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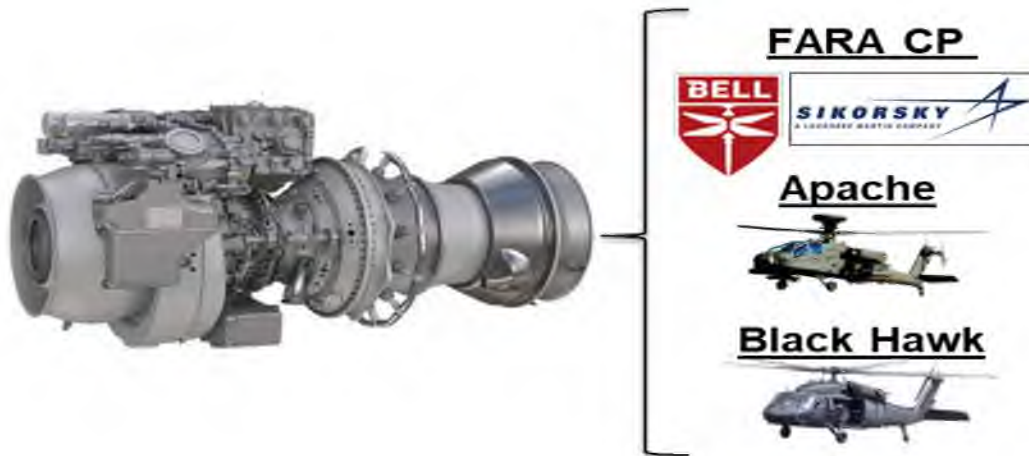
Department of Defense  
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

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# IMPROVED TURBINE ENGINE (ITEP)

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**December 2021 Selected Acquisition Report (SAR)**



December 31, 2021

Department of the Army

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## Executive Summary

**Program Highlights Since Last Report (Congress):** The program requirements are stable; however, the program has incurred COVID-19 cost increases resulting in an Over Target Baseline (cost overrun) but within Acquisition Program Baseline cost limits.

Army Acquisition Executive signed the Acquisition Decision Memorandum on January 29, 2019 approving Milestone B, allowing entry into the Engineering and Manufacturing Development (EMD) phase. EMD contract was competitively awarded to General Electric Aviation on February 1, 2019. Acquisition Program Baseline (APB) approved on August 26, 2019, establishing Average Procurement Unit Cost and Program Acquisition Unit Cost. The FY2020 Rescission and FY2021 Mark to the program caused a 6-month delay to platform integration contracts which resulted in a high risk APB schedule deviation for Developmental Testing (DT) completion and Milestone C (from APB Objective - July 2024; to APB Threshold - January 2025). With the Army's restoration of \$32.5M in FY2022 and \$17.5M in FY2023 and FY2024 to prevent a high risk APB schedule deviation and unrecoverable schedule delays, the program now has 12- to 14-months (FY2022) to make up an original 18-month integration schedule for DT start to achieve Milestone C Objective. The FY22 Conference Mark of \$15M for "platform integration previously funded" will delay platform developmental testing by 2 months and potentially result in an Acquisition Program Baseline schedule deviation. This schedule delay will impact the ITEP's Milestone C and subsequent Low Rate Initial Production award and is considered moderate risk.

On October 10, 2020, GE submitted a Request for Equitable Adjustment (REA) IAW FAR 52.216-10(e)(4) requesting a contract modification to avoid being penalized for costs incurred for reasons beyond its control. The REA proposed a funding adjustment of ~\$42.2M in cost through FY2024: \$15.2M in FY2020, \$14.2M in FY2021, and \$12.7M in FY2022-2024; and an addition of four months to Preliminary Flight Rating (PFR). Currently, the Aviation Turbine Engine Project Office (ATE PO), Army Contracting Command (ACC), and Defense Contract Management Agency (DCMA) completed a Tiger Team review of the REA and have provided the ACC with two recommended positions for FY2020 reconciliation: 1) Schedule and 2) Cost. The GE COVID incentive schedule modification was awarded on July 7, 2021, providing 110 days of relief. On September 30, 2021, ACC submitted a formal offer to GE for FY 2020 cost relief, negotiations are on-going.

