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Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

Modernized Selected Acquisition Report (MSAR) Improved Turbine Engine Program (ITEP)

FY 2024 President's Budget

Effective: December 31, 2023

Defense Acquisition Visibility Environment

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(U) Common DoD Abbreviations

\$B	Billions of Dollars
\$K	Thousands of Dollars
\$M	Millions of Dollars
ACAT	Acquisition Category
Acq O&M	Acquisition-Related Operations and Maintenance
ADM	Acquisition Decision Memorandum
APA	Additional Performance Attribute
APB	Acquisition Program Baseline
APPN	Appropriation
APUC	Average Procurement Unit Cost
BA	Budget Authority or Budget Activity
Blk	Block
BY	Base Year
CAE	Component Acquisition Executive
CAPE	Cost Assessment and Program Evaluation
CARD	Cost Analysis Requirements Description
CCE	Component Cost Estimate
CCP	Component Cost Position
CDD	Capability Development Document
CLIN	Contract Line Item Number
CPD	Capability Production Document
CY	Calendar Year or Constant Year
DAB	Defense Acquisition Board
DAE	Defense Acquisition Executive
DAES	Defense Acquisition Executive Summary
DAVE	Defense Acquisition Visibility Environment
DoD	Department of Defense
DSN	Defense Switched Network
EMD	Engineering and Manufacturing Development
EVM	Earned Value Management
FD	Full Deployment
FDD	Full-Deployment Decision
FMS	Foreign Military Sales
FOC	Full Operational Capability
FRP	Full-Rate Production
FY	Fiscal Year
FYDP	Future Years Defense Program
ICD	Initial Capabilities Document
ICE	Independent Cost Estimate
Inc	Increment
IOC	Initial Operational Capability
IT	Information Technology
JROC	Joint Requirements Oversight Council
KPP	Key Performance Parameter
KSA	Key System Attribute

LRIP	Low-Rate Initial Production
MDA	Milestone Decision Authority
MDAP	Major Defense Acquisition Program
MILCON	Military Construction
N/A	Not Applicable
O	Objective
O&M	Operations and Maintenance
O&S	Operating and Support
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
PAUC	Program Acquisition Unit Cost
PB	President's Budget
PE	Program Element
PEO	Program Executive Officer
PM	Program Manager
POE	Program Office Estimate
R&MF	Revolving and Management Funds
RDT&E	Research, Development, Test, and Evaluation
SAR	Selected Acquisition Report
SCP	Service Cost Position
T	Threshold
TBD	To Be Determined
TY	Then Year
U.S.	United States
U.S.C	United States Code
UCR	Unit Cost Reporting
USD(A&S)	Under Secretary of Defense (Acquisition and Sustainment)

(U) Program Description

Full Name
Improved Turbine Engine Program

Short Name
ITEP

PNO
487

Milestone Decision Authority
Component Acquisition Executive

Lead Component
Department of the Army

Program Executive Office
PEO Aviation

Joint Program
No

Acquisition Type
Major Defense Acquisition Program

Adaptive Acquisition Pathway
Major Capability Acquisition

Acquired Systems
Improved Turbine Engine

Acquisition Category
IC

Acquisition Status
Active Acquisition

Mission
Blank IAW DMAG guidance.

(U) Responsible Office**Program Executive Officer**

PEO Aviation

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(U) Executive Summary

Program Highlights Since Last Report

ITEP achieved two significant accomplishments in FY 2023. The first was the formal acceptance of the first T901 engine in September 2023, marking the Army's receipt of its first new engine in decades. The second was the commencement of Preliminary Flight Rating (PFR) testing. PFR testing are in-plant tests leading to an Airworthiness Release (AWR).

Although ITEP has made significant progress, the Army decided to delay production of the T901 to enable additional time for the engine development and for integration into the Black Hawk and Apache platforms. The delay allows additional time to reduce risk during Black Hawk and Apache integration and testing prior to a production decision. As a result, the ITEP APA funding line was eliminated in PB25 AF3.2 as of February 13, 2024.

Prior to the decision to delay production/reduce APA funding, the Milestone Decision authority approved a rebaseline of the Acquisition Program Baseline due to schedule delays in March 2023.

The Program Manager (PM) will submit a Program Deviation Report to the Milestone Decision Authority. The PM established technical knowledge points for Army leadership to enable a production decision at the appropriate time.

Defense Cost & Resource Center (DCARC) Cost and Software Data Reporting (CSDR) compliance rating is Green.

(U) History of Significant Developments Since Program Inception

Date	Description
January 2024	Completed engine test requirements to enable aircraft ground testing
November 2023	Future Attack Reconnaissance Aircraft (FARA) Ground Test (GT) Software Test Readiness Review (STRR)
October 2023	Delivered two engines to FARA Competitive Effort
September 2023	Army accepted the first T901 engine
March 2023	Army Acquisition Executive (AAE) signed Acquisition Program Baseline (APB) on March 13, 2023 approving a schedule rebaseline.
February 2023	Completion of Black Hawk Critical Design Review (CDR)
August 2022	Award of Black Hawk Integration Contract Phase 2
June 2022	Completed FARA Software Critical Design Review (CDR)
June 2022	Concluded First Engine to Test (FETT)
December 2021	Award of Apache Integration Contract Phase 2
December 2021	Completion of Black Hawk Preliminary Design Review (PDR)
October 2021	Completion of Apache CDR
July 2021	Completion of FARA Competitive Prototype (PDR)
June 2020	Completion of ITEP CDR
January 2019	The AAE signed the Acquisition Decision Memorandum (ADM) on January 29, 2019, approving Milestone B, allowing entry into the Engineering and Manufacturing Development Phase.

