| Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army | | | | | | | | | | | Date: May 2021 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>2040: *Research, Development, Test & Evaluation, Army I* BA 7: *Operational Systems Development* | | | | | R-1 Program Element (Number/Name)<br>PE 0607139A *I Improved Turbine Engine Program* | | | | | | | |
| **COST ($ in Millions)** | **Prior Years** | **FY 2020** | **FY 2021** | **FY 2022 Base** | **FY 2022 OCO** | **FY 2022 Total** | **FY 2023** | **FY 2024** | **FY 2025** | **FY 2026** | **Cost To Complete** | **Total Cost** |
| Total Program Element | - | 197.941 | 232.159 | 275.024 | - | 275.024 | - | - | - | - | - | - |
| ES6: *Improved Turbine Engine Program* | - | 197.941 | 232.159 | 275.024 | - | 275.024 | - | - | - | - | - | - |
| **Program MDAP/MAIS Code:** 487 | | | | | | | | | | | | |

**A. Mission Description and Budget Item Justification**

Improved Turbine Engine Program (ITEP) develops, tests, qualifies, and integrates the next generation turboshaft engine on Future Attack Reconnaissance Aircraft (FARA), Black Hawk and Apache aircraft. The Improved Turbine Engine (ITE) replaces the existing T700 engine design originated in the 1970's and meets the operational requirement of 6,000 feet pressure altitude and 95 degrees (6K/95). The ITE will fit inside the existing engine bays of the Black Hawk and Apache Helicopters and provides a significant power enhancement of up to fifty percent (total of 3,000 class shaft horsepower) with increased fuel efficiency. Additional benefits include improved design life, enhanced reliability, lower maintenance cost and restored capability lost due to aircraft weight growth without an increase to the logistics footprint. The program consists of systems engineering and program management, detailed design engineering, design assurance, hardware manufacturing and testing, component and module level development and testing, system level testing and qualification, and platform integration and qualification. ITEP is postured to accelerate based on General Electric contract incentives and integration.

FY 2020 funding continued the EMD effort initiated in FY 2019, platform/engine integration A-kit development, completion of engine Critical Design Review (CDR), initiation of engine component testing, completion of Apache Integrated Baseline Review (IBR), completion of engine fit check for Apache and Black Hawk platforms, completion of Apache A-Kit Preliminary Design Review (PDR), and completion of the Systems Requirements Review (SRR) for Apache and Black Hawk. FY 2021 funding completed Apache Incremental Critical Design Review #1 (iCDR), continues the EMD effort, continues engine component testing leading to First Engine To Test (FETT), will complete Black Hawk Integrated Baseline Review (IBR), will complete the Live Fire Test Design Plan, begins Preliminary Flight Rating (PFR) testing, begins physical airframe integration, initiates Apache A-Kit iCDR #2, and initiates Black Hawk A-Kit PDR. FY 2022 funding will continue PFR testing leading to a Preliminary Flight Rated engine in FY 2023, continues physical airframe integration, and continues Live Fire detailed test planning, completes Apache A-Kit iCDR #2, completes Black Hawk A-Kit PDR, and initiates Black Hawk A-Kit CDR. FY 2023 funding provides for completion of Black Hawk A-Kit CDR, completion of Live Fire detailed test planning, initiation of work to prepare for Live Fire static engine tests, initiation of aircraft flight/qualification testing for both Apache and Black Hawk, and the initiation of engine full qualification testing. FY 2024 funding provides for continuation of aircraft flight/qualification testing for both Apache and Black Hawk, completion of Live Fire static engine tests, completion of engine qualification, initiation of work to prepare for the Live Fire dynamic engine tests, and the beginning Low Rate Initial Production (LRIP). FY 2025 funding provides for completion of Live Fire dynamic engine tests, continuation of flight/qualification for both Black Hawk and Apache, continuation of LRIP, execution of Initial Operational Test and Evaluation (IOTE) for Black Hawk and Apache, beginning engine integration and A-kit development for the H-60V platform, and initiation of work to prepare for the Live Fire platform level testing (as needed). FY 2026 funding provides for H-60V A-kit CDR, and begins physical airframe integration.

| Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Army | | | | | Date: May 2021 |
|---|---|---|---|---|---|
| Appropriation/Budget Activity<br>2040: *Research, Development, Test & Evaluation, Army* / BA 7: *Operational Systems Development* | | | R-1 Program Element (Number/Name)<br>PE 0607139A / *Improved Turbine Engine Program* | | |
| **B. Program Change Summary ($ in Millions)** | **FY 2020** | **FY 2021** | **FY 2022 Base** | **FY 2022 OCO** | **FY 2022 Total** |
| Previous President's Budget | 206.434 | 249.257 | 245.566 | - | 245.566 |
| Current President's Budget | 197.941 | 232.159 | 275.024 | - | 275.024 |
| Total Adjustments | -8.493 | -17.098 | 29.458 | - | 29.458 |
| • Congressional General Reductions | - | - | | | |
| • Congressional Directed Reductions | - | -8.000 | | | |
| • Congressional Rescissions | - | - | | | |
| • Congressional Adds | - | - | | | |
| • Congressional Directed Transfers | - | - | | | |
| • Reprogrammings | - | - | | | |
| • SBIR/STTR Transfer | -8.493 | -9.098 | | | |
| • Adjustments to Budget Years | - | - | 29.458 | - | 29.458 |

**Change Summary Explanation**

Increase in PB22 due to increased engine testing of multiple systems engines, procurement of long-lead hardware for aircraft integration, Live Fire detailed test planning, and airframe integration.

| Exhibit R-2A, RDT&E Project Justification: PB 2022 Army | | | Date: May 2021 |
|---|---|---|---|
| Appropriation/Budget Activity<br>2040 / 7 | R-1 Program Element (Number/Name)<br>PE 0607139A / *Improved Turbine Engine Program* | Project (Number/Name)<br>ES6 / *Improved Turbine Engine Program* | |

| COST ($ in Millions) | Prior Years | FY 2020 | FY 2021 | FY 2022 Base | FY 2022 OCO | FY 2022 Total | FY 2023 | FY 2024 | FY 2025 | FY 2026 | Cost To Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ES6: *Improved Turbine Engine Program* | - | 197.941 | 232.159 | 275.024 | - | 275.024 | - | - | - | - | - | - |
| Quantity of RDT&E Articles | - | - | - | - | - | - | - | - | - | - | | |

**A. Mission Description and Budget Item Justification**

Improved Turbine Engine Program (ITEP) develops, tests, qualifies, and integrates the next generation turboshaft engine on Future Attack Reconnaissance Aircraft (FARA), Black Hawk and Apache aircraft. The Improved Turbine Engine (ITE) replaces the existing T700 engine design originated in the 1970's and meets the operational requirement of 6,000 feet pressure altitude and 95 degrees (6K/95). The ITE will fit inside the existing engine bays of the Black Hawk and Apache Helicopters and provides a significant power enhancement of up to fifty percent (total of 3,000 class shaft horsepower) with increased fuel efficiency. Additional benefits include improved design life, enhanced reliability, lower maintenance cost and restored capability lost due to aircraft weight growth without an increase to the logistics footprint. The program consists of systems engineering and program management, detailed design engineering, design assurance, hardware manufacturing and testing, component and module level development and testing, system level testing and qualification, and platform integration and qualification. ITEP is postured to accelerate based on General Electric contract incentives and integration.