There are no significant software-related issues with this program at this time.

## History of Significant Developments Since Program Initiation:

Date	Description
Jan-2019	The Army Acquisition Executive signed the Acquisition Decision Memorandum on January 29, 2019 approving Milestone B, allowing entry into the Engineering and Manufacturing Development Phase.
Jul-2020	Successful Engine Control System Component Critical Design Review, Software Critical Design Review, and capstone Engine System Critical Design Review were all conducted in a virtual environment.
Dec-2020	Successful completion of Apache Incremental Critical Design Review #1 (CDR), which was conducted in a virtual environment.
Apr-2021	Contract award of Black Hawk Integration Contract Phase 1.2.

Jun-2021	Successful completion of Black Hawk integrated Baseline Review (IBR), which was conducted in a virtual environment.
Jul-2021	FARA Software Preliminary Design Review.

## Schedule

### Schedule Events

Event Title (or Header)	Current Objective	Current Threshold	Current Estimate/Actual Date
Milestone B	Jan-2019	Jan-2019	Jan-2019
Critical Design Review	Apr-2020	Oct-2020	Jul-2020
Developmental Test & Evaluation	Jul-2024	Jan-2025	Nov-2024
Milestone C	Jul-2024	Jan-2025	Nov-2024
Initial Operational Test & Evaluation	Mar-2026	Sep-2026	Apr-2026
Full Rate Production	Jul-2026	Jan-2027	Nov-2026
Initial Operational Capability	Jul-2027	Jan-2028	Jul-2027

<i>Schedule Notes:</i>	<i>Schedule Deviation Explanations:</i>
	The FY20 Rescission and FY21 Mark to the program caused a 6 month delay to platform integration contracts which resulted in a high risk APB schedule deviation for Developmental Testing (DT) completion and Milestone C (from Acquisition Program Baseline objective - July 2024; to Acquisition Program Baseline Threshold - January 2025). With the Army restoration of \$32.5M in FY22 and \$17.5M in FY23 and FY24 to prevent a high risk Acquisition Program Baseline schedule deviation and unrecoverable schedule delays, the program now has 12- to 14-months (FY2022) to make up an original 18-month integration schedule for Developmental Testing start to achieve Milestone C objectives and is considered a moderate risk.

### Significant Schedule Risks

Event	Date	Description
Current	12/1/2021	Delay in Developmental Testing (DT) completion and Milestone C



## Performance

Performance Attributes					
Current Objective	Current Threshold	Current Estimate	Deviation?	Demonstrated Performance	Date
<b>Attribute Title:</b>	<b>System Survivability</b>			<b>KPP</b>	
<p>The statistically average production engine will have an Infrared (IR) signature contribution from exhaust and component radiance that is less than the 701D engine at Maximum Rated Power in a comparably configured platform at 6K/95°F without suppressed engine exhaust. The statistically average production engine will also have an integrated IR suppression that is pilot controlled from either off (no suppression) or on (full suppression) capability and will have no more than 2% engine power loss when fully suppressed. The IR suppressor system should default to full suppression in the event of an actuator failure for redundancy.</p>	<p>The production engine will have an Infrared (IR) Signature contribution from exhaust and component radiance that will not exceed the 701D engine at Maximum Rated Power in a comparably configured platform at 6K/95°F without suppressed engine exhaust.</p>	<p>The production engine will have an Infrared (IR) signature contribution from exhaust and component radiance that will not exceed the 701D engine at Maximum Rated Power in a comparably configured platform at 6K/95°F without Suppressed engine exhaust.</p>		TBD	

