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Weapon Systems Annual Assessment
Knowledge Gaps Pose Risk to Sustaining
Recent Positive Trends (GAO-18-360SP)

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Weapon Systems Annual Assessment Knowledge Gaps Pose Risk to Sustaining Recent Positive Trends (GAO-18-360SP)

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May 2018



Sources: (Left to Right) Patriot Advanced Capability-3 Missile Segment Enhancement, U.S. Army; VH-92A Presidential Helicopter Replacement, 2016 Sikorsky Aircraft Corporation, a Lockheed Martin Company; Next Generation Operational Control System, U.S. Air Force; and F-35 Lightning II, 2016 Lockheed Martin.

Key Observations

- 1. Programs initiated since implementation of acquisition reforms in 2010 show better recent cost performance than other programs.**
 - The 25 major defense acquisition programs (MDAP) initiated since 2010 had an overall cost decrease (\$5.6 billion) between 2016 and 2017.
 - The 61 MDAPs initiated prior to 2010 had an overall cost increase (\$60.3 billion) between 2016 and 2017.

- 2. Programs continue to not fully implement knowledge-based practices, which could portend future cost growth.**
 - Lack of knowledge-based practices implementation was evident in both the since 2010 and pre-2010 subsets of programs.
 - In an exploratory statistical analysis, we found that programs that completed one or more of three specific practices had significantly lower cost and schedule growth as compared to programs that did not.

Scope and Methodology

UNCLASSIFIED



Selected Acquisition Report (SAR)

RCS: DD-A&T(Q&A)823-197



DDG 1000 Zumwalt Class Destroyer (DDG 1000)