FY 2020 funding continued the EMD effort initiated in FY 2019, platform/engine integration A-kit development, completion of engine Critical Design Review (CDR), initiation of engine component testing, completion of Apache Integrated Baseline Review (IBR), completion of engine fit check for Apache and Black Hawk platforms, completion of Apache A-Kit Preliminary Design Review (PDR), and completion of the Systems Requirements Review (SRR) for Apache and Black Hawk. FY 2021 funding completed Apache Incremental Critical Design Review #1 (iCDR), continues the EMD effort, continues engine component testing leading to First Engine To Test (FETT), will complete Black Hawk Integrated Baseline Review (IBR), will complete the Live Fire Test Design Plan, begins Preliminary Flight Rating (PFR) testing, begins physical airframe integration, initiates Apache A-Kit iCDR #2, and initiates Black Hawk A-Kit PDR. FY 2022 funding will continue PFR testing leading to a Preliminary Flight Rated engine in FY 2023, continues physical airframe integration, and continues Live Fire detailed test planning, completes Apache A-Kit iCDR #2, completes Black Hawk A-Kit PDR, and initiates Black Hawk A-Kit CDR. FY 2023 funding provides for completion of Black Hawk A-Kit CDR, completion of Live Fire detailed test planning, initiation of work to prepare for Live Fire static engine tests, initiation of aircraft flight/qualification testing for both Apache and Black Hawk, and the initiation of engine full qualification testing. FY 2024 funding provides for continuation of aircraft flight/qualification testing for both Apache and Black Hawk, completion of Live Fire static engine tests, completion of engine qualification, initiation of work to prepare for the Live Fire dynamic engine tests, and the beginning Low Rate Initial Production (LRIP). FY 2025 funding provides for completion of Live Fire dynamic engine tests, continuation of flight/qualification for both Black Hawk and Apache, continuation of LRIP, execution of Initial Operational Test and Evaluation (IOTE) for Black Hawk and Apache, beginning engine integration and A-kit development for the H-60V platform, and initiation of work to prepare for the Live Fire platform level testing (as needed). FY 2026 funding provides for H-60V A-kit CDR, and begins physical airframe integration.

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2020 | FY 2021 | FY 2022 |
|---|---|---|---|
| ***Title:*** ITEP | 197.941 | 232.159 | 275.024 |

| Exhibit R-2A, RDT&E Project Justification: PB 2022 Army | | Date: May 2021 |
|---|---|---|
| **Appropriation/Budget Activity**<br>2040 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0607139A / *Improved Turbine Engine Program* | **Project (Number/Name)**<br>ES6 / *Improved Turbine Engine Program* |

| B. Accomplishments/Planned Programs ($ in Millions) | FY 2020 | FY 2021 | FY 2022 |
|---|---|---|---|
| ***Description:*** ITEP - a multi-platform turbine engine development required across existing Army aircraft to fill the capability gaps for Army Aviation Operations<br><br>***FY 2021 Plans:***<br>FY 2021 completed Apache Incremental Critical Design Review #1 (iCDR), completes Live Fire Test Design Plan, completes Black Hawk Integrated Baseline Review (IBR), continues the EMD effort, continues engine component testing leading to First Engine To Test (FETT), begins Preliminary Flight Rating (PFR) testing, initiates Apache A-Kit iCDR #2, initiates Black Hawk A-Kit PDR, and begins physical airframe integration.<br><br>***FY 2022 Plans:***<br>FY 2022 funding will continue PFR testing, leading to a Preliminary Flight Rated engine in FY 2023, complete Apache A-Kit iCDR #2, complete Black Hawk A-Kit PDR, initiate Black Hawk A-Kit CDR, continue physical airframe integration, and continue Live Fire detailed test planning.<br><br>***FY 2021 to FY 2022 Increase/Decrease Statement:***<br>Increase due to PFR engine testing of multiple engines, Apache A-Kit iCDR #2, Black Hawk A-Kit PDR, initiation of Black Hawk CDR, procurement of long-lead hardware for aircraft integration, Live Fire detailed test planning, and airframe integration on both platforms. | | | |
| **Accomplishments/Planned Programs Subtotals** | 197.941 | 232.159 | 275.024 |

**C. Other Program Funding Summary ($ in Millions)**

N/A

**Remarks**

For FY 2014 and prior, all funding for ITEP was contained in Program Element (PE) 0203744A - Aircraft Modifications/Product Improvement Programs, Project 504. FY 2015 funding was initially moved to PE 0203744A, Project EB1. Prior to execution, FY 2015 and beyond funding was moved to to PE 0607139A, Project ES6.

**D. Acquisition Strategy**

Following a successful Milestone B decision, a cost-plus-incentive-fee contract was awarded to General Electric for EMD contractual effort in FY 2019.