Attribute Title:	Ballistic Survivability			KPP	
<p>The automatic redundant digital engine control unit design will be such that engagement by a single round shall not result in loss of automatic engine control function. The unit must autonomously function to continue to provide full automatic engine control without crew interaction. Threat round characteristics are as defined in the Apache Lot 4 Capability Production Document classified annex dated April 2, 2013.</p>	<p>(T=O) The automatic redundant digital engine control unit design will be such that engagement by a single round shall not result in loss of automatic engine control function. The unit must autonomously function to continue to provide full automatic engine control without crew interaction. Threat round characteristics are as defined in the Apache Lot 4 Capability Production Document classified annex dated April 2, 2013.</p>	<p>The automatic redundant digital engine control unit design will be such that engagement by a single round shall not result in loss of automatic engine control function. The unit must autonomously function to continue to provide full automatic engine control without crew interaction. Threat round characteristics are as defined in the Apache Lot 4 Capability Production Document classified annex dated April 2, 2013.</p>		TBD	
Attribute Title:	Cybersecurity			KPP	
<p>Installation, operations and sustainment of the Improved Turbine Engine (ITE) does not increase the number of known cybersecurity vulnerabilities on the hosting platforms. The ITE shall provide means to rapidly restore functionality in the event of compromise.</p>	<p>Installation, operations and sustainment of the Improved Turbine Engine (ITE) produces no Category 1 (critical) known vulnerabilities on the hosting platforms. Physical separation shall be maintained between the ITE and architecture not requiring communication. The ITE shall provide</p>	<p>Installation, operations and sustainment of the Improved Turbine Engine (ITE) produces no category 1 (critical) known vulnerabilities on the hosting platforms. Physical separation shall be maintained between the ITE and architecture not requiring</p>		TBD	

	redundancy to prevent and mitigate functionality in the event of compromise.	communication. The ITE shall provide redundancy to prevent and mitigate functionality in the event of compromise.			
<b>Attribute Title:</b>	<b>Sustainment</b>			<b>KPP</b>	
Ao = 98% Am = 80%	Ao = 95% Am = 70%	Ao = 95% Am = 70%		TBD	
<b>Attribute Title:</b>	<b>Training</b>			<b>KPP</b>	
The Training Program shall train 100% of the identified Critical Training Tasks in a Live, Virtual, or Constructive environment to the identified Military Occupational Specialty and skill level at the location identified in the System Training Plan. The system training capability shall replicate/emulate operation and maintenance tasks of the Improved Turbine Engine (ITE) to 80% of the physical fidelity and 100% of the functional fidelity of the ITE for critical training tasks. Maintainer proficiency shall be maintained on 100% of critical and 90% of supporting tasks within 180 days	(T=O) The Training Program shall train 100% of the identified Critical Training Tasks in a Live Virtual, or Constructive environment to the identified Military Occupational Specialty and skill level at the location identified in the System Training Plan. The system training capability shall replicate/emulate operation and maintenance tasks of the Improved Turbine Engine (ITE) to 80% of the physical fidelity and 100% of the functional fidelity of the ITE for critical training tasks. Maintainer proficiency shall be maintained on 100% of critical and 90% of supporting	The Training Program shall train 100% of the identified Critical Training Tasks in a Live, Virtual, or Constructive environment to the identified Military Occupational Specialty and skill level at the location identified in the System Training Plan. The system training capability shall replicate/emulate operation and maintenance tasks of the Improved Turbine Engine (ITE) to 80% of the physical fidelity and 100% of the functional fidelity of the ITE for critical training tasks. Maintainer proficiency shall be maintained on 100% of critical		TBD	

