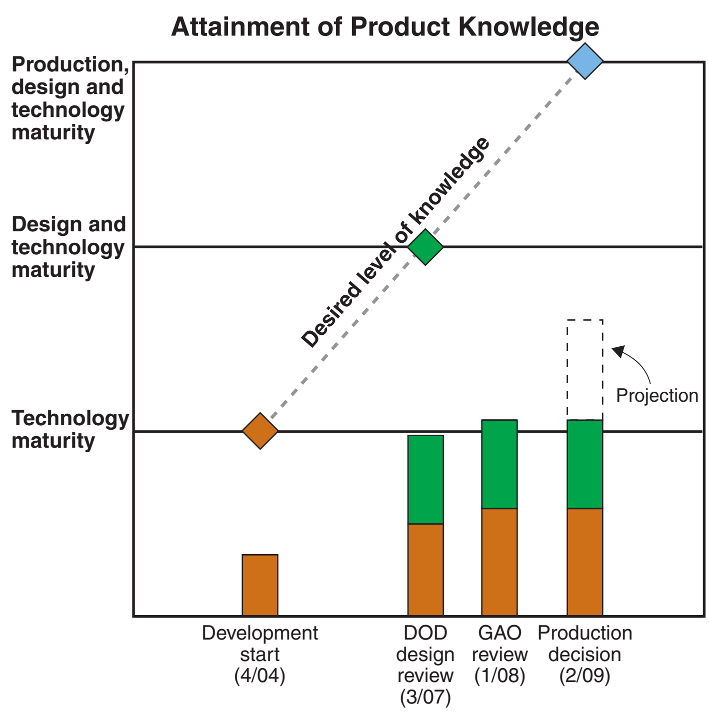
Prime contractor: General Dynamics C4 Systems
Program office: San Diego, Calif.
Funding needed to complete:
R&D: $298.3 million
Procurement: $9,015.5 million
Total funding: $9,313.7 million
Procurement quantity: 328,514

Program Performance (fiscal year 2008 dollars in millions)

	As of 05/2004	Latest 08/2007	Percent change
Research and development cost	$517.3	$688.2	33.0
Procurement cost	$9,015.5	$9,015.5	0
Total program cost	$9,532.8	$9,703.6	1.9
Program unit cost	$.029	$.029	1.9
Total quantities	329,574	329,574	0
Acquisition cycle time (months)	85	93	9.4

Costs and quantities reflect the program of record. Both are expected to change as part of the program's restructuring.

The critical technologies for JTRS HMS have undergone some changes as a result of the program's 2006 restructuring. Currently, Phase I includes two critical technologies, both of which are approaching maturity. Critical technologies for Phase II have yet to be defined. Developing multiple layers of communication security and obtaining National Security Agency certification continues to be a challenge. In addition, while the key networking waveform has been integrated onto JTRS HMS radios in a static laboratory environment, program officials report that it will take additional efforts to transition the waveform to a realistic operational platform. Furthermore, achieving size, weight, and heat dissipation requirements for the two-channel handheld radio remains a significant challenge.



JTRS HMS Program

Technology Maturity

The JTRS HMS program started system development in 2004 with only one of its six critical technologies mature. However, changes were made to the program's acquisition approach and critical technologies as a result of the program's restructuring in 2006. The restructured program currently includes two concurrent phases of development. Phase I development intends to maximize the use of commercial off-the-shelf components and products. As such, the program currently reports only two critical technologies—logical partitioning and software power management—for Phase I products. Both technologies are approaching maturity and are expected to be fully mature to support the program's low rate production decision in 2009.

Phase II development will encompass a customized design. Critical technologies and associated technology maturity levels for Phase II will be defined in a technology readiness assessment scheduled to begin 12 months prior to the Phase II low-rate production decision in-process review currently scheduled for April 2010. The program expects that all critical technologies for Phase II will mature sufficiently to begin low-rate production deliveries by the second quarter of fiscal year 2011.

Developing multiple levels of communication security and obtaining security certification from the National Security Agency is a challenge for JTRS HMS. The security challenges persist, in part, because waveform software is being developed while security requirements are still evolving.

Developing the Operating Environment software and integrating it with waveform software also remains a significant challenge. JTRS HMS radios will operate the Soldier Radio Waveform, which is a low-power, short-range networking waveform optimized for radios with severe size, weight, and power constraints such as dismounted soldier radios and small form radios. The waveform is being developed by the JTRS Network Enterprise Domain, which is a separate domain under the JTRS Joint Program Executive Office. The initial version of the Soldier Radio Waveform has been successfully integrated into early prototypes. While the waveform has demonstrated some functionality in a static laboratory environment, program officials noted that it will take some effort to transition the waveform to a realistic operational platform. In particular, program officials are concerned about the waveform's security architecture and how this may affect integrating it into a JTRS radio. Given these concerns, the waveform's development schedule may be ambitious.

Design Stability

Program officials stated that there will be 527 drawings associated with the program. Of that total, 121 are associated with Phase I and 406 with Phase II. To date, only 55 percent of the Phase I drawings have been released to the manufacturer. The program expects the remaining drawings to be released in the second quarter of fiscal year 2008. None of the Phase II drawings are expected to be released until after the Phase II critical design review scheduled for the fourth quarter of fiscal year 2008. Achieving size, weight, and heat dissipation requirements are still significant challenges on the two-channel handheld radio, in part because of security requirements. The program expects early prototypes of the 2-channel hand-held to be available in early fiscal year 2008.

Other Program Issues

The JTRS program was restructured in 2006 due to a number of high-risk elements of the JTRS program. Despite the significant challenges that remain, the restructuring appears to put the program in better position to succeed by emphasizing an incremental, more moderate risk approach to developing and fielding capabilities. The restructuring received final approval by the milestone decision authority in late November 2007.

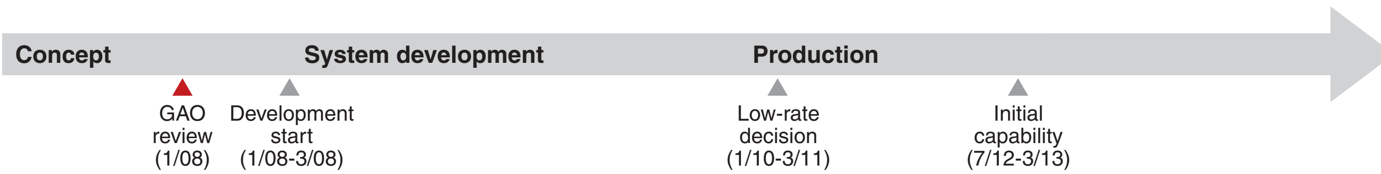
Agency Comments

The JTRS Joint Program Executive Office provided technical comments, which were incorporated as appropriate.

KC-X Program

The Air Force KC-X program is the first of three phases in the recapitalization of the current KC-135 aerial refueling tanker fleet. It is planned to provide sustained aerial refueling capability to facilitate global attack, air-bridge, deployment, sustainment, homeland defense, theater support, specialized national defense missions, as well as airlift capabilities for passenger and palletized cargo deployment. The current KC-X acquisition strategy is to procure 179 commercial aircraft and modify them for military use.

Source: ASC/PAM.
Note: Photo is of the KC-135 Stratotanker, the aircraft the KC-X will replace.



Program Essentials

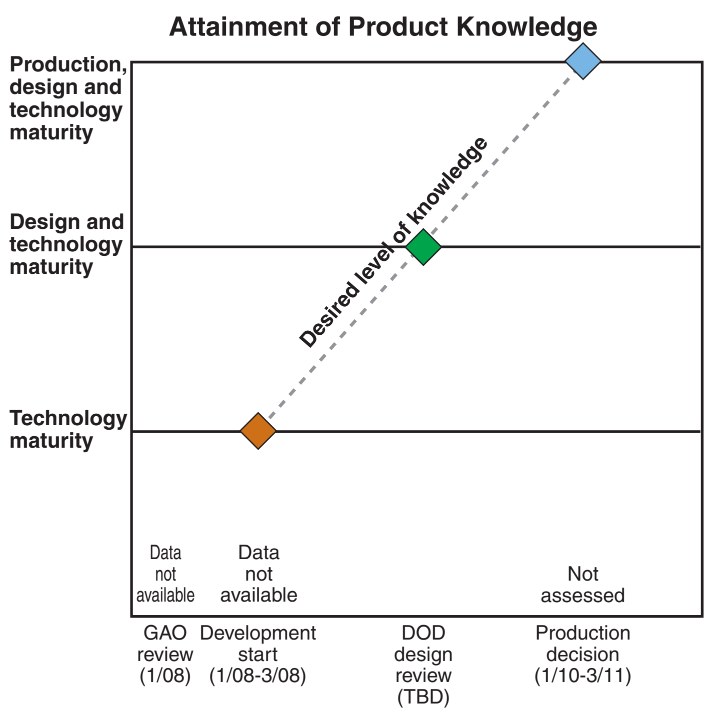
Prime contractor: TBD
Program office: Wright-Patterson AFB, Ohio
Funding needed to complete:
- R&D: $1,834.3 million
- Procurement: $10,631.2 million
- Total funding: $12,465.5 million
- Procurement quantity: 48

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$1,941.7	NA
Procurement cost	NA	$10,631.2	NA
Total program cost	NA	$12,572.9	NA
Program unit cost	NA	$241.787	NA
Total quantities	NA	52	NA
Acquisition cycle time (months)	NA	69	NA

Cost and quantity data are budgeted amounts for fiscal year 2005 through fiscal year 2013. An additional $89.8 million remains available in the Tanker Replacement Transfer Fund (TRTF).

Program officials state the KC-X program will enter system development in fiscal year 2008 with mature or near-mature technologies. While the candidate commercial airframes and engines are in wide use, with mature manufacturing processes and established logistic chains, program officials believe the systems integration effort required to meet military requirements will be complex and technically challenging. The program is the Air Force's highest acquisition priority, yet a comprehensive business case analysis that fully considered life cycle costs was not conducted in deciding its acquisition strategy. The primary decision factor was budgetary—limited funds for system development and a $3 billion ceiling on future annual procurements.



KC-X Program

Technology Maturity

Program officials state that the KC-X program will enter system development sometime in fiscal year 2008 with mature technologies or technologies approaching maturity. However, actual maturity levels will be dependent upon the aircraft design and source selected. Program officials assess technical risks as medium, as they anticipate that critical technologies will be at least in prototype form and demonstrated in a relevant environment.

Design Stability

Because the program has not begun system development, it has not yet scheduled a critical design review. While the candidate commercial airframes and engines are in wide use with mature manufacturing processes and established logistic chains, program officials believe that systems integration required to meet military requirements will be very complex and technically challenging. The program acknowledges that experiences from other programs, particularly avionics modernization programs, confirm that systems integration and software developments are inherently risky from cost, schedule, and performance standpoints. We have also found this to be the case in our review of other programs. Although new immature technologies are not likely to be applied to KC-X solutions, it is envisioned that the technical integration of existing avionics systems will drive significant software development as part of the total development effort. While physical integration of the KC-X hardware is not particularly challenging, it is the electrical, antenna, and software integration that will require significant effort.

Other Program Issues

The KC-135 recapitalization is in the first of three expected phases—KC-X, KC-Y, and KC-Z—which may involve the procurement of a total of about 600 aircraft over about 40 years. The Air Force considers this its highest acquisition priority, and the entire cost for recapitalization could exceed $100 billion.

A March 2006 analysis of alternatives (AOA) formed the foundation for much of the cost, schedule, and budgeting assumptions. An internal Air Force estimate indicates the potential for higher development and production costs for the KC-X program than estimated in the AOA. Specifically, development costs could range from $2 billion to $4 billion. It is expected that final costs for the program will be determined by both the program office and an Office of the Secretary of Defense independent estimate prior to the beginning of system development later this year.

For the KC-X program, the Air Force is using a competitive approach that will select a single source for development and procurement. While other options were considered, the Air Force did not conduct a comprehensive business case analysis that fully considered life cycle costs in deciding its approach. Instead, the acquisition strategy was based primarily on budgetary constraints—including limited available near-term funding for system development and a $3 billion ceiling on future annual procurements.

Agency Comments

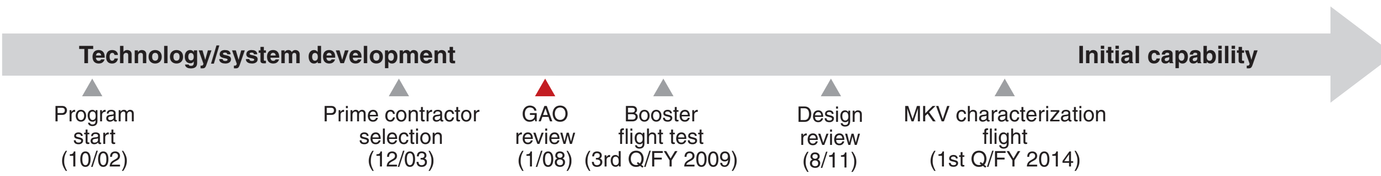
In commenting on this draft, the Air Force stated that program costs and program dates are dependent upon the outcome of source selection and Milestone B, and currently vary by offeror.

A full analysis of alternatives was performed for the purpose of developing the KC-X acquisition strategy. Additionally, a detailed analysis of a dual source contract award was completed, and the results were presented to senior leadership. The KC-X acquisition strategy emphasizes competition and the first 80 KC-X aircraft will be competitively priced. Furthermore, the follow-on KC-Y and KC-Z programs will be competitively priced.

Kinetic Energy Interceptors (KEI)

MDA's KEI element is a missile defense system designed to destroy medium, intermediate, and intercontinental ballistic missiles during the boost and midcourse phases of flight. The objective system will include a fire control and communications unit, hit-to-kill interceptors, and launchers. MDA plans to launch the KEI interceptor from a variety of platforms, including land-based, and sea-based platforms. We assessed the land-based, mobile KEI program.

Source: ATK.



Program Essentials

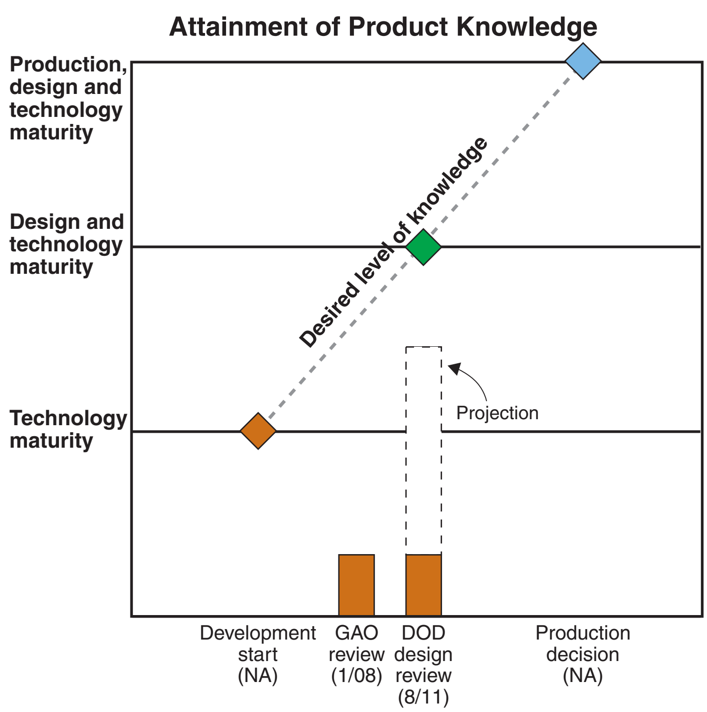
Prime contractor: Northrop Grumman
Program office: Huntsville, Ala.
Funding FY08-FY13:
- R&D: $2,911.7 million
- Procurement: NA
- Total funding: $2,911.7 million
- Procurement quantity: NA

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 09/2007	Percent change
Research and development cost	NA	$4,038.2	NA
Procurement cost	NA	0	NA
Total program cost	NA	$4,038.2	NA
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Columns include known costs and quantities from the program's inception through fiscal year 2013.

According to program officials, in April 2007 MDA directed the KEI program to focus on development of technologies critical to the interceptor's booster and defer work on the fire control and communications unit and the launcher. The program is developing four critical booster technologies and none are expected to reach full maturity until after system design review in fiscal year 2011. Additionally, MDA transferred development responsibility for the interceptor kill vehicle critical technologies to other programs. Although the program responsible for developing 16 of the 17 kill vehicle technologies reports that most are nearly mature, we disagree because the technologies have not been demonstrated in the smaller form or with the fit required for the KEI interceptor.



KEI Program

Technology Maturity

This year, the KEI program increased the total number of critical technologies from 7 to 21, recognizing that technologies being developed by other programs will be essential to the KEI interceptor's kill vehicle. The KEI program office is responsible for 4 technologies, while the other 17 are the responsibility of the Multiple Kill Vehicle (MKV) and Space Tracking and Surveillance System (STSS) program offices. In some cases, these technologies were originally being developed by the KEI program.

The KEI program's current focus is on developing 4 booster technologies. These include the attitude control system, booster motors, third stage rocket motor, and trapped ball thrust vector control. These technologies are at relatively low levels of maturity and are not projected to be nearing maturity until the fourth quarter of fiscal year 2011, 2 years after the 2009 booster flight test could lead to a commitment to fully develop KEI. Backup technologies exist for the 4 booster technologies, but they are at the same low level of maturity.

During fiscal year 2007, program officials conducted several static fire tests of the first and second stage rocket motors and wind tunnel tests of the boost vehicle. The static fire tests collect data on rocket motor performance in induced environments, while the wind tunnel tests, which were completed in April 2007, helped to validate aerodynamic models for the boost vehicle.

Of the 17 technologies, the MKV program is responsible for maturing 16, and the STSS program is responsible for 1. According to the MKV program, 14 of the 16 technologies are nearing maturity, while the other 2 are at relatively low levels of maturity. However, only the carrier vehicle's divert and attitude control system which allows the vehicle to alter its course to its target, has demonstrated that it is nearing maturity. The other 15 technologies have been used in other weapon programs, but the hardware has not been tested in the smaller form and with the fit required for the KEI interceptor. Program officials agree that these technologies may need to be repackaged to properly fit the KEI and further testing may be needed at that time to ensure the technology is ready to be incorporated into KEI's design. The STSS Program Office is developing the algorithms that enable the kill vehicle to discriminate between the exhaust plume and the missile body itself. This technology is at a relatively low level of maturity and will not reach full maturity until after KEI holds its system design review in 2011.

Design Stability

Last year, KEI officials estimated the KEI element would incorporate about 7,500 drawings and that 5,000 of these drawings would be complete when the program holds a critical design review in the fourth quarter of fiscal year 2011. However, program officials recently noted that the number of drawings was based on the fire control and communications component, the mobile launcher, and the booster. The number of drawings is expected to increase when MDA begins developing all the components because more interfaces with the Ballistic Missile Defense System's (BMDS) Command, Control, Battle Management, and Communications component will be required as it matures, as more sensors with which KEI must connect are fielded, and as the BMDS as a whole becomes more complex. The number of drawings will also be adjusted to remove kill vehicle drawings and software that will be reported by other programs, such as the MKV program.

Other Program Issues

According to program officials, prior to the replan in April 2007, KEI was focused on developing a three-stage interceptor capable of engaging ballistic missiles in the boost phase of their flight. The first two rocket motor stages are being developed and flight tested under the first booster flight program. The original baseline third stage was a shrouded Standard Missile-3 third stage rocket motor. Program officials stated that because MDA also wants KEI to engage ballistic missiles during the midcourse of their flight, the interceptor will eventually develop a third stage rocket motor to accommodate this wider flight envelope. The third stage will not be tested prior to or as part of the first booster flight test.

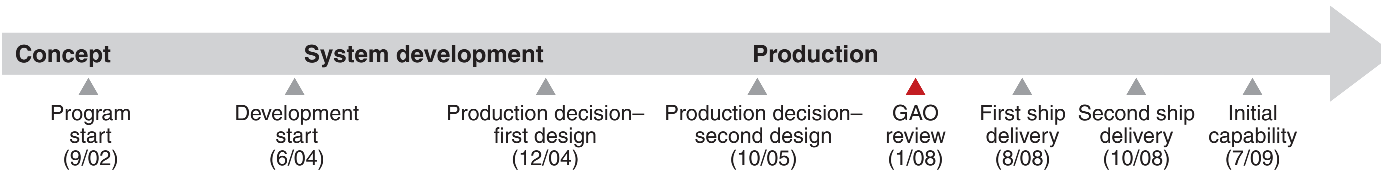
Agency Comments

In commenting on a draft of this assessment, the program office provided technical comments, which were incorporated as appropriate.

Littoral Combat Ship (LCS)

The Navy's LCS is designed to perform mine countermeasures, anti-submarine warfare, and surface warfare missions. It consists of the ship itself—referred to as a seaframe—and the mission package it carries and deploys. The Navy plans to construct the first eight LCS seaframes—known as Flight 0—in two unique designs. Two seaframes—one of each design—are under construction and expected to deliver in August and October 2008. We assessed only the Flight 0 seaframes. See pages 119 to 124 for analyses of mission packages.

Source: U.S. Navy.



Program Essentials

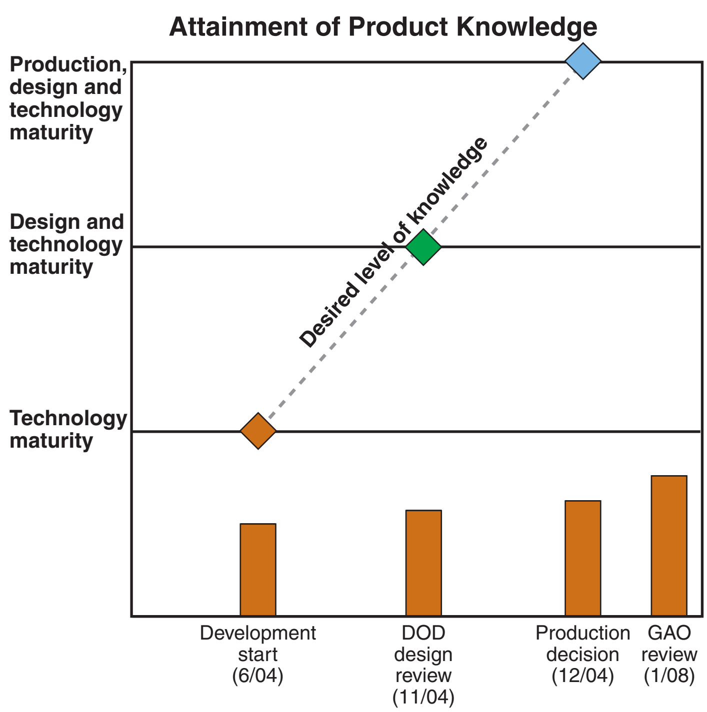
Prime contractor: General Dynamics, Lockheed Martin
Program office: Washington, D.C.
Funding needed to complete:
- R&D: $267.4 million
- Procurement: $2,701.7 million
- Total funding: $2,969.1 million
- Procurement quantity: 9

Program Performance (fiscal year 2008 dollars in millions)

	As of 05/2004	Latest 10/2007	Percent change
Research and development cost	$1,304.6	$1,516.9	16.2
Procurement cost	$0.0	$3,716.3	NA
Total program cost	$1,304.6	$5,233.2	301.1
Program unit cost	$652.297	$348.880	-46.5
Total quantities	2	15	650.0
Acquisition cycle time (months)	41	62	51.2

Research and development funding includes detail design and construction of two ships.

Fifteen of 19 critical technologies for the two LCS seaframe designs are fully mature, and another 2 technologies are approaching maturity. The overhead launch and retrieval system in the Lockheed Martin design and the aluminum structure in the General Dynamics design are immature. In addition, the Navy identified watercraft launch and recovery as a major risk affecting both seaframe designs, and the aviation landing/retrieval system planned for the Lockheed Martin design may not be qualified for use. Further, weight increases experienced in construction degraded the hydrodynamic performance of each seaframe, prompting the Navy to reduce range at transit speed requirements for LCS. Cost growth led the Navy to cancel construction of the third and fourth LCS and defer construction of additional ships. The Navy continues to modify its acquisition strategy for LCS.



LCS Program

Technology Maturity

The Navy identifies a total of 19 critical technologies across both LCS seaframe designs. Fifteen of these technologies are fully mature, and another 2 technologies are approaching maturity. Two other technologies—the overhead launch and retrieval system in the Lockheed Martin design and the aluminum structure in the General Dynamics design—remain immature.

The Navy has identified the watercraft launch and recovery concept as a major risk to both LCS seaframe designs. This capability is essential to complete anti-submarine warfare and mine countermeasures missions planned for LCS. According to the Navy, industry watercraft launch and recovery designs are untested and unproven. To mitigate this risk, the Navy is conducting launch and recovery modeling and simulation, model basin testing, and experimentation. The Navy is encouraging the LCS seaframe industry teams to adopt similar approaches. Final integration of watercraft to each LCS seaframe design is not expected until the third quarter of fiscal year 2009—after the Navy has accepted delivery of the first two LCS seaframes.

In addition, while the Navy has identified the aviation landing/retrieval system as a mature technology, it is concerned that this system may not be qualified for use on the Lockheed Martin seaframe and may, in fact, result in damage to aircraft. The Navy has developed a system qualification and certification plan to mitigate this risk and intends to conduct pierside testing and training of the aviation landing/retrieval system in the first quarter of fiscal year 2009.

Design and Production Maturity

The Navy assesses LCS seaframe design stability by monitoring changes to the requirements documents, execution of engineering change proposals, and the completion of contract deliverables related to drawings, ship specifications, and independent certification of the design. Seaframe construction is monitored through use of earned value management to measure cost and schedule performance as well as evaluation of manufacturing hours spent on rework, deficiencies detected and corrected, and the number of test procedures performed.

The Navy adopted a concurrent design-build strategy for the first two LCS seaframes, which has since proven unsuccessful. Contributing challenges included implementation of new design guidelines (referred to as Naval Vessel Rules), delays to major equipment deliveries, and an unwavering focus on achieving schedule and performance goals. Subsequently, these events drove low levels of outfitting, out-of-sequence work, and rework on the lead ships—all of which increased construction costs.

In addition, the lack of a complete and integrated design prior to ship construction led to weight increases for both seaframe designs. This weight growth degraded the hydrodynamic performance of each seaframe and shortened endurance ranges below threshold requirements. To compensate, the Navy has revised the LCS capability development document to reduce the speeds associated with threshold and objective endurance range requirements. The Navy now expects both seaframe designs to meet endurance range requirements.

Other Program Issues

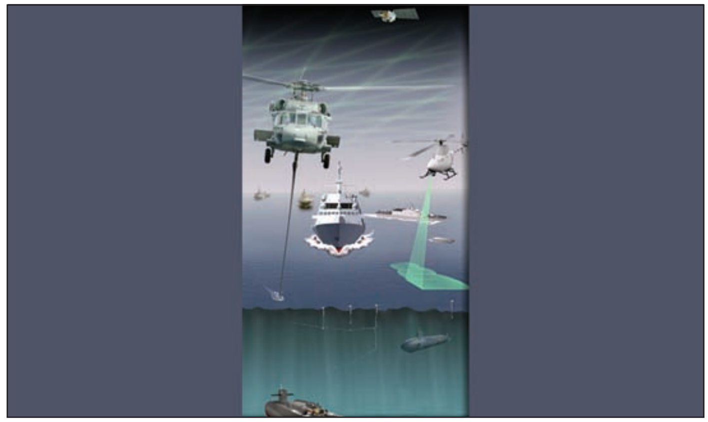
The Navy expects the first two LCS to exceed their combined budget of $472 million by over 100 percent and anticipates lead ship delivery will occur nearly 18 months later than initially planned. As a result of these challenges, the Navy canceled construction of the third and fourth LCS and deferred construction of additional seaframes. The Navy plans to use funds previously appropriated for construction of the fifth and sixth LCS seaframes to pay for cost growth on the remaining two ships under contract. The Navy continues to modify its acquisition strategy for LCS.

Agency Comments

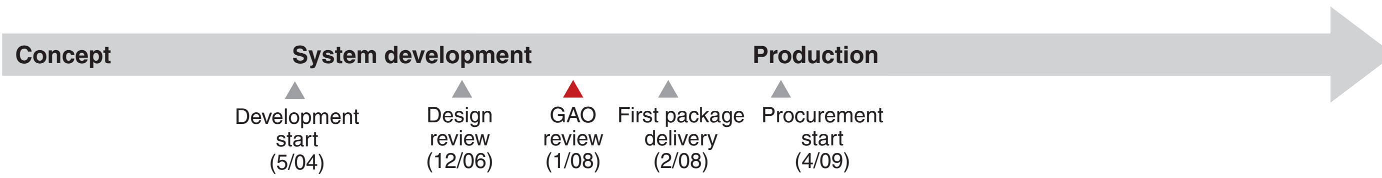
In commenting on a draft of this assessment, the Navy provided technical comments, which were incorporated as appropriate.

Littoral Combat Ship: Anti-Submarine Warfare (ASW)

The ASW mission package is one of three mission packages for the Navy's Littoral Combat Ship. ASW is designed to counter threats from submarines in waters close to shore, called littorals, using manned and unmanned mission systems. The mission package is being developed and delivered in increments of capability, with the first package—consisting primarily of prototypes—to be delivered in 2008. For discussions on the other mission packages, as well as LCS itself, see pages 117, 121, and 123.



Source: Northrop Grumman Corporation.



Program Essentials

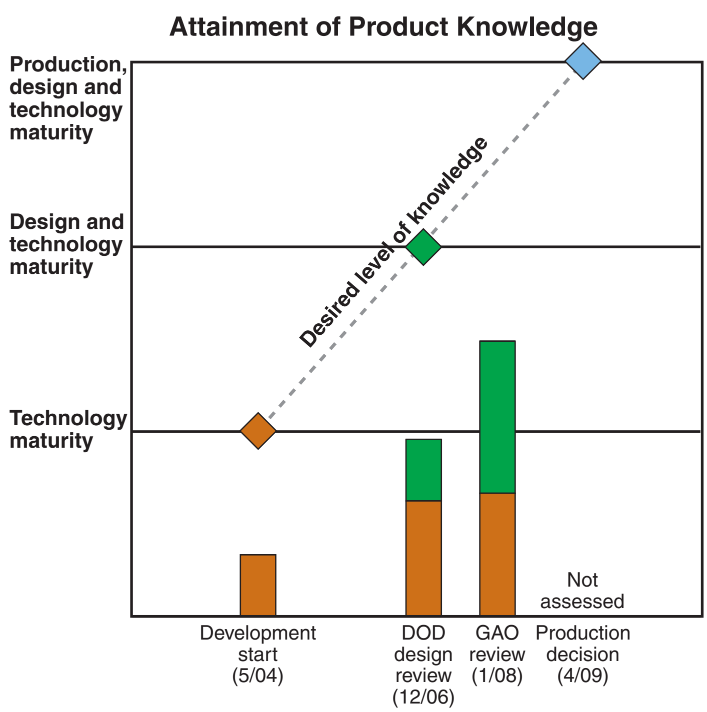
Prime contractor: Northrop Grumman
Program office: Washington, D.C.
Funding needed to complete:
R&D: $13.1 million
Procurement: $703.6 million
Total funding: $716.8 million
Procurement quantity: 14

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$191.5	NA
Procurement cost	NA	$721.2	NA
Total program cost	NA	$912.7	NA
Program unit cost	NA	$57.046	NA
Total quantities	NA	16	NA
Acquisition cycle time (months)	NA	NA	NA

The cost to procure the MH-60R and the Vertical Take-off Autonomous Aerial Vehicle are not reflected in the mission package program costs, as they are not procured directly by the program.

As the delivery of the first anti-submarine warfare mission package approaches, the critical technologies and design both continue to mature. The program office identified 12 technologies as critical for this package, 5 of which remain immature. A production representative, deployable package will not be delivered until fiscal year 2011. The program tracks design drawings for only those portions of mission systems that require alteration to deploy from LCS, as well as those for the containers in which mission systems are stored and transported. The design was not complete at critical design review. Neither the critical technologies nor the design of this package are expected to be fully mature until after they have been demonstrated as prototypes aboard the second LCS ship. The program office does not currently track critical process control data or use other production metrics.



LCS ASW Program

Technology Maturity

Delivery of the first anti-submarine warfare mission package for LCS is expected to occur in February 2008. Of the 12 critical technologies identified, seven are fully mature, two are approaching full maturity, and three are immature. The technologies currently requiring further development include sensors for submarine detection intended for use on unmanned platforms. If they fail to develop as expected, it could increase reliance on the manned MH-60R helicopter, which has reached full maturity, or the unmanned surface vehicle and its towed array sensor, both of which are nearing full maturity.

Design Stability

The Navy's warfare center in Newport, Rhode Island and systems center in San Diego, California are responsible for the ASW mission package design. This mission package contains a number of systems that have been developed and designed by other programs for other purposes, such as the MH-60R and the Vertical Take-off Autonomous Aerial Vehicle. The LCS mission module program office tracks design stability for only those portions of mission systems that require alterations to deploy from LCS and the containers in which they are transported and stored. Seventy-four percent of the drawings needed for these alterations are currently complete. For example, while the Remote Multi-Mission Vehicle was developed as a mine countermeasures system for use on destroyers, the program office is working to integrate it with sensors to detect submarines and to enable its launch and recovery from the LCS. These design changes will be integrated into production through the submission of engineering change proposals to the affected system's original program office. Quantities with designs specific to LCS will then be ordered as extensions to existing contracts where available.

Production Maturity

The LCS ASW mission package containers—which include the connections necessary for the utilities needs of mission systems—are designed by the Navy and will be produced by Northrop Grumman Corporation, Integrated Systems Division. Northrop Grumman will be responsible for collecting the mission systems and integrating them with the containers beginning with the package delivered in 2011.

The first two ASW mission modules will be assembled by the Navy's warfare center in Newport, which does not track critical process control data or other production metrics. The program relies on others for the production of mission systems when possible, and on its contractor for production of the mission package containers. The exception is the unmanned surface vehicle, where no current production contractor exists. According to the program office, these systems are being produced by U.S. Naval laboratories.