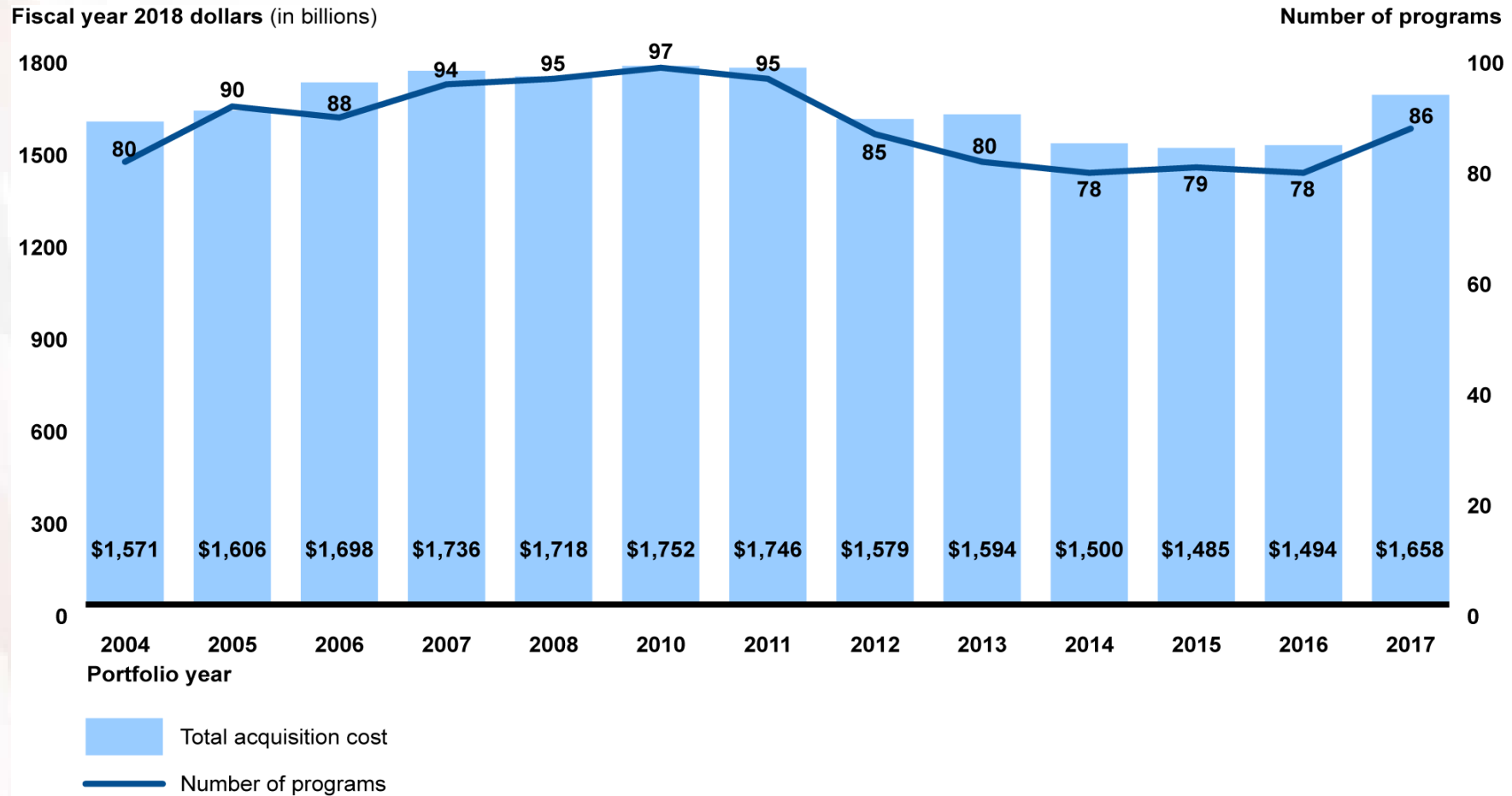
As of FY 2018 President's Budget

Defense Acquisition Management
Information Retrieval
(DAMIR)

UNCLASSIFIED

- Using DOD's annual Selected Acquisition Reports, we analyzed cost and schedule performance for the 86 MDAPs that comprised the 2017 portfolio.
 - This included analysis of the subsets of programs initiated since 2010 and before 2010.
- Using programs' responses to our acquisition management questionnaire, we analyzed 57 current and future MDAPs' implementation of 8 key knowledge-based acquisition practices.

DOD's Portfolio Cost and Size Have Increased Since 2016, but Remain within Historic Ranges