<p>of the training event. The ITE shall facilitate operator and maintainer task proficiency and skill retention by incorporating trainability considerations in aspects of system design. The ITE shall make use of embedded job/memory aids to assist Soldiers in performing critical tasks and reducing refresher training requirements. ITE components and operator/maintainer interfaces shall provide built-in task performance feedback to enhance skill retention.</p>	<p>tasks within 180 days of the training event. The ITE shall facilitate operator and maintainer task proficiency and skill retention by incorporating trainability considerations in aspects of system design. The ITE shall make use of embedded job/memory aids to assist Soldiers in performing critical tasks and reducing refresher training requirements. ITE components and operator/maintainer interfaces shall provide built-in task performance feedback to enhance skill retention.</p>	<p>and 90% of supporting tasks within 180 days of the training event. The ITE shall facilitate operator and maintainer task proficiency and skill retention by incorporating trainability considerations in aspects of system design. The ITE shall make use of embedded job/memory aids to assist Soldiers in performing critical tasks and reducing refresher training requirements. ITE components and operator/maintainer interfaces shall provide built-in task performance feedback to enhance skill retention.</p>			
<b>Attribute Title:</b>	<b>Energy</b>			<b>KPP</b>	
<p>The Improved Turbine Engine (ITE) must provide an increased fuel efficiency when compared to current 701D engine at cruise condition of no less than 25% (<math>\leq</math> 0.352 lbs/Shaft Horsepower-hr) improvement in</p>	<p>The Improved Turbine Engine (ITE) must provide an increased fuel efficiency when compared to current 701D engine at cruise condition of no less than 13% (<math>\leq</math> 0.409 lbs/Shaft Horsepower-hr) improvement in</p>	<p>The Improved Turbine Engine (ITE) must provide an increased fuel efficiency when compared to current 701D engine at cruise condition of no less than 13% (<math>\leq</math> 0.409 lb./Shaft Horsepower-hr) improvement in</p>		TBD	



Specific Fuel Consumption as measured in an appropriate test cell facility with the engine operating at 1450 Shaft Horsepower and environmental conditions set at 6K/95°F.	Specific Fuel Consumption as measured in an appropriate test cell facility with the engine operating at 1450 Shaft Horsepower and environmental conditions set at 6K/95°F.	Specific Fuel Consumption as measured in an appropriate test cell facility with the engine operating at 1450 Shaft Horsepower and environmental conditions set at 6K/95°F.			
<b>Attribute Title:</b>	<b>UH-60 Worldwide Performance</b>			<b>KPP</b>	
An H-60 with the installed Improved Turbine Engine (ITE) will have sufficient power available to perform a 750 feet per minute Vertical Rate of Climb (VROC) from Hover Out of Ground Effect (HOGE) at mission start with a takeoff gross weight of 22,000 lbs up to 6K/95°F at Maximum Continuous Power. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95°F.	An H-60 with the installed Improved Turbine Engine (ITE) will have sufficient power available to perform a 500 feet per minute Vertical Rate of Climb (VROC) from Hover Out of Ground Effect (HOGE) at mission start with a takeoff gross weight of 20,632 lbs up to 6K/95°F using no more than 95% Maximum Rated Power. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95°F.	An H-60 with the installed Improved Turbine Engine (ITE) will have sufficient power available to perform a 500 feet per minute Vertical Rate of Climb (VROC) from Hover Out of Ground Effect (HOGE) at mission start with a takeoff gross weight of 20,632 lbs up to 6K/95°F using no more than 95% Maximum Rated Power. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95°F.		TBD	
<b>Attribute Title:</b>	<b>AH-64E Worldwide Performance</b>			<b>KPP</b>	
An AH-64E with the installed Improved Turbine Engine (ITE) will have sufficient power available	An AH-64E with the installed Improved Turbine Engine (ITE) will have sufficient power available	An AH-64E with the installed Improved Turbine Engine (ITE) will have sufficient power available		TBD	

to Hover Out of Ground Effect (HOGE) at mission start with a takeoff gross weight of 20,260 lbs up to 6K/95°F at Maximum Continuous Power. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95°F.	to Hover Out of Ground Effect (HOGE) at mission start with a takeoff gross weight of 18,461 lbs up to 6K/95°F using no more than 95% Maximum Rated Power. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95°F.	available to Hover Out of Ground Effect (HOGE) at mission start with a takeoff gross weight of 18,461 lbs up to 6K/95°F using no more than 95% Maximum Rated Power. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95°F.			
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<i>Performance Notes:</i>	<i>Performance Deviation Explanations:</i>