ITEP Platform Integration Trade Studies Contracts were awarded to the Boeing Company and the Sikorsky Corporation in FY 2015. In FY 2019, two follow-on efforts were awarded to design and develop A-kits to integrate the ITE into both the Apache and Black Hawk platforms. Following a successful Apache A-Kit iCDR in FY 2021 and FY 2022, and Black Hawk A-Kit CDR in FY2023, the integration efforts will continue to include fabrication of the A-kits, flight test support, and pubs/provisioning.

Upon completion of EMD, an LRIP contract will be awarded in FY 2024.

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army | | | Date: May 2021 |
|---|---|---|---|
| Appropriation/Budget Activity<br>2040 / 7 | R-1 Program Element (Number/Name)<br>PE 0607139A / *Improved Turbine Engine Program* | Project (Number/Name)<br>ES6 / *Improved Turbine Engine Program* | |

**Management Services ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2020 Cost | FY 2020 Award Date | FY 2021 Cost | FY 2021 Award Date | FY 2022 Base Cost | FY 2022 Base Award Date | FY 2022 OCO Cost | FY 2022 OCO Award Date | FY 2022 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITEP SEPM - Organic | Allot | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 36.007 | 9.455 | Oct 2019 | 9.550 | Nov 2020 | 9.640 | Oct 2021 | - | | 9.640 | Continuing | Continuing | Continuing |
| ITEP SEPM - Contractor | C/IDIQ | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 14.332 | 3.425 | Oct 2019 | 3.608 | Nov 2020 | 3.878 | Oct 2021 | - | | 3.878 | Continuing | Continuing | Continuing |
| ITEP SEPM - OGA | MIPR | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 18.480 | 2.161 | Oct 2019 | 2.215 | Oct 2020 | 2.365 | Oct 2021 | - | | 2.365 | Continuing | Continuing | Continuing |
| | | **Subtotal** | 68.819 | 15.041 | | 15.373 | | 15.883 | | - | | 15.883 | Continuing | Continuing | N/A |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2020 Cost | FY 2020 Award Date | FY 2021 Cost | FY 2021 Award Date | FY 2022 Base Cost | FY 2022 Base Award Date | FY 2022 OCO Cost | FY 2022 OCO Award Date | FY 2022 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engine OEM EMD Contract | C/CPIF | General Electric Company (GE) : Lynn, MA | 121.900 | 132.267 | Oct 2019 | 148.510 | Nov 2020 | 135.461 | Oct 2021 | - | | 135.461 | Continuing | Continuing | Continuing |
| Platform Integration and Qualification Contracts | SS/CPIF | The Boeing Company, The Sikorsky Corporation : | 22.529 | 35.939 | Oct 2019 | 45.071 | Apr 2021 | 99.025 | Jan 2022 | - | | 99.025 | Continuing | Continuing | Continuing |

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army | | | Date: May 2021 |
|---|---|---|---|
| Appropriation/Budget Activity<br>2040 / 7 | R-1 Program Element (Number/Name)<br>PE 0607139A / *Improved Turbine Engine Program* | Project (Number/Name)<br>ES6 / *Improved Turbine Engine Program* | |

**Product Development ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2020 Cost | FY 2020 Award Date | FY 2021 Cost | FY 2021 Award Date | FY 2022 Base Cost | FY 2022 Base Award Date | FY 2022 OCO Cost | FY 2022 OCO Award Date | FY 2022 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Phoenix, AZ, Stratford, CT | | | | | | | | | | | | | |
| | | **Subtotal** | 144.429 | 168.206 | | 193.581 | | 234.486 | | - | | 234.486 | Continuing | Continuing | N/A |