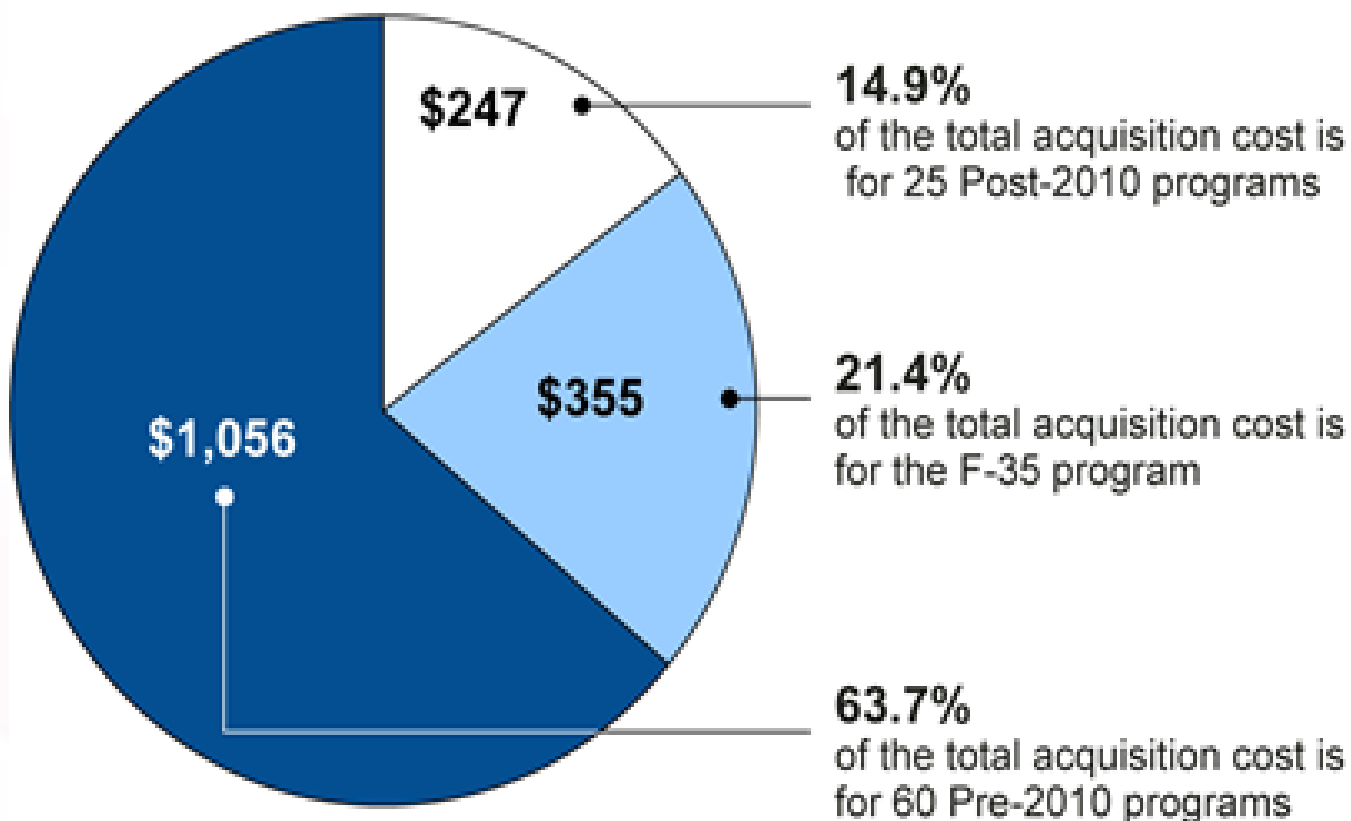


Source: GAO analysis of Department of Defense data. | GAO-18-360SP

Note: DOD did not issue Selected Acquisition Reports (SAR) in 2009, which precluded us from having the cost baseline information necessary to include 2009 in this analysis.

Over 85 Percent of the 2017 Portfolio's Estimated Total