Other Program Issues

The first two ASW mission packages, expected to deliver in fiscal year 2008, will consist largely of prototypes or low-rate initial production items. According to the program office, these mission packages are not considered deployable and will be used only to demonstrate performance and concepts of operation from LCS seaframes. The mission systems delivered in these packages will eventually be upgraded to production representative, deployable systems. The first mission packages may also deliver without some of the software needed for full functionality. The third mission package, expected for delivery in 2011, should consist of fully mature, deployable, and production representative mission systems. According to program officials, the final number of anti-submarine warfare mission packages to be procured and the concepts of operation that guide their use are currently under review.

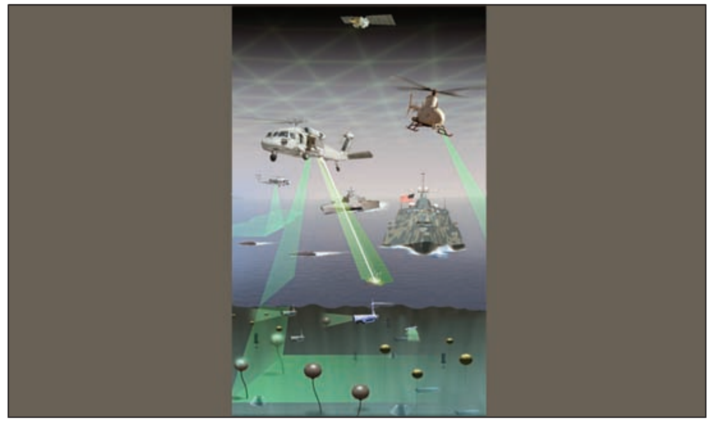
Agency Comments

LCS mission modules program officials noted they define production of a mission package as the support container procurement, assembly, checkout, and verification of readiness for issue of the mission module components that constitute an integrated package. They contend traditional manufacturing processes and metrics may not be applicable to the production of a mission package.

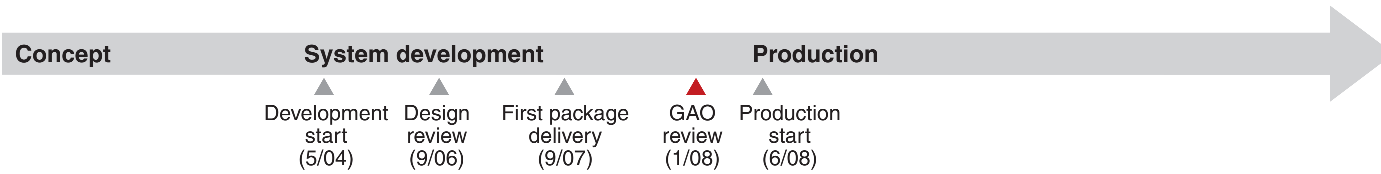
These officials also stated that the the first two ASW unmanned surface vehicles were designed and built under a contract to build a total of four. They plan to transition production responsibility to a program of record in fiscal year 2009 for future mission packages.

Littoral Combat Ship: Mine Countermeasures (MCM)

The Mine Countermeasures (MCM) for the Navy's Littoral Combat Ship include mine hunting, neutralization, and sweep systems deployed from the MH-60S helicopter and other unmanned underwater, aerial, and surface vehicles. Packages represent increments of capability, the first of which was delivered in September 2007 and included six of 11 planned systems. The third delivery, scheduled for fiscal year 2011, will contain the full capability needed for the MCM mission. Pages 117, 119 and 123 describe LCS and its other mission packages.



Source: Northrop Grumman Corporation.



Program Essentials

Prime contractor: Northrop Grumman
Program office: Washington, D.C.
Funding needed to complete:
R&D: $4.2 million
Procurement: $1,841.4 million
Total funding: $1,854.3 million
Procurement quantity: 22

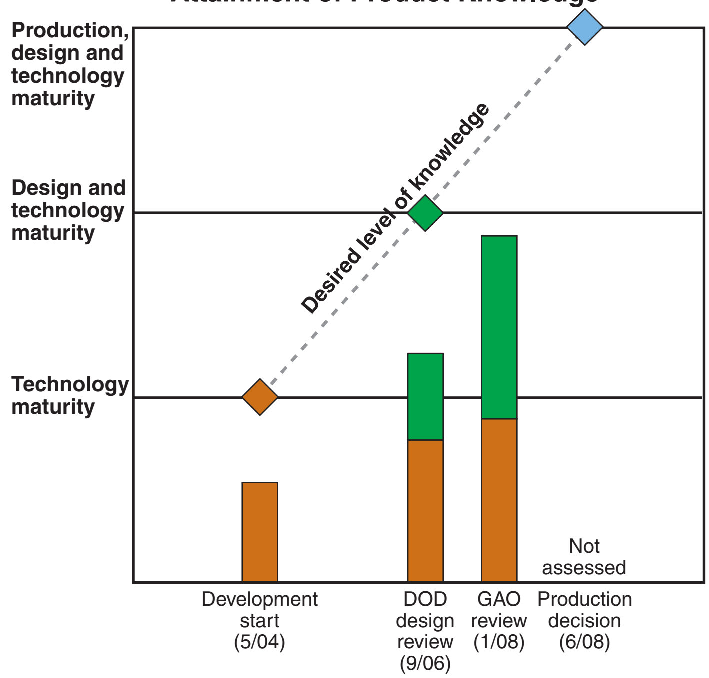
Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$119.9	NA
Procurement cost	NA	$847.7	NA
Total program cost	NA	$976.0	NA
Program unit cost	NA	$40.665	NA
Total quantities	NA	24	NA
Acquisition cycle time (months)	NA	NA	NA

Quantities are subject to change pending finalization of concepts of operation and alignment with LCS seaframe characteristics.

Technologies used in the MCM package are all mature or approaching maturity. However, delays in testing some airborne systems from the MH-60S helicopter--due to both integration challenges and competing fleet demands for the MH-60S—may delay the fielding of some MCM systems to later packages. Some systems in the MCM package were initially developed for fielding on other ships, and the Navy is redesigning them to accommodate launch and recovery systems planned for LCS. The MCM package design is not yet stable; at the design readiness review, only 47 percent of design drawings were releasable. The program does not track production metrics and is relying on test results using ships other than LCS to inform full-rate production decisions.

Attainment of Product Knowledge



LCS MCM Program

Technology Maturity

The program office identified 11 technologies for use in the fully capable MCM package: four vehicles, five sensors for hunting and sweeping, and two weapons for neutralization. All technologies are mature or approaching maturity. We evaluated five of these systems last year in our review of Airborne Mine Countermeasures—a capability dependent on successful integration of new systems with the MH-60S helicopter. Difficulty scheduling and conducting some system tests with the helicopter may affect plans to field MCM systems with the package. Recent tests identified technical challenges with a cable the helicopter uses to tow MCM systems. If the cable continues to malfunction in testing, fielding of airborne MCM systems may be delayed.

Design Stability

The MCM package design is not yet stable. The Navy only tracks the design of mission system elements that require modification for use on LCS, along with drawings for system storage, support, and transport containers. At the design readiness review, 47 percent of expected drawings were releasable; subsequently the expected number of drawings increased by about 12 percent due to changes driven by weight, cost, and producibility issues.

Although the MCM package has yet to be fully demonstrated aboard LCS, the Navy plans to make full-rate production decisions on several MCM systems. These systems are scheduled for tests that assess their suitability and effectiveness, but the Navy plans to conduct these tests aboard other ships, not LCS. LCS features a new automated launch, recovery, and handling system that is fully integrated with the seaframe; however, the Navy will not be able to test MCM systems with it until a seaframe is delivered in fiscal year 2009. As a result, the Navy may not fully understand the suitability of new MCM systems to operate from LCS.

Production Maturity

The program office is not tracking critical process control or other production data. Although the Navy will deliver packages in fiscal years 2009 and 2010, they will continue to be configured with prototypes and low-rate initial production articles as they become available. The package will not be configured in production-representative form until the third package, expected for delivery in fiscal year 2011, the same time the design is to be stable. The LCS program has primary responsibility for integrating mission systems into modules for use on LCS, but relies on other program offices and contractors for production of mission systems when possible.

Other Program Issues

The Navy continues to refine concepts of operation for LCS and its mission packages. While initial packages meet the Navy's weight requirement, they lack some systems required for full mission capability. Currently, the fully configured package is expected to exceed its weight requirement by about 10 percent. The Navy is exploring ways to reduce weight while maintaining capability. If desired weight reductions are not achieved, the Navy may be forced to reduce MCM capability or accept a reduction in the ship's speed and endurance. This would affect earlier packages the Navy plans to backfit to be fully capable. Also, the crew members needed to operate the MCM package may exceed seaframe capacity. Navy mission planners and operators estimated 19 mission package and 23 aviation detachment crew would be needed per ship to complete planned missions—seven more than capacity.

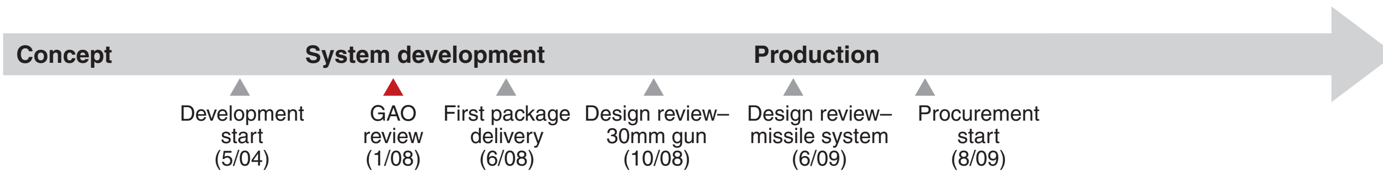
Agency Comments

Program officials state they define production as support container procurement, assembly, checkout and verification of readiness for issue of mission module components constituting an integrated package. They note design stability will be achieved at completion of the Technical Data Package for the first production package planned for delivery in fiscal year 2011. Traditional manufacturing processes and metrics may not be applicable to mission package production, and the LCS seaframe construction schedule allows limited access for package testing prior to delivery. Mission modules and systems are undergoing extensive testing in ways that do not require the ship. Surrogate platforms are being used to test some systems. Crew workload has been reassessed; the original estimate of 19 has been reduced to 15 mission package crew members, and the aviation detachment will increase from 20 to 23 to meet the mission requirement.

Littoral Combat Ship: Surface Warfare (SuW)

The SuW mission package is one of three mission packages for the Navy's Littoral Combat Ship. SuW is designed to detect, track, and engage small boat threats to maximize striking power and successfully move through waters close to shore, called littorals. The mission package is being developed and delivered in increments of capability, with the first SuW package—consisting primarily of prototypes—scheduled for delivery in June 2008. For discussions on the other mission packages, as well as LCS itself, see pages 117, 119, and 121.

Source: Northrop Grumman Corporation.



Program Essentials

Prime contractor: Northrop Grumman
Program office: Washington, D.C
Funding needed to complete:
  R&D: $33.7 million
  Procurement: $493.2 million
  Total funding: $526.9 million
  Procurement quantity: 22

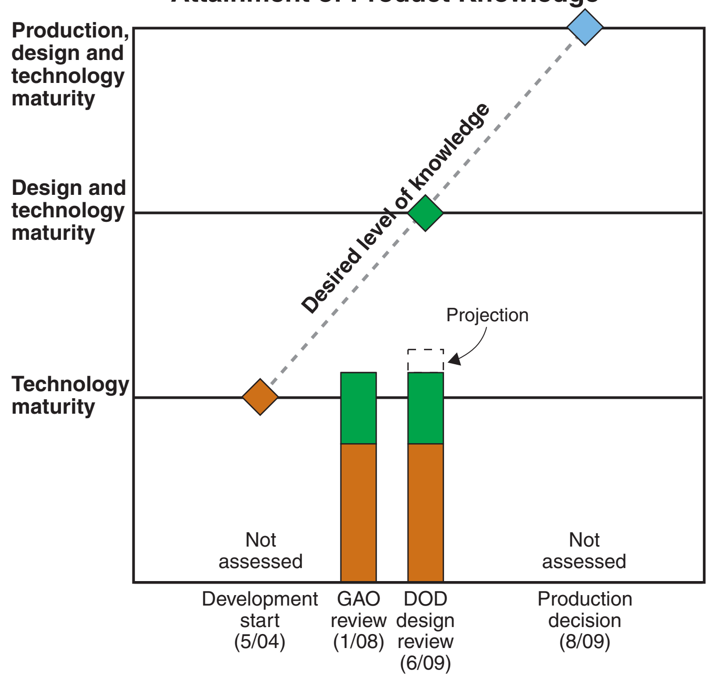
Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$156.0	NA
Procurement cost	NA	$493.2	NA
Total program cost	NA	$649.1	NA
Program unit cost	NA	$27.047	NA
Total quantities	NA	24	NA
Acquisition cycle time (months)	NA	NA	NA

The cost to procure the MH-60R and the Vertical Take-off Autonomous Aerial Vehicle are not reflected in the mission package costs as they are not procured directly by the program.

The program office identified four critical technologies for the SuW mission package, three of which are mature. A production representative, deployable package will not be delivered until fiscal year 2011. The non-line-of-sight missile system is not mature and the program relies on the Army to develop that system. Design of the SuW mission package is tracked in a unique manner, as many of the technologies are complete systems in themselves. The program office tracks only the changes to those systems needed to interface and deploy with LCS. Design completion of the SuW mission package has been delayed due to the immaturity of the missile system and funding issues for the 30 mm gun. The program office does not currently track critical process control data or other production metrics.

Attainment of Product Knowledge



LCS SuW Program

Technology Maturity

The program office identified four technologies for use in the SuW mission package. Of these the manned MH-60R helicopter, unmanned Vertical Take-off Autonomous Aerial Vehicle, and 30 mm gun system are considered fully mature, while the non-line-of-sight missile system remains immature. While the program office considers the 30 mm gun itself to be mature, its integration with LCS is not complete.

The Navy relies on the Army's Future Combat System for development of the missile system and will work with FCS to integrate it with LCS. As a result, the first SuW package, currently scheduled for delivery in June 2008, will not include the missile system. The first missile launcher will be delivered as a prototype without missiles in the second mission package in 2009, and missiles will deliver with the fourth mission package in fiscal year 2011. Should this technology fail to develop as anticipated, LCS will become more reliant on its guns for self-defense and upon the MH-60R for striking targets at greater distances.

Design Stability

Design of the SuW mission package is tracked in a unique manner. To ensure the technologies used will be compatible with LCS, the program has established interface specifications that each system must meet. The program office tracks design drawings, which are at 34 percent, for those parts of the systems it adapts to ensure the correct interface with LCS. According to program officials, the SuW mission package differs from other mission packages in that it will not be placed in containers for deployment on LCS. Instead, the 30 mm gun and missile system will be placed directly on the ship.

Due to a lack of technical maturity, completion of the missile system design for LCS has been delayed and is scheduled to complete in fiscal year 2011, after the missile system is demonstrated aboard LCS. According to the program office, the main challenge in the design is passing Navy munitions and safety requirements.

The Navy delayed design of the 30 mm gun module for budgetary reasons and will not complete the design until fiscal year 2009. In addition, the program has been discussing adding a capability for manned firing of the 30 mm gun as well as the planned remote firing capability. Introduction of this requirement could lead to further design changes. According to the program office, developmental testing of the gun will begin in 2009.

Production Maturity

According to the program office, the first three mission packages will be assembled and delivered by the Navy warfare center in Dahlgren, Virginia, which does not track critical process control data or other production metrics. Beginning in 2011, production-representative mission packages will be produced and delivered by Northrop Grumman. The LCS program relies on other program offices and their contractors for the production of mission systems when possible.

Other Program Issues

The first two mission packages are scheduled for delivery in fiscal years 2008 and 2009. However, neither of these is complete or deployable. For example, the first package will contain only a prototype of the 30 mm gun system. The first mission package delivery with all key systems present in production representative variants does not occur until the fourth mission package in fiscal year 2011. According to program officials, the quantities and concept of operations for the mission package are not yet finalized.

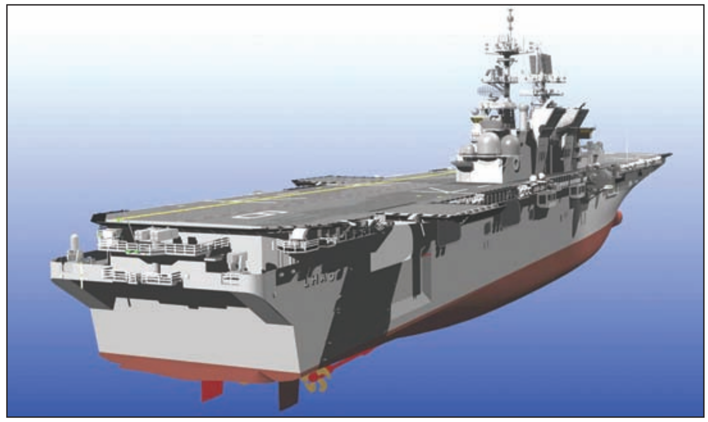
Agency Comments

The LCS mission modules program office defines production of a mission package as the support container procurement, assembly, checkout and the verification of readiness for issue of the mission module components that constitute an integrated mission package. Traditional manufacturing processes and metrics may not be applicable to the production of a mission package.

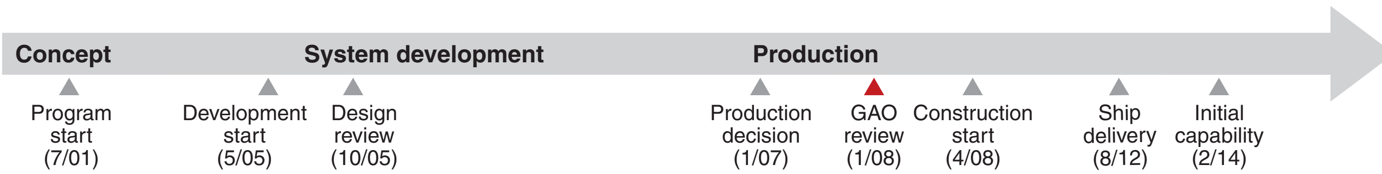
The delivery strategy for the SuW mission package includes an incremental capability approach that delivers mature mission modules first, such as the 30mm gun module, followed by the delivery of the missile capability, after its technology maturity has been achieved. The Army is leading the development of the missile system and the Navy continues to work closely with the Army on its integration into LCS.

LHA 6 Amphibious Assault Ship Replacement Program

The Navy's LHA 6 will replace aging Tarawa-class amphibious assault ships and is designed to embark, land, and support expeditionary forces. The LHA 6 is a modified variant of the LHD 8 amphibious assault ship currently under construction. The LHA 6 design will feature enhanced aviation capabilities and is optimized to support new aircraft such as the V-22 Osprey and Joint Strike Fighter. The LHA 6 is scheduled to start fabrication in April 2008 and is expected for delivery in 2012.



Source: Amphibious Warfare Program Office, LHA 6 Program Office.



Program Essentials

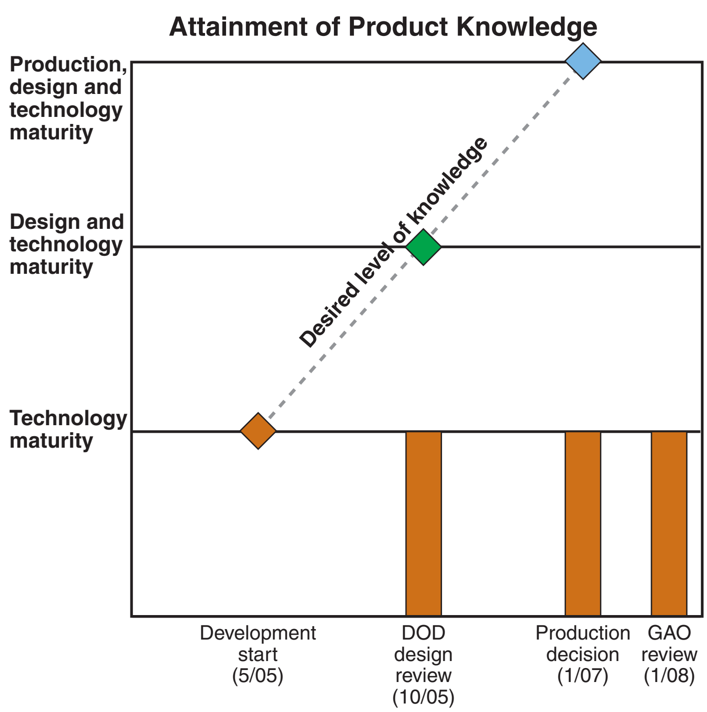
Prime contractor: Northrop Grumman Ship Systems
Program office: Washington, D.C.
Funding needed to complete:
- R&D: $31.9 million
- Procurement: $1,378.1 million
- Total funding: $1,409.9 million
- Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of 01/2006	Latest 08/2007	Percent change
Research and development cost	$209.8	$211.3	0.7
Procurement cost	$2,810.4	$2,980.9	6.1
Total program cost	$3,020.3	$3,192.1	5.9
Program unit cost	$3,020.258	$3,192.086	5.9
Total quantities	1	1	0
Acquisition cycle time (months)	146	151	3.4

Another LHA ship—LHA 7—is being acquired separately through the Maritime Prepositioning Force Future program and is not reflected here.

In 2005, DOD and the Navy determined that the LHA 6 program had no critical technologies because all of the ship's critical systems and equipment utilize technologies from existing Navy programs. Almost 45 percent of LHA 6 design is based on LHD 8, currently under construction. The program office identified six key subsystems needed to achieve the system's full capability, one of which is not fully mature. In addition, there are two subsystems that may pose some risk–the air conditioning plant and the machinery control system. The ship design is about 30 percent complete.



LHA 6 Program

Technology Maturity

In 2005, DOD and the Navy concluded that all LHA 6 components and technologies were fully mature, technology requirements were sufficient to enter system development, and the program could proceed without a formal technology readiness assessment. The program did identify six key subsystems needed to achieve full LHA 6 capability. Five of these subsystems are mature technologies used on numerous Navy ships. According to program officials, these technologies will not be modified for LHA 6 and further development will not be required for ship integration. The sixth key subsystem, the Joint Precision Approach and Landing System (JPALS)—a Global Positioning System (GPS)-based aircraft landing system—is not mature. JPALS will be used to support the all-weather landings of next-generation Navy aircraft, including the Joint Strike Fighter. JPALS is still in development and is expected to be fielded on other ships prior to its integration on LHA 6. According to the program office, JPALS is not needed to achieve the LHA 6 operational requirements, and the ship's construction schedule is not dependent on JPALS availability. Although JPALS is already planned as a post-delivery item, officials state that the LHA 6 design has incorporated space for JPALS based on initial estimates of its specifications and that legacy aviation control will serve as the backup technology in the event that JPALS development is delayed.

Though they are not considered critical technologies, the program office has identified two subsystems that may pose some risk—the air conditioning plant and the machinery control system. The 500-ton air conditioning plant for the LHA 6 is the only machinery/auxiliary system that differs from the LHD 8 ship and, according to program officials, is a minor adaptation of plants used aboard Virginia-class submarines. Program officials state that the LHA 6 air conditioning plants are undergoing shock and vibration testing and have begun production.

According to program officials, the machinery control system on LHA 6—which controls the ship's propulsion and electric plants, damage control, and auxiliary systems—is an area of risk. LHA 6 will reuse 75 percent of the machinery control system software from LHD 8, and while the LHA 6 machinery control system is to be a less complex version of the system on LHD 8, program officials have stated it is the biggest technology risk on LHD 8. Due to increasing quantity and automation of machinery control systems on ship classes in coming years, the Navy conducted an internal review to determine capacity and availability of technical resources to oversee the implementation and introduction of these systems into the fleet. Although the program office previously stated that the reuse of LHD 8 machinery control system software is a deliberate strategy to mitigate cost, schedule, and technical risk, officials are now concerned about difficulty and delays in the LHD 8 machinery control system; this may affect the schedule for LHA 6.

Design Stability

The Navy conducted a design review of LHA 6 in October 2005, and determined that its preliminary design was stable. According to program officials almost 45 percent of the design effort is expected to be based on LHD 8, while more than half of the ship will require newly created designs or modifications from LHD 8. Major adjustments from the LHD 8 design will include expansion of the aviation hanger deck to create more space for future aircraft, removal of the well deck to accommodate increased hanger space and additional aviation fuel capacity, and updated warfare systems.

The Navy finalized a fixed-price incentive contract for detail design and construction with Northrop Grumman Ship Systems in June 2007. According to the program office, design of the ship is about 30 percent complete.

Navy officials noted that a production readiness review that will assess design progress is scheduled for March 2008.

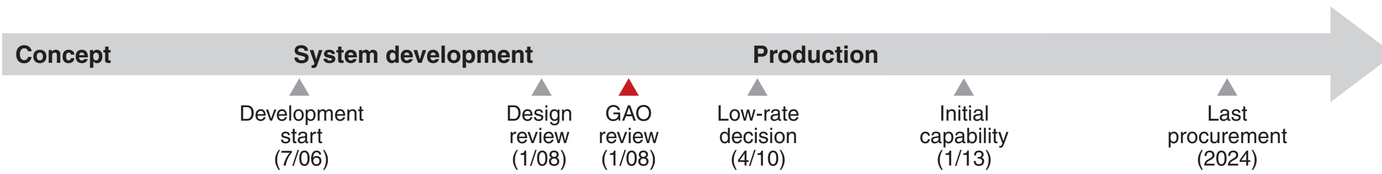
Agency Comments

In commenting on a draft of this assessment, the Navy provided technical comments, which were incorporated as appropriate.

Longbow Apache Block III

The Army's AH-64D Longbow Apache can be employed day or night, in adverse weather and obscurants, and is capable of engaging and destroying advanced threat weapon systems. The primary targets of the aircraft are mobile armor and air defense units, with secondary targets being threat helicopters. Block III enhancements are intended to ensure the Longbow Apache is compatible with the Future Combat System architecture, is a viable member of the future force, and is supportable through 2030. We assessed all phases of the program.

Source: U.S. Air Force, Apache PMO.



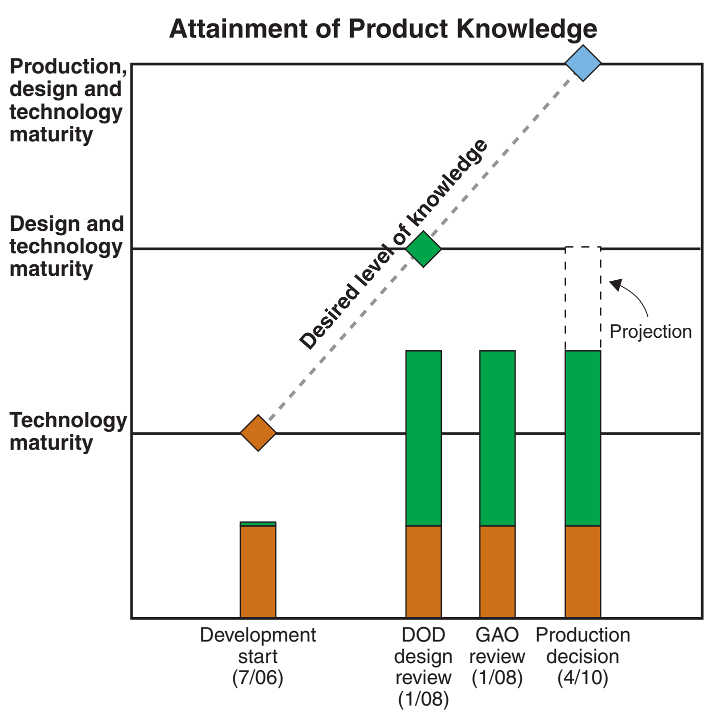
Program Essentials

Prime contractor: Boeing
Program office: Huntsville, Ala.
Funding needed to complete:
R&D: $793.2 million
Procurement: $6,388.3 million
Total funding: $7,181.5 million
Procurement quantity: 634

Program Performance (fiscal year 2008 dollars in millions)

	As of 08/2006	Latest 12/2006	Percent change
Research and development cost	$1,097.5	$1,082.9	-1.3
Procurement cost	$5,780.8	$6,388.3	10.5
Total program cost	$6,878.3	$7,471.2	8.6
Program unit cost	$11.426	$11.692	2.3
Total quantities	602	639	6.1
Acquisition cycle time (months)	79	78	-1.2

The Apache Block III entered system development and demonstration in July 2006 with one critical technology—an improved drive system—which is approaching full maturity. The program plans to complete three phases of development and meet requirements through a series of technology insertions, each requiring integration, test, and qualification. The Army reports that these technology insertions were fully mature at development start. Only the first phase of insertions will need to be installed at the factory; the others can be installed in the field. A production decision for the first phase is scheduled in fiscal year 2010. Since development start, an increase in production quantities and a subsequent delivery restructure have led to an increase of total procurement costs. Weight is closely monitored to avoid affecting performance while not exceeding required limits.



Longbow Apache BLIII Program

Technology Maturity

The system entered development in July 2006 with one critical technology, an improved drive system, which is approaching full maturity. This technology will be used in a helicopter transmission for the first time and is expected to improve the available power and reliability over the existing transmission. The drive system has been demonstrated in a relevant environment, and the Army has plans for flight testing in fiscal years 2009 and 2010 to evaluate its full maturity.

To upgrade and modernize the Apache system, a time-phased series of technical insertions is planned for development. The Apache Block III funding profile does not allow all of the required system improvements to be fielded with the first aircraft lot. The insertion plan was based on (1) program funding availability, (2) aircraft going to the factory one time for modification, and (3) a single final Block III configuration. The technology insertion approach leverages other development programs with mature, production ready technologies that will require integration, test, and qualification on the Apache Block III platform.

System development occurs in three phases. The first phase will complete integration qualification of all required hardware changes applied to Apache Block III helicopters. Two limited development phases with follow-on improvements requiring further technical insertions will be necessary. With the exception of the common data link hardware, the follow-on development phases will consist of software improvements that although limited in scope, still require planning, test, and evaluation. These insertions will be applied in the field, and aircraft will not be required to return to the factory to achieve the later configuration upgrades. A low-rate production decision for the first phase of development is scheduled for April 2010, with a full-rate decision scheduled for April 2012. Subsequent configuration upgrades for the remaining development phases will be dependent on successful interim design reviews scheduled for fiscal years 2014 and 2016.

Design Stability

According to program officials, 92 percent of design drawings were released at the design review in January 2008. Criteria established in the development contract requires 85-90 percent of the total drawings be complete for a successful design review. If they are not releasable, the program office will assess the criticality of the drawing shortage and require the contractor to provide a plan for completion. Until the maturity of the critical technology and technology insertions have been demonstrated, the potential for design changes remains.

The weight of the Apache Block III aircraft is considered a moderate cost risk. The current design weight margin is approximately 100 pounds below specification empty weight. Historical data from other new helicopter development programs indicate a 5-percent typical weight growth. As a result, subsystem integrated product teams monitor weight allocations weekly and are trying to minimize weight increases to the aircraft.

Other Program Issues

Since the start of program development, the Vice Chief of Staff of the Army approved a program change increasing the Apache Block III production quantity from 597 to 634. Further, deliveries were restructured from 60 to 48 a year, thereby stretching the program schedule by 4 years. The costs associated with both the remanufacture of the additional 37 aircraft and the stretched delivery schedule led to an increase in total procurement costs, as reported in the December 2006 Selected Acquisition Report.

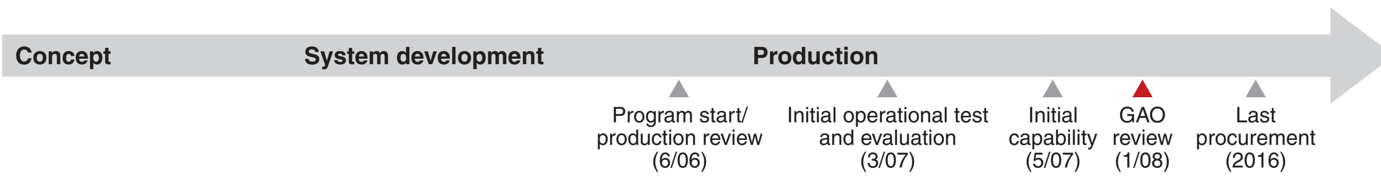
Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated where appropriate.

Light Utility Helicopter (LUH)

The Army's Light Utility Helicopter is a new aircraft acquisition that will conduct exclusively noncombat missions in support of specific Army tasks, to include homeland security support operations, disaster relief, search and rescue, general support, medical evacuation, and support for Army training and test centers. The Army is purchasing a commercially available helicopter for this mission rather than enter into a new development program. The commercial system has been in use as a medical evacuation helicopter.

Source: LUH Product Office.