## Acquisition Budget Costs

### Total Acquisition Costs

Budget Year: 2023      Base Year: 2019

Appropriation Category (\$Millions)	Objective Base Year (Current APB)	Threshold Base Year (Current APB)	Budget Estimate Base Year	Budget Estimate Then Year	Deviation?
<b>RDT&amp;E</b>	\$ 1,983.0	\$ 2,181.3	\$ 1,918.3	\$ 2,076.4	
<b>Procurement</b>	\$ 10,030.5	\$ 11,033.6	\$ 9,700.2	\$ 15,458.3	
<b>MILCON</b>	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	
<b>Acq O&amp;M</b>	\$ 74.9	\$ 82.4	\$ 4.7	\$ 4.9	
<b>Total Acquisition</b>	\$ 12,088.4		\$ 11,623.2	\$ 17,539.6	
<b>PAUC</b>	\$ 1.932	\$ 2.125	\$ 1.857	\$ 2.803	
<b>APUC</b>	\$ 1.621	\$ 1.783	\$ 1.567	\$ 2.498	

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## Total End Item Quantity

Quantity	Current APB	Current Estimate
Development Qty	69	69
Procurement Qty	6,189	6,189

### Budget Notes:

ITEP is currently reviewing COVID-19 cost impacts submitted by General Electric in their Request for Equitable Adjustment. No COVID-19 impacts are incorporated into this submission.

Acquisition O&M funding represents civilian pay for the Project Management Office from FY 2016 - FY 2019

Reduction in PAUC and APUC since last SAR is solely due to change in inflation indices.

**Acquisition Cost Deviation Explanations:** N/A

### Quantity Notes:

Development Quantity includes equivalent engines. Core engines will be rebuilt multiple times during the Preliminary Flight Rating (PFR) and Qualification Testing (QT) test periods.

## Risk and Sensitivity Analysis

Current Procurement Risks:
1. NONE



## Unit Cost

### Current Baseline Compared with Current Estimate

Current Baseline Base Year: 2019

Category (\$ Millions)	Current Baseline	Current Estimate	% Change	Breach? Significant or Critical
<b>Program Acquisition Unit Cost</b>				
Acquisition Cost	\$ 12,088.4	\$ 11,623.2		
Program Quantity	6,258	6,258		
PAUC	\$ 1.932	\$ 1.857	-3.85%	None
<b>Average Procurement Unit Cost</b>				
Procurement Cost	\$ 10,030.5	\$ 9,700.2		
Procurement Quantity	6,189	6,189		
APUC		\$ 1.567	0.00%	None

### Original Baseline Compared with Current Estimate

Original Baseline Base Year: 2019

Category (\$ Millions)	Original Baseline	Current Estimate	% Change	Breach? Significant or Critical
<b>Program Acquisition Unit Cost</b>				
Acquisition Cost	\$ 12,088.4	\$ 11,623.2		
Program Quantity	6,258	6,258		
PAUC	\$ 1.932	\$ 1.857	-3.85%	None
<b>Average Procurement Unit Cost</b>				
Procurement Cost	\$ 10,030.5	\$ 9,700.2		
Procurement Quantity	6,189	6,189		
APUC	\$ 1.621	\$ 1.567	-3.29%	None

## Contracts

<b>Contract Number:</b>	W58RGZ-19-C-0003/3		<b>Order Number:</b>		<b>Contract Title:</b>	Engine EMD Contract	
CAGE Code		City					
CAGE Legal Name		State/Province			Contract Strategy	FAR 15: Negotiated Contracts	
<b>Effort Number</b>							
Supportive Phase	Development	Latest Modification Number			Definitization Date	5/31/2019	
Contract Type	Cost-Plus-Incentive Fee	Latest Modification Date			Work Start Date	5/31/2019	
Technical Data Rights	Government Purpose	Notes					
<b>Contract/Effort Price, Quantity and Performance (\$M)</b>							
Initial Target Price	\$ 512.00	Current Target Price	\$ 512.00	Contractor's EAC	\$ 542.60		
Initial Ceiling Price	\$ 540.00	Current Ceiling Price	\$ 540.00	PM's EAC	\$ 555.00		
Initial Quantity	46	BAC	\$ 540.00	BCWP	\$ 261.50	Work Completed	48.43%
Current Quantity	46	ACWP	\$ 267.10	BCWS	\$ 264.90	Cost Variance	-\$ 5.60
Delivered Quantity	0					Schedule Variance	-\$ 3.40
<b>Factors Contributing to Cost Variance and Projected Effects on Program Costs:</b>				<b>Factors Contributing to Schedule Variance and Projected Effects on Program Schedule:</b>			
The unfavorable cumulative cost variance is due to COVID-19 impacts that increased labor rates. Specific drivers include in-sourcing engineering services (higher cost), military programs absorbing a higher portion of overhead expenses (downturn of commercial aviation sector), telework inefficiencies during design activities, and management attention focused on financial viability.				The unfavorable cumulative schedule variance is due to COVID-19 impacts. This resulted in decreased productivity due to teleworking during critical design reviews.			