Acquisition Cost Is for the 61 Programs That DOD Initiated Prior to 2010

Fiscal year 2018 dollars (in billions)



Source: GAO analysis of Department of Defense data. | GAO-18-360SP



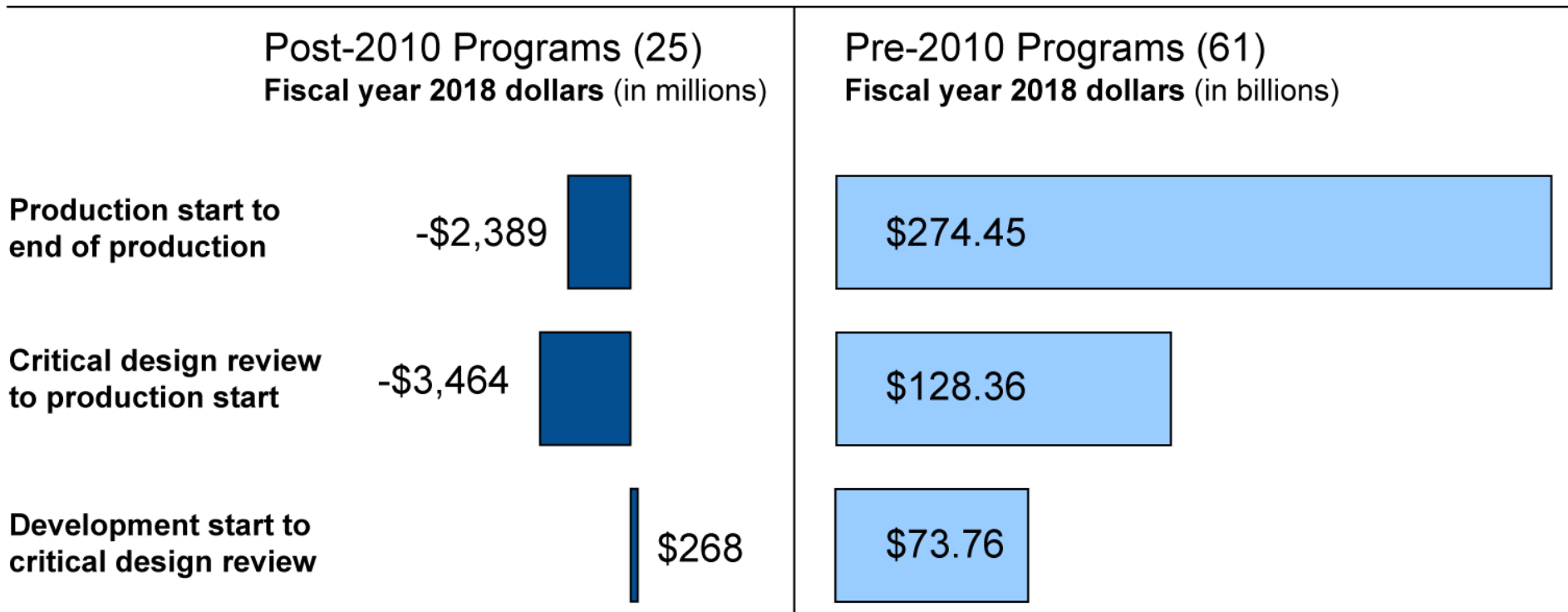
DOD Estimates that its 2017 Portfolio Will Cost More and Take Longer to Deliver as Compared to the 2016 Portfolio