Program Essentials

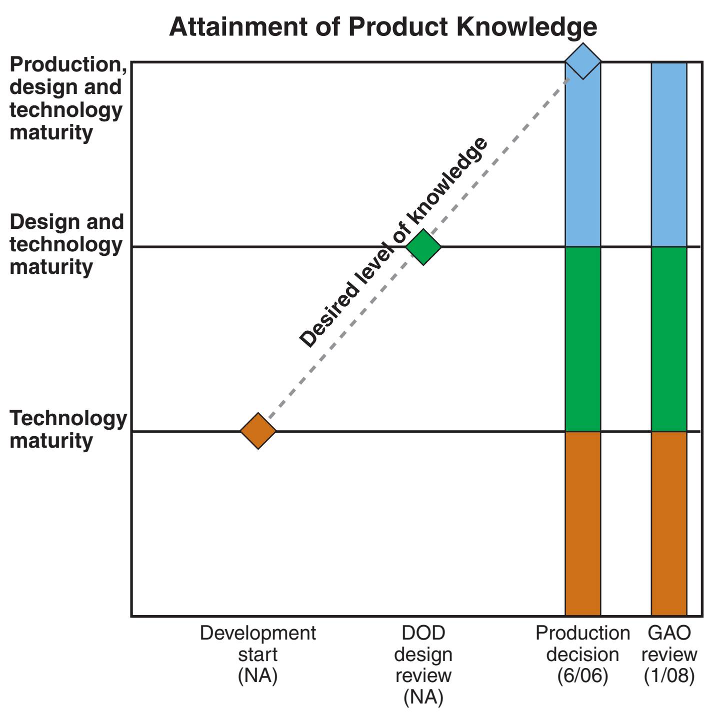
Prime contractor: EADS North America Defense Co.
Program office: Huntsville, Ala.
Funding needed to complete:
- R&D: $0.0 million
- Procurement: $1,555.9 million
- Total funding: $1,555.9 million
- Procurement quantity: 280

Program Performance (fiscal year 2008 dollars in millions)

	As of 06/2006	Latest 08/2007	Percent change
Research and development cost	$0.0	$3.4	100.0
Procurement cost	$1,617.0	$1789.5	10.9
Total program cost	$1,617.0	$1,792.8	10.9
Program unit cost	$5.022	$5.568	10.9
Total quantities	322	322	0
Acquisition cycle time (months)	10	11	10.0

The system is a commercial system with no developmental efforts or design review. Acquisition cycle time measurement is not applicable.

The LUH is a commercial off-the-shelf procurement. No further developmental efforts are planned, and the system's technology and design are mature. Production maturity is high since the selected system—the Eurocopter-145—is a Federal Aviation Administration (FAA) certified aircraft and currently in use commercially. The contract for the system was awarded on June 30, 2006. Limited operational test and evaluation was conducted in March 2007. The system is currently in low-rate production and 16 aircraft were delivered as of November 2007. Full-rate production was approved in August 2007.



LUH Program

Technology Maturity

The LUH is an off-the-shelf procurement of a fully developed, FAA-certified commercial aircraft. The LUH program office considers the system's five critical technologies as mature. These critical technologies are (1) network-ready communications, (2) cabin size sufficient for 2 crew and 6 passenger seats, (3) force protection—defined as the capability of the crew to operate all flight controls while wearing standard protection suits, (4) survivability—defined as meeting FAA standards for crashworthy seats and fuel tanks, and (5) performance—defined as the ability to carry 2 patients on litters with a medical attendant and equipment. Four modifications were approved to be added to the aircraft: a secure military radio, a cabin temperature ventilation system to mitigate a temperature elevation observed during limited operation test and evaluation, an engine inlet barrier filter, and a modification to the medical evacuation mission support kit. Program officials state that no development efforts are necessary for the aircraft or the modifications.

Design Stability

We did not assess the status of the LUH design because program officials said that the aircraft was based on a fully developed commercial aircraft and therefore stable. Also, since the LUH aircraft is already flying, the program office is not requiring the contractor to provide technical drawings for the system.

Production Maturity

Program officials state that production maturity is at a high level because the aircraft is a commercially available helicopter and production lines are already established. For this reason, they will not require statistical process control data on the system as it is produced.

The Army awarded a low-rate initial production contract for up to 42 aircraft in June 2006 and full-rate production was approved in August 2007. Sixteen aircraft have been delivered as of November 2007. The Army plans to acquire a total of 322 aircraft.

Other Program Issues

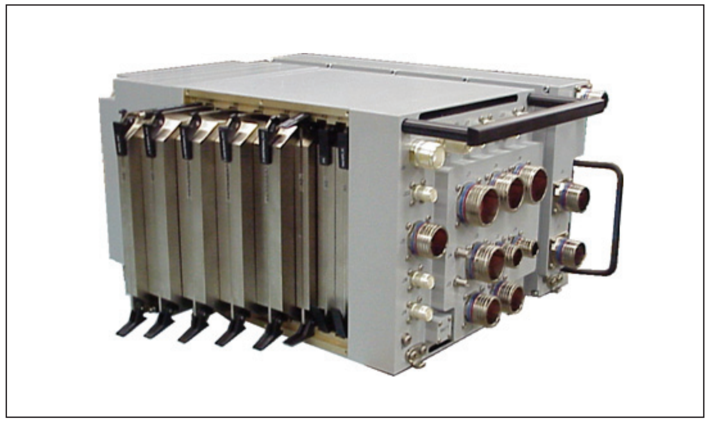
The helicopter will not fly combat missions or be deployed into combat areas and the contractor will provide total logistics support. Due to a reprogramming of funding in fiscal year 2007, some of the aircraft buys have been moved to later in the program. This action and the four modifications discussed earlier have resulted in an increase in total procurement costs.

Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated where appropriate.

Multifunctional Information Distribution System (MIDS)

The MIDS program is transforming the existing MIDS Low Volume Terminal—a jam-resistant, secure voice and data information distribution system—into a 4-channel, JTRS-compliant radio that will be used in different types of aircraft, ships, and ground stations for the military services. We assessed the development of the MIDS-JTRS core terminal. We also reviewed the status of the planned JTRS platform capability package, which includes an airborne networking waveform, being developed by the JTRS Network Enterprise Domain.



Source: MIDS JTRS Program Office.

Concept | **System development** | **Production**

- Program/ development start–core terminal (12/04)
- Design review–core terminal (5/06)
- GAO review (1/08)
- Low-rate decision–core terminal (3/08)
- Initial capability–core terminal (3/09)

Program Essentials

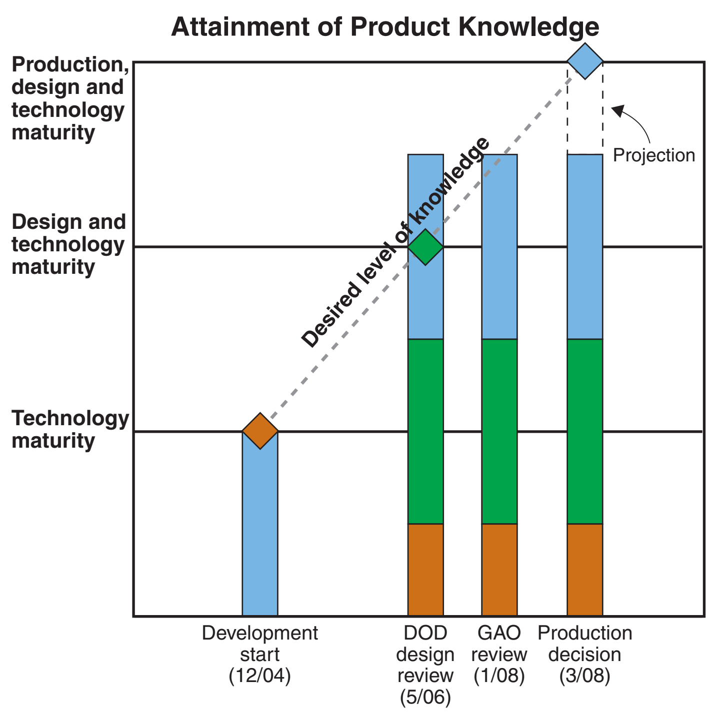
Prime contractor: Data Link Solutions, ViaSat
Program office: San Diego, Calif.
Funding needed to complete:
R&D: $95.9 million
Procurement: $194.4 million
Total funding: $290.1 million
Procurement quantity: 371

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2004	Latest 08/2007	Percent change
Research and development cost	$295.1	$417.1	41.3
Procurement cost	$0.0	$205.5	100.0
Total program cost	$295.1	$622.6	110.9
Program unit cost	$9.223	$1.438	-84.4
Total quantities	32	433	1253.1
Acquisition cycle time (months)	50	50	0

Procurement costs and quantity relate only to core terminal.

All four of the core terminal critical technologies are approaching maturity. In addition, core terminal engineering development models have been integrated into F/A-18 aircraft and are now undergoing testing in an operational environment. Test results will be used to support a planned low-rate initial production decision. The design of the core terminal is considered stable and production processes are considered mature. However, in September 2007, the JTRS Board of Directors suspended the design, development, fabrication, and testing of the JTRS platform capability package pending a determination of whether there were enough potential users among the military services to support this effort.



MIDS Program

Technology Maturity

The core terminal's four critical technologies—(1) Link-16 waveform software, (2) Link-16 architectural design, (3) operating environment, and (4) programmable crypto module—are approaching maturity. Several technical issues emerged during development, but they have largely been resolved. In 2006, cryptographic subsystem component stability and power issues caused a delay in software and firmware development, leading to delays in radio integration, test, and qualification efforts. Also, since the core terminal will be the first JTRS radio to undergo National Security Agency certification, it has faced challenges in meeting security requirements. Presently, it has received National Security Agency design concurrence and over-the-air approval in a F/A-18 aircraft. In addition, a delay in requirements approval has resulted in a 12-month delay of the program's low-rate initial production decision. To mitigate the impact of this delay, program officials have modified and accelerated the delivery plan for air worthiness and production transition terminals. According to program officials, the accelerated delivery of these terminals will support the developmental and operational testing schedule and allow the program to meet the planned initial operational capability date scheduled for fiscal year 2009. They further noted that the program office began demonstrating the terminal's capabilities in an operational environment during the first quarter of fiscal year 2008 and thus far have not disclosed any significant technical issues. Program officials stated that these test results will be used to support the core terminal program's low-rate initial production decision, scheduled for March 2008.

Design Stability

According to program officials, the core terminal's design is stable, as the program has released 100 percent of its design drawings to the manufacturer. However, until the maturity of the core terminal's critical technologies has been demonstrated in an operational environment, the potential for design changes remain.

Production Maturity

Program officials stated that production maturity is high because the core terminal is a form, fit, and function replacement for the MIDS Low Volume Terminal. They further noted that the MIDS-JTRS program type manufacturing processes are the same as those employed in the MIDS Low Volume Terminal program.

Other Program Issues

In March 2006, the program office began preliminary studies and specification work on the JTRS platform capability package. This package will allow the MIDS-JTRS radio to operate a wideband networking waveform specifically designed for low latency airborne missions. In September 2007, the JTRS Board of Directors suspended the design, development, fabrication, and testing of the JTRS platform capability package, pending a determination of whether there were enough potential users among the military services to support this effort. Furthrmore, the JTRS Joint Program Executive Office has been advised by the Deputy Under Secretary of Defense for Science and Technology to conduct an independent technical assessment of waveforms, networking, and network managment approaches. As a result, the award of the development contract has been delayed. Program officials stated that continuance of this delay may affect the terminal's system detail design schedule, funding, and its ability to meet the initial operational capability scheduled for the second quarter of fiscal year 2011 for the Air Force.

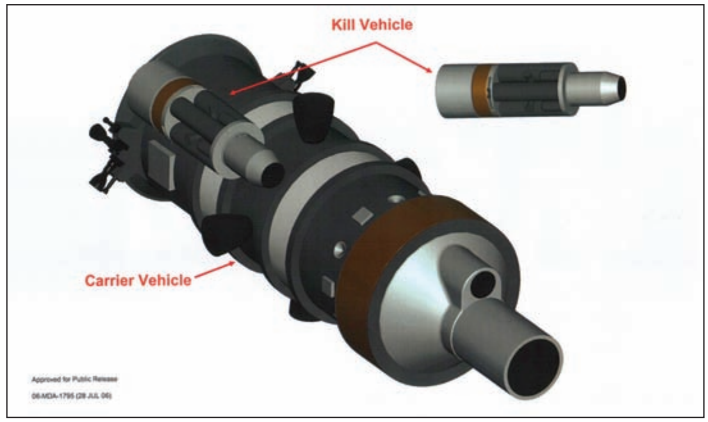
Program officials also noted that platform integration costs for the core terminal will be minimal due to the terminal's form, fit, and function replacement of the MIDS Low Volume Terminal. However, like other JTRS waveforms, integration costs for the JTRS platform capability package will be significant and are not currently funded as part of the JTRS program. According to Navy officials, the cost to integrate the full networking functionality of the JTRS platform capability package into four variants of airborne platforms is estimated to be $868 million.

Agency Comments

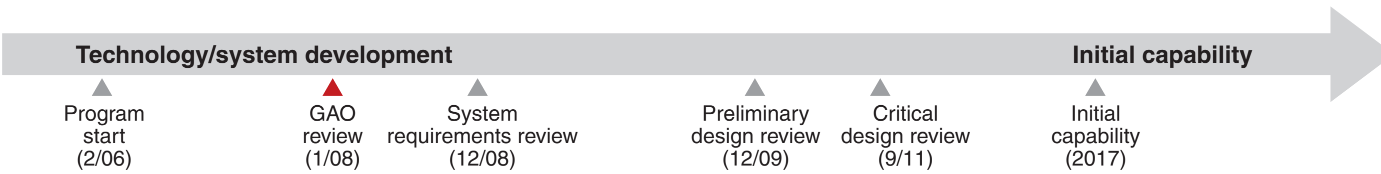
In commenting on a draft of this assessment, the MIDS-JTRS program office provided technical comments, which were incorporated as appropriate.

Multiple Kill Vehicle

MDA's MKV is being designed to provide multiple kill capability to all midcourse defense system interceptors. The payload in its current concept is expected to engage midcourse threat clusters by deploying multiple kill vehicles from a larger carrier vehicle. Key components of the carrier and kill vehicles include the seekers and the divert and attitude control systems. An initial capability is expected in 2017. We assessed the carrier and kill vehicle concept currently being developed for the Ground-based and Kinetic Energy interceptors.



Source: MDA/MK.



Program Essentials

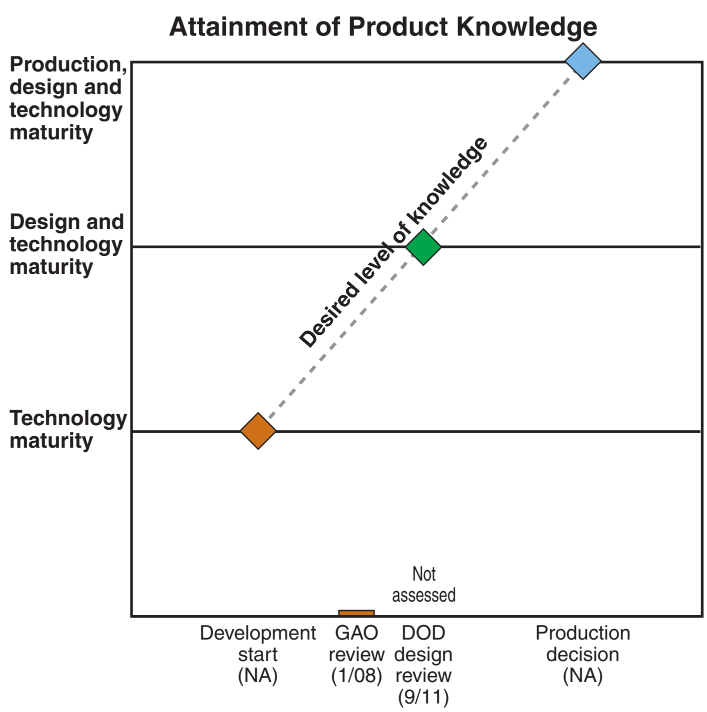
Prime contractor: Lockheed Martin, Raytheon
Program office: Arlington, Va.
Funding FY08-FY13:
R&D: $2,957.8 million
Procurement: $0.0 million
Total funding: $2,957.8 million
Procurement quantity: NA

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 10/2007	Percent change
Research and development cost	NA	$3,197.6	NA
Procurement cost	NA	0	NA
Total program cost	NA	$3,197.6	NA
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Costs include all known costs from program inception through fiscal year 2013.

The MKV program was started in 2006, and the program remains in the technology development phase. We assessed only one technology—the divert and attitude control system on the carrier vehicle—as mature. Conversely, the MKV program assessed 14 of the 16 technologies critical to the MKV concept as approaching maturity because they have been tested in other programs. However, despite being used on other programs, most of these technologies must be repackaged if they are to fit onto the Ground-based (GBI) and Kinetic Energy (KEI) interceptors. The program continues to mitigate its highest risk, engagement management algorithms, and expects to demonstrate the system's ability to manage multiple kill vehicles in 2010.



MKV Program

Technology Maturity

According to our analysis, only 1 of the 16 MKV critical technologies is mature. The technologies for the carrier vehicle include the divert and attitude control system (DACS), cooler, inertial measurement units (IMU), focal plane array (FPA), optics, power, processor, and carrier vehicle-ground datalink. The technologies critical to the kill vehicle include the DACS, seeker FPA, cooler, optics, IMUs, power, processors, and carrier vehicle-to-kill vehicle datalink. According to the program, all 16 assessed MKV technologies are mature, with the exception of 2—the carrier vehicle's optics and FPA. We disagree with the program's evaluation and consider only 1 of the 16 technologies, the carrier vehicle DACS, as nearing maturity. Although all of the critical technologies have been used in other programs, most need to be repackaged to have the correct form and fit for the GBI and KEI. To date, only the carrier vehicle DACS hardware has been repackaged and successfully tested.

The program continues to mitigate its top risk, the engagement management algorithms, which are necessary to ensure the multiple kill vehicles can engage targets successfully. According to program officials, in 2010 the program plans to perform hardware testing using a digital simulation test bed intended to demonstrate this engagement functionality.

Design Stability

We were unable to assess the design maturity of the MKV program because the program has not yet estimated the number of drawings that will be required. According to program officials, the program will not have a good estimate until it holds a preliminary design review in 2009.

Other Program Issues

MDA plans to employ a parallel path to develop the MKV for the GBI, KEI, and Aegis BMD Standard Missile-3 (SM-3) Block IIB missile. Currently, Lockheed Martin is developing MKV concepts for the GBI and KEI, and it is also expected to develop a design for the Aegis BMD SM-3. In 2007, the MKV program added a contractor—Raytheon—to design a second concept in parallel with Lockheed Martin's concept. Raytheon has been contracted to develop MKV solutions for Aegis BMD SM-3 as well as for the GBI and KEI, although, according to program officials, they have just begun work and have not yet developed a firm concept. Raytheon's work, funded under the KEI program through 2007, was expected to become a part of the Aegis BMD SM-3 contract in 2008. However, in the conference report accompanying the 2008 Defense Appropriation Act, the conferees indicated their intent to remove all funds from the MKV program designated for the SM-3 effort, citing concerns that MDA does not have the resources to adequately fund both this work and its current work on an MKV for the GBI and KEI. Furthermore, the conferees also agreed that no funding under the Aegis BMD SM-3 program be used for the MKV program. Although MDA's parallel path approach emphasizes common standards, architecture, and interfaces that allow flexibility to increase the likelihood of delivery to the weapon system integrators, its development has caused at least a year delay in key milestone reviews.

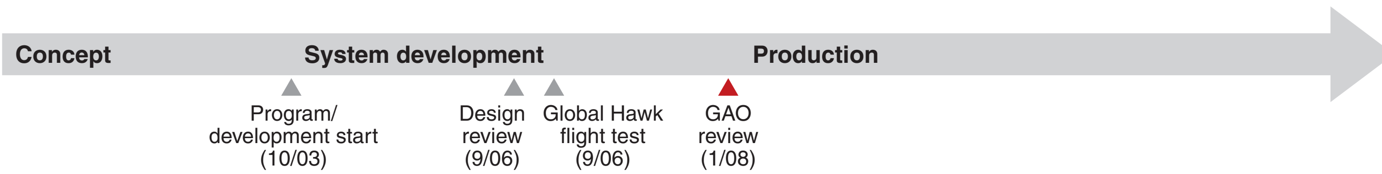
Agency Comments

The program office provided technical comments, which were incorporated as appropriate.

Multi-Platform Radar Technology Insertion Program

The Air Force's Multi-Platform Radar Technology Insertion Program (MP-RTIP) is designing a modular, scalable, two-dimensional active electronically scanned array radar for integration into the Global Hawk unmanned aerial vehicle platform. The radar will provide improved ground moving target indicator and synthetic aperture radar imaging. The MP-RTIP program funds research, development, and test and evaluation activities only; the Global Hawk program will fund production of the radars.

Source: Northrop Grumman Corporation.



Program Essentials

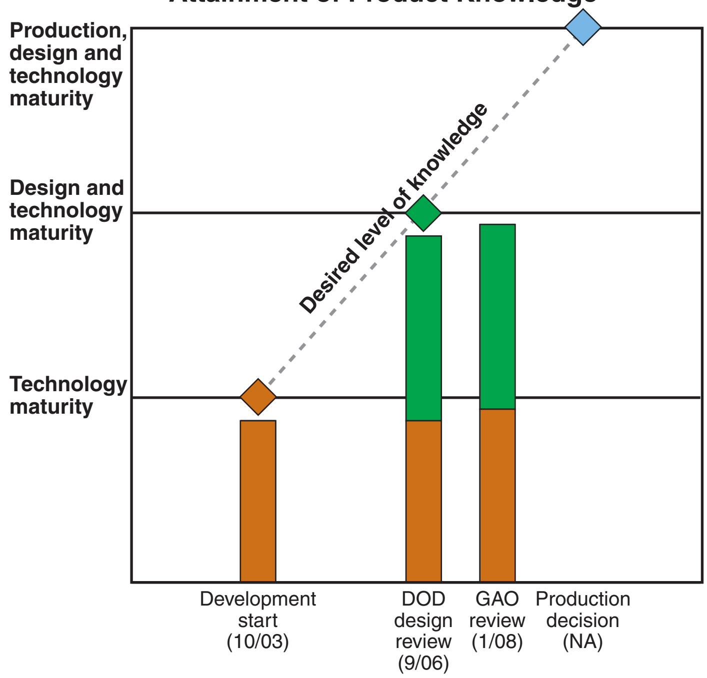
Prime contractor: Northrop Grumman
Program office: Hanscom AFB, Mass.
Funding needed to complete:
- R&D: $80.0 million
- Procurement: NA
- Total funding: $80.0 million
- Procurement quantity: NA

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2003	Latest 12/2006	Percent change
Research and development cost	$1,706.1	$1,325.4	-22.3
Procurement cost	NA	NA	NA
Total program cost	$1,706.1	$1,325.4	-22.3
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Seven of MP-RTIP's eight critical technologies for the Global Hawk radar are mature, and the design is stable. In 2006, the MP-RTIP program completed three Global Hawk MP-RTIP development units and several software builds, and also commenced system-level testing. A Global Hawk MP-RTIP radar unit was installed on a surrogate testbed aircraft (Proteus) and flight testing began in September 2006. Expected completion of Proteus flight testing has been delayed from September 2007 to summer of 2008 because software necessary for this testing has taken longer to develop than planned. However, program officials stated that the revised testing time-frame will not affect Global Hawk's ability to integrate the radar in fiscal year 2009 for developmental and operational testing.

Attainment of Product Knowledge



MP-RTIP Program

Technology Maturity

Of the eight critical technologies MP-RTIP is developing for the Global Hawk radar, seven are fully mature, while the remaining technology—software modes necessary to operate the radar—is approaching maturity. According to program officials, this technology is being matured during ongoing flight testing and is expected to be fully mature by summer 2008.

Design Stability

The program had completed 100 percent of its planned drawings as of August 2007. The total number of drawings has decreased by about 8 percent since design review because some of the previously completed drawings were not part of the current MP-RTIP Global Hawk radar configuration. Going forward, the potential for design changes remains until the maturity of the remaining critical technology is demonstrated in an operational environment.

Production Maturity

We did not assess MP-RTIP's production maturity because the program only consists of research, development, and test and evaluation activities; the Global Hawk program is responsible for radar production.

Other Program Issues

Originally, the MP-RTIP program also included the development of the Wide Area Surveillance radar for integration into a wide-body aircraft, specifically the E-10A aircraft. However, the fiscal year 2008 President's budget eliminated funding for the Wide Area Surveillance radar, and the E-10A Technology Development Program was terminated by the Air Force in February 2007. The Senate Committee on Armed Services noted that the MP-RTIP radar should be on platforms larger than the Global Hawk in its report on the National Defense Authorization Act for fiscal year 2008. The committee recommended an increase in funding of about $275 million so that MP-RTIP radar technology can be retrofitted into the E-8 Joint Surveillance Target Attack Radar System (Joint STARS) aircraft. In Conference Report number 110-477 accompanying the National Defense Authorization Act for Fiscal Year 2008, the conferees authorized approximately $178 million in supplemental funding for the E-10A program. This funding was requested primarily to further the development of MP-RTIP, including possibly investigating the use of MP-RTIP radar technology on platforms other than the Global Hawk.

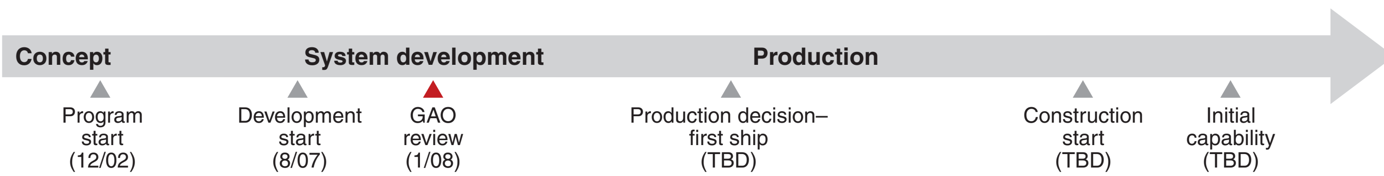
Agency Comments

In commenting on a draft of this assessment, the Air Force concurred with our findings. Program officials also provided technical comments, which were incorporated where appropriate.

Maritime Prepositioning Force (Future)/ Mobile Landing Platform

The Navy's Mobile Landing Platform (MLP) is a vessel in the planned Maritime Prepositioning Force (Future)—MFP(F)—squadron that would facilitate at-sea vehicle and cargo transfer and serve as a staging area for supplies that support activities on shore. The Navy plans to procure a total of three MLP ships. The MLP program—a new ship design for the Navy—is currently in the technology development phase.

Source: MPF(F)/MLP Program Office.



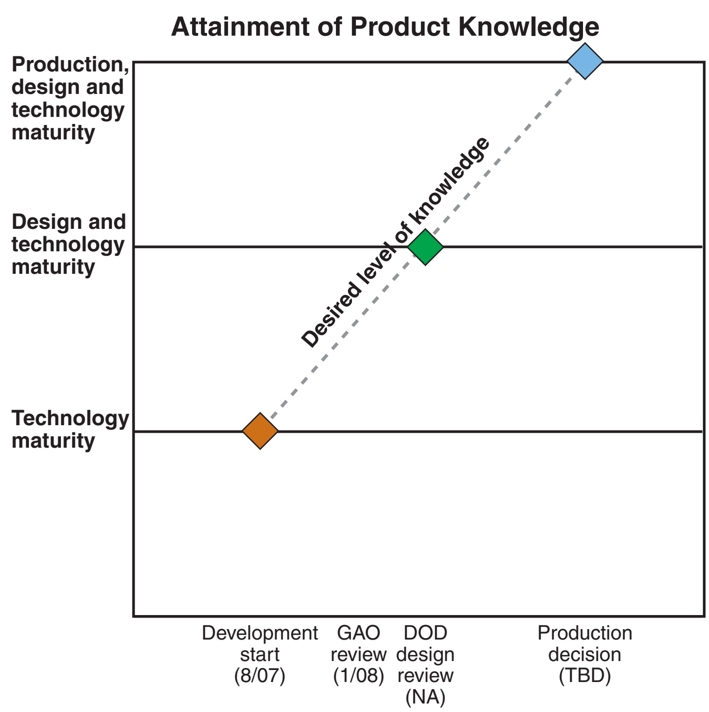
Program Essentials

Prime contractor: TBD
Program office: Washington, D.C.
Funding needed to complete:
R&D: $36.7 million
Procurement: $2,629.4 million
Total funding: $2,666.1 million
Procurement quantity: 3

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2003	Latest 02/2007	Percent change
Research and development cost	NA	$58.9	NA
Procurement cost	NA	$2,628.3	NA
Total program cost	NA	$2,687.1	NA
Program unit cost	NA	$895.700	NA
Total quantities	NA	3	NA
Acquisition cycle time (months)	NA	NA	NA

In 2006, the Navy identified two critical technologies that will be used on the MLP—skin-to-skin replenishment and landing platform technologies. After completing a series of at-sea tests on the skin-to-skin replenishment system between fiscal years 2005 and 2006, the Navy focused its attention on a component of landing platform technologies that it believed would be more efficient. Landing platform technologies—now reported as the only critical technology—is not currently mature, but the MLP program office expects it to be mature by early 2008. Design and production maturity could not be assessed because these activities have not begun.



MPF(F)/ MLP Program

Technology Maturity

In 2006, the program office identified two critical technologies—skin-to-skin replenishment and landing platform technologies—with skin-to-skin replenishment reported as mature and landing platform technologies as approaching maturity. The Navy conducted a series of at-sea tests to assess the skin-to-skin replenishment system's ability to transfer vehicles between an MLP surrogate ship and another ship at very close proximity. The tests were conducted using commercial-based technology similar to the technology desired by the Navy. While the program office concluded that skin-to-skin replenishment had been successfully demonstrated, it decided to instead use a component of landing platform technologies—dynamic positioning—which it believed would offer more efficient vehicle and cargo transfer.

In 2007, the program office identified only one critical technology for MLP—landing platform technologies—and listed it at a lower level of maturity than in 2006. According to the program office, this technology has three components: (1) dynamic positioning, which aligns the MLP with other ships using position sensors and the ship's propulsion system to adjust its relative position; (2) test article vehicle transfer system ramp for transferring vehicles and cargo between ships; and (3) surface craft interfaces that allow the MLP to partially submerge in water, which facilitates at-sea boarding by Landing Craft Air Cushion and Army amphibious vehicles. The landing platform technologies enable the MLP to serve as a staging area for vehicles and equipment in support of on-shore military activities.

The program office has tested the functionality of the surface craft interface component and plans to develop a test article of the ramp in 2008. The program office conducted an at-sea test of the dynamic positioning component using a commercially available system on a leased barge. The test was conducted in sea conditions less challenging than those during the skin-to-skin replenishment tests.

The MLP program office reported that landing platform technologies was not mature and that no formal technology readiness assessment on the technology had been conducted, but it expected to fully mature the technology by early 2008. The program office also stated that the use of a backup technology for landing platform technologies would cause substantially degraded performance by the MLP. The Navy identified other relevant systems expected on board the MLP, including cargo handling systems, cranes, and forklifts to maneuver cargo and munitions, but did not believe these additional systems required new development.

Design Stability

There is no existing MLP design that could be assessed. According to the Navy, the MLP design will be similar to that of existing commercial heavy lift ships. The MLP will be used to transport, embark, and disembark various amphibious military vehicles.

Other Program Issues

According to the program office, because the ship is linked to the overall acquisition of the Maritime Prepositioning Force (Future), the MLP acquisition cannot move forward until these future force requirements are approved by DOD. Until the MPF(F) requirements are determined, any technology development and testing activities for the MLP are considered concept demonstration.

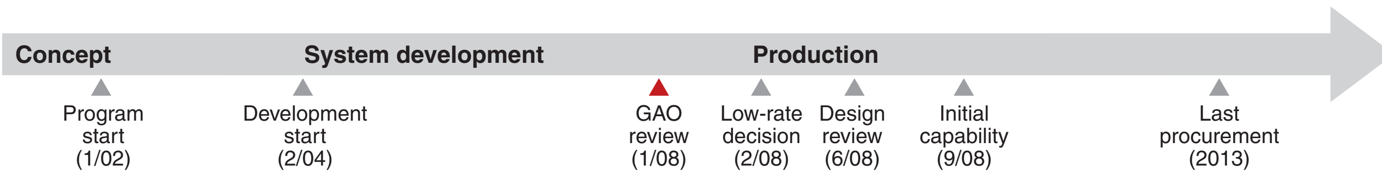
Agency Comments

The program office provided technical comments, which were incorporated as appropriate.

Reaper Unmanned Aircraft System

The Air Force's MQ-9 Reaper (formerly Predator B) is a multirole, medium-to-high altitude endurance unmanned aerial vehicle system capable of flying at higher speeds and higher altitudes than its predecessor, the MQ-1 Predator A. The Reaper is designed to provide a ground attack capability to find, fix, track, target, engage, and assess small ground mobile or fixed targets. Each system will consist of four aircraft, a ground control station, and a satellite communications suite.

Source: General Atomics Aeronautical Systems, Inc.



Program Essentials

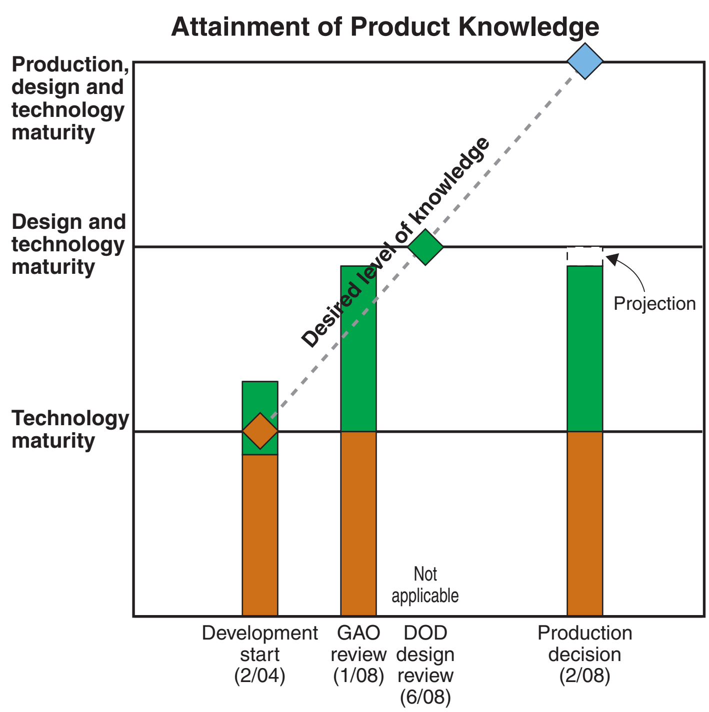
Prime contractor: General Atomics Aeronautical Systems
Program office: Wright-Patterson AFB, Ohio
Funding FY08-FY13:
- R&D: $225.9 million
- Procurement: $993.3 million
- Total funding: $1,367.4 million
- Procurement quantity: 50

Program Performance (fiscal year 2008 dollars in millions)

	As of 08/2004	Latest 08/2007	Percent change
Research and development cost	$192.1	$353.2	83.9
Procurement cost	$500.2	$1,733.0	246.5
Total program cost	$692.3	$2,234.6	222.9
Program unit cost	$20.978	$27.587	31.5
Total quantities	63	81	28.6
Acquisition cycle time (months)	70	56	-20.0

Latest cost and quantity data are through fiscal year 2013; earlier cost and quantity data only go through fiscal year 2009. The Air Force could not provide comparable cost information.