**Support ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2020 Cost | FY 2020 Award Date | FY 2021 Cost | FY 2021 Award Date | FY 2022 Base Cost | FY 2022 Base Award Date | FY 2022 OCO Cost | FY 2022 OCO Award Date | FY 2022 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITEP Engineering Support - Organic | Allot | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 0.657 | 0.178 | Oct 2019 | 0.182 | Oct 2020 | 0.186 | Oct 2021 | - | | 0.186 | Continuing | Continuing | Continuing |
| ITEP Engineering Support - Contractor | C/IDIQ | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 8.484 | 2.296 | Oct 2019 | 2.729 | Oct 2020 | 2.894 | Oct 2021 | - | | 2.894 | Continuing | Continuing | Continuing |
| ITEP Engineering Support - OGA | MIPR | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 21.678 | 7.959 | Oct 2019 | 11.119 | Nov 2020 | 12.205 | Oct 2021 | - | | 12.205 | Continuing | Continuing | Continuing |
| Platform Integration Support | MIPR | Program Management Office (PMO) Apache and Black Hawk Project Offices : Redstone Arsenal, AL | - | 3.765 | Oct 2019 | 5.955 | Oct 2020 | 6.075 | Oct 2021 | - | | 6.075 | Continuing | Continuing | Continuing |

| Exhibit R-3, RDT&E Project Cost Analysis: PB 2022 Army | | | Date: May 2021 |
|---|---|---|---|
| Appropriation/Budget Activity<br>2040 / 7 | R-1 Program Element (Number/Name)<br>PE 0607139A / *Improved Turbine Engine Program* | Project (Number/Name)<br>ES6 / *Improved Turbine Engine Program* | |

**Support ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2020 Cost | FY 2020 Award Date | FY 2021 Cost | FY 2021 Award Date | FY 2022 Base Cost | FY 2022 Base Award Date | FY 2022 OCO Cost | FY 2022 OCO Award Date | FY 2022 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Subtotal** | 30.819 | 14.198 | | 19.985 | | 21.360 | | - | | 21.360 | Continuing | Continuing | N/A |