Fiscal year 2018 dollars in billions

| | 2016 portfolio estimates | 2017 portfolio estimates | Net change between 2016 and 2017 | Percentage change between 2016 and 2017 |
|--|--------------------------|--------------------------|----------------------------------|---|
| 25 programs initiated since 2010 | | | | |
| Total estimated acquisition cost | \$252.4 | \$246.8 | -\$5.6 | -2.2 |
| Average cycle time in months to deliver initial capabilities | 92.4 | 95.0 | 2.6 | 2.8 |
| 61 programs initiated before 2010 | | | | |
| Total estimated acquisition cost | 1,350.7 | 1,411.0 | 60.3 | 4.5 |
| Average cycle time in months to deliver initial capabilities | 133.9 | 134.8 | 0.9 | 0.7 |
| All 86 programs in 2017 portfolio | | | | |
| Total estimated acquisition cost | 1,603.1 | 1657.8 | 54.7 | 3.4 |
| Average cycle time in months to deliver initial capabilities | 121.7 | 123.0 | 1.3 | 1.1 |

Source: GAO analysis of Department of Defense data. | GAO-18-360SP

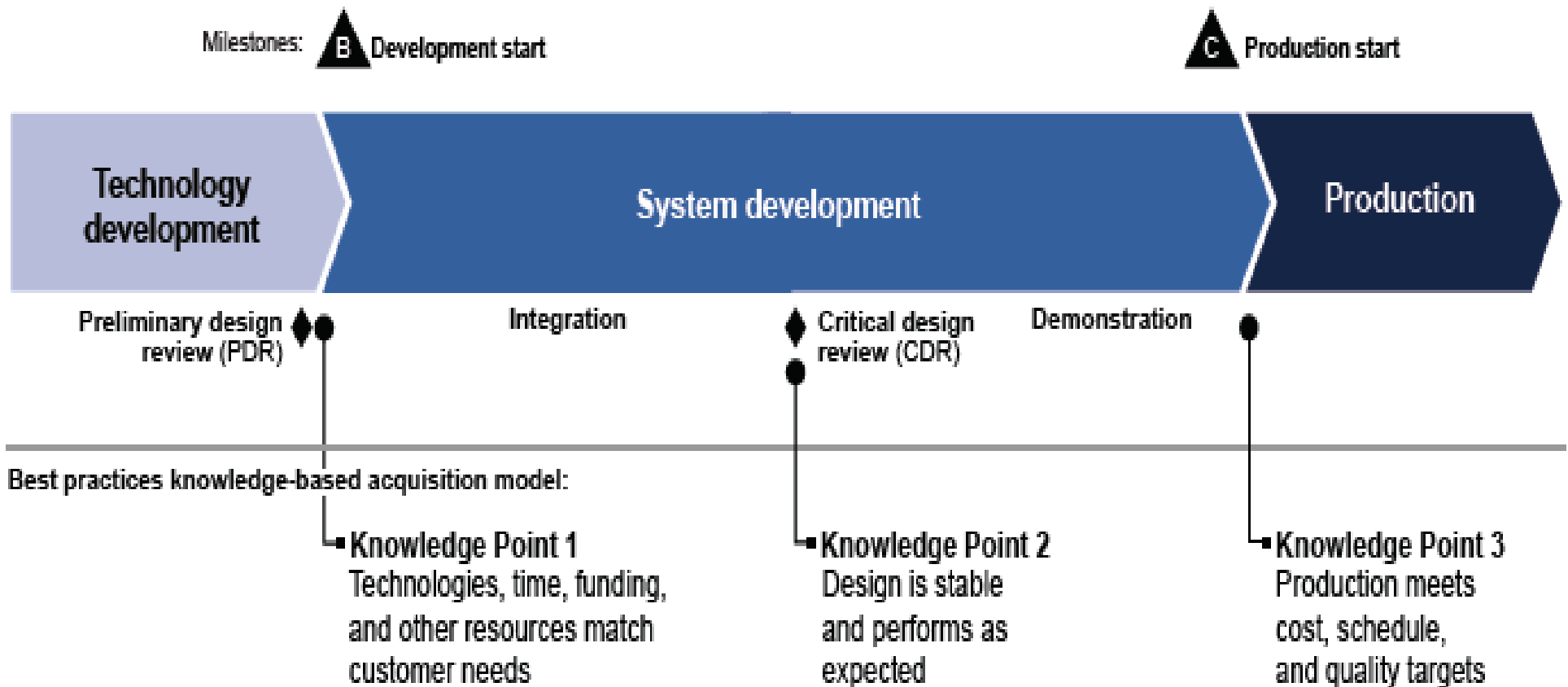
Programs Initiated since 2010 Have Shown Less Cost Growth, and in Earlier Phases, than Older Programs



Source: GAO analysis of Department of Defense data. | GAO-18-360SP

Defense Acquisition Cycle and GAO-Identified Knowledge Points

Department of Defense (DOD) Acquisition Process



Source: GAO analysis of DOD-provided data, DOD Instruction 5000.02, and best practices. | GAO-18-360SP

DOD Programs Continue to Not Fully Implement Knowledge-based Acquisition Practices

- Most of the 45 current programs we assessed this year proceeded through the three knowledge points without completing all 8 key knowledge-based acquisition practices associated with them.
- This trend is consistent with observations we have made throughout our previous annual assessments.

| Practices Associated with the Three Key Knowledge Points (KP) | Thirty-seven programs GAO previously assessed that had completed the KP | Eight programs GAO assessed in 2018 that recently completed the KP |
|---|---|--|
| Demonstrate all critical technologies are very close to final form, fit, and function within a relevant environment | | |
| Demonstrate all critical technologies are in form, fit, and function within a realistic environment | | |
| Completed preliminary design review before system development start | | |
| Release at least 90 percent of design drawings to manufacturing | | |
| Test a system-level integrated prototype | | |
| Demonstrate critical manufacturing processes are in statistical control | | |
| Demonstrate critical processes on a pilot production line | | |
| Test a production-representative prototype in its intended environment | | |

Programs completing each best practice ● 75 - 100 percent ◐ 50 - 74 percent ○ 0 - 49 percent

Implementation of Knowledge-Based Practices for Programs that Entered System Development during Our Assessment Period

| Knowledge Based Practices at System Development Start | John Lewis Class Fleet Replenishment Oiler (T-AO 205) |
|--|---|
| Demonstrate all critical technologies are very close to final form, fit, and function within a relevant environment. (TRL 6) | ● |
| Demonstrate all critical technologies are in form, fit, and function within a realistic environment. (TRL 7) | ● |
| Complete preliminary design review before system development start | ○ |
| ● Practice implemented ○ Practice not implemented -- Data not available N/A Practice not applicable Source: GAO analysis of DOD data GAO-18-360SP | |