The Reaper entered system development in February 2004 with three of its four critical technologies mature. The fourth technology—stores management system—experienced several delays, but is now considered mature. The Reaper's critical design review has been delayed until June 2008, nearly 3 years later than originally planned. By that point, the program office estimates that 94 percent of the design drawings will be complete. Despite the design review delay, the program continues to produce and field aircraft. The lack of demonstrated design and production maturity represents a significant risk to the program. In addition, initial operational testing is not scheduled to be completed until the third quarter of fiscal year 2008, when about 45 percent of the aircraft quantity will have already been placed on contract.



MQ-9 (Reaper) Program

Technology Maturity

All four of the Reaper's critical technologies—the synthetic aperture radar, the multispectral targeting system, the air vehicle, and the stores management subsystem—are now mature. Development of the stores management subsystem was initially expected to be mature in 2004, but it encountered several delays. In December 2006, it began weapons release testing and is now considered mature. Subsequent increments may require other new technologies.

Design Stability

The program office currently reports that over 80 percent of the drawings for the first increment aircraft are complete and expects that 94 percent of the drawings will be complete by the critical design review. The design review was initially planned for September 2005, but has slipped repeatedly since the program began development, and is now scheduled for June 2008, 4 months after the production decision. According to program officials, the delays were caused by the user's requirement for early fielding of the aircraft. Program officials acknowledge that additional drawings will be needed for subsequent aircraft increments.

Production Maturity

The program does not use statistical process controls to ensure product quality. Instead, it uses other quality control measures such as scrap, rework, and repair to track product quality. Although the contractor has met the MQ-9 production requirements to date, the concurrent production of the Predator, Reaper, and Warrior has greatly increased the contractor's business base and workforce requirements. The Air Force is in the process of completing a manufacturing readiness assessment for the program.

Other Program Issues

Since inception, the Reaper program has followed a nontraditional acquisition path highlighted by changing requirements. Within the past year, total program quantities have increased from 63 to 81 aircraft and the fiscal year 2007 purchase quantity increased from 2 to 12 aircraft. Since development started, program unit costs have increased by over 30 percent—primarily due to a user requirement for an early operational capability that included the Hellfire missile and a digital electronic engine control. These changes also increased the weight of the aircraft, requiring stronger landing gear, fuselage, and control surfaces. Further requirements changes resulted in an even more robust early fielding configuration. Subsequent aircraft will have upgrades to the radar and weapons as well as further software developments. The production of these aircraft before the critical design review and operational testing adds significant risk to the program. To date, the Air Force has taken delivery of 14 aircraft and plans to make a production decision prior to the system critical design review. By the time the program completes initial operational testing, the Air Force will have already contracted for about 45 percent of the total production aircraft quantity. Changes stemming from the test program would further disrupt the aircraft's cost, schedule, and manufacturing plan.

Agency Comments

In commenting on a draft of this assessment, the Air Force stated that it was forced into a nontraditional acquisition path to rapidly meet the demands of the Global War on Terrorism. While this path has introduced some inefficiencies, the Air Force stated that it has delivered effective combat capability well ahead of what would have been achievable using a traditional acquisition path. It also noted that the majority of the production to date has been the result of congressional direction and funding provided in excess of DOD requests. Program officials maintain there is manageable and accepted risk with production taking place before critical design review and operational testing. The Reaper underwent an integrated system exercise in September 2007 to operationally assess its readiness for early deployment. A second exercise will assess its readiness for initial operational testing.

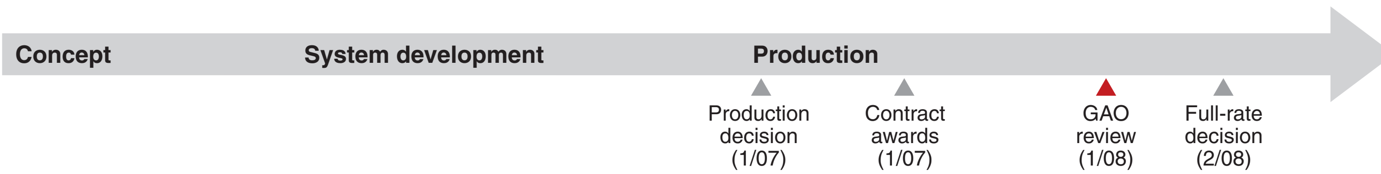
GAO Response

Our reviews of DOD weapon systems confirm that producing the system before the completion of the design review and operational testing adds significant cost risk to the program. Further, the first integrated system exercise was a limited developmental test and not a replacement for rigorous operational testing.

Mine Resistant Ambush Protected (MRAP) Vehicle

The MRAP is a joint program led by the Navy and Marine Corps to procure a family of armored vehicles to protect personnel from mine blasts, and fragmentary and direct-fire weapons. DOD will acquire three categories of vehicles: Category I for urban combat missions; Category II for convoy escort, troop transport, explosive ordinance disposal, and ambulance missions; and Category III for clearing mines and improvised explosive devices. The Marine Corps, Army, Air Force, Navy, and Special Operations Command are acquiring vehicles.

Source: Joint MRAP Family of Vehicles Program Office.



Program Essentials

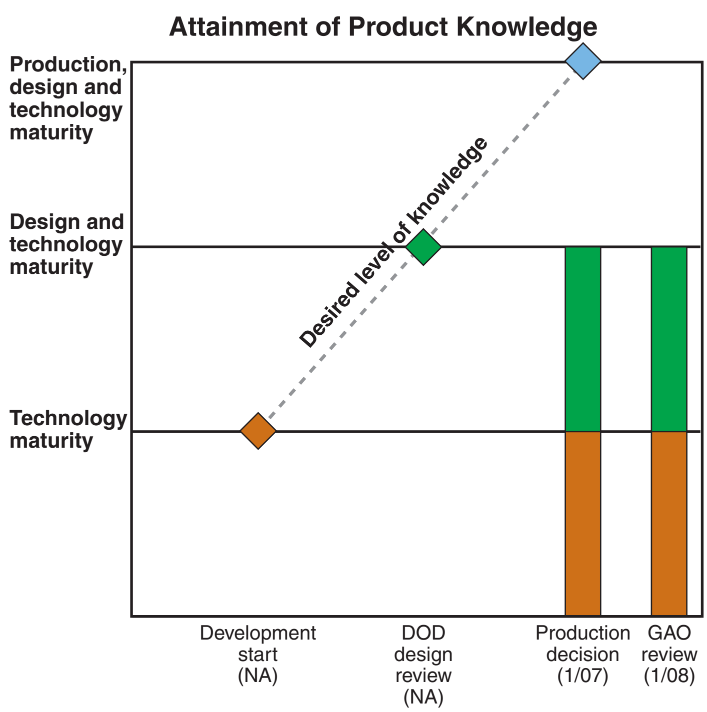
Prime contractor: Various
Program office: Quantico, Va.
Funding needed to complete:
R&D: TBD
Procurement: TBD
Total funding: TBD
Procurement quantity: TBD

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 10/2007	Percent change
Research and development cost	NA	$177.3	NA
Procurement cost	NA	$12,552.6	NA
Total program cost	NA	$13,501.4	NA
Program unit cost	NA	$1.430	NA
Total quantities	NA	9439	NA
Acquisition cycle time (months)	NA	NA	NA

Latest cost and quantity estimate is based on the President's budgets and supplemental requests for fiscal years 2006 through 2008 but does not include recent orders for more vehicles.

The MRAP program is DOD's highest-priority acquisition program. To meet an urgent, joint-service operational need, DOD is buying MRAP as nondevelopmental items. The greatest challenge for vendors will be obtaining sufficient quantities of ballistic-grade steel. Another significant challenge will be producing enough tires to equip the fleet and provide for replacements. Finally, integration of government-furnished equipment is taking three times longer than desired. DOD is pursuing a very aggressive schedule while at the same time grappling with a significant number of unknowns that could delay fielding or increase costs. The program is trying to concurrently produce the baseline MRAP, develop and produce various upgrades, and develop an MRAP II vehicle.



MRAP Program

Production Maturity

DOD is buying MRAP vehicles as nondevelopmental items, so we did not assess whether production processes were mature. We did assess the ability of vendors to manufacture the required number of vehicles in the time frames needed to achieve accelerated production and fielding requirements.

The greatest challenge for vendors is obtaining sufficient quantities of ballistic-grade steel. A DOD assessment found there is sufficient steel available to produce the 11,891 contracted vehicles. However, as the total number of vehicles procured increases and the amount of armor per vehicle grows to meet the threat, there may not be enough steel. A second challenge is producing enough tires to equip the fleet and provide replacements. Tire production was expected to reach 9,500 per month by February 2008, but 20,000 per month could be needed to support production and replacement in the field. Replacement rates are not yet known.

DOD has taken steps to ensure availability of key materials. For example, DOD has given MRAP contracts a higher priority (DX rating) that requires these contracts to be accepted and performed before all other nonpriority government and commercial contracts. DOD has also allocated funds to procure an advance reserve of steel and to increase tire production capacity. In addition, some of the vendors and suppliers have made corporate investments to maximize capacity.

All vehicles come from the vendor without mission equipment, which must be integrated onto vehicles before fielding. This equipment is 20 percent of the total program cost and includes items such as a tracking system that identifies friendly forces and a system to jam improvised explosive devices. A large challenge is integrating the entire suite of mission equipment onto the vehicles in a timely manner. It currently takes an average of 21 days to install the equipment on a vehicle, but the goal is to reduce that to 7 days. The plan is to process 50 vehicles per day for a total of 1,000 vehicles per month.

Other Program Issues

Due to urgent fielding requirements, the MRAP program is pursuing a very aggressive schedule while at the same time grappling with a significant number of unknowns, such as the total quantity required and the long-term sustainment strategy. DOD has taken steps to reduce these risks, including implementing a contracting strategy that only commited the government to purchase initial test assets. Additional purchases are based on demonstrated performance and production capability. Further, the focus of the effort is on crew protection, with reliability given less priority.

In order to rapidly field the vehicles, DOD substantially reduced the normal scope of test and evaluation. For example, there is no minimum requirement for vehicle reliability, and durability testing covered only 300 hard surface miles and 200 off-road miles in the first test phase. By the time the first phase of developmental testing had been completed, over 3,700 vehicles were already on order—a commitment of nearly $2 billion. The current plan places 11,891 vehicles on contract before operational effectiveness and operational suitability are determined. As a result, test results could lead to costly retrofits or replacements.

The program is concurrently pursuing the original baseline MRAP, varioius upgrades, and an MRAP II variant. In order to avoid a break in production, orders for additional vehicles may be necessary before test results are available for the upgrade efforts or the MRAP II.

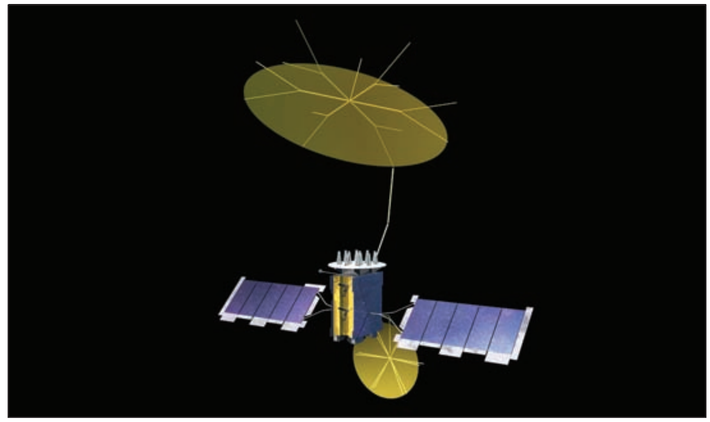
DOD acknowledges that a long-term sustainability strategy and full life cycle support cost estimate has yet to be established. This is an area of risk that could have a large impact on DOD.

Agency Comments

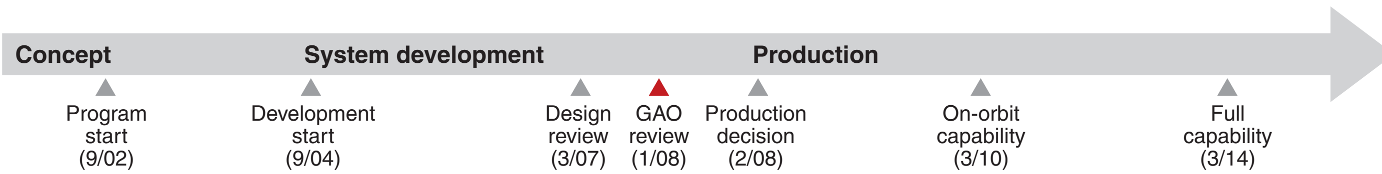
Joint Program Office officals provided technical comments, which were incorporated. In commenting, officials characterized the test program as phased to support key decisions in order to field the most survivable vehicles as quickly as possible while addressing upgrades or modifications in future testing. As developmental and operational tests continue, vehicles will undergo additional reliability and durability testing. Changes resulting from these tests will be incorporated as appropriate.

Mobile User Objective System (MUOS)

The Navy's MUOS, a satellite communication system, is expected to provide a worldwide, multi-service population of mobile and fixed-site terminal users with an increase in narrowband communications capacity and improved availability for small terminals. It is to replace the Ultra High Frequency Follow-On satellite system currently in operation and provide interoperability with legacy terminals. MUOS consists of a network of satellites and an integrated ground network. We assessed both the space and ground segments.



Source: Lockheed Martin, © 2007 Lockheed Martin.



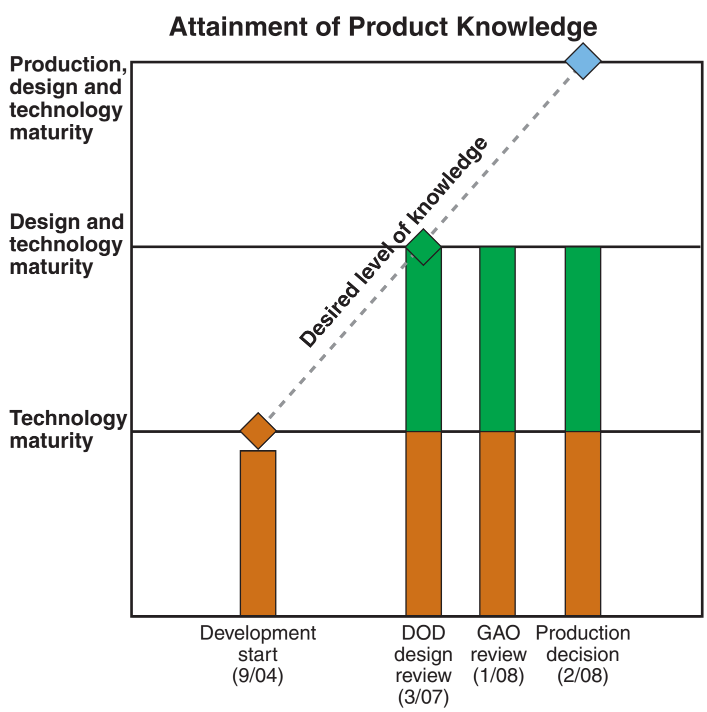
Program Essentials

Prime contractor: Lockheed Martin Space Systems
Program office: San Diego, Calif.
Funding needed to complete:
- R&D: $1,808.3 million
- Procurement: $2,353.3 million
- Total funding: $4,184.9 million
- Procurement quantity: 4

Program Performance (fiscal year 2008 dollars in millions)

	As of 09/2004	Latest 08/2007	Percent change
Research and development cost	$3,464.2	$3,574.1	3.2
Procurement cost	$2,882.4	$2,353.3	-18.3
Total program cost	$6,383.4	$5,991.7	-6.1
Program unit cost	$1,063.893	$998.609	-6.1
Total quantities	6	6	0.0
Acquisition cycle time (months)	91	91	-27.4

In September 2004, the MUOS program was authorized to begin development. All of the program's critical technologies are mature, and about 95 percent of design drawings had been completed at the critical design review in March 2007. Production maturity could not be determined because the program does not collect statistical process control data. The delivery of MUOS capabilities has become time-critical due to the operational failure of two UHF Follow-On satellites. The program is at risk of cost and schedule growth, and problems encountered under the Joint Tactical Radio System program may result in underutilization of MUOS capabilities.



MUOS Program

Technology Maturity

According to the program office, all critical technologies are mature.

Design Stability

At critical design review, about 95 percent of the expected number of design drawings had been completed. According to the program office, the size of the spacecraft at critical design review was much larger than at development start. The program considers satellite mass growth to be of moderate risk to the program. If the mass of the spacecraft grows to exceed the capability of the planned launch vehicle, design changes to the spacecraft would be made which could reduce mission performance. The program stated that this risk can be eliminated in 2008 if more than 50 percent of the predicted spacecraft mass has been validated with actual values and launch vehicle mass margins are not exceeded. According to the program office, as of November 2007, satellite mass had remained stable since the completion of critical design review.

Production Maturity

The program office does not collect statistical process control data. However, it is collecting and tracking data on defects in manufacturing processes to assess the maturity of MUOS production. The program began production activities in May 2007 after the contractor successfully completed a production readiness review.

Other Program Issues

The importance of the first MUOS launch has increased due to the unexpected failures of two UHF Follow-On satellites, one in June 2005 and another in September 2006. As a result, UHF communication capabilities are predicted to degrade below the required level of availability in February 2009, 14 months before the first MUOS satellite is to become operational. DOD is examining options for addressing this capability gap, including developing an integrated waveform to increase communications capacity provided by existing satellites and continuing to lease additional satellite communications capacity. Additionally, U.S. Strategic Command has tasked the Operationally Responsive Space office to review and identify other potential near-term options to augment UHF satellite communications.

While the MUOS space segment is only slightly behind schedule, contractor costs have increased over budget. Through October 2007, space segment costs were about $149 million, or about 32 percent, over the contractor's initial estimate due primarily to subcontract cost increases, piece part material cost increases, the addition of personnel to resolve design issues and test anomalies, and higher costs for increases in satellite structure size. The program office does not expect the trend in cost increases to breach the program office's cost estimate.

According to the program office, development of MUOS ground software represents one of the highest risks to the program due to the size and complexity of the contractor's design. As of September 2007, software development was nearly on schedule, with about 70 percent of the total effort complete. However, the program office projects the effort to cost $251 million, 54 percent over the initial contractor estimate of about $163 million. Additionally, a May 2007 independent software review concluded the development is at high risk for cost increases and schedule delays due, in part, to an optimistic assumption of software development productivity and code growth.

Full utilization of MUOS capabilities is dependent on the fielding of terminals developed by the Joint Tactical Radio System program. However, development problems encountered under the JTRS program have resulted in deferrals of requirements and have increased risk that MUOS capabilities will be underutilized until MUOS-compliant terminals are fielded. According to the program office, MUOS satellites can be launched and their legacy payload capability can be used to support warfighter requirements if problems are encountered with MUOS ground software and/or JTRS synchronization.

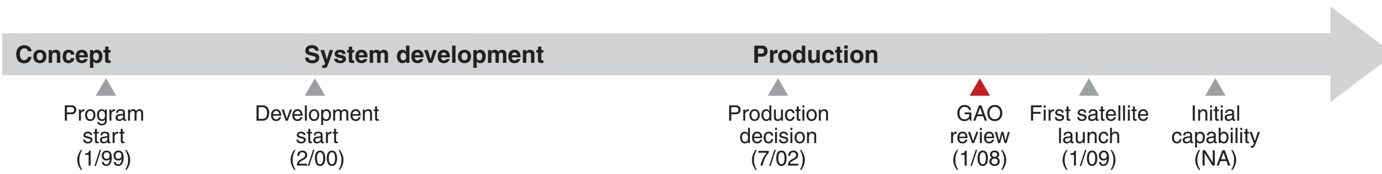
Agency Comments

In commenting on a draft of this assessment, the Navy provided technical comments, which were incorporated as appropriate.

Navstar Global Positioning System (GPS) Space & Control

GPS is an Air Force-led joint program with the Army, Navy, Department of Transportation, National Geospatial-Intelligence Agency, United Kingdom, and Australia. This space-based radio-positioning system nominally consists of a 24-satellite constellation providing navigation and timing data to military and civilian users worldwide. In 2000, Congress approved the modernization of Block IIR and Block IIF satellites. In addition to satellites, GPS includes a control system and receiver units. We focused our review on Block IIF.

Source: Global Positioning Systems Wing.



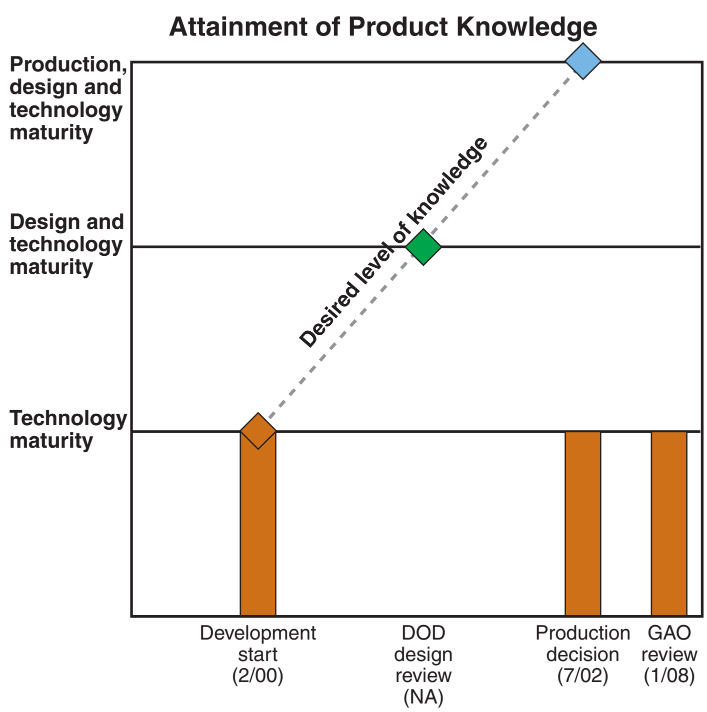
Program Essentials

Prime contractor: Boeing, Lockheed Martin
Program office: El Segundo, Calif.
Funding needed to complete:
- R&D: $362.9 million
- Procurement: $641.9 million
- Total funding: $1,004.4 million
- Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of 02/2002	Latest 12/2006	Percent change
Research and development cost	$2,090.9	$2,597.4	24.2
Procurement cost	$3,813.3	$4,459.3	16.9
Total program cost	$5,904.2	$7,056.7	19.5
Program unit cost	$178.915	$213.841	19.5
Total quantities	33	33	0
Acquisition cycle time (months)	TBD	TBD	TBD

The program office estimates that the launch of the first Block IIF satellite will be delayed to January 2009, over two years from its original launch estimate. This delay is due to risks and challenges in working through development and production concerns, such as technical issues with signal capabilities. The program also continues to experience development and production cost overruns. In addition, problems with control system software development have resulted in the deferral of requirements and commensurate capabilities.



NAVSTAR GPS-Space & Control Program

Technology Maturity

The Block IIF critical technology—space—qualified atomic frequency standards- is mature.

Design Stability

We could not assess design stability because the Block IIF contract does not require that design drawings be delivered to the program. According to the program office, it assesses design maturity through reviews of contractor testing, technical interchange meetings, periodic program reviews, and participation in the contractor development process.

Production Maturity

We could not assess production maturity because the contractor is not required to collect statistical process control data on the Block IIF satellite development and production contract.

Other Program Issues

The program estimates that the launch of the first Block IIF satellite will be delayed over 2 years from its original launch date (December 2006 to January 2009), due in part to (1) late hardware deliveries, (2) technical challenges with signal transponders, and (3) the addition of mission assurance activities. Recently, the program successfully completed the integration of new software for the control segment that will replace the legacy mainframe system and provide command and control capability. However, additional critical tests such as thermal vacuum testing are still needed to confirm the satellite's ability to operate in the harsh space environment.

The program continues to experience cost increases due to technical problems resulting in production cost overruns. In fiscal year 2006, the Air Force reprogrammed an additional $148 million into the Block IIF program to cover the contractor's estimate for production of the first three satellites. At the same time, the Air Force requested an addition $66 million in fiscal year 2008 and $46 million in fiscal year 2009 to cover the government's independent estimate for production of these satellites.

Ongoing delays with software development for the Block IIF control system have resulted in the deferral of requirements to the future control segment of the next generation of GPS satellites. The program expects this deferral to reduce control system costs to the Block IIF segment by $101 million, which could then be used to offset the contractor cost overruns.

A DOD report recently found that the development of GPS user equipment—under separately funded and managed programs—has not been synchronized with the development of the satellites and control system, increasing the risk of substantial delays in realistic operational testing and fielding of capabilities.

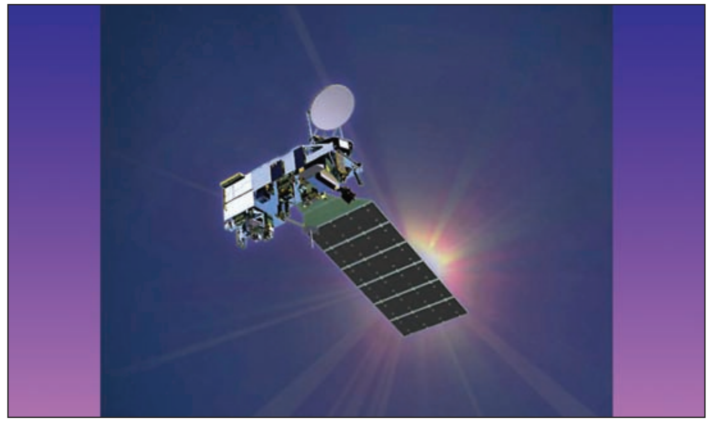
GPS III, the next generation of satellites, recently experienced a budget cut of $100 million. In addition, the current launch date for the first GPS III satellite has slipped from 2013 to 2014. According to program officials, the potential gap in capabilities will occur between the time the last GPS IIF satellite is launched (currently scheduled for around 2012) and the first GPS III satellite is launched.

Agency Comments

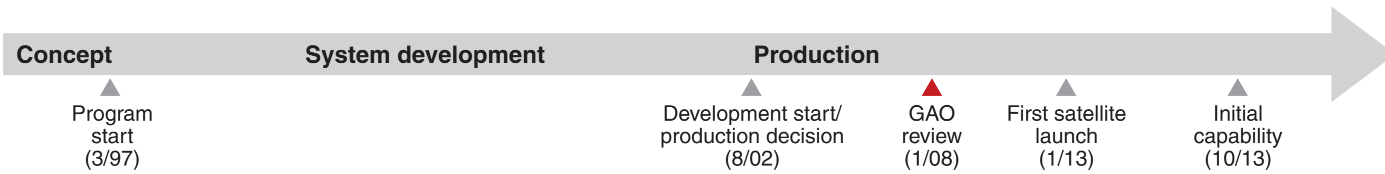
The Air Force concurred with this assessment and provided technical comments, which were incorporated as appropriate.

National Polar-orbiting Operational Environmental Satellite System (NPOESS)

NPOESS is a tri-agency—National Oceanic and Atmospheric Administration (NOAA), DOD, and National Aeronautics and Space Administration—satellite program to monitor the weather and environment through the year 2026. Current NOAA and DOD satellites will be merged into a single national system. NOAA and DOD each provide 50 percent of the funding for NPOESS. The program consists of four segments: space; command, control, and communications; interface data processing; and the launch segment. We assessed the space segment.



Source: NPOESS Integrated Program Office.



Program Essentials

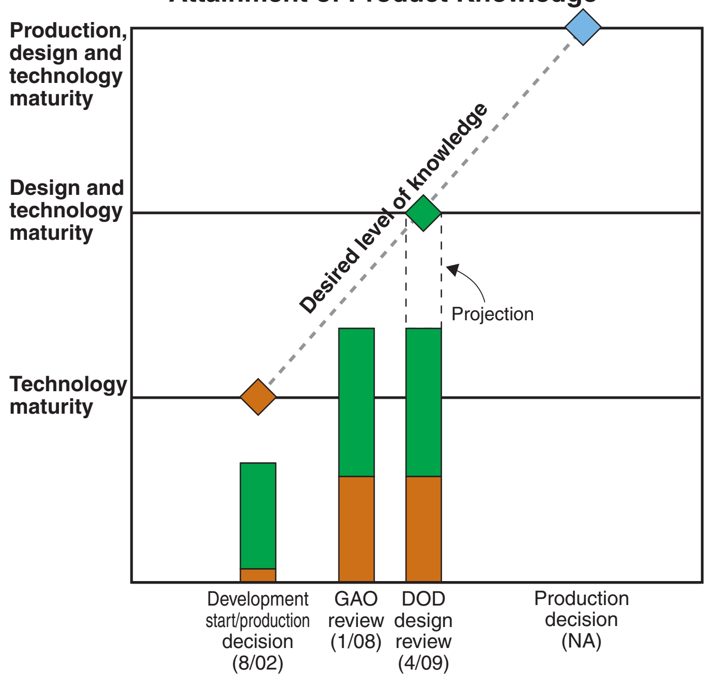
Prime contractor: Northrop Grumman Space Technology
Program office: Silver Spring, Md.
Funding needed to complete:
- R&D: $3,798.1 million
- Procurement: $2,816.6 million
- Total funding: $6,614.7 million
- Procurement quantity: 2

Program Performance (fiscal year 2008 dollars in millions)

	As of 08/2002	Latest 08/2007	Percent change
Research and development cost	$5,044.4	$7,892.5	56.5
Procurement cost	$1,302.2	$2,816.6	116.3
Total program cost	$6,346.6	$10,709.1	68.7
Program unit cost	$1,057.758	$2,677.286	153.1
Total quantities	6	4	-33.3
Acquisition cycle time (months)	172	200	16.3

In July 2007, the NPOESS program restructure was finalized in response to a Nunn-McCurdy program acquisition unit cost breach of the critical cost growth threshold. As part of the restructure, seven of the original 14 critical technologies were removed from the program. Of the remaining technologies, three are immature but are expected to be mature by the design review in April 2009. While the program restructure lowered risk for future cost and schedule problems, it increased the risk of a satellite coverage gap and significantly reduced climate data collection capabilities. As of November 2007, about 75 percent of the design drawings had been released. Production maturity could not be assessed because the program is not collecting statistical process control data.

Attainment of Product Knowledge



NPOESS Program

Technology Maturity

Only one of the program's 14 original critical technologies was mature at the development and production decision in August 2002. As part of the program's restructure, seven of the critical technologies were removed from the program. Of the remaining seven technologies, four are mature, and the program projects that all will be mature by the design review in April 2009.

The primary purpose of the NPOESS Preparatory Project, an effort funded by NASA to develop and operate a demonstration satellite, is to reduce development risk by providing processing centers with an early opportunity to work with sensors, ground control, and data-processing systems and allow for incorporating lessons learned into the four NPOESS satellites. Under the restructured NPOESS program, the satellite is expected to demonstrate the performance of three of four sensors deemed critical (because they are to provide data for key weather products) and one noncritical sensor in an operational environment. The launch of this satellite has been delayed about 40 months to September 2009.

Design Stability

In August 2002, the program began development and production before achieving design stability or production maturity. The program office revised the estimated number of design drawings to accommodate the deletion of a major sensor and estimates a total of 6,648 drawings. As of November 2007, about 75 percent of the drawings had been released. The design review date has been delayed 36 months to April 2009.

Production Maturity

The program office does not collect statistical process control data due to the small number of satellites to be built. However, program officials stated that the contractors track and use various metrics for subcomponent production, such as rework percentages, defect containment, and schedule and cost performance.

Other Program Issues

In response to a Nunn-McCurdy program acquisition unit cost breach of the critical cost growth threshold, the program office, in conjunction with the prime contractor, completed a program restructuring of NPOESS in July 2007. The restructure included acquiring fewer satellites, an overall increase in program costs, delays in satellite launches, and deletions or replacements of satellite sensors.

At an estimated life cycle cost of about $12.5 billion through 2026 for four satellites, the cost of the restructured NPOESS program is about $4.1 billion over the previous cost estimate of $8.4 billion for six satellites. The launch of the first satellite has been delayed from November 2009 to January 2013. The launch of the second satellite has been delayed from June 2011 to January 2016. As we recently reported, the delayed launches of fewer satellites will result in reduced satellite data collection coverage, requiring dependence on a European satellite for coverage during midmorning hours. Additionally, the launch delays increase the risk of a coverage gap for the existing constellation of satellites should there be premature satellite failures or unsuccessful launches of legacy satellites.

The restructured program also deleted four of 13 original instruments and reduced the functionality of four sensors. As a result, the revised NPOESS system will have significantly less capability for providing global climate measures than was originally planned. According to the program office, key performance parameters, or critical user requirements, have not changed as a result of the revised program. Consequently, the reduced capability of the system will not meet all critical requirements.

As we recently reported, the program office has made progress in the acquisition since the restructure. However, significant risks remain. For example, two critical sensors have experienced major developmental problems, adding risk to the Preparatory Project schedule, which could have associated impacts on schedule and costs of the overall program.