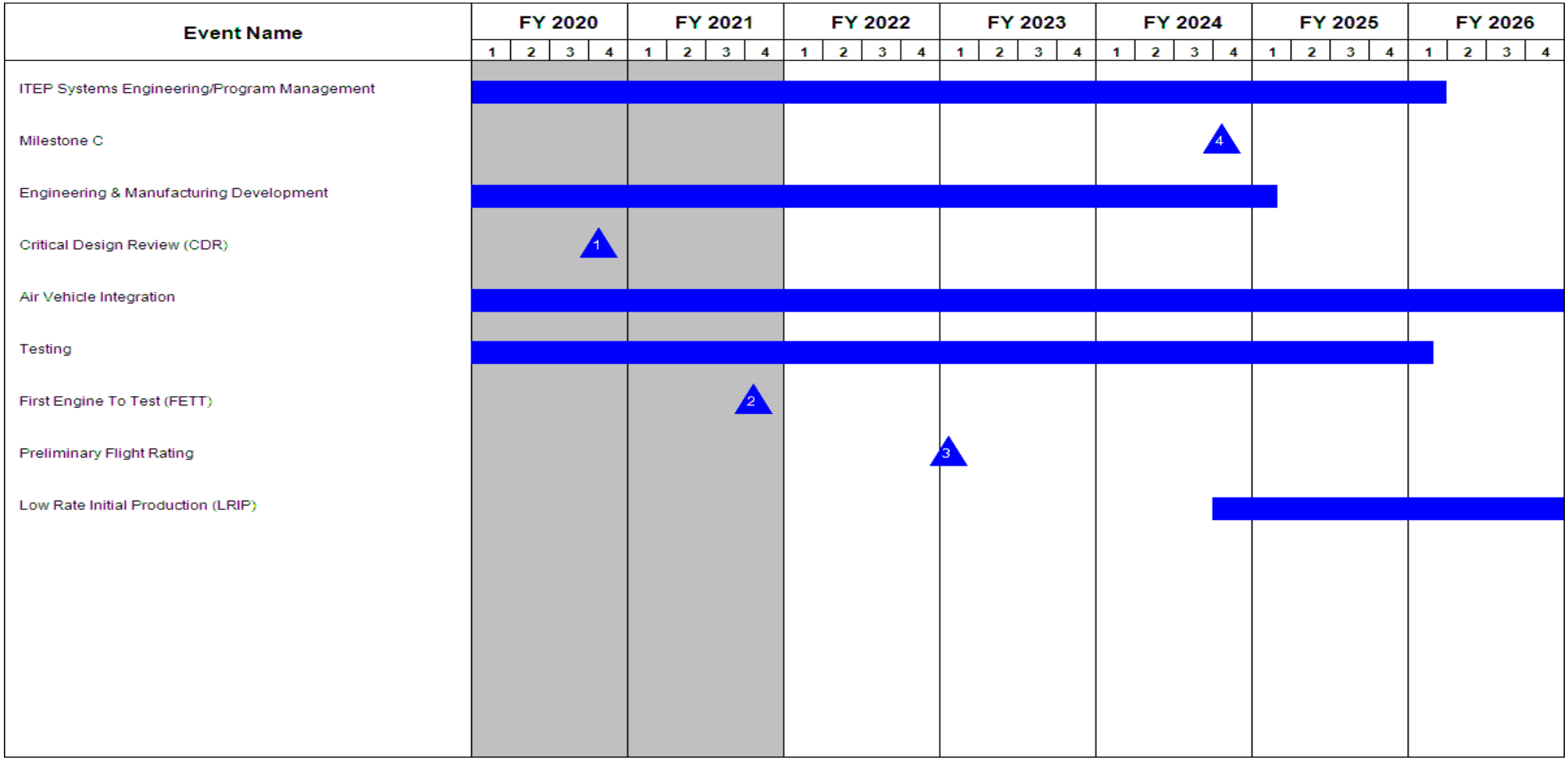
**Test and Evaluation ($ in Millions)**

| Cost Category Item | Contract Method & Type | Performing Activity & Location | Prior Years | FY 2020 Cost | FY 2020 Award Date | FY 2021 Cost | FY 2021 Award Date | FY 2022 Base Cost | FY 2022 Base Award Date | FY 2022 OCO Cost | FY 2022 OCO Award Date | FY 2022 Total Cost | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Government Test Planning/Test Setup and Analysis | SS/TBD | Program Management Office (PMO) Aviation Turbine Engines Project Office (ATE), Various : Redstone Arsenal, AL | 0.128 | 0.496 | Oct 2019 | 3.220 | Oct 2020 | 3.295 | Oct 2021 | - | | 3.295 | Continuing | Continuing | Continuing |
| | | **Subtotal** | 0.128 | 0.496 | | 3.220 | | 3.295 | | - | | 3.295 | Continuing | Continuing | N/A |

| | Prior Years | FY 2020 | | FY 2021 | | FY 2022 Base | | FY 2022 OCO | | FY 2022 Total | Cost To Complete | Total Cost | Target Value of Contract |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Cost Totals** | 244.195 | 197.941 | | 232.159 | | 275.024 | | - | | 275.024 | Continuing | Continuing | N/A |

**Remarks**

| Exhibit R-4, RDT&E Schedule Profile: PB 2022 Army | | Date: May 2021 |
|---|---|---|
| **Appropriation/Budget Activity**<br>2040 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0607139A / *Improved Turbine Engine Program* | **Project (Number/Name)**<br>ES6 / *Improved Turbine Engine Program* |



| Exhibit R-4A, RDT&E Schedule Details: PB 2022 Army | | Date: May 2021 |
|---|---|---|
| **Appropriation/Budget Activity**<br>2040 / 7 | **R-1 Program Element (Number/Name)**<br>PE 0607139A / *Improved Turbine Engine Program* | **Project (Number/Name)**<br>ES6 / *Improved Turbine Engine Program* |

## Schedule Details

| | Start | | End | |
|---|---|---|---|---|
| **Events** | **Quarter** | **Year** | **Quarter** | **Year** |
| ITEP Systems Engineering/Program Management | 1 | 2015 | 1 | 2026 |
| Milestone C | 4 | 2024 | 4 | 2024 |
| Engineering & Manufacturing Development | 2 | 2019 | 1 | 2025 |
| Critical Design Review (CDR) | 4 | 2020 | 4 | 2020 |
| Air Vehicle Integration | 2 | 2019 | 4 | 2026 |
| Testing | 2 | 2019 | 1 | 2026 |
| First Engine To Test (FETT) | 4 | 2021 | 4 | 2021 |
| Preliminary Flight Rating | 1 | 2023 | 1 | 2023 |
| Low Rate Initial Production (LRIP) | 4 | 2024 | 4 | 2026 |