Implementation of Knowledge-Based Practices for Programs that Completed a Critical Design Review during Our Assessment Period

| Knowledge-based practices at critical design review | <i>Combat Rescue Helicopter</i> | <i>F-15 Eagle Passive Active Warning Survivability System</i> | <i>Indirect Fire Protection Capability Increment 2-Intercept Block 1</i> | <i>Next Generation Jammer Increment 1</i> |
|---|---------------------------------|---|--|---|
| Release at least 90 percent of design drawings to manufacturing | ● | ○ | ● | ● |
| Test a system-level integrated prototype | ○ | ○ | ○ | ○ |
| ● Practice implemented ○ Practice not implemented -- Data not available N/A Practice not applicable | | | | |
| Source: GAO analysis of DOD data GAO-18-360SP | | | | |

Implementation of Knowledge-Based Practices for Programs that Entered Production during our Assessment Period

| Knowledge Based Practices at Production Decision | <i>Air and Missile Defense Radar</i> | <i>CH-53K Heavy Lift Replacement Helicopter</i> | <i>MQ-8 Fire Scout</i> |
|---|--------------------------------------|---|------------------------|
| Demonstrate Manufacturing Readiness Level of at least a 9 or critical processes are in statistical control | ○ | ○ | N/A |
| Demonstrate critical processes on a pilot production line | N/A | ● | ● |
| Test a production-representative prototype in its intended environment | ○ | ● | ● |
| <ul style="list-style-type: none"> ● Practice implemented ○ Practice not implemented -- Data not available N/A Practice not applicable | | | |
| Source: GAO analysis of DOD data GAO-18-360SP | | | |



Projected Implementation of Knowledge-Based Practices for Future Programs

| | Development Start | Projected to Demonstrate all critical technologies in a realistic environment | Projected to complete all systems engineering reviews | Plan to constrain system development to 6 years or less |
|--|--------------------|---|---|---|
| Advanced Pilot Training | Spring/Summer 2018 | N/A | ○ | ● |
| Amphibious Ship Replacement | TBD | N/A | -- | N/A |
| B-2 Extremely High Frequency Satellite Communications | TBD | N/A | -- | -- |
| Ground Based Strategic Deterrent | 9/3/2020 | ○ | ● | -- |
| Improved Turbine Engine Program | TBD | ○ | ● | -- |
| Joint Surveillance Target Attack Radar System Recapitalization | 3/31/2018 | ○ | ● | ● |
| Long Range Precision Fires | 1/15/2021 | N/A | ● | ● |
| MQ-25 Unmanned Aircraft System | 7/30/2018 | N/A | ○ | ● |
| Navy Frigate | 9/25/2020 | N/A | ○ | N/A |
| UH-1N Utility Helicopter Replacement | N/A | N/A | ○ | ○ |
| VC-25B Presidential Aircraft Replacement | 6/29/2018 | N/A | ○ | ○ |
| Weather System Follow-on Microwave | 3/25/2019 | ● | ○ | ○ |

● Practice planned to be implemented ○ Practice not planned to be implemented -- Data not available N/A Not Applicable

Source: GAO analysis of DOD data | GAO-18-360SP

Exploratory Statistical Analysis Suggests that Certain Knowledge-Based Acquisition Practices Correspond with Better Acquisition Outcomes

- We observed, on average, MDAPs that completed some or all of the following knowledge-based acquisition practices had lower cost increases, 56 to 63 percentage points, than other programs:
 1. demonstrated all critical technologies were very close to final form, fit, and function, within a relevant environment, before starting development;
 2. held a preliminary design review prior to starting development; and
 3. released at least 90 percent of their design drawings to manufacturing by critical design review.
- We analyzed 15 programs that completed knowledge points 1, 2, and 3.
- We conducted a means test comparing averages across systems that did and did not complete knowledge-based acquisition practices using a 95 percent confidence level.

Questions?



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