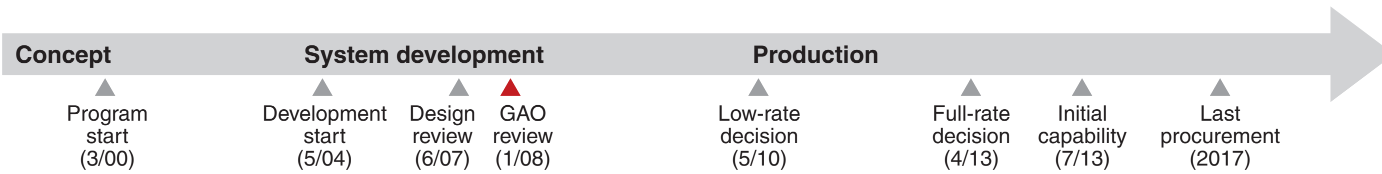
Agency Comments

In commenting on a draft of this assessment, the NPOESS Integrated Program Office noted that while the NPOESS system will not meet all critical science requirements, it is expected to meet all critical operational weather requirements and provide considerable science benefit.

P-8A Multi-mission Maritime Aircraft

The Navy's P-8A Multi-mission Maritime Aircraft (P-8A), a militarized version of the Boeing 737, is the replacement for the P-3C. Its primary roles are persistent antisubmarine warfare; anti-surface warfare; and intelligence, surveillance, and reconnaissance. The P-8A shares an integrated maritime patrol mission with the Broad Area Maritime Surveillance Unmanned Aircraft System and the EPX (formerly the Navy Aerial Common Sensor). These systems are intended to sustain and improve the Navy's maritime warfighting capability.

Source: The Boeing Company.



Program Essentials

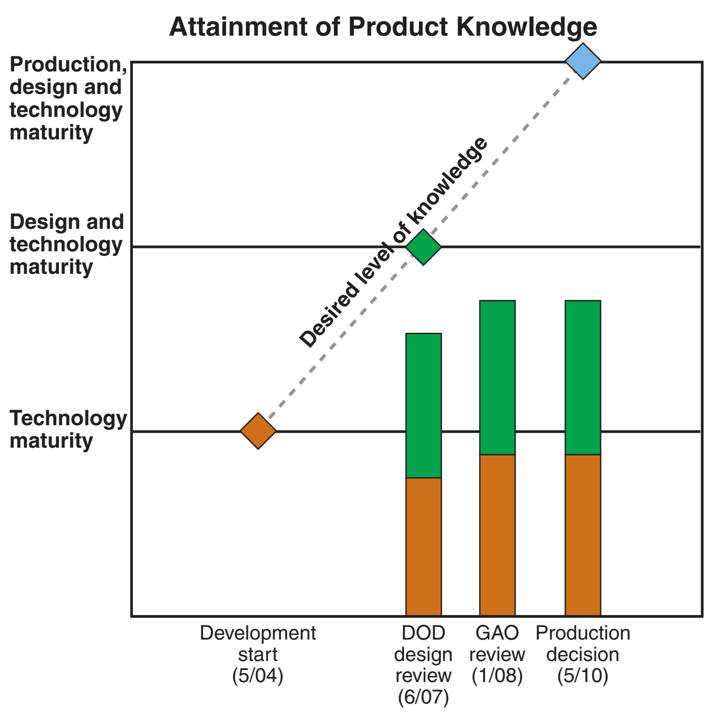
Prime contractor: Boeing
Program office: Patuxent River, Md.
Funding needed to complete:
- R&D: $3,886.9 million
- Procurement: $21,969.1 million
- Total funding: $25,968.9 million
- Procurement quantity: 108

Program Performance (fiscal year 2008 dollars in millions)

	As of 05/2004	Latest 08/2007	Percent change
Research and development cost	$7,152.7	$6,669.9	-6.7
Procurement cost	$22,190.3	$21,969.1	-0.9
Total program cost	$29,473.8	$28,773.6	-2.3
Program unit cost	$256.294	$252.400	-1.5
Total quantities	115	114	-0.7
Acquisition cycle time (months)	160	160	0

Figures shown are based on the December 2006 Selected Acqusition Report and do not reflect the total cost increase discussed below and in the Other Program Issues section.

The P-8A program entered development with four critical technologies. Since then, the program has removed one critical technology, replaced two with backups, and added a new critical technology. Of the current critical technologies, only one is mature. The program office completed critical design review (CDR) in June 2007 and design readiness review (DRR) in August 2007. However, only 70 percent of the design drawings were complete at CDR. The P-8A has experienced a $1.2 billion contract cost increase due to inefficiencies in the release of design drawings, software development risks, and subcontractor cost and scope increases. Further, the program office is currently assessing how its production aircraft will meet the specialty metals provision of the Berry Amendment.



P-8A MMA Program

Technology Maturity

None of the P-8A's initial four critical technologies were mature when it entered development in May 2004. The program identified mature backup technologies for each of the four, which, according to program officials, would still allow the P-8A to meet minimum requirements. Last year, we reported that the acoustic bellringer algorithm technology was replaced with a less capable but more mature backup. More recently, during a technology readiness assessment in November 2006, the program made significant changes to the critical technologies list. First, the integrated rotary sonobuoy launcher was removed from the critical technologies list. While the program still plans to utilize this technology, it was recategorized as a developmental risk. As such, it may not be fully mature prior to production and could lead to delays should design changes or a backup technology be necessary. Second, the program replaced the data fusion technology with its backup. Program officials stated that alternative algorithms can be utilized in place of the data fusion technology, which will provide less capable data fusion, but will still meet minimum P-8A requirements. Third, the Magnetic Anomaly Detector Control Surface Compensation Algorithms were added as a critical technology. These compensation algorithms, needed to reduce noise interference, pose an additional technical risk because they have not been tested on an aircraft. The program currently estimates that this technology will reach maturity by low rate decision in 2010, which is 6 years later than recommended best practices. Finally, the ESM digital receiver, which is being leveraged from the EA-18G program, is currently the only critical technology for the program that has been demonstrated in a realistic environment, and is considered mature.

Design Stability

The P-8A program released only 70 percent of its design drawings to the manufacturer by CDR in June 2007. According to P-8A officials, the program experienced schedule delays and cost increases associated with the completion and release of design drawings because of contractor coordination problems. The Navy endorsed funding for four operational flight test aircraft in September 2007.

Production Maturity

The contractor has estimated that the cost of producing an aircraft that is compliant with the specialty metals provision of the Berry Amendment would be significantly greater than current program cost estimates. The program office is currently assessing how its production aircraft will comply with these restrictions.

The P-8A will undergo structural modifications while on the production line. This effort to reduce production time and cost represents the first time that DOD will attempt to militarize an aircraft on a commercial production line and has added risk to the program.

Other Program Issues

As of June 2007, the System Development and Demonstration contract costs had risen from $3.8 billion to $5.0 billion as a result of contract modifications to address software development risks as well as delays in releasing system design drawings. This will delay the build and delivery dates for the seven aircraft test articles by 7 to 14 months. The cost increase was also driven by subcontractor/supplier issues, according to the program office. For example, at the subcontractor level, some development costs have exceeded estimates and schedules have slipped. Despite the cost increase and delays, the program is still attempting to meet its milestones and cost targets by combining the developmental and operational test programs.

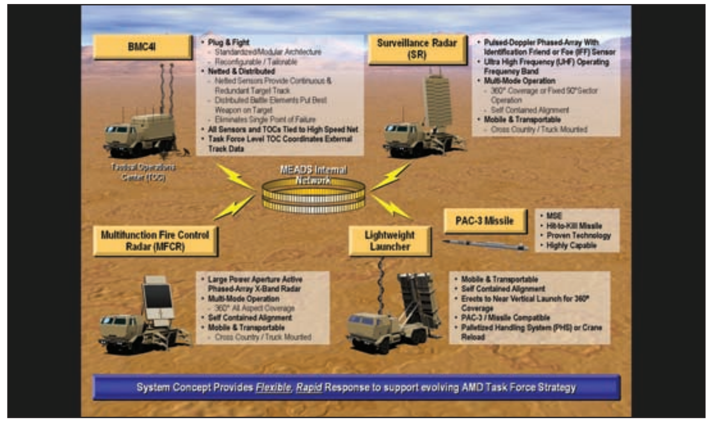
Because the P-8A mission overlaps with that of the BAMS UAS, changes or delays in the development of that program may result in the need to procure additional P-8A aircraft. See page 51 for more information on BAMS UAS.

Agency Comments

The program office states that the maturation of critical technologies is on schedule to support the System Development and Demonstration phase. The airplane remains about 60-65 percent common with the commercial 737. Although contract costs have grown, they remain below the program objective value for development cost parameters and below the system development cost estimates. The program continues to meet or exceed the cost, schedule, and performance parameters defined in the P-8A Acquisition Program Baseline Agreement.

PATRIOT/MEADS Combined Aggregate Program (CAP) Fire Unit

The Army's Patriot/MEADS Combined Aggregate Program (CAP) transitions the Patriot missile system to MEADS. MEADS's mission is to provide low to medium altitude air and missile defense with the capability to counter, defeat, or destroy tactical ballistic missiles, cruise missiles, or other air-breathing threats. MEADS is a codevelopment program among the United States, Germany, and Italy. We assessed the MEADS fire unit portion of the program that includes the launchers, radars, Battle Management component, and launcher reloaders.



Source: Lower Tier Project Office, Combined Aggregate Program (LTPO-CAP).

Concept | **System development** | **Production**

- Development start (8/04)
- GAO review (1/08)
- Design review (10/09)
- Initial production decision (11/12)
- Last production decision (3/17)
- Initial capability (9/17)

Program Essentials

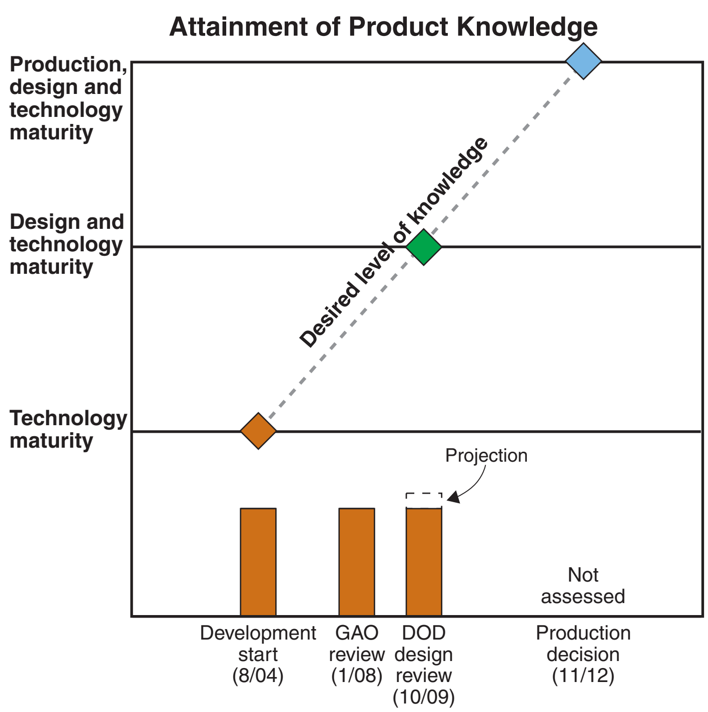
Prime contractor: MEADS International
Program office: Huntsville, Ala.
Funding needed to complete:
R&D: $4,023.3 million
Procurement: $12,851.5 million
Total funding: $16,874.7 million
Procurement quantity: 48

Program Performance (fiscal year 2008 dollars in millions)

	As of 08/2004	Latest 12/2006	Percent change
Research and development cost	$5,041.1	$4,746.8	-5.8
Procurement cost	$13,348.6	$12,851.5	-3.7
Total program cost	$18,389.7	$17,598.3	-4.3
Program unit cost	$383.119	$366.631	-4.3
Total quantities	48	48	0
Acquisition cycle time (months)	158	157	-0.6

MEADS fire unit began development in 2004 with two mature critical technologies, three critical technologies nearing maturity, and one immature critical technology. The technologies remain at these levels. Program plans call for a system design review in 2009, but officials estimate that only one of the six fire unit technologies will be more mature at that time than at development start. The program office anticipates that all critical technologies will be mature by the start of production in the first quarter of fiscal year 2013.

Current plans call for insertion of MEADS components into Patriot Fire Units beginning with acquisition decisions in 2008 and continuing in 2010 and 2013. However, MEADS will need to rebaseline its program cost and schedule because development of the Battle Management component is being transferred to the Integrated Air and Missile Defense Project Office.



PATRIOT/MEADS CAP Fire Unit Program

Technology Maturity

Only two of the six critical technologies—the launcher electronics and Patriot Advanced Capability (PAC)-3 missile integration—are mature. Three other critical technologies—the low noise exciter that manages the radars' frequencies, the cooling system for the radars, and a slip ring that carries power and coolants to the radars—are nearing maturity. The remaining critical technology—the fire control radar transmit/receive module—is immature.

The program office estimates that the maturity level of the low noise exciter, the radar cooling system, and the slip ring will remain unchanged when product development begins and that the transmit receive module will be nearing full maturity. The office expects all critical technologies to be fully mature by the start of production in the first quarter of fiscal year 2013. There are no backup technologies for any of the MEADS critical technologies.

Design Stability

We could not assess the design stability of MEADS because the number of releasable drawings and total drawings expected was not available. The program office expects to identify the total number of releasable drawings at a design review scheduled in 2009.

Other Program Issues

MEADS is being developed to employ the PAC-3 Missile Segment Enhancement variant. The Missile Segment Enhancement is funded by the U.S. to improve on the current PAC-3 missile capability. Program estimates indicate that the Army plans to develop and procure missiles at a cost of approximately $6.1 billion. We did not assess the Missile Segment Enhancement variant of the PAC-3, and the associated costs are not included in our funding information.

The MEADS program adopted an acquisition approach wherein MEADS major items are incrementally inserted into the current Patriot force. The three insertions will be based on acquisition decisons in 2008, 2010, and 2013 and each increment is expected to physically introduce new or upgraded capability into the program in 2009, 2011, and 2015.

A 2006 Army initiative, to provide a common Battle Management system for MEADS and other Army air and missile defense systems has in part, resulted in the establishment of the Integrated Air and Missile Defense Project Office that will lead the Battle Management component development effort. According to the MEADS program office, because MEADS CAP is dependent on the Battle Management Command component, it cannot execute its schedule as planned and will need to rebaseline the program cost and schedule after the Integrated Air and Missile Defense system development demonstration decision in March 2009.

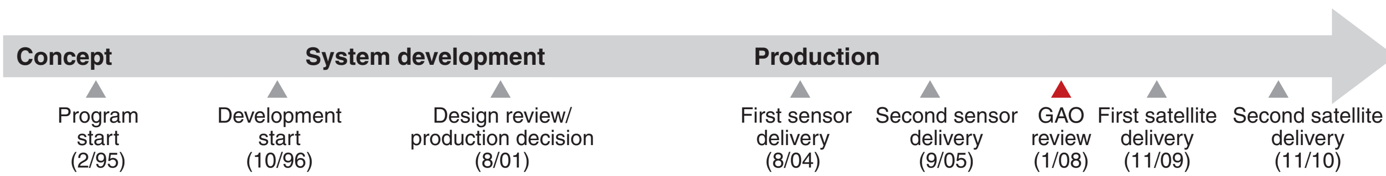
Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

Space Based Infrared System (SBIRS) High

The Air Force's SBIRS High satellite system is intended to meet requirements for missile warning, missile defense, technical intelligence, and battlespace awareness missions. A planned replacement for the Defense Support Program, SBIRS High is a constellation of four satellites in geosynchronous earth orbit (GEO), two sensors on host satellites in highly elliptical orbit (HEO), and fixed and mobile ground stations. Last year, two additional HEO sensors were authorized for procurement. We assessed the space segment.

Source: Lockheed Martin Space Systems Company, Sunnyvale, Calif,



Program Essentials

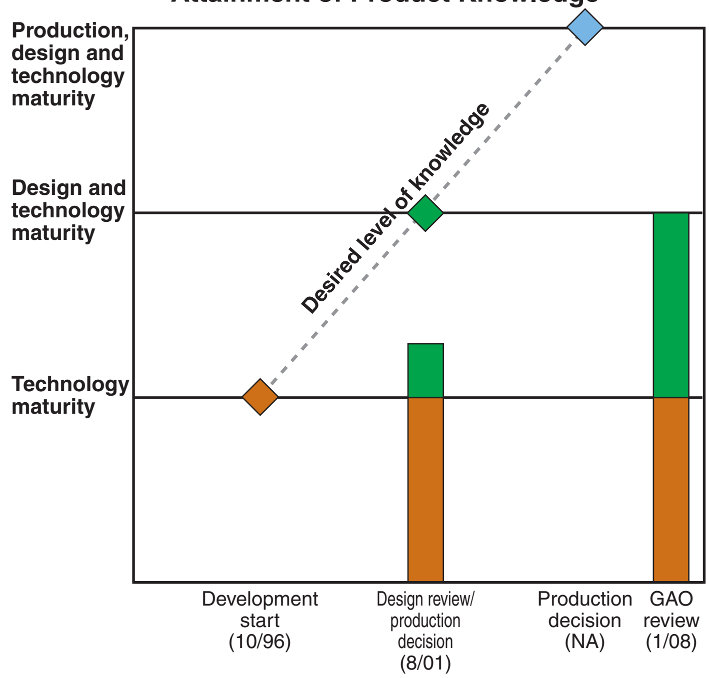
Prime contractor: Lockheed Martin Space Systems
Program office: El Segundo, Calif.
Funding needed to complete:
- R&D: $1,697.8 million
- Procurement: $1,572.0 million
- Total funding: $3,329.6 million
- Procurement quantity: 1

Program Performance (fiscal year 2008 dollars in millions)

	As of 10/1996	Latest 12/2006	Percent change
Research and development cost	$4,156.1	$8,542.7	105.5
Procurement cost	0	$1,682.7	NA
Total program cost	$4,365.2	$10,470.4	139.9
Program unit cost	$873.041	$3,490.125	299.9
Total quantities	5	3	-40.0
Acquisition cycle time (months)	TBD	TBD	TBD

The SBIRS High program's critical technologies are mature. Based on the number of design drawings released and the total number expected, the design is considered mature. Production maturity could not be determined because the contractor does not collect production statistical process control data. After delays of 18 and 21 months, two HEO sensors have been delivered. According to program officials, the first sensor's on-orbit performance is exceeding expectations. The first GEO satellite launch is estimated for December 2009, representing a schedule slip of about a year, and program office confidence in this estimate is moderate. Further, design problems have recently emerged and additional schedule slippage of the GEO launches is possible.

Attainment of Product Knowledge



SBIRS High Program

Technology Maturity

The SBIRS High program's critical technologies are mature.

Design Stability

The program's design is considered stable since almost all drawings have been released, but design-related problems could still emerge. Design problems delayed the delivery of the first two HEO sensors and increased program costs. A design flaw recently identified on the GEO satellites will likely delay the launch of the first satellite and increase costs. Specifically, the flight software that controls the health and status of the space vehicle was found to be inadequate. Correcting the problem may necessitate hardware and software changes that could, according to the Air Force, cause a minimum delay of 1 year and cost increases of up to $1 billion. The complexity of the GEO satellites is greater than that of the HEO sensors, and as of September 2007, only 20 percent of planned integration testing on the first satellite was complete. As such, there is high probability that further design flaws may be discovered, leading to more cost and schedule increases.

Production Maturity

We did not assess production maturity because the contractor does not collect statistical process control data. The program tracks and assesses production maturity by reviewing monthly test data and updates.

Other Program Issues

Recent program assessments by the Defense Contract Management Agency indicate cost and schedule variances are high risk, and worsening. The cost variance at completion is over $133 million, more than five times what we noted in our September 2007 report. Cost and schedule variances are expected to increase due to spacecraft rework, software redesign, and delays in integration and test activities. Software overall is considered high risk, due in part to the need for redesign.

The program continues to have problems with its flight software system and the pointing and control assembly software. DCMA reported that the flight software system is more than 50 percent behind schedule due to replanning and testing delays, and delivery of the pointing and control assembly software is about 45 percent behind schedule due in part to poor planning and execution, slips in rehearsal activities, and problems with the ground system. Software problems have already delayed the first GEO satellite launch by about a year.

While program officials are expected to implement the program within the existing funding profile, they acknowledge that management reserves set aside to fix unexpected problems will likely be depleted in early 2009. Subsequent problems may further affect cost and schedule.

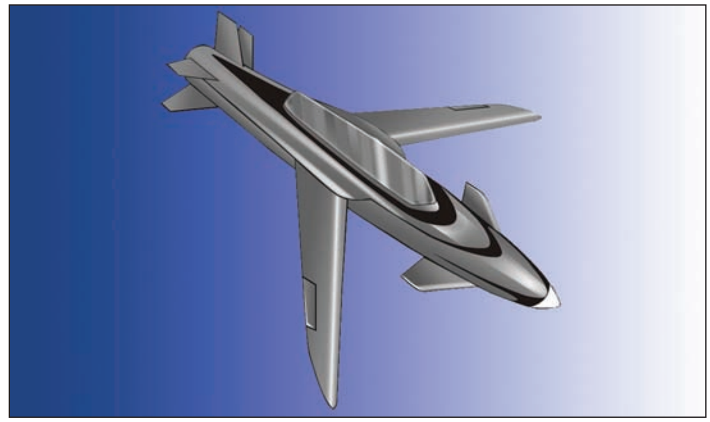
In December 2005, the Air Force was directed to begin efforts to develop a viable competing capability in parallel with the SBIRS program, previously known as the Alternative Infrared Satellite System (AIRSS). We reported in September 2007 that the Air Force had not positioned the AIRSS effort for success, because knowledge that could inform technology development and design was not fully leveraged. DOD agreed, revised the effort's development strategy, and gave it a new name--the Third Generation Infrared Surveillance (3GIRS). Sensor development under 3GIRS—now a follow-on to the SBIRS High program—continues, and sensor prototypes are slated for delivery around March 2008.

Agency Comments

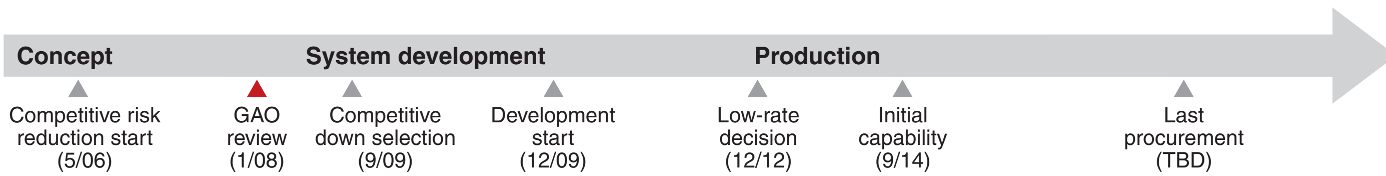
According to the program office, the first GEO space vehicle and payload have completed thermal vacuum testing, and the satellite is completing the first phase of a test to verify system interfaces and demonstrate connectivity. The principal SBIRS activity is completing first-time integration of a complex satellite, and is designed to discover issues. While the recent flight software issues are disappointing, the recovery plan presented in November 2007 to the Secretary of the Air Force and the Defense Acquisition Executive is expected to succeed. The Air Force further expects that correcting the problem will cost well below the original estimate of $1 billion dollars.

Small Diameter Bomb (SDB), Increment II

The Air Force's Small Diameter Bomb Increment II will provide the capability to attack mobile targets from standoff range in adverse weather. The program builds on a previous increment that provided capability against fixed targets. SDB II will add capability for multiple kills per pass, multiple ordnance carriage, near-precision munitions, and reduced munitions footprint. SDB II will be installed on the Air Force F-15E and the Navy and Marine Corps Joint Strike Fighter, and is designed to work with other aircraft, such as the F-22A.



Source: SDB II Program Office.



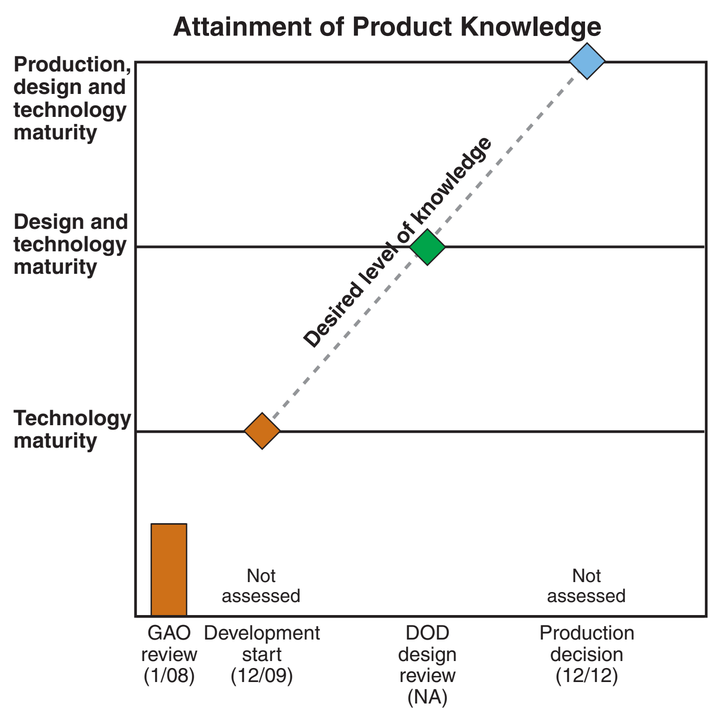
Program Essentials

Prime contractor: Boeing, Raytheon
Program office: Eglin AFB, Fla.
Funding needed to complete:
R&D: $627.8 million
Procurement: TBD
Total funding: $627.8 million
Procurement quantity: 12,000

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$765.4	NA
Procurement cost	NA	TBD	NA
Total program cost	NA	TBD	NA
Program unit cost	NA	TBD	NA
Total quantities	NA	12,046	NA
Acquisition cycle time (months)	NA	57	NA

Two of the five critical technologies for SDB II are currently in use on legacy Air Force and Navy systems. All technologies are expected to be nearing full maturity by development start in December 2009. In May 2006, the Air Force awarded competitive risk-reduction contracts to Boeing and Raytheon. The 42-month risk reduction phase is expected to allow the contractors to further develop the immature technologies. The contractors will compete for the system development and demonstration contract, which the program plans to award in December 2009. Each competing contractor is attempting to reach critical design review-level maturity. If achieved, this will allow the program to focus development efforts on qualification, validation, and testing. The first SDB II delivery is expected in fiscal year 2014.



SDB II Program

Technology Maturity

While the program office reports that two of the technologies are mature, that assessment refers to their use on legacy Air Force and Navy systems. The technologies' application to SDB II-specific requirements still requires additional development work. Three other technologies, the multimode seeker, net-ready data link, and payload (warhead and fuze), also need further development. According to program officials, the seeker will be the most challenging technology to demonstrate due to the complexity of the algorithms it will require and the need to package the multi-mode seeker into a small volume. The program's technology levels were assessed prior to beginning the risk reduction phase, and their status will not be updated until the program selects a single contractor design in December 2009. The program expects that each critical technology will be mature or approaching full maturity when the program begins system development and demonstration, regardless of the winning contractor.

Program officials plan to mature these technologies through extensive early testing using modeling and simulation techniques, and relying on other programs that have used the same or similar technologies. Each contractor will conduct these activities separately. In order to select a winning design, the program plans to evaluate the level of technology maturity achieved by each contractor during the risk reduction phase.

Design Stability

The two SDB II contractors are competing under separate risk reduction contracts. One contractor will be selected at the end of the risk reduction phase for the system development and production efforts. Specific details pertaining to each contractor's current design are competition sensitive and contractor proprietary. The program office utilizes a variety of program milestones and technical reviews to assess each contractor's design stability. The program office will further assess the contractors' progress through interim feedback sessions. Additionally, the program office participates in contractor risk reviews on a recurring basis to maintain insight into the system's current design maturity. In order to maximize their chance of being selected for the design and prodution contracts, the competing contractors are attempting to reach critical design review level maturity. If achieved, this will reduce system design risk carried forward into the system development and demonstration phase.

Other Program Issues

The government plans to procure the SDB II based on contractor-developed and government-approved system performance specifications. The requirements in the risk reduction contracts are performance-based, whereby each contractor must meet a set of objectives stated in the contract. As such, the contractors will control their own activities, with the government maintaining insight and leveraging the competitive environment to mitigate risk. Each contractor will submit system performance specifications as part of its offer to the government for system development. These specifications become contractually binding once a single contrator is selected in fiscal year 2009. At that time, the contractor will be accountable for system performance. Accordingly, the contractor is responsible not only for the design of the weapon system, but also for planning the developmental test and evaluation program to verify the system performance. The government will assess the contractor's verification efforts for adequacy before three major decision points: award of the low-rate production contract, declaration that the system is ready for dedicated operational test, and award of the full-rate production contract after the beyond-low-rate production assessment.

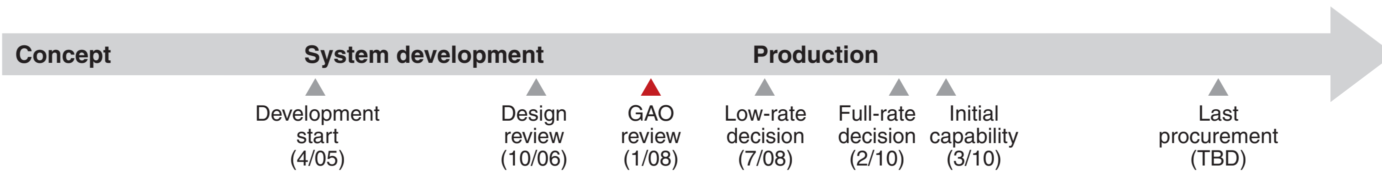
Agency Comments

In commenting on a draft of this assessment, the Air Force concurred with the information presented and provided technical comments, which were incorporated as appropriate.

Sky Warrior Unmanned Aircraft System (UAS)

The Army expects its Extended Range Multi-Purpose Unmanned Aircraft System, Sky Warrior, to fill a capability gap for an unmanned aircraft system at the division level. The system will include 12 aircraft, ground control stations, ground and air data terminals, automatic takeoff and landing systems, and ground support equipment. The Army plans for Sky Warrior to operate alone or with other platforms such as the Apache helicopter and perform missions including reconnaissance, surveillance, and target acquisition and attack.

Source: General Atomics Aeronautical Systems, Inc.



Program Essentials

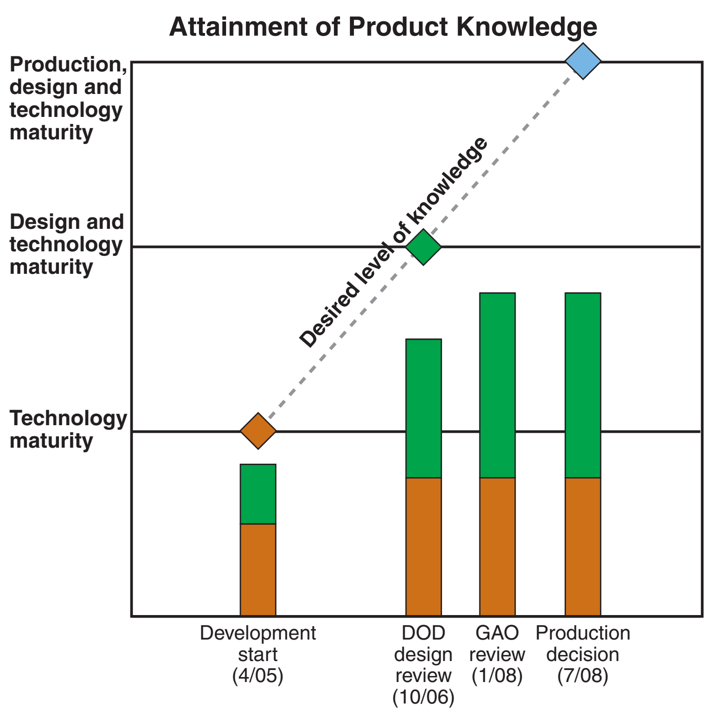
Prime contractor: General Atomics
Program office: Huntsville, Ala.
Funding needed to complete:
- R&D: $111.3 million
- Procurement: $1,463.1 million
- Total funding: $1,649.4 million
- Procurement quantity: 11

Program Performance (fiscal year 2008 dollars in millions)

	As of 04/2005	Latest 08/2007	Percent change
Research and development cost	$327.5	$375.0	14.5
Procurement cost	$636.9	$1,161.6	82.4
Total program cost	$964.2	$1,536.7	59.4
Program unit cost	$192.836	$128.055	-33.1
Total quantities	5	12	140.0
Acquisition cycle time (months)	50	59	18.0

Development and procurement costs and quantities shown are from program inception through fiscal year 2015.

The maturity of Sky Warrior's four critical technologies remains the same as reported last year, with two mature critical technologies and two nearing maturity. The program office anticipates all technologies will be mature by the time of production start, currently scheduled for August 2008. There are backup technologies in place should the technologies not mature as planned, but their use would result in a less capable system. Program officials stated that 96 percent of drawings have been released to manufacturing. However, the total number of drawings increased by over 37 percent from the program office's original projection at design review in October 2006. Program officials indicated that the increase largely resulted from requirements changes and redesign. DOD recently directed the Sky Warrior and Predator programs be combined into a single program.



Sky Warrior UAS Program

Technology Maturity

Two of Sky Warrior's four critical technologies—the heavy fuel engine and the automatic takeoff and landing system—are mature. The other two critical technologies—the Ethernet and the tactical common data link—are nearing maturity. The Sky Warrior program office expects they will be fully mature by the production start planned for August 2008.

The Ethernet is expected to provide communications between Sky Warrior aircraft and ground control stations as well as interoperability with other Army aviation platforms. Although the program office considers the Ethernet a proven technology, there are no unmanned systems to date that have employed it in the same way it will be used on the Sky Warrior. The data link has been demonstrated on the Air Force's Predator A unmanned aircraft system, but it has not yet been fielded on any unmanned aerial vehicle.

The program office has technologies in place as backups for the Ethernet and data link, but it does not anticipate their use. If it became necessary to use the backups, they would result in a less capable system. Backups for the data link are not mature or have slower data transmission rates.