## Technologies and Systems Engineering

### Significant Technical Risks

Event	Date	Description
Current	11/30/2021	Surface Acoustic Wave /Torque Measurement System (SAW/TMS Manufacturing Readiness: If Meggitt's delayed manufacturing trails identify any unanticipated challenges, then design modification or process refinement post CDR may be required. Schedule delays may occur while producibility improvements are developed and implemented.
Current	11/30/2021	Additive Technology Center (ATC) A205 Production Schedule Delays: If incurred schedule delays for front frame deliveries cannot be recovered, then engines to support FARA Competitive Prototype may be delayed up to 2 months beyond the first engine need date. Delays from ATC drive delays in engine assembly may occur so that engines are late to support test events. Delays in test execution may impact other program milestones.
Current	11/30/2021	Stage 4 Turbine Nozzle Casting Delivery Delay: If the Stage 4 Turbine Nozzle casting vendor continues to have delivery issues (metallurgical non-conformances), then a schedule delay of 10 months (45 weeks) will be realized as additional time is required to develop the manufacturing process.

### Deliveries and Expenditures

Quantities	Planned to Date	Actual to Date	Total Quantity	Percent Delivered
Development	0	0	69	0.00%
Procurement	0	0	6,189	0.00%
<b>Total</b>	0	0	6,258	0.00%

Years Appropriated to date	11	Total Years Appropriated Funding (Current Baseline):	45	Percent Years Appropriated:	24.44%
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Appropriation Category (\$Millions)	Then Year Appropriated Amount	Then Year Expended Amount
RDT&E	1,311.70	902.00
Procurement	0.00	0.00



MILCON	0.00	0.00
Acq O&M	4.90	4.90
<b>Total Appropriated/Expended</b>	1,316.60	906.90
<b>Percent Appropriated/Expended</b>	7.51%	5.17%

<i>Deliveries &amp; Expenditures Notes:</i>

## Low-Rate Initial Production

	Initial Decision LRIP	Current Total LRIP
Approval Date	1/29/2019	1/29/2019
Approval LRIP Quantity	255	255
Approval Document Title	MSB ADM	MSB ADM
Start Year	2024	2025
End Year	2026	2027

*Rationale if quantity exceeds 10% of the total number of articles to be produced:*

*CUI:* \_\_\_\_\_

Quantity Note: CUI:

## Operating and Support (O&S) Cost

### Total Program O&S Costs Compared with Baseline

	Current Base Year Objective	Current Base Year Threshold	Current Base Year Estimate	Current Then Year Estimate	Deviation?
Total O&S (\$Millions)	\$11,276.0	\$12,403.6			

Deviation Explanation:

### Operating and Support Cost Breakdown

Category (Base Year \$Millions)	System Name:	System Name:
Unit-Level Manpower		
Unit Operations		
Maintenance		
Sustaining Support		
Continued System Improvements		
Other		
<b>Total O&amp;S</b>	\$0	\$0

### Cost Estimate Source

**Type:** Component Cost Position

**Approval Authority and Date:** 29 Jan 2019

#### O&S Notes:

ITEP will produce engines for Apache and Black Hawk aircraft. As a Class IX repair part, Operating and Support Costs are not tracked at the component level.