Design Stability

Program officials stated that they have released 96 percent of drawings to manufacturing. However, the Sky Warrior's design has proven more difficult to mature than anticipated. The program office now anticipates a total of 4,428 drawings, over 37 percent more than the total expected at the time of the design review in October 2006.

According to program officials, several factors contributed to the increased number of drawings. These include reliability and redundancy improvements to the aircraft, requirement changes due to the Sky Warrior's migration from a military intelligence asset to an aviation asset, and redesign of the system's ground control station.

Production Maturity

We could not assess Sky Warrior's production maturity because the contractor does not use statistical process control as its metric. Instead, the contractor employs global technology standards per the International Standards Organization as its method for monitoring, controlling, and improving processes. The Sky Warrior program office stated that this approach is acceptable because Sky Warrior production is relatively low volume, and the contractor generally employs nearly 100 percent testing of all critical items.

Other Program Issues

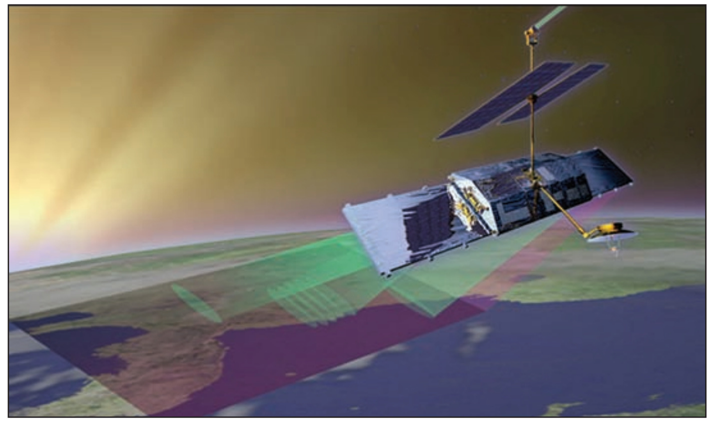
In September 2007, DOD issued a memorandum directing that the Predator and Sky Warrior programs be combined into a single acquisition program in order to achieve common development, procurement, sustainment, and training activities. The memo indicated that the two programs would migrate to a single contract by October 2008. According to Sky Warrior program officials, the impact of this direction on the program is not yet known because all aspects of the merger are still being determined.

Agency Comments

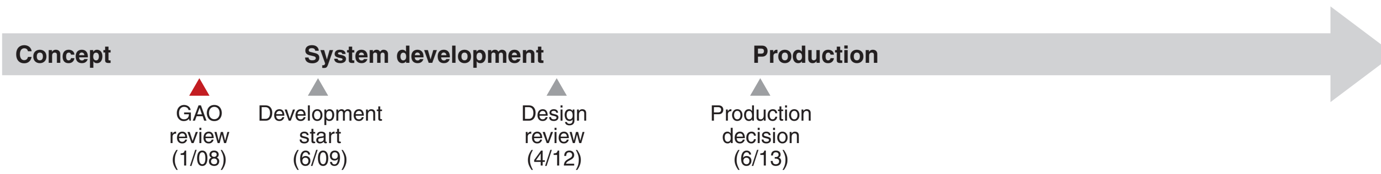
The Sky Warrior program office stated that the majority of the increase in drawing numbers resulted from requirements changes as well as technology improvements for enhancing system performance. The office indicated that it believes Sky Warrior was designed in a reasonable amount of time once final requirements were decided, and that it does not feel the system design was more difficult to mature than anticipated. Additionally, the office noted that although the Sky Warrior contractor does not use statistical process control to assess production maturity, the office itself employs measurements for that purpose. Those measurements include design stability, infrastructure tooling, test equipment, facilities, materials and personnel training, and process capability.

Space Radar (SR)

DOD and the intelligence community are collaborating to develop a single common radar system to provide global, persistent, all-weather, day and night, intelligence, surveillance, and reconnaissance capabilities, particularly in denied areas. As envisioned by the program office, SR is to consist of a constellation of low-earth-orbiting satellites, ground systems, and communications network, and would generate large volumes of radar data for transmission to ground-, air-, ship-, and space-based platforms. We assessed the space segment.



Source: Space Radar Integrated Program Office.



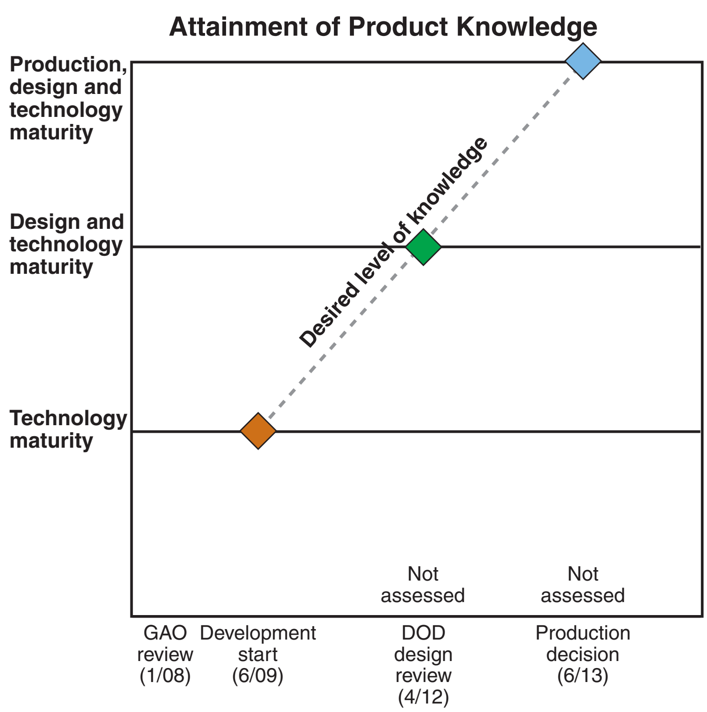
Program Essentials

Prime contractor: TBD
Program office: Chantilly, Va.
Funding needed to complete:
- R&D: TBD
- Procurement: TBD
- Total funding: TBD
- Procurement quantity: 8

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$12,219.5	NA
Procurement cost	NA	$5,290.6	NA
Total program cost	NA	$19,400.4	NA
Program unit cost	NA	$1,940.041	NA
Total quantities	NA	10	NA
Acquisition cycle time (months)	NA	NA	NA

The SR program is supported by five critical technologies that remain immature. The program office is focusing its efforts on technology risk reduction and concept development activities. The Integrated Program Office has made several changes to the acquisition approach, including those related to cost and schedule, to address continuing concerns about the affordability of SR. The program also revised its development start date from the last quarter of 2008 to the third quarter of 2009, an 8-month extension. Launch of the first SR satellite is scheduled for fiscal year 2016. Design and production maturity could not be assessed because SR has not begun product development.



SR Program

Technology Maturity

The five critical technologies that we reported in our last assessment of SR have not changed and remain immature. The technologies are the advanced analog/digital converter, integrated radio frequency assembly, low earth orbit laser communication terminals, surface moving target indication processing algorithms, and open ocean surveillance processing algorithms. According to program office officials, these technologies will continue to evolve and reflect an initial attempt to define what is critical to the program. Two prime contractors were awarded risk reduction contracts to help mature SR's critical technologies. These contractors are competing for SR's system development contract and may have different approaches in how they plan to provide a space radar capability, which could result in a different set of critical technologies than currently defined by the program office. The program office expects all critical technologies to be mature when the product development phase begins in the third quarter of 2009. However, as we reported in August 2007, the program office will need to gain significant knowledge on these technologies to be well positioned for success by program start.

Other Program Issues

In January 2005, DOD and the intelligence community committed to pursue a single space radar capability and have worked to establish a key funding agreement that addresses short-term cost sharing responsibilities. However, as we reported in August 2007, SR lacks a long-term funding agreement beyond fiscal year 2013, adding uncertainty to the ability of DOD and the intelligence community to afford expensive programs such as SR. Additionally, recent changes have occurred in the location of the SR budget—shifting from unclassified Air Force accounts to a DOD classified program account. Specifically, from the inception of the SR program, its budget and funding resided in unclassified Air Force accounts. However, starting in fiscal year 2008, the SR budget and funding were moved to the Defense Reconnaissance Support Activities budget, and are now classified. The SR program office estimates the cost of developing, producing, and operating the system through 2027 to range from $20 billion to $25 billion, although the cost is subject to change based on evolving program requirements.

While the program office continues to remain focused on developing a single space radar system to meet user needs, other challenges remain. The program office told us that it is adjusting its acquisition approach to better balance capability, affordability, and risk through incrementally evolving the SR capability. For fiscal year 2008, the program office will focus on risk reduction and technology maturity activities as well as continuing with requirements definition, modeling and simulation, and joint systems engineering to ensure affordability and achievability of the first SR satellites. The program office is continuing its progress toward fully defining program requirements by June 2009. However, the program has experienced some schedule delays, and as we reported in August 2007, the SR program may not have planned enough time for design, integration, and production activities, which could result in further schedule delays. Our analysis showed that the planned acquisition time frame from program start to initial launch capability is shorter than what DOD has achieved or estimated for other complex satellite systems.

At the time of this printing, we obtained an official statement from the National Reconnaissance Office of Strategic Communications/Office of Corporate Communication that DOD and the Intelligence Community have decided not to pursue the Space Radar Program of Record, citing that this program is not affordable and will be restructured immediately.

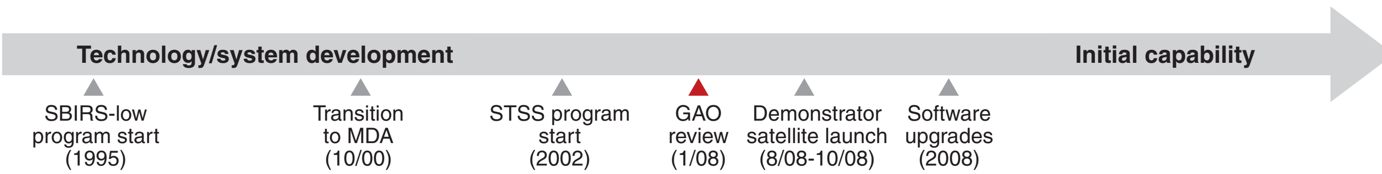
Agency Comments

In commenting on a draft of this report, the Air Force stated that the SR Integrated Program Office is currently adjusting SR's acquisition approach and is moving toward a progressive capabilities acquisition strategy that better balances affordability with incremental capability evolution. This new approach is expected to affect the current fiscal year 2008 and beyond program plan. The 2008 Defense Appropriations Conference report anticipates a revised plan in early calendar year 2008, and the SR Integrated Program Office is working toward that goal. The Air Force also provided technical comments, which were incorporated as appropriate.

Space Tracking and Surveillance System (STSS)

MDA's STSS element is being developed in incremental, capability-based blocks designed to track enemy missiles throughout their flight. The initial increment is composed of two demonstration satellites built under the Space Based Infrared System Low program. MDA plans to launch these satellites in 2008 to assess how well they work within the context of the missile defense system. The agency is also studying improvements to the STSS program, and it will be building next generation satellites. We assessed the two demonstration satellites.

Source: Northrop Grumman Corporation.



Program Essentials

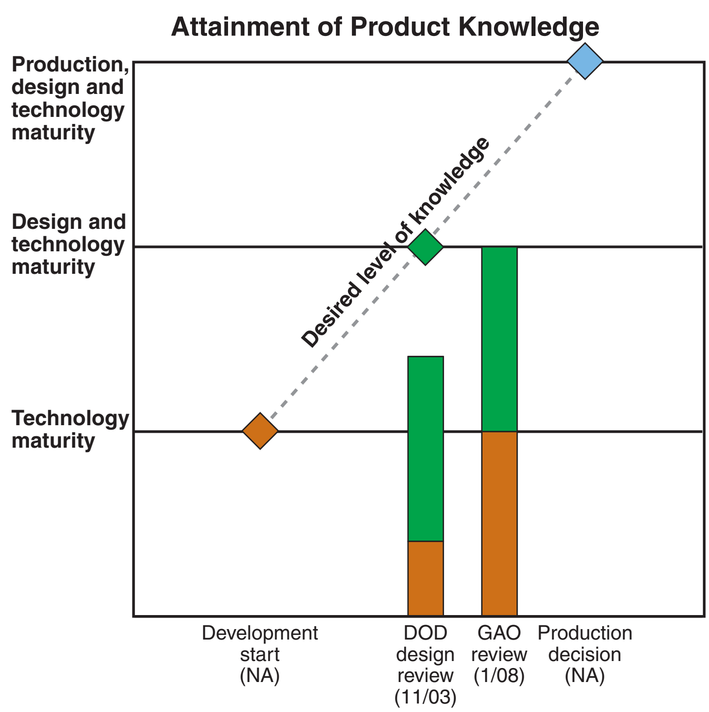
Prime contractor: Northrop Grumman Space Technology
Program office: El Segundo, Calif.
Funding FY08-FY13:
- R&D: $3,002.7 million
- Procurement: $0.0 million
- Total funding: $3,002.7 million
- Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 02/2007	Percent change
Research and development cost	NA	$6,591.2	NA
Procurement cost	NA	NA	NA
Total program cost	NA	$6,591.2	NA
Program unit cost	NA	TBD	NA
Total quantities	NA	2	NA
Acquisition cycle time (months)	NA	NA	NA

Columns include known costs and quantities from the program's inception through fiscal year 2013.

All of the STSS program's five critical technologies are mature. The STSS design appears otherwise stable, with all drawings released to manufacturing. However, a thermal vacuum test on the first space vehicle to assess the ability of the satellite to operate in the cold vacuum of space took twice as long as scheduled, problems with STSS integration caused the contractor to overrun its fiscal 2007 budget, and higher priorities at the United Launch Alliance site moved the program down on the launch priority list. These factors have delayed the STSS launch until possibly as late as October 2008. However, this date is dependent upon the successful integration of the sensor payloads with the satellite platforms, sufficient fiscal year 2008 funding to support the new launch date, and launch site availability.



STSS Program

Technology Maturity

All five critical technologies—satellite communication cross-links, onboard processor, acquisition sensor, track sensor, and the single-stage cryocooler—are mature. The last two technologies—track sensor and the single-stage cryocooler—reached maturity when the thermal vacuum testing on the first satellite's payload was completed in February 2006.

Design Stability

The STSS program's design is stable, with all drawings released to manufacturing. When the STSS program started in 2002, design drawings and the satellite components for the partially built satellites from the Space Based Infrared System Low effort were released to manufacturing. By the time STSS went through its design review in November 2003, the program office had released all subsequent design drawings.

Other Program Issues

The launch of the demonstration satellites was delayed from 2007 to 2008 for several reasons. Since the satellites are legacy hardware built under the former Space Based Infrared System Low program, there are no spares available for testing, and the need to handle parts carefully to avoid damage caused schedule delays. In addition, a number of interface issues arose during thermal vacuum testing, causing the test to take twice as long as scheduled. Further delays occurred when problems with component hardware were recognized and when the launch site encountered schedule conflicts.

The STSS contractor overran its fiscal year 2007 budget, and as such, fiscal year 2007 funds were not available to launch the satellites. The program office subsequently planned to launch the satellites during the early part of fiscal year 2008, but the launch pad was already occupied. Program officials did not want to commit to a new launch date until the thermal vacuum testing for the second space vehicle was completed. The program office is planning to have the satellites ready to launch in July 2008, in time for a launch window in August 2008, but a GPS satellite launch is scheduled for that time and the United Launch Alliance site has announced it cannot support two simultaneous Delta II missions. If the low STSS launch priority status is not upgraded, the new launch date may be as late as October 2008. However, as currently programmed, the fiscal year 2008 budget does not have sufficient funds to support the launch.

Despite delays in hardware and software testing and integration, other parts of the STSS program have proceeded according to schedule. Lessons learned from the thermal vacuum test for the first satellite in these areas facilitated the completion of the second satellite's thermal vacuum test, which was complete in November 2007. In addition, procedures for ground, flight, maintenance, and contingency, testing have been developed and certified. The operations crew is moving toward Final Readiness Certification and plans a March 2008 mission "dress rehearsal" that will certify that the crew is ready to operate STSS. Finally, the second part of the acceptance test for the STSS ground component was completed in September 2007, and the command and control capabilities of the ground segment will be demonstrated in a system operability demonstration.

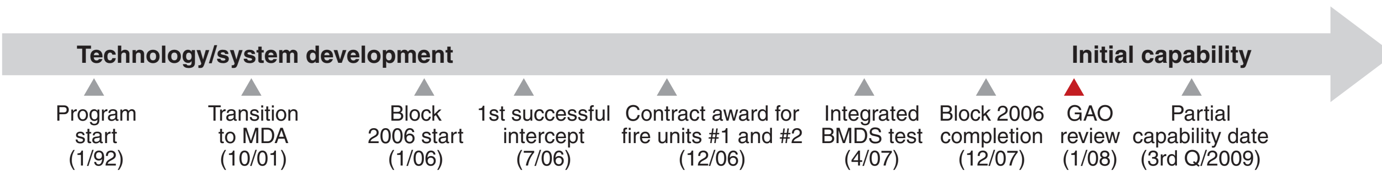
Agency Comments

In commenting on a draft of this assessment, MDA concurred with the information provided in this report.

Terminal High Altitude Area Defense (THAAD)

MDA's THAAD element is being developed in incremental, capability-based blocks to provide a ground-based missile defense system able to defend against short- and medium-range ballistic missile attacks. THAAD will include missiles, a launcher, an X-band radar, and a fire control and communications system. We assessed the design for the Block 2008 initial capability of one fire unit that MDA plans to deliver to the Army in fiscal year 2009 for limited operational use.

Source: THAAD Project Office.



Program Essentials

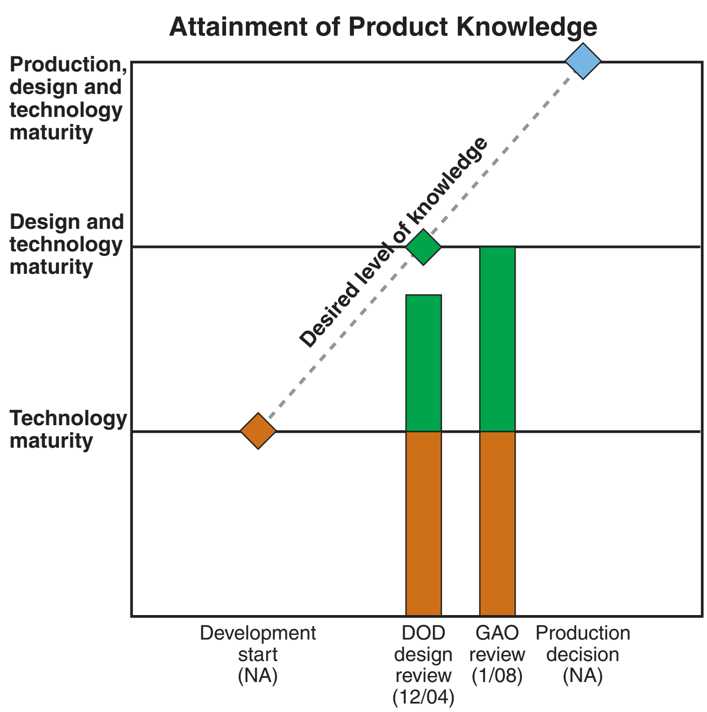
Prime contractor: Lockheed Martin
Program office: Huntsville, Ala.
Funding FY08-FY13:
R&D: $4,136.7 million
Procurement: $0.0 million
Total funding: $4,136.7 million
Procurement quantity: 0

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$15,561.4	NA
Procurement cost	NA	0	NA
Total program cost	NA	$15,561.4	NA
Program unit cost	NA	NA	NA
Total quantities	NA	NA	NA
Acquisition cycle time (months)	NA	NA	NA

Columns include known costs and quantities from the program's inception through fiscal year 2013.

THAAD's technologies are mature and its design is generally stable, with 94 percent of its design drawings released. During Block 2006, the program continued to mature THAAD's design and expects to deliver a limited operational capability during Block 2008. In fiscal year 2007, the program successfully conducted three of four scheduled tests. Two tests resulted in intercepts of unitary targets at different levels of the atmosphere. A third test verified the interceptor's components inside the atmosphere. According to program officials, the fourth test was delayed until fiscal year 2008 due to quality assurance issues, along with target and range availability. Additionally, the THAAD program is overrunning its fiscal year 2007 cost budget by $91.1 million dollars. Rework and design complexities are the primary reasons for the cost increase.



THAAD Program

Technology Maturity
Program officials assessed all of THAAD's critical technologies as mature. All of these technologies are included in four major components: the fire control and communications component, the interceptor, the launcher, and the radar.

Design Stability
Approximately 94 percent of THAAD's 12,282 drawings have been released, indicating that THAAD's design is stable. The number of drawings increased from a 2003 design review because previously excluded drawings were added for radar components, as well as for the missile component.

The THAAD program rebaselined flight plans in fiscal year 2007 when MDA directed the program to eliminate three flight tests from the test plan because of budget pressures and limited target and range availability. According to program officials, key objectives from the deleted flight tests will be incorporated into other flight tests.

THAAD officials originally expected to complete four flight tests prior to the end of fiscal year 2007 but instead were only able to conduct three. Two tests resulted in successful intercepts of "Scud"-type targets at different levels of the atmosphere, while the third test successfully demonstrated component capability in a high-pressure environment. The third test was the lowest altitude fly-out of a THAAD interceptor to date. The fourth flight test has been delayed due to a quality control issue with the interceptor and range and target availability.

Production Maturity
We did not assess THAAD's production maturity because the program is only delivering test units until fiscal year 2009. MDA has purchased two fire units while simultaneously conducting developmental activities. The first will be delivered in fiscal year 2009, with the second expected to become available during fiscal year 2010. Prior to a production decision, the program office plans to assess production maturity using risk assessments and verification reviews to ensure that the contractor's processes are repeatable and of high quality.

Other Program Issues
In fiscal year 2007, THAAD completed the transition of its test facilities from the White Sands Missile Range to the Pacific Missile Range Facility. This allows tests of the THAAD interceptor that were previously constrained by space limitations at the White Sands Range. Additionally, the transition enables other MDA elements to participate in flight tests. For example, one test in fiscal year 2007 utilized communications with the Aegis system as well as the communication link with the Command, Control, Battle Management and Communications system.

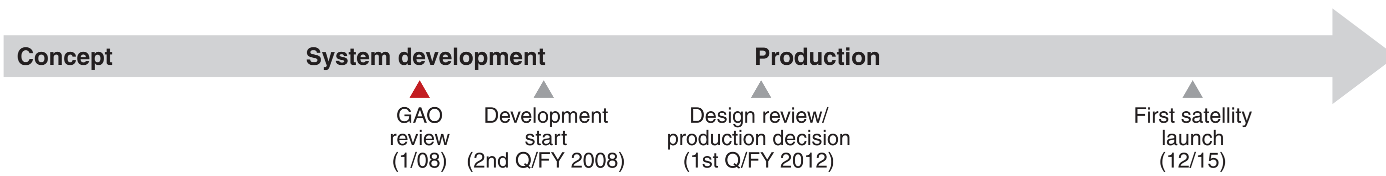
Hardware issues and technical problems are causing the program's prime contractor to experience negative cost variances. The variances can primarily be attributed to the missile, launcher, and system test components associated with the design and fabrication of the launch and test support equipment. As of September 2007, the THAAD program was overruning its fiscal year 2007 cost budget by $91.1 million.

Agency Comments
MDA provided technical comments, which were incorporated where appropriate.

Transformational Satellite Communications System (TSAT)

The Air Force's TSAT system will provide high-data-rate military satellite communications services to DOD users worldwide, including mobile tactical warfighting elements. The system will provide survivable, jam-resistant, global, secure, and general-purpose radio frequency and laser cross-links with other air and space systems. The TSAT system will consist of a constellation of five satellites, plus a spare, a network management architecture, and a ground control system. We assessed the satellites and the ground system.

Source: TSAT Program Office.



Program Essentials

Prime contractor: Lockheed Martin Integrated Systems Solutions (TMOS)
Program office: El Segundo, Calif.
Funding needed to complete:
R&D: TBD
Procurement: TBD
Total funding: TBD
Procurement quantity: 4

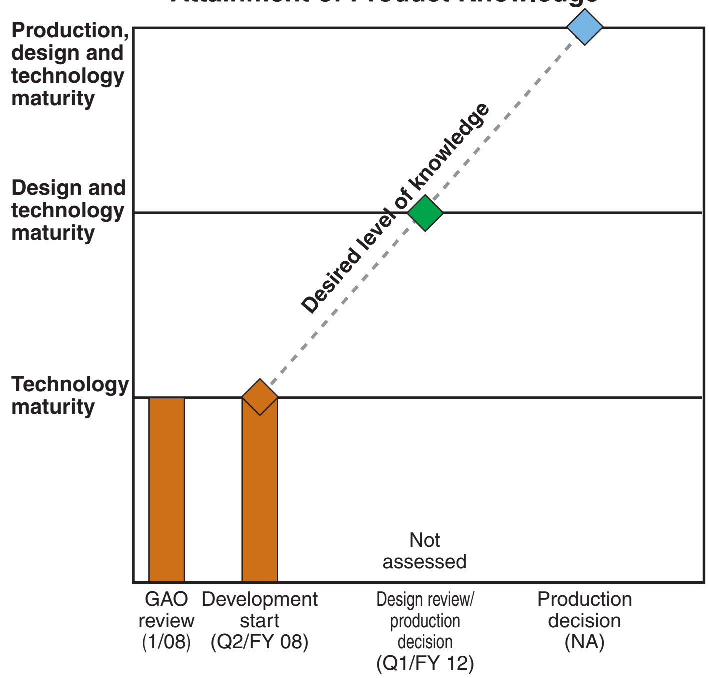
Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 08/2007	Percent change
Research and development cost	NA	$11,778.8	NA
Procurement cost	NA	$194.9	NA
Total program cost	NA	$12,035.3	NA
Program unit cost	NA	$2,005.888	NA
Total quantities	NA	6	NA
Acquisition cycle time (months)	NA	99	NA

Columns include costs and quantities budgeted as of fiscal year 2008.

According to the program office, all seven critical technologies are mature. In April 2007, the TSAT program completed the systems design review. Also, the maturity of the critical technologies was validated by an independent technology readiness assessment in June 2007. A Defense Space Acquisition Board is scheduled to convene in the second quarter of fiscal year 2008 to determine if the overall TSAT program is ready to enter the development phase. The first satellite launch has been delayed by over 12 months due to a DOD decision that includes a budget reduction to the TSAT program over concerns about an optimistic schedule and synchronization with other programs in the Global Information Grid.

Attainment of Product Knowledge



TSAT Program

Technology Maturity

On the basis of subsystem-level tests conducted in 2007 by the contractors competing for the space segment contract, and verified by an independent contractor, the Air Force determined that all of the TSAT program's seven critical technologies are mature. Since our last assessment, dynamic bandwidth and resource allocation, protected bandwidth efficient modulation waveforms, and single-access laser communication have reached maturity.

Other Program Issues

According to program officials, the TSAT program had invested over $2 billion by the end of fiscal year 2007 for research, development, and risk reduction activities. However, information on cost, design stability, production maturity, or satellite software development metrics will not be available until the TSAT program formally enters the development phase and awards the space segment contract. At that time, the program should also have an approved Acquisition Program Baseline that includes validated requirements, total cost estimates for the first block of satellites, and key milestone dates.

In December 2006, DOD issued a program decision memorandum that reduced the TSAT program budget by $232 million for fiscal year 2008. According to DOD officials, the budget reduction was due to concerns about an overly optimistic TMOS (TSAT Mission Operations System—the ground control system that will provide network management and the overall network architecture), software development schedule, and the long-term synchronization of TSAT with the terrestrial portion of the Global Information Grid, including terminals and teleports. As a result, all TSAT satellite launches were delayed by at least one year. The first launch was delayed from October 2014 to late 2015.

The Air Force's fiscal year 2008 TSAT budget request included $481.9 million to award a contract to begin satellite development in the third quarter of fiscal year 2008. According to DOD officials, the program is scheduled to undergo a program review approximately 8 months after space segment contract award to synchronize the space segment with TMOS and systems engineering and integration efforts in order to establish a TSAT-wide baseline.

Agency Comments

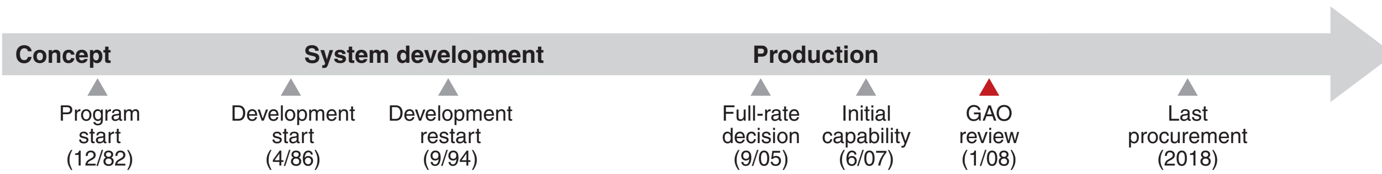
In commenting on a draft of this assessment, the Air Force stated that since the last assessment, the TSAT program Key Decision Point B (KDP-B) Defense Space Acquisition Board has been postponed into the second quarter of fiscal year 2008. The postponement will result in the delay to the space segment contract award to no earlier than the third quarter of fiscal year 2008.

According to Air Force officials, during the past year, TSAT has successfully matured the key technologies and completed the TSAT system design review. In accordance with National Security Space Acquisition Policy 03-01, the independent technology readiness assessment, Independent Program Assessment, and Independent Cost Estimate required prior to KDP-B were completed in mid-2007.

V-22 Joint Services Advanced Vertical Lift Aircraft

The V-22 is a tilt rotor aircraft developed for Marine Corps, Air Force, and Navy use. The MV-22 will replace Marine Corps CH-46E helicopters. The MV-22 Block B variant addresses reliability and maintenance concerns of earlier variants. The Block B variant was deployed to Iraq in September 2007. The Special Operations CV-22 variant is undergoing its first operational tests and is scheduled for fielding in 2009. Our assessment focuses on the MV-22 Block B but relates to the CV-22 due to common design and manufacturing processes.

Source: U.S. Navy.



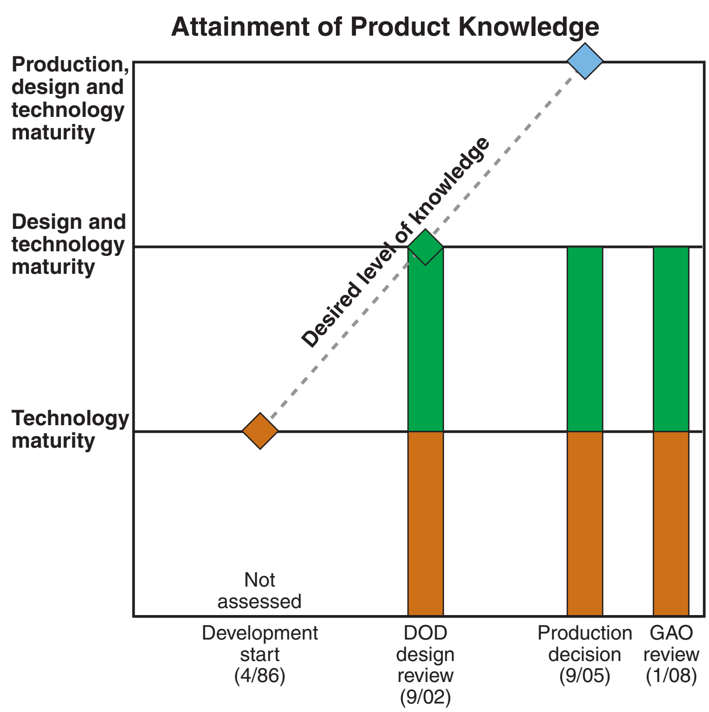
Program Essentials

Prime contractor: Bell-Boeing
Program office: Patuxent River, Md.
Funding needed to complete:
R&D: $546.9 million
Procurement: $27,593.4 million
Total funding: $28,203.0 million
Procurement quantity: 345

Program Performance (fiscal year 2008 dollars in millions)

	As of 04/1986	Latest 12/2006	Percent change
Research and development cost	$4,033.2	$12,473.9	209.3
Procurement cost	$33,822.9	$42,087.5	24.4
Total program cost	$38,080.5	$54,767.3	43.8
Program unit cost	$41.709	$119.579	186.9
Total quantities	913	458	-49.8
Acquisition cycle time (months)	117	295	152.1

A number of design changes to the MV-22 Block B are under review, including a fix for hydraulic fluid leaks that have contributed to engine fires; a new troop seat design; reliability improvements for desert or icy environment operations; and cost reduction initiatives. The program office believes these design changes will address safety, reliability, and performance concerns. The proposed multiyear production contract would increase annual production rates but include fewer aircraft than expected. Aircraft continue to be accepted with deviations and waivers, and the contractor's ability to produce aircraft at the higher rates is a concern, but it is being managed closely by the program office. Earlier Block A aircraft continue to be upgraded to the Block B design at a cost of $15 million to $20 million per aircraft, according to program officials.



V-22 Program

Technology and Design Maturity

The V-22 is being produced in blocks. Program officials state that, based on DOD criteria, Block A technologies are considered mature. Some Block A variants are being upgraded to the Block B configuration, which is the deployable configuration There are a number of design changes under review that could address safety, reliability, performance, and cost issues with the Block B design. For example, a newly designed crashworthy troop seat addresses deficiencies identified during testing in 2000. The new troop seats, which will be installed on new production aircraft, provide higher G-force load capabilities consistent with current G-force load requirements. Program officials state, however, that the aircraft structure was not designed to meet these new increased G-force load requirements and it is possible that the airframe's structural capability could be exceeded in certain crash scenarios. The exact difference between the seat loading and the airframe capability is being assessed to determine ways to strengthen the airframe to better match the higher G-force load capabilities of the troop seats now being installed.

Fires have recently occurred in the engine compartment due to leaking hydraulic fluid coming into contact with hot engine parts, forcing the program office to make design changes to components and couplings in that area. Program officials are investigating whether the contractor could make changes to the engine compartment drainage system or if all hydraulic lines could be removed completely from the engine compartments to keep this from occurring. In the near term, frequent inspections are being conducted to check for hydraulic leaks.

Program officials are also concerned that aircraft reliability and mission capability rates could be reduced when operating in desert environments such as Iraq, where it is now deployed, and in icy environments, such as Afghanistan. The effects of sand and dust on the aircraft systems and ice protection system maturity may affect mission capability rates. The program office states that both of these issues are being tracked and could result in design changes, especially as more maintenance experience is gained from deployment of the aircraft.

A number of engineering change proposals have been made that would lower unit recurring flyaway cost to a level the contractor believes is needed to generate foreign military sales. The program continues to investigate ways to reduce the procurement cost of the aircraft.

Production Maturity

In the Defense Appropriations and Authorization Acts for fiscal year 2007, Congress authorized and appropriated funds for the Navy to enter into a multiyear contract for the V-22, beginning with the fiscal year 2008 program year. Negotiations for a multiyear procurement contract are still under way. Original plans called for quickly increasing annual production to 42 aircraft per year—a rate that is substantially higher than the 11 aircraft per year the program was held to through fiscal year 2006. The highest annual production rate planned for the multiyear contract has since been decreased to 36 aircraft, and the total quantities were reduced from 185 to 167 aircraft. The V-22 program recognizes the challenges with increasing the annual production rate under the multiyear procurement contract, specifically the inherent challenge of producing the fuselage and wing at separate locations and then assembling them at a third site.

As reported in our last assessment, production aircraft continue to be conditionally accepted with deviation and waiver issues. These included erratic behavior of multifunction displays and anomalies during engine start. The multifunction display behavior was addressed with a mission computer software update that provided an alternative solution, but did not determine the root cause, as it could not be replicated in the lab. The engine start anomaly was addressed by design corrections. Also, new government-furnished troops seats, which meet current G-force load requirements, were not available for installation on all recently delivered aircraft.

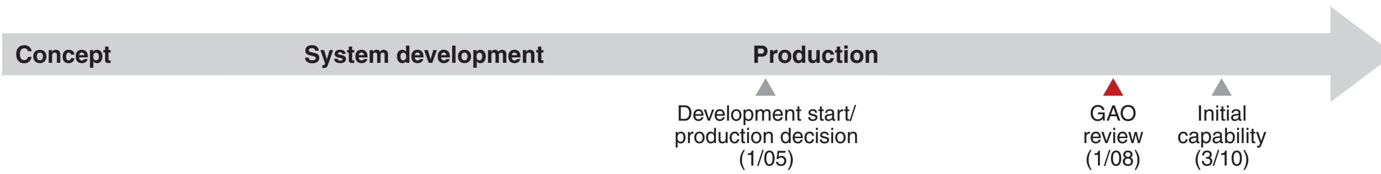
Agency Comments

In commenting on a draft of this assessment, the V-22 program office provided technical comments, which were incorporated where appropriate.

VH-71 Presidential Helicopter Replacement Program

The Navy's VH-71 will be a dual-piloted, multi-engine helicopter employed by Marine Helicopter Squadron One to provide safe, reliable, and timely transportation for the President and Vice President of the United States, heads of state, and others. When the President is aboard, it will serve as the Commander in Chief's primary command and control platform. The VH-71 will replace the VH-3D and VH-60N, and will be developed in two increments. We assessed Increment I and made observations on Increment II.

Source: Presidential Helicopters Program Office.



Program Essentials

Prime contractor: Lockheed Martin Systems Integration
Program office: Patuxent River, Md.
Funding needed to complete:
- R&D: $1,069.3 million
- Procurement: $2,342.1 million
- Total funding: $3,411.4 million
- Procurement quantity: 20

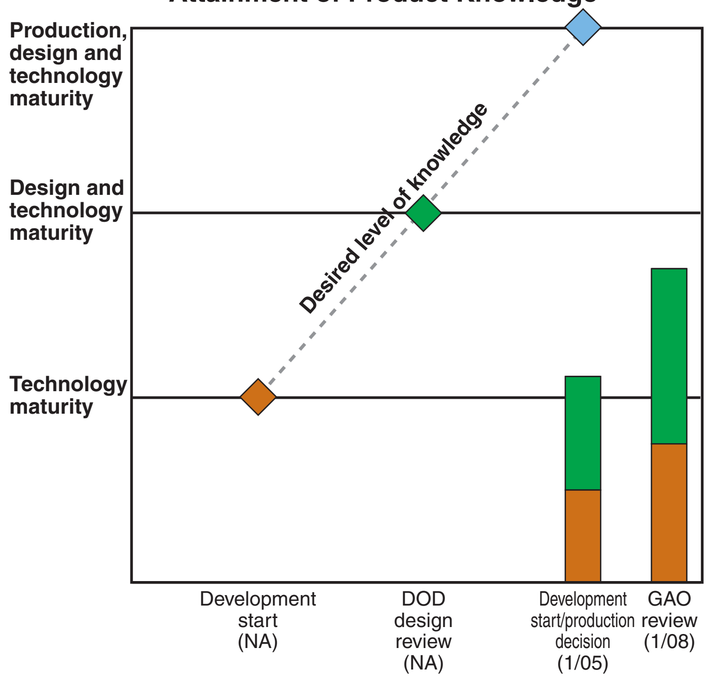
Program Performance (fiscal year 2008 dollars in millions)

	As of 02/2006	Latest 09/2007	Percent change
Research and development cost	$3,825.4	TBD	NA
Procurement cost	$2,409.3	TBD	NA
Total program cost	$6,415.1	TBD	NA
Program unit cost	$278.916	TBD	NA
Total quantities	23	TBD	NA
Acquisition cycle time (months)	57	TBD	NA

Increment I and II development and Increment I production are funded with R&D funding. The program is being restructured and cost and cycle time are expected to grow.

The VH-71 program began system development and committed to production without fully maturing technologies, achieving design stability, or demonstrating production maturity due to a high-risk schedule driven by White House needs. The program is approaching full technology maturity and design stability for Increment I. However, concurrency in design, testing, and production continues to put the program at risk for cost growth and schedule delays. Some Increment I performance requirements have been deferred to Increment II, and weight issues continue to drive performance risks. In 2006, the program office determined that the Increment II program was not executable. It is reassessing this increment and will be making cost, schedule, and performance trade-offs; further cost growth and schedule delays are expected. This graph depicts product knowledge for Increment I.

Attainment of Product Knowledge



VH-71 Program

Technology Maturity

The VH-71 program's two Increment I critical technologies, the Communication and Subsystem Processing Embedded Resource Communication Controller (CASPER) and Cockpit Control Display (CCD), were approaching maturity when the program began development and committed to production in January 2005. The program office now states the designation of these technologies as critical was erroneous because these systems presented integration, not maturity, risks. The CCD is now mature. However, the CASPER has not been demonstrated in a realistic environment. According to a program official, the CASPER has only been tested in a lab and has not been subjected to the movements and vibrations it will experience during flight. Our assessment does not include classified portions of this program.

The VH-71 program does not expect to identify any critical technologies for Increment II. However, the program office is tracking three items—an advanced blade design, voice-over Internet protocol security, and the automatic flight computer system—because of potential technology maturity concerns. According to the program office, these items are still in the early stages of development but are based on existing technologies or systems. For example, the basic technology of the advanced blade design is fielded on another helicopter, but the rotor disc is being increased in size from 45 feet to 64 feet, a change that could pose potential technology issues.

Design Stability and Production Maturity

In January 2005, the VH-71 program committed to the production of five aircraft without a final design or fully defined production processes. The program's August 2006 design review was held 10 months later than planned and did not meet the Navy's criteria for a successful system-level review. An additional design review took place in February 2007. Currently, 86 percent of the Increment I drawings are releasable to manufacturing. However, according to Defense Contract Management Agency officials, there are still changes being made to the design that affect the basic aircraft. There are approximately 30 to 40 new specification change notices per month, and that trend is not abating. While DCMA does not see this as a high number, it does point to continuing design changes, which may result in retrofitting of the five pilot production aircraft. Weight growth has negatively affected the projected performance of the Increment I aircraft and could affect the program's ability to meet the range requirement for Increment II. Concurrency in design, testing, and production, also continues to drive the risk of cost growth and schedule delays on the program.

Other Program Issues

The VH-71 program is currently in the midst of restructuring Increment II. Changes to this portion of the program could entail significant cost and schedule increases. Even before these changes, the cost of the VH-71 prime contract was projected to increase by over $1 billion. Earned value data from July 2007 showed that the estimated price of the contract increased almost $741 million dollars. According to the program office, there is an additional $300 million in out-of-scope work that has not yet been put on contract. The effect of these contract cost increases on the overall cost of the program will likely not be known until after the program has a new acquisition strategy. DOD officials have also stated that a critical Nunn-McCurdy breach is imminent for this program. However, a stop work order has been issued for Increment II development efforts, leaving future program direction and costs unknown at this time.

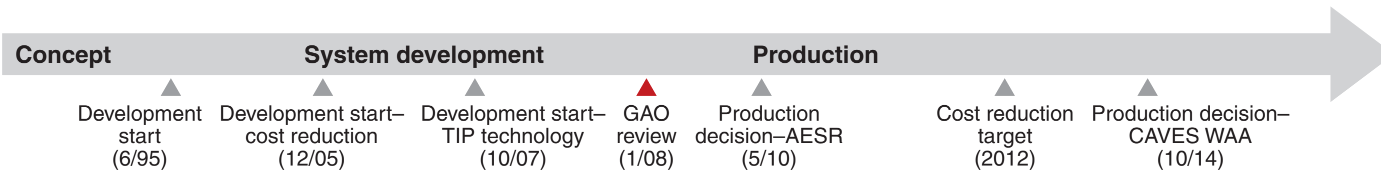
Agency Comments

In commenting on a draft of this assessment, the Navy stated that the VH-71 Increment I program is executing an accelerated schedule driven by an urgent White House need to replace existing aging assets. Concurrency in development, design, and production to meet the accelerated schedule is acknowledged as high risk and is part of the program's approved acquisition strategy. As noted in our assessment, the Navy said that program mitigation plans include conducting performance trade-offs by deferring Increment I requirements to Increment II with customer agreement. Performance trade-offs have been made, and an assessment of these trades along with program impacts on Increment II cost and schedule is ongoing. According to the Navy, the concurrency described in our assessment of Increment I design, testing, and production will be significantly reduced and/or removed in the revised Increment II program, which will follow a more typical acquisition approach.

Virginia-Class Submarine (SSN 774)

The Virginia-class attack submarine is designed to combat enemy submarines and surface ships, fire cruise missiles, and provide improved surveillance and special operation support to enhance littoral warfare. The Navy is working to reduce construction costs by about $400 million per ship by fiscal year 2012. The Technology Insertion Program (TIP) consists of three technologies designed to improve performance and lower construction costs of these ships. We assessed the status of the Navy's cost reduction efforts and progress of the TIP.

Source: General Dynamics Electric Boat.



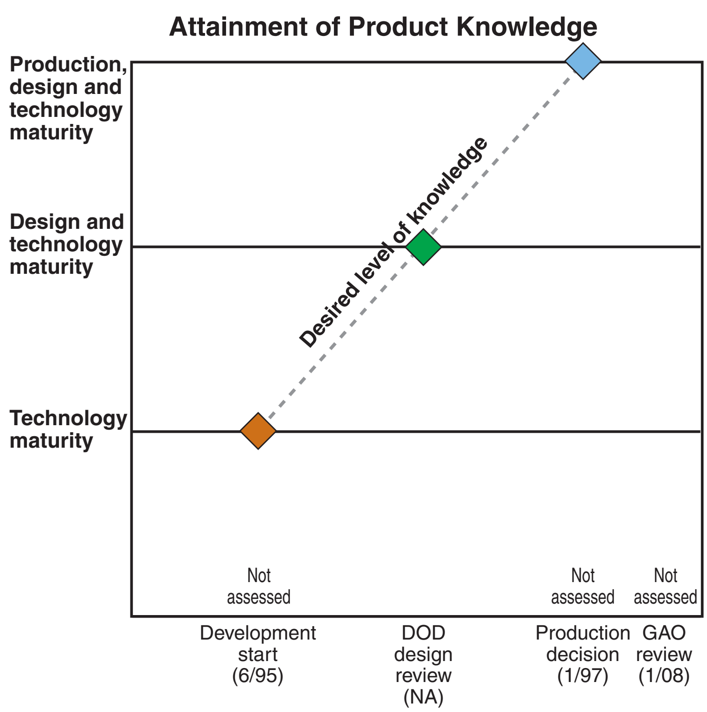
Program Essentials

Prime contractor: General Dynamics, Electric Boat
Program office: Washington, D.C.
Funding needed to complete:
R&D: $1,228.2 million
Procurement: $49,611.9 million
Total funding: $50,840.1 million
Procurement quantity: 21

Program Performance (fiscal year 2008 dollars in millions)

	As of 06/1995	Latest 12/2006	Percent change
Research and development cost	$4,283.9	$6,119.1	42.8
Procurement cost	$53,123.9	$75,132.2	41.4
Total program cost	$57,407.3	$81,251.4	41.5
Program unit cost	$1,913.578	$2,708.378	41.5
Total quantities	30	30	0.0
Acquisition cycle time (months)	134	148	10.4

The program's near term efforts are focused on cost reduction, with a goal of ordering and building two submarines per year at a cost of $2 billion each (in 2005 dollars) in 2012. The Navy seeks to reduce construction costs by introducing more efficient production processes, developing cost effective design changes, and leveraging economies of scale. According to the Navy, about 79 percent of the necessary savings for construction and design have been achieved. However, a recent cost analysis indicated that the Navy may have difficulty achieving its cost target. The Technology Insertion Program was delayed to reduce cost and schedule risk, and further evaluate technologies. The TIP consists of three systems: Advanced Electromagnetic Signature Reduction, Advanced Sail, and Conformal Acoustic Velocity Sensor Wide Aperture Array, the first of which is scheduled for insertion in 2010.



Virginia Class Submarine Program

Technology Maturity

The Advanced Electromagnetic Signature Reduction (AESR) is a software package that uses improved algorithms to continuously monitor and recalibrate the submarine's signature. Similar software has been demonstrated in British submarines, but the technology is considered immature because modifications to the software will require additional testing. Software modification is expected to begin in October 2008, and insertion is scheduled for fiscal year 2010. Once development is complete, AESR will be retrofitted on all Virginia-class submarines.

The Advanced Sail is a redesign of the structure that sits atop the main body of the submarine. The new design provides expanded space to carry weapons, anti-submarine systems, and communications systems external to the hull. Development began in June 2006, and the composite material used to construct the sail has been demonstrated under a separate program. However, insertion of the Advanced Sail has been delayed because related costs may exceed budget limits. A new bow design that also adds payload space for weapons and systems will be used on submarines starting in fiscal year 2009. The Navy will await testing of the new bow before completing a new sail design.

The Conformal Acoustic Velocity Sensor Wide Aperture Array (CAVES WAA) is intended to be a more cost-effective sensor array. CAVES WAA consists of two developmental technologies—fiber optic sensors and integrated panels that house them and manage their signature—that will be integrated together. Both technologies are still immature. To save costs, the insertion schedule has been deferred 2 years, to fiscal year 2014. In fiscal year 2009, the Navy will conduct at-sea testing of a CAVES WAA integrated panel being used as part of another application, but not in the form necessary for the Virginia-class submarine.

Design Stability

The Navy is attempting to lower the cost of each submarine by $100 million through design changes without affecting ship capabilities. Eleven changes will be introduced on SSN 783, which begins construction in fiscal year 2008. Most changes consist of simplifying the design of minor systems such as the direct feed and brine overboard discharge system. Some major systems, such as the large aperture bow array, are also being redesigned. The new bow design, incorporating payload tubes and a large aperture bow array, is at an early stage and is scheduled for introduction on SSN 784 in fiscal year 2009. The design is less complex to build, has fewer components, and can be tested during earlier phases of construction.

Other Program Issues

The Navy is attempting to save another $100 million per submarine through capital improvements at the shipyards and implementing a more efficient construction sequence. According to the Navy, about $61 million has been invested in capital expenditures. For example, the shipyards upgraded their facilities to be able to reduce the number of sections used to build submarines from 13 to 4. Using fewer and larger sections lowers cost and allows for increased work during module outfitting.

The Navy hopes to reduce construction time from more than 80 months to just 60 months. While SSN 778 and SSN 779 are expected to be delivered in 72 and 68 months, respectively, construction time must be reduced by another 17 and 12 percent, respectively, in order to meet the 60 month target. Historically, construction efficiencies tend to be captured in the early part of a production run, but SSN 778 and SSN 779 are the fifth and sixth ships being built. Additionally, a recent Navy estimate indicates that construction for the SSN 784 may take 6 months longer than target.

The Navy expects to save $200 million per submarine by using a multiyear procurement contract to increase the production rate, improve construction efficiency, and lower overhead and support costs. Bulk purchases of materials could also lower costs. Past programs have benefitted from such contracts.

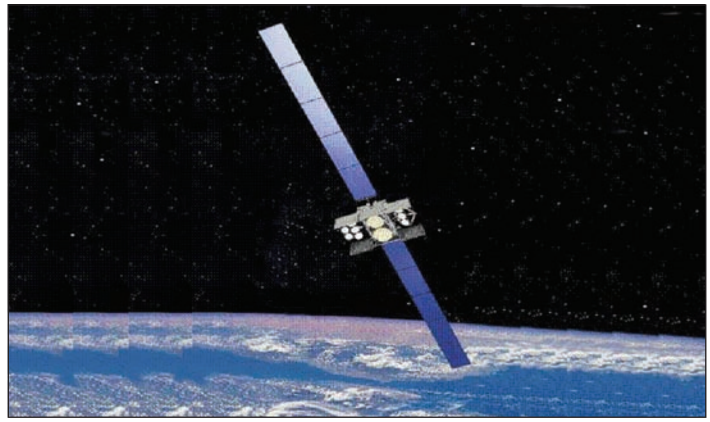
According to program officials, about 79 percent of the program's target savings for construction and design has already been achieved (approximately $158 million). However, a recent cost analysis of the program indicated that the Navy may have difficulty achieving target costs in fiscal year 2012.

Agency Comments

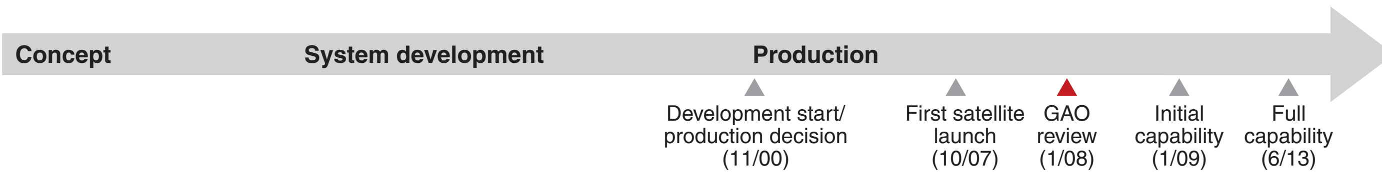
The Navy provided technical comments, which were incorporated as appropriate.

Wideband Global SATCOM (WGS)

WGS is a joint Air Force and Army program intended to provide essential communications services to U.S. warfighters, allies, and coalition partners during all levels of conflict short of nuclear war. It is the next-generation wideband component in DOD's future Military Satellite Communications architecture and is composed of the following principal segments: space segment (satellites), terminal segment (users), and control segment (operators). We assessed the space segment.



Source: WGS Program Office.



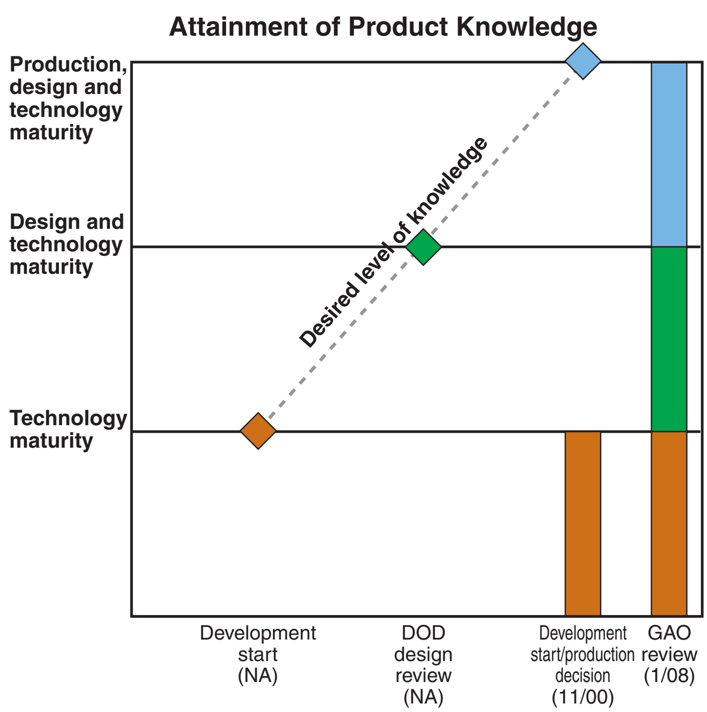
Program Essentials

Prime contractor: Boeing Satellite Development Center
Program office: El Segundo, Calif.
Funding needed to complete:
- R&D: $0.0 million
- Procurement: $468.5 million
- Total funding: $468.5 million
- Procurement quantity: 1

Program Performance (fiscal year 2008 dollars in millions)

	As of 12/2000	Latest 12/2006	Percent change
Research and development cost	$203.1	$331.9	63.4
Procurement cost	$929.4	$1,698.9	82.9
Total program cost	$1,132.5	$2,030.7	79.3
Program unit cost	$377.498	$406.145	7.9
Total quantities	3	5	66.9
Acquisition cycle time (months)	50	94	88.0

The WGS program's technology and design are mature. We did not review production maturity data because of the commercial nature of the WGS Block 1 acquisition, but unit-level manufacturing for WGS is complete. The Air Force is considering acquiring WGS in a three-block approach. Block 1 includes the first three satellites, the first of which was launched in October 2007. The second and third satellites are scheduled to launch in August 2008 and December 2008 respectively. Block 2 includes two satellites and an option for a third. The United States and Australia signed a memorandum of understanding in November 2007 allowing Australia to join the WGS program and provide funding to expand the WGS program to six satellites. The Air Force is continuing to study the possibility of a Block 3.



WGS Program

Technology Maturity

WGS has two critical technologies: the digital channelizer and the phased array antenna. According to program officials, both technologies were mature when the program made a production decision in November 2000.

Design Stability

The design for WGS is mature and the program office has released all the expected drawings to manufacturing. The first satellite has been launched and the second and third are in testing. According to the program office, the satellite design and configuration will not change for Block 2 except for an upgrade that will allow ground controllers to direct two antennas to bypass the onboard channelizer for added airborne intelligence, surveillance, and reconnaissance support. Bypassing the channelizer will double the data transfer rate for those two channels. The WGS acquisition strategy indicates that the upgrade is low risk because the design and modification are within existing technology and contractor capabilities.

Production Maturity

The commercial nature of the WGS Block 1 acquisition precludes the program office from having access to production control data. Manufacturing processes for these satellites are complete, and the Air Force does not anticipate any new manufacturing processes will be necessary for Block 2. The majority of the 1.5 million satellite parts are expected to remain the same for Block 2, but due to a 3-year break in production between Blocks 1 and 2, some parts are now obsolete. However, according to the program office, all of the new parts can be incorporated into satellite assembly without changing design or manufacturing processes.

WGS Block 1 consists of three satellites. The first satellite was originally scheduled for launch in June 2007, but due to delays with both the satellite and the launch vehicle, the satellite was launched in October 2007. Specifically, a test failure on the second WGS satellite and performance issues with other Boeing satellites prompted the WGS program to reevaluate the first satellite. After further analysis, the satellite was cleared to launch. Additionally, readiness of the launch vehicle was delayed to identify and address a fuel valve problem during a recent launch. The second and third satellites are in testing and were scheduled to launch in March 2008 and July 2008 respectively. However, due to issues identified during testing, which have to date been resolved, the program delayed the launch dates for these two satellites until August 2008 and December 2008 respectively. Furthermore, the program has pushed back the expected initial operational capability date to January 2009 due to the delay in launching the first satellite. Since achieving initial operational capability only requires one satellite, the program office does not expect further delays due to schedule changes on the second and third satellites.

Other Program Issues

Following commercial item acquisition procedures, the Air Force awarded a firm-fixed price contract for the Block 1 satellites. However, the satellite's two critical technologies—the X-band phased array antenna system and digital channelizer—are no longer considered commercial items even though their design and configuration will not change for Block 2. Therefore, in February 2006, the Air Force did not use commercial item procedures when it negotiated and awarded a $1.07 billion fixed price incentive fee contract for the Block 2 satellites that includes more reporting requirements such as earned value management data. The program office did not have access to this type of information under the Block 1 contract.

Agency Comments

In commenting on a draft of this assessment, the Air Force provided technical comments, which were incorporated as appropriate.

Warfighter Information Network-Tactical (WIN-T), Increment 1

WIN-T is the Army's high-speed and high-capacity backbone communications network. WIN-T connects Army units with higher levels of command and provides the Army's tactical portion of the Global Information Grid. WIN-T is being restructured following a Nunn-McCurdy unit cost breach, and will be fielded in four increments. The first increment absorbs the former Joint Network Node-Network (JNN-N) program and provides the Army an initial battlefield networking capability down to the Army's battalion level. We assessed the first increment.

Source: PM, WIN-T.

Concept | System development | Production

- Program/ development start (2/04)
- Design review (3/04)
- Low-rate decision (6/07)
- GAO review (1/08)
- Initial capability–increment 1a (1/09)
- Full-rate decision (6/09)
- Operational test increment 1b completed (8/10)

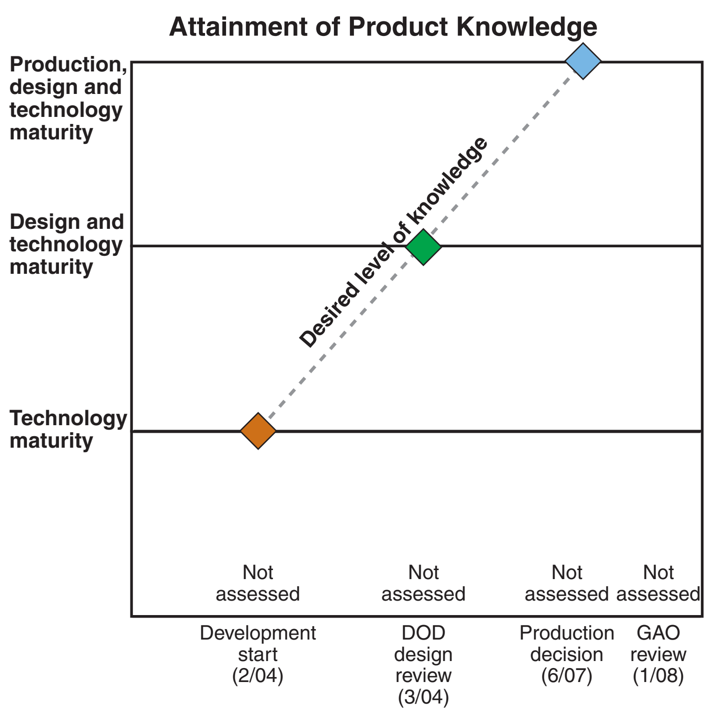
Program Essentials

Prime contractor: General Dynamics C4 Systems
Program office: Fort Monmouth, N.J.
Funding needed to complete:
R&D: $16.2 million
Procurement: $1,789.3 million
Total funding: $1,805.4 million
Procurement quantity: 607

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 10/2007	Percent change
Research and development cost	NA	$23.9	NA
Procurement cost	NA	$3,865.5	NA
Total program cost	NA	$3,889.0	NA
Program unit cost	NA	$2.319	NA
Total quantities	NA	1,677	NA
Acquisition cycle time (months)	NA	19	NA

Because its precursor, the JNN-N program, was based on mature commercial networking and satellite communications technologies, the Army had not initially identified any critical technologies for WIN-T Increment 1. Therefore we did not assess its technology maturity. The Army completed a technology readiness assessment for WIN-T Increment 1 in early 2008. While design stability is evaluated during design reviews, it cannot be assessed using our methodology because the program office does not produce releasable drawings for the design, which is based upon mature commercial hardware and software products. In October 2007, DOD approved an acquisition program baseline for Increment 1. The WIN-T overarching acquisition strategy was approved in early January; the Increment 1 annex to this strategy is in final processing.



WIN-T Incr. I Program

Technology Maturity

Technology maturity for WIN-T Increment 1 could not be assessed because the Army had not identified any critical technologies for JNN-N, the precursor to WIN-T Increment 1. However, the June 2007 acquisition decision memorandum that approved the restructuring of the WIN-T program requires the Army to conduct a technology readiness assessment of the winning proposal for WIN-T Increment 1 within 120 days of contract award, and to submit this assessment to the department's Director for Defense Research and Engineering (DDR&E) for approval. As contract award took place in late September 2007, this technology readiness assessment was due to DDR&E by late January 2008. In February 2008, a DDR&E representative confirmed that her office had received the Army's assessment and was reviewing it. If the Army decides to insert technologies from future WIN-T increments into Increment 1, DDR&E must agree that those technologies are mature prior to insertion.

Design Stability

Design stability for WIN-T Increment 1 could not be assessed using our methodology because, according to a program office representative, the development program integrates mature hardware and software products and does not produce drawings for these commercial products. Rather, according to this representative, design stability is assessed during design reviews and subsequent testing of those designs. The program office also noted that it does not redesign the system from one production lot to another; rather, newer, more capable commercial components replace outdated components as they become available.

Other Program Issues

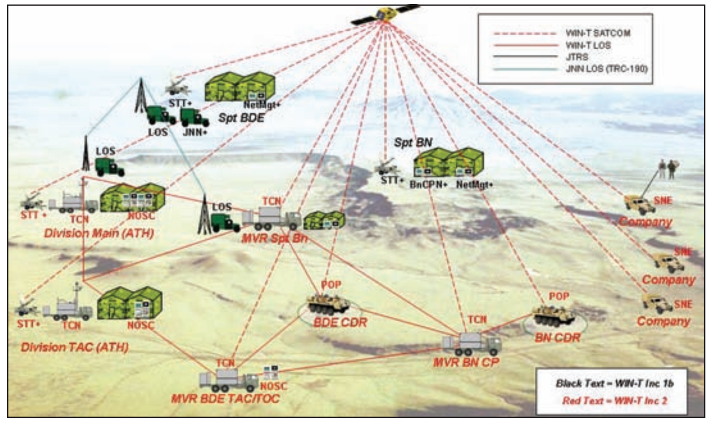
Previously, the Army fielded JNN-N as a separate beyond-line-of-sight communications network to units deployed in Iraq. JNN-N began the transitioning of the Army's communications systems to Internet protocol-based systems, and provided an interface to DOD communications services, such as the Defense Information Systems Network, with multiple levels of security. However, JNN-N was only established as a formal program when it was designated as the first increment of the restructured WIN-T program in June 2007. Prior to WIN-T restructuring, the Army had already procured 759 JNN-N nodes and proposed moving forward with the acquisition of low-rate initial production (LRIP) quantities of JNN-N equipment needed to conduct initial operational testing, and to equip deploying units. As of March 2007, shortly before the WIN-T restructuring, the Army had planned to acquire additional quantities of JNN-N to field to the rest of the Army once initial operational testing had been completed, a beyond-LRIP report had been submitted to Congress, and a full-rate production decision had been made. As a result of the WIN-T restructuring, the Under Secretary of Defense for Acquisition Technology and Logistics approved the Army moving forward with the acquisition of the full complement of needed JNN-N capabilities as the first increment of WIN-T. Initial operational tests will still be conducted in the first quarter of fiscal year 2009. Army representatives stated that recent statutory changes made by Section 231 of the National Defense Authorization Act for Fiscal Year 2007 grant the Director, Operational Test and Evaluation, the flexibility to deliver the beyond-LRIP report "as soon as practicable," and allow the Army to acquire Increment 1 assets in lots sized to meet its operational needs. The Army interprets this new statutory language to permit it to contract for quantities of WIN-T Increment 1 nodes in fiscal year 2008 to support operational needs, even if prior to the completion of initial operational testing required for a beyond-LRIP report. In September 2007, the Army contracted for 336 more Increment 1 nodes, 25 more than the 311 nodes identified as the LRIP quantities in the September 2007 WIN-T Increment 1 Selected Acquisition Report, which was submitted to Congress on November 14, 2007. This will be clarified in future SAR submissions.

Agency Comments

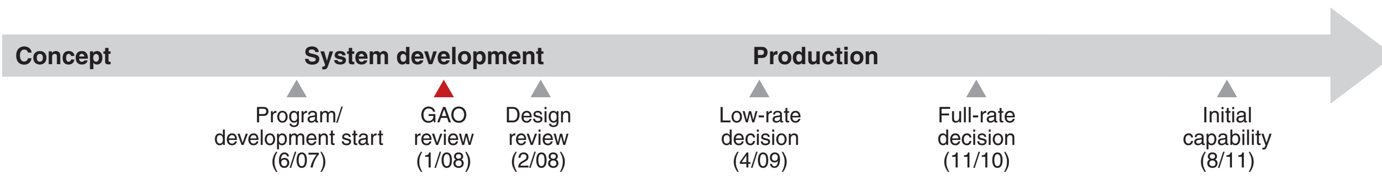
In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

Warfighter Information Network-Tactical (WIN-T), Increment 2

WIN-T is the Army's high-speed and high-capacity backbone communications network. WIN-T connects Army units with higher levels of command and provides the Army's tactical portion of the Global Information Grid. WIN-T is being restructured following a Nunn-McCurdy unit cost breach, and will be fielded in four increments. The second increment will provide the Army with an initial networking on-the-move capability, while the third will provide a full networking on-the-move capability and fully support the Army's Future Combat Systems.



Source: PM, WIN-T.



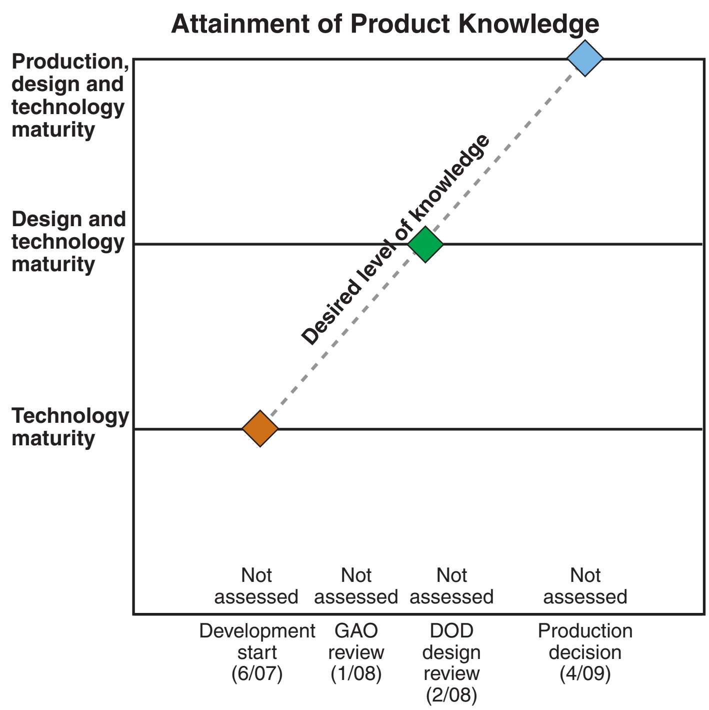
Program Essentials

Prime contractor: General Dynamics C4 Systems
Program office: Fort Monmouth, N.J.
Funding needed to complete:
R&D: $218.8 million
Procurement: $3,301.4 million
Total funding: $3,520.2 million
Procurement quantity: 1,837

Program Performance (fiscal year 2008 dollars in millions)

	As of NA	Latest 10/2007	Percent change
Research and development cost	NA	$227.0	NA
Procurement cost	NA	$3,301.4	NA
Total program cost	NA	$3,528.4	NA
Program unit cost	NA	$1.864	NA
Total quantities	NA	1,893	NA
Acquisition cycle time (months)	NA	50	NA

The original WIN-T program entered system development in August 2003 with 3 of its 12 critical technologies nearing maturity. Insufficient technical readiness was cited as one of the key factors leading to the Nunn-McCurdy unit cost breach. Subsequently, DOD decided to field WIN-T incrementally using only mature technologies. However, on the basis of what was determined to be an insufficient body of evidence for assessing technology readiness, the Office of the Secretary of Defense and the Army have agreed that additional information will be provided in order to prove the critical technologies. While design stability will be evaluated during WIN-T design reviews, it cannot be assessed using our methodology because the program office does not track the number of releasable drawings.



WIN-T Incr. 2 Program

Technology Maturity

Technology maturity for WIN-T Increment 2 could not be assessed because it was only recently separated from the original WIN-T system development effort, and the required technology readiness assessment for this increment has not yet been approved by the Office of the Secretary of Defense's Director of Defense Research and Engineering. In June 2007, the WIN-T program was restructured to field in four increments using technologies for each increment that DDR&E assesses as approaching maturity prior to establishment of the increment's baseline and fully mature prior to the start of production for the increment. Increment 2 will provide the Army with initial networking on-the-move capabilities, while future increments will provide full networking on-the-move capabilities, will fully support FCS, and will provide the Army protected satellite communication on-the-move.

The original WIN-T program entered system development with only 3 of its original 12 critical technologies approaching full maturity. Insufficient technical readiness was cited as one of the key factors leading to the March 2007 Nunn-McCurdy unit cost breach of the original WIN-T program. Moreover, while the Army had prepared a revised technology readiness assessment for the original WIN-T program in 2006, DDR&E did not concur with the Army's assessment for two of the five critical technology areas identified in this revised assessment—network operations and high-mobility networking. The Army was required to submit a new technology readiness assessment for WIN-T Increment 2 to DDR&E by early November 2007. DDR&E must agree that each critical technology assessed is approaching maturity—a prototype tested in a relevant environment—to be considered part of the system development baseline for this increment. While the Army and DDR&E were unable to reach consensus in 2006 on the maturity of the WIN-T's critical technologies, an agreement in principle has now been reached regarding how to measure such maturity. As agreed, the Army submitted an initial Increment 2 technology readiness assessment in November 2007; this assessment was updated with results from tests of Increment 2 capabilities that were held in October and November 2007. In February 2008, a DDR&E representative confirmed that her office had received the Army's updated assessment and is reviewing it.

Other Program Issues

In March 2007, the WIN-T program reported a Nunn-McCurdy unit cost breach to the congressional defense committees. In June 2007, the Under Secretary of Defense for Acquisition, Technology and Logistics provided formal certification of the restructured WIN-T program to Congress. The restructured program now consists of four increments, each governed by an overarching acquisition strategy for providing networking and communications capability to operational and tactical ground forces. Acquisition program baselines for Increments 1 and 2 were approved in October 2007. Establishment of an acquisition program baseline for WIN-T Increment 3, intended to field full networking on-the-move capabilities and to fully support the needs of the Army's Future Combat System, will take place once FCS requirements for WIN-T have been firmly established. A formal agreement between the WIN-T and FCS program managers was expected to be completed later this year, in time for the Increment 3 preliminary design review currently scheduled for August 2008.

Agency Comments

In commenting on a draft of this assessment, the Army provided technical comments, which were incorporated as appropriate.

Agency Comments

DOD was provided a draft of this report and had no comments on the overall report, but did provide technical comments on the individual assessments. These comments, along with the agency comments received on the individual assessments, are included as appropriate.

We are sending copies of this report to interested congressional committees; the Secretary of Defense; the Secretaries of the Army, Air Force, and Navy; and the Director, Office of Management and Budget. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you have any question on this report, please contact me at (202) 512-4841. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Major contributors to this report are listed in appendix III.

Michael J. Sullivan
Director
Acquisition and Sourcing Management

List of Congressional Committees

The Honorable Carl Levin
Chairman
The Honorable John McCain
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Daniel K. Inouye
Chairman
The Honorable Ted Stevens
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Ike Skelton
Chairman
The Honorable Duncan L. Hunter
Ranking Member
Committee on Armed Services
United States House of Representatives

The Honorable John P. Murtha
Chairman
The Honorable C.W. Bill Young
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States House of Representatives

Scope and Methodology

In conducting our work, we evaluated performance and risk data from each of the programs included in this report. We summarized our assessments of each individual program in two components—a system profile and a product knowledge assessment. We did not validate the data provided by the Department of Defense (DOD). However, we took several steps to address data quality. Specifically, we reviewed the data and performed various quality checks, which revealed some discrepancies in the data. We discussed the underlying data and these discrepancies with program officials and adjusted the data accordingly. We determined that the data provided by DOD were sufficiently reliable for our engagement purposes after reviewing DOD's management controls for assessing data reliability.

Macro Analysis

We analyzed data from the National Defense Budget Estimates for 2008 to determine the trends in research, development, test, and evaluation (RDT&E) and procurement actual and planned obligation authority for the period 1978 to 2012. All dollar amounts in this report are fiscal year 2008 dollars except where noted. We also analyzed budget information from the Office of Management and Budget to determine trends in discretionary spending, including defense spending, and nondiscretionary funding since 1978.

To determine the planned RDT&E and procurement funding for major defense acquisition programs from 2008 to 2012, we obtained information from the Defense Acquisition Management Information Retrieval system, referred to as DAMIRs. We retrieved data that showed annual funding requirements for RDT&E and procurement for all major defense acquisition programs with DOD Selected Acquisition Reports (SAR) dated December 2006. We converted the data into fiscal year 2008 dollars. This information was summarized and then sorted by the top 10 programs with the highest funding requirements during the period fiscal year 2008 to 2012. We also used the Selected Acquisition Report Summary tables to identify the number of major defense acquisition programs submitting SARs as of December 1999, December 2004, and December 2006.

Data for the total planned investment of major defense acquisition programs was obtained from funding stream data included in the SARs or, in a few cases, directly from program offices and then aggregated across all program in fiscal year 2008 dollars for each selected portfolio (fiscal years 2000, 2005, and 2007). We refer to programs with SARs dated December 1999 as the fiscal year 2000 portfolio, programs with SARs dated December 2004 as the fiscal year 2005 portfolio, and programs with SARs dated

December 2006 as the 2007 portfolio. The commitments outstanding represent the difference between the total planned commitment and what has been expended through the fiscal year the SARs were issued. Also, the data do not include the full costs of acquiring Missile Defense Agency programs. To assess the cost and schedule performance of selected portfolios, we obtained data primarily from the SARs or, in a few cases, directly from program offices. In our analysis we have broken some SAR programs (such as Missile Defense Agency systems) into smaller elements or programs. We compared cost and schedule data from the first full estimate, generally system development start, with the current estimate. For the few programs that did not have development or a full estimate, we compared the current estimate to the planning estimate to measure changes in development costs and schedule delays but excluded these programs from our analysis of total acquisition costs and program acquisition unit costs. Where comparative cost and schedule data were not available for programs, these programs were excluded from the analysis when appropriate. We did not adjust the cost data to reflect changes in quantities that may have occurred over the life of the programs. Also, data do not include full costs of developing Missile Defense Agency programs, and in most cases these programs were left out of the comparative analysis.

To assess the performance and outcomes of the 72 weapon system programs in our assessment, we collected information contained in program SARs or data provided by program offices as of January 15, 2008. To assess the overall outcomes to date for the 72 programs, it was necessary to identify those programs with the requisite cost, schedule, and quantity data at the first full estimate, generally Milestone B, and the latest estimate. Of the 72 programs in our assessment, 47 programs had relevant data on RDT&E costs, 45 had data on program acquisition unit cost,[1] and 41 had data on schedules for delivering initial capabilities. The remaining programs not included in this analysis had not yet entered system development and/or did not have comparative data. We summed the first full estimate and latest estimate of RDT&E costs for the programs with relevant data and calculated the percentage change between the two estimates. The unit cost growth assessment reflects the share of the 45 programs with relevant data that have experienced program acquisition unit cost growth greater than 25 percent. The schedule assessment is the

[1] We excluded programs that had planning estimates as their first full estimate for the unit cost analysis.

simple average of the change in months of the planned or actual delivery of initial operational capability between first and latest estimates.

To assess the knowledge attainment of programs at critical decision points, we identified programs that had actually proceeded through each juncture (system development start, DOD design review, and production start) and obtained their assessed knowledge levels at those points. The knowledge level information was drawn from data provided by the program offices as of January 15, 2008. (For more information, see the product knowledge assessment section in this appendix.) Programs in our assessment were in various stages of the acquisition life cycle, and not all programs provided all knowledge information for each point. Programs were not included in our analysis if relevant decision and/or knowledge point data were not available. For each decision point, we then summarize knowledge attainment of the programs as the percentage of programs with data that achieved the relevant knowledge point. The technology maturity for programs at various decision points includes 41 programs at system development start, 37 programs at design review, and 22 programs at production. Design maturity data for various decision points include 31 programs at design review and 17 programs at production. We then compared the results of this year's analysis with our 2005, 2006, and 2007 assessments. We also assessed the cumulative knowledge attainment at program decision points of programs that we had information on. For system development start, that is the percentage of programs that had mature technologies. At design review, we assessed what percentage of programs had stable designs and mature technologies at development start. And, at the production decision, we assessed what percentage of programs had their processes in statistical control and a stable design at the design review, and mature technologies at system development start.

The maturity levels of the 356 critical technologies at system development start was collected from program officials as described in further detail in the product knowledge data section in this appendix. We included only programs, and their technologies, that have actually entered system development. To compare differences in RDT&E cost growth between programs with mature technologies at system development start and programs with immature technologies, we examined 33 programs that have actually passed through development start with relevant first and latest cost estimates. We then calculated the total RDT&E cost growth of all programs with mature technologies and compared it to total RDT&E cost growth of all programs with immature technologies.

We collected data from program offices on the date each program has or plans to conduct key development tests of (1) an early system prototype and (2) a production representative prototype, and then compared these dates to scheduled or actual system design review and production decision dates. These comparisons are based on information from 35 programs for early system prototypes and 40 programs for production representative prototypes—both actual and future scheduled dates are included. We also collected information from program offices on software size, usually expressed in terms of lines of code. We compared software size over time for 28 programs to determine software growth for these programs.

We submitted an additional data collection instrument this year and collected programmatic data from 53 of the programs in our assessment, largely those that have entered system development.[2] We did not validate the data provided by the program offices but reviewed the data and performed various checks, which revealed some discrepancies in the data. We clarified the data accordingly. The information included key schedule dates, program office staffing, program baselines, and requirements changes. We analyzed the data to determine the frequency of program rebaselines and requirements changes and to assess the timing of key technical events such as the preliminary design review. Where relevant, this information was compared to respective program outcome and schedule data. The assessment of programs having completed preliminary design review prior to system development start is based on responses from 39 programs. The assessment of the average time between development start and scheduled or actual preliminary design review is based on responses from 35 programs.

We summarized information provided by 52 programs on staffing by function (program management, administrative support, business functions, engineering and technical, other, and overall total) and type (i.e., military, civilian, support contractor, federally funded research development center, or university and affiliates). Data from the 52 programs were summed together to obtain total staffing levels by function and by type. We then summarized the data to present the distribution of total staff in each function by type of staff. We also analyzed information provided by 43 programs on the number of program baselines. We did not

[2] We requested data from 4 additional programs but did not receive requested information in time from the H-1 Upgrades, DDG 1000 Destroyer, CVN 21, and Wideband Global SATCOM programs.

include in our analysis baselines resulting from passing through development or production milestones. Finally, we summarized information provided by 46 programs regarding the number of programs experiencing requirements changes after system development start. We did not attempt to understand the degree or complexity of the requirement changes. We then compared the development cost outcomes for programs that have experienced requirement changes to development outcomes to date for programs that had not.

Finally, we relied on GAO's body of work over the past years that has examined DOD acquisition issues. In recent years, we have issued reports that have identified systemic problems and made recommendations to DOD for improvements in how it acquires its major weapon systems. These reports cover topics such as contracting, program management, acquisition policy, and cost estimating. We have also issued many detailed reports that have evaluated specific weapon systems such as aircraft programs, ships, communication systems, satellites, missile defense system, and future combat systems. Finally, we used information from numerous GAO products that examine how commercial best practices can improve outcomes for various DOD programs. During the past 10 years, we have gathered information based on discussions with more than 25 major commercial companies. Our work has shown that valuable lessons can be learned from the commercial sector and can be applied to the development of weapon systems.

System Profile Data on Each Individual Two-Page Assessment

Over the past several years, DOD has revised its policies governing weapon system acquisitions and changed the terminology used for major acquisition events. To make DOD's acquisition terminology more consistent across the 72 program assessments, we standardized the terminology for key program events. For most individual programs in our assessment, "development start" refers to the initiation of an acquisition program as well as the start of system development. This coincides with DOD's Milestone B. For a few programs in our assessment (mostly programs that began before 2001), they have a separate "program start" date which begins a pre-system development phase for program definition and risk reduction activities, this "program start" date generally coincides with DOD's old milestone terminology for Milestone I, followed by a "development start" date, either DOD's old Milestone II or new Milestone B, depending on when the program began system development. The "production decision" generally refers to the decision to enter the production and deployment phase, typically with low-rate initial production. The "initial capability" refers to the initial operational capability—sometimes also called first unit equipped or required asset availability. For shipbuilding programs, the schedule of key program events in relation to milestones varies for each individual program. Our assessments of shipbuilding programs report key program events as determined by each program's individual strategy. For the Missile Defense Agency (MDA) programs that do not follow the standard Department of Defense acquisition model, but instead develop systems in incremental capability-based blocks, we identified the key technology development efforts that lead to an initial capability for the block assessed.

The information presented on the funding needed to complete from fiscal year 2008 through completion, unless otherwise noted, draws on information from SARs or on data from the program office. In some instances the data were not yet available, and we annotate this by the term "to be determined" (TBD), or "not applicable," annotated (NA). The quantities listed refer only to procurement quantities. Satellite programs, in particular, produce a large percentage of their total operational units as development quantities, which are not included in the quantity figure.

To assess the cost, schedule, and quantity changes of each program, we reviewed DOD's SARs or obtained data directly from the program offices. In general, we compared the latest available SAR information with a baseline for each program. For programs that have started product development—those that are beyond Milestone II or B—we compared the latest available SAR to the development estimate from the first SAR issued after the program was approved to enter development. For systems that have not yet started system development, we compared the latest available data to the planning estimate issued after Milestone I or A. For systems not included in SARs, we attempted to obtain comparable baseline and current data from the individual program offices. For MDA systems for which a baseline was not available, we compared the latest available cost information to the amount reported last year.

All cost information is presented in fiscal year 2008 dollars using Office of the Secretary of Defense-approved deflators to eliminate the effects of inflation. We have depicted only the programs' main elements of acquisition cost—research and development and procurement. However, the total program costs also include military construction and acquisition operation and maintenance costs. Because of rounding and these additional costs, in some situations the total cost may not match the exact sum of the research and development and procurement costs. The program unit costs are calculated by dividing the total program cost by the total quantities planned. These costs are often referred to as program acquisition unit costs. In some instances, the data were not applicable, and we annotate this by using the term “NA.” In other instances, the current absence of data on procurement funding and quantities precludes calculation of a meaningful program acquisition unit cost, and we annotate this by using the term “TBD.” The quantities listed refer to total quantities, including both procurement and development quantities.

The schedule assessment is based on acquisition cycle time, defined as the number of months between the program start and the achievement of initial operational capability or an equivalent fielding date. In some instances, the data were not yet available, and we annotate this by using the term “TBD,” or saying that they are classified.

The intent of these comparisons is to provide an aggregate or overall picture of a program’s history. These assessments represent the sum total of the federal government’s actions on a program, not just those of the program manager and the contractor. DOD does a number of detailed analyses of changes that attempt to link specific changes with triggering events or causes. Our analysis does not attempt to make such detailed distinctions.

Product Knowledge Data on Each Individual Two-Page Assessment

To assess the product development knowledge of each program at key points in development, we submitted a data collection instrument to each program office. The results are graphically depicted in each two-page assessment. We also reviewed pertinent program documentation, such as the operational requirements document, the acquisition program baseline, test reports, and major program reviews.

To assess technology maturity, we asked program officials to apply a tool, referred to as technology readiness levels (TRL), for our analysis. The National Aeronautics and Space Administration originally developed technology readiness levels, and the Army and Air Force science and technology research organizations use them to determine when technologies are ready to be handed off from science and technology managers to product developers. Technology readiness levels are measured on a scale of 1 to 9, beginning with paper studies of a technology’s feasibility and culminating with a technology fully integrated into a completed product. (See app. II for the definitions of technology readiness levels.) Our best practices work has shown that a technology readiness level of 7—demonstration of a technology in a realistic environment—is the level of technology maturity that constitutes a low risk for starting a product development program. In our assessment, the technologies that have reached technology readiness level 7, a prototype demonstrated in a realistic environment, are referred to as mature or fully mature and those that have reached technology readiness level 6, a prototype demonstrated in a relevant environment, are referred to as approaching or nearing maturity and are assessed as attaining 50 percent of the desired level of knowledge. Satellite technologies that have achieved technology readiness level 6 are assessed as fully mature due to the difficulty of demonstrating maturity in an operational environment—space.

In most cases, we did not validate the program offices' selection of critical technologies or the determination of the demonstrated level of maturity. We sought to clarify the technology readiness levels in those cases where information existed that raised concerns. If we were to conduct a detailed review, we might adjust the critical technologies assessed, the readiness level demonstrated, or both. It was not always possible to reconstruct the technological maturity of a weapon system at key decision points after the passage of many years.

To assess design stability, we asked program officials to provide the percentage of engineering drawings completed or projected for completion by the design review, the production decision, and as of our current assessment. In most cases, we did not verify or validate the percentage of engineering drawings provided by the program office. We sought to clarify the percentage of drawings completed in those cases where information that raised concerns existed. Completed engineering drawings were defined as the number of drawings released or deemed releasable to manufacturing that can be considered the "build-to" drawings.

To assess production maturity, we asked program officials to identify the number of critical manufacturing processes and, where available, to quantify the extent of statistical control achieved for those processes. In most cases, we did not verify or validate this information provided by the program office. We sought to clarify the number of critical manufacturing processes and percentage of statistical process control where information existed that raised concerns. We used a standard called the Process Capability Index, which is a process performance measurement that quantifies how closely a process is running to its specification limits. The index can be translated into an expected product defect rate, and we have found it to be a best practice. We sought other data, such as scrap and rework trends, in those cases where quantifiable statistical control data were unavailable. Although the knowledge points provide excellent indicators of potential risks, by themselves, they do not cover all elements of risk that a program encounters during development, such as funding instability. Our detailed reviews on individual systems normally provide for a fuller treatment of risk elements.

Technology Readiness Levels

Technology readiness level	Description	Hardware/software	Demonstration environment
1. Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties	None (paper studies and analysis)	None
2. Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.	None (paper studies and analysis)	None
3. Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	Analytical studies and demonstration of nonscale individual components (pieces of subsystem)	Lab
4. Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.	Low-fidelity breadboard. Integration of nonscale components to show pieces will work together. Not fully functional or form or fit but representative of technically feasible approach suitable for flight articles.	Lab
5. Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.	High-fidelity breadboard. Functionally equivalent but not necessarily form and/or fit (size weight, materials, etc). Should be approaching appropriate scale. May include integration of several components with reasonably realistic support elements/subsystems to demonstrate functionality.	Lab demonstrating functionality but not form and fit. May include flight demonstrating breadboard in surrogate aircraft. Technology ready for detailed design studies.
6. System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated realistic environment.	Prototype. Should be very close to form, fit and function. Probably includes the integration of many new components and realistic supporting elements/subsystems if needed to demonstrate full functionality of the subsystem.	High-fidelity lab demonstration or limited/restricted flight demonstration for a relevant environment. Integration of technology is well defined.

(Continued From Previous Page)

Technology readiness level	Description	Hardware/software	Demonstration environment
7. System prototype demonstration in a realistic environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in a realistic environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.	Prototype. Should be form, fit and function integrated with other key supporting elements/subsystems to demonstrate full functionality of subsystem.	Flight demonstration in representative realistic environment such as flying test bed or demonstrator aircraft. Technology is well substantiated with test data.
8. Actual system completed and "flight qualified" through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.	Flight-qualified hardware	Developmental Test and Evaluation (DT&E) in the actual system application.
9. Actual system "flight proven" through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.	Actual system in final form	Operational Test and Evaluation (OT&E) in operational mission conditions.

Source: GAO and its analysis of National Aeronautics and Space Administration data.

GAO Contact and Acknowledgments

GAO Contact

Michael J. Sullivan (202) 512-4841

Acknowledgments

Principal contributors to this report were Brian Mullins, Assistant Director; Ridge C. Bowman; Quindi C. Franco; and Matthew B. Lea. Other key contributors included David B. Best, Thomas J. Denomme, Bruce Fairbairn, Arthur Gallegos, William R. Graveline, Barbara H. Haynes, Michael J. Hesse, Richard Horiuchi, J. Kristopher Keener, John E. Oppenheim, Kenneth E. Patton, Charles W. Perdue, Robert S. Swierczek, Wendy P. Smythe, Alyssa B. Weir, Paul G. Williams, and Karen S. Zuckerstein.

The following staff were responsible for individual programs:

System	Primary Staff
Airborne Laser (ABL)	LaTonya D. Miller
Aegis Ballistic Missile Defense (Aegis BMD)	Michele R. Williamson
Advanced Extremely High Frequency Satellites (AEHF)	Bradley L. Terry
Air Force Distributed Common Ground System (AF DCGS)	Guisseli Reyes-Turnell/Paul G. Williams
Amphibious Assault Ship Replacement Program (LHA 6)	Gwyneth B. Woolwine
Armed Reconnaissance Helicopter (ARH)	Michael J. Hesse/Wendy P. Smythe
Advanced Threat Infrared Countermeasure/Common Missile Warning System (ATIRCM/CMWS)	Danny G. Owens
B-2 Spirit Advanced Extremely High Frequency SatCom Capability (B-2 EHF SATCOM)	Elizabeth DeVan /Andrew H. Redd
B-2 Radar Modernization Program (B-2 RMP)	Don M. Springman/Sean C. Seales
Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS)	W. William Russell IV
C-130 Avionics Modernization Program (C-130 AMP)	Sean D. Merrill /Erin L. Stockdale
C-130J Hercules	Matthew T. Drerup
C-5 Avionics Modernization Program (C-5 AMP)	Brian T. Smith/Cheryl K. Andrew
C-5 Reliability Enhancement and Reengining Program (C-5 RERP)	Cheryl K. Andrew/Brian T. Smith

(Continued From Previous Page)

System	Primary Staff
CH-53K Heavy Lift Replacement (HLR)	Kevin J. Heinz
Combat Search and Rescue Replacement Vehicle (CSAR-X)	Travis J. Masters/Julie C. Hadley
CVN- 21 Nuclear Aircraft Class Carrier	Diana L. Moldafsky/Erin E. Carson
Distributed Common Ground System-Army (DCGS-A)	Justin M. Jaynes/Guisseli Reyes-Turnell
DDG 1000 Destroyer	Diana L. Moldafsky/Raj C. Chitikila
E-2D Advanced Hawkeye (E-2D AHE)	Lauren M. Heft
EA-18G	Jerry W. Clark/Bonita P. Oden
Evolved Expendable Launch Vehicle-Atlas V, Delta IV (EELV)	Maria A. Durant
Expeditionary Fire Support System (EFSS)	Bonita P. Oden/Laura T. Holliday
Expeditionary Fighting Vehicle (EFV)	Quindi C. Franco/Alan R. Frazier
Extended Range Munition (ERM)	Christopher R. Durbin
Excalibur Precision Guided Extended Range Artillery Projectile	Richard A. Cederholm
F-22A Modernization	Marvin E. Bonner/Robert K. Miller
Family of Advanced Beyond Line-of-Sight Terminals (FAB-T)	Alexandra K. Dew/Winnie Tsen
Future Combat Systems (FCS)	Marcus C. Ferguson/John M. Ortiz
Global Hawk Unmanned Aircraft System	Bruce D. Fairbairn/Charlie Shivers
Ground-Based Midcourse Defense (GMD)	Steven B. Stern
H-1 Upgrades	Ian N. Jefferies
Joint Air-to-Surface Standoff Missile (JASSM)	William C. Allbritton/Carrie R. Wilson
Joint Cargo Aircraft (JCA)	Letisha T. Watson/Beverly A. Breen
Joint High Speed Vessel (JHSV)	Moshe Schwartz
Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)	Alan R. Frazier/Wendy P. Smythe
Joint Strike Fighter (JSF)	Simon J. Hirschfeld/Matthew B. Lea
Joint Tactical Radio System Airborne, Maritime, Fixed-Station (JTRS AMF)	Paul G. Williams/Guisseli Reyes-Turnell
Joint Tactical Radio System Ground Mobile Radio (JTRS GMR)	Ridge C. Bowman/Paul G. Williams
JTRS Handheld, Manpack, Small Form Fit (JTRS HMS)	Ridge C. Bowman/ Guisseli Reyes-Turnell
KC-X Program (KC-X)	Mary Jo Lewnard/Wendell K. Hudson
Kinetic Energy Interceptor (KEI)	Michael J. Hesse
Littoral Combat Ship (LCS)	Christopher R. Durbin
Littoral Combat Ship: Anti-Submarine Warfare (ASW)	J. Kristopher Keener/Daniel Chen

(Continued From Previous Page)

System	Primary Staff
Littoral Combat Ship: Mine Countermeasures (MCM)	Gwyneth B. Woolwine
Littoral Combat Ship: Surface Warfare (SuW)	J. Kristopher Keener/Daniel Chen
Light Utility Helicopter (LUH)	Beverly A. Breen
Longbow Apache Block III	Wendy P. Smythe
Multi-Functional Information Distribution System (MIDS)	Jeffrey V. Rose/Paul G. Williams
Multiple Kill Vehicle (MKV)	Meredith A. Kimmett
Multi-Platform Radar Technology Insertion Program (MP-RTIP)	Anne McDonough-Hughes/Kathryn I. O'Dea
Maritime Prepositioning Force (Future)/Mobile Landing Platform (MPF(F)/MLP)	Raj C. Chitikila/Lisa L. Berardi
Reaper Unmanned Aircraft System (MQ-9)	Rae Ann H. Sapp/Charlie Shivers
Mine Resistant Ambush Protected (MRAP) Vehicle	Dayna L. Foster/J. Kristopher Keener/Michael W. Aiken/ Charlie Shivers/Erin L. Stockdale
Mobile User Objective System (MUOS)	Richard Y. Horiuchi
NAVSTAR Global Positioning System (GPS) Space & Control	Josie H. Sigl
National Polar-orbiting Operational Environmental Satellite System (NPOESS)	Suzanne Sterling
P-8A Multi-mission Maritime Aircraft (P-8A MMA)	Heather L. Barker Miller/Kathryn M. Edelman
PATRIOT/ MEADS Combined Aggregate Program (CAP) Fire Unit	Ronald N. Dains/Tana M. Davis
Space Based Infrared System High (SBIRS High)	Claire A. Cyrnak
Small Diameter Bomb, Increment II (SDB II)	Carrie R. Wilson
Sky Warrior UAS (UAS)	Tana M. Davis
Space Radar (SR)	Lisa P. Gardner
Space Tracking and Surveillance System (STSS)	Sigrid L. McGinty/Angela Pleasants
Theater High Altitude Area Defense (THAAD)	Steven B. Stern/ LaTonya D. Miller
Transformational Satellite Communications System (TSAT)	Arturo Holguin Jr.
V-22 Joint Services Advanced Vertical Lift Aircraft	Jerry W. Clark/Bonita P. Oden
VH-71 Presidential Helicopter Replacement Program	Ronald E. Schwenn/ David Schilling
Virginia Class Submarine (SSN 774)	Moshe Schwartz
Wideband Global SATCOM (WGS)	E. Brandon Booth

(Continued From Previous Page)

System	Primary Staff
Warfighter Information Network-Tactical-Increment 1 (WIN-T Incr. 1)	James P. Tallon/Guisseli Reyes-Turnell
Warfighter Information Network-Tactical-Increment 2 (WIN-T Incr. 2)	James P. Tallon/Guisseli Reyes-Turnell

Source: GAO.

Related GAO Products

Best Practices: Increased Focus on Requirements and Oversight Needed to Improve DOD's Acquisition Environment and Weapon System Quality. GAO-08-294. Washington, D.C.: February 1, 2008.

Defense Acquisitions: Assessments of Selected Weapon Programs. GAO-07-406SP. Washington, D.C.: March 30, 2007.

Best Practices: Stronger Practices Needed to Improve DOD Technology Transition Processes. GAO-06-883. Washington, D.C.: September 14, 2006.

Best Practices: Better Support of Weapon System Program Managers Needed to Improve Outcomes. GAO-06-110. Washington, D.C.: November 1, 2005.

Defense Acquisitions: Major Weapon Systems Continue to Experience Cost and Schedule Problems under DOD's Revised Policy. GAO-06-368. Washington, D.C.: April 13, 2006.

DOD Acquisition Outcomes: A Case for Change. GAO-06-257T. Washington, D.C.: November 15, 2005.

Defense Acquisitions: Stronger Management Practices Are Needed to Improve DOD's Software-Intensive Weapon Acquisitions. GAO-04-393. Washington, D.C.: March 1, 2004.

Best Practices: Setting Requirements Differently Could Reduce Weapon Systems' Total Ownership Costs. GAO-03-57. Washington, D.C.: February 11, 2003.

Defense Acquisitions: Factors Affecting Outcomes of Advanced Concept Technology Demonstration. GAO-03-52. Washington, D.C.: December 2, 2002.

Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes. GAO-02-701. Washington, D.C.: July 15, 2002.

Defense Acquisitions: DOD Faces Challenges in Implementing Best Practices. GAO-02-469T. Washington, D.C.: February 27, 2002.

Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes. GAO-01-288. Washington, D.C.: March 8, 2001.

Best Practices: A More Constructive Test Approach Is Key to Better Weapon System Outcomes. GAO/NSIAD-00-199. Washington, D.C.: July 31, 2000.

Defense Acquisition: Employing Best Practices Can Shape Better Weapon System Decisions. GAO/T-NSIAD-00-137. Washington, D.C.: April 26, 2000.

Best Practices: DOD Training Can Do More to Help Weapon System Programs Implement Best Practices. GAO/NSIAD-99-206. Washington, D.C.: August 16, 1999.

Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes. GAO/NSIAD-99-162. Washington, D.C.: July 30, 1999.

Defense Acquisitions: Best Commercial Practices Can Improve Program Outcomes. GAO/T-NSIAD-99-116. Washington, D.C.: March 17, 1999.

Defense Acquisitions: Improved Program Outcomes Are Possible. GAO/T-NSIAD-98-123. Washington, D.C.: March 17, 1998.

Best Practices: Successful Application to Weapon Acquisition Requires Changes in DOD's Environment. GAO/NSIAD-98-56. Washington, D.C.: February 24, 1998.

Best Practices: Commercial Quality Assurance Practices Offer Improvements for DOD. GAO/NSIAD-96-162. Washington, D.C.: August 26, 1996.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site (www.gao.gov). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to www.gao.gov and select "E-mail Updates."

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are $2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office
441 G Street NW, Room LM
Washington, D.C. 20548

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm
E-mail: fraudnet@gao.gov
Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Ralph Dawn, Managing Director, dawnr@gao.gov, (202) 512-4400
U.S. Government Accountability Office, 441 G Street NW, Room 7125
Washington, D.C. 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, D.C. 20548