(U) Schedule**(U) Schedule Events**

Events		Development Chg 1 (Current) 3/13/2023 Objective / Threshold		Current Estimate 12/31/2023	Actual
Milestone B	MS B	Jan 2019	Jan 2019	-	29 Jan 2019
Critical Design Review	CDR	Apr 2020	Oct 2020	-	31 Jul 2020
Developmental Test and Evaluation	DT&E	Apr 2026	Dec 2026	Apr 2026	-
Milestone C	MS C	Apr 2026	Dec 2026	Apr 2026	-
Initial Operational Test and Evaluation	IOT&E	Jan 2027	Jan 2028	Jan 2027	-
Full Rate Production	FRP Decision	May 2028	Jan 2029	May 2028	-
Initial Operational Capability	IOC	Apr 2029	Dec 2029	Apr 2029	-

Notes

The Milestone Decision Authority (MDA) approved a revised Acquisition Program Baseline (APB) in March 2023, documenting a prior schedule deviation. As part of the Aviation Rebalancing Initiative and the associated APA funding cut in PB25 AF3.2 as of February 13, 2024, the PM established technical knowledge points for Army leadership to enable a production decision at the appropriate time.

Schedule Baseline Deviation Explanation

None

(U) Current Significant Schedule Risks and Risks Identified at Milestones/Decisions

Event	Date	Description
Other	9/17/2024	Manufacturing Development and Quality If GE and suppliers do not adequately mature manufacturing development and quality performance, then continued hardware delivery delays will delay the Preliminary Flight Rating, developmental testing, and program milestones from 6 to 12 months.
Other	2/13/2024	Current Schedule In February 2024, the Army decided to delay ITEP production, the PM will submit a Program Deviation Report to the Milestone Decision Authority.

(U) Performance

(U) Performance Attributes

System Survivability		KPP
Current Estimate 12/31/2023	Will meet threshold.	
Demonstrated Performance -	TBD	
Development Chg 1 (Current) 3/13/2023	Objective	The statistically average production engine will have an IR signature contribution from exhaust and component radiance that is less than the 701D engine at MRP in a comparably configured platform at 6K/95degF 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.
	Threshold	The production engine will have an IR signature contribution from exhaust and component radiance that will not exceed the 701D engine at MRP in a comparably configured platform at 6K/95degF without suppressed engine exhaust.
Ballistic Survivability		KPP
Current Estimate 12/31/2023	Will meet threshold.	
Demonstrated Performance -	TBD	
Development Chg 1 (Current) 3/13/2023	Objective	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 CPD classified annex dated April 2, 2013.
	Threshold	(T=0) 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 CPD classified annex dated April 2, 2013.
Cybersecurity		KPP
Current Estimate 12/31/2023	Will meet threshold.	
Demonstrated Performance	TBD	

-		
Development Chg 1 (Current) 3/13/2023	Objective	Installation, operations and sustainment of the 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.
	Threshold	Installation, operations and sustainment of the 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 redundancy to prevent and mitigate functionality in the event of compromise.
Sustainment		KPP
Current Estimate 12/31/2023		Will meet threshold.
Demonstrated Performance -		TBD
Development Chg 1 (Current) 3/13/2023	Objective	Ao = 98% Am = 80%
	Threshold	Ao = 95% Am = 70%
Training		KPP
Current Estimate 12/31/2023		Will meet threshold.
Demonstrated Performance -		TBD
Development Chg 1 (Current) 3/13/2023	Objective	The Training Program shall train 100% of the identified Critical Training Tasks in a Live, Virtual, or Constructive environment to the identified MOS 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 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 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.
	Threshold	(T=0) The Training Program shall train 100% of the identified Critical Training Tasks in a Live, Virtual, or Constructive environment to the identified MOS 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 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 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.
Energy		KPP
Current Estimate 12/31/2023		Will meet threshold.
Demonstrated Performance -		TBD
Development Chg 1 (Current)	Objective	The ITE must provide an increased fuel efficiency when compared to current 701D engine at cruise condition of no less than 25% (≤ 0.352 lbs/SHP-hr) improvement in SFC as measured in an appropriate test cell facility with the engine operating at 1450 SHP and environmental conditions set at 6K/95degF.
3/13/2023	Threshold	The ITE must provide an increased fuel efficiency when compared to current 701D engine at cruise condition of no less than 13% (≤ 0.409 lbs/SHP-hr) improvement in SFC as measured in an appropriate test cell facility with the engine operating at 1450 SHP and environmental conditions set at 6K/95degF.
UH-60 Worldwide Performance		KPP
Current Estimate 12/31/2023		Will meet threshold.
Demonstrated Performance -		TBD
Development Chg 1 (Current)	Objective	An H-60 with the installed ITE will have sufficient power available to perform a 750 fpm VROC from HOGE at mission start with a takeoff gross weight of 22,000 lbs up to 6K/95degF at MCP. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95degF.
3/13/2023	Threshold	An H-60 with the installed ITE will have sufficient power available to perform a 500 fpm VROC from HOGE at mission start with a takeoff gross weight of 20,632 lbs up to 6K/95degF using no more than 95% MRP. *Note: HOGE is at zero wind conditions and zero airspeed at 6K/95degF.
AH-64E Worldwide Performance		KPP
Current Estimate 12/31/2023		Will meet threshold.
Demonstrated Performance -		TBD
Development Chg 1 (Current)	Objective	An AH-64E with the installed ITE will have sufficient power available to HOGE at mission start with a takeoff gross weight of 20,260 lbs up to 6K/95degF at MCP.

3/13/2023		*Note: HOG E is at zero wind conditions and zero airspeed at 6K/95degF.
	Threshold	An AH-64E with the installed ITE will have sufficient power available to HOG E at mission start with a takeoff gross weight of 18,461 lbs up to 6K/95degF using no more than 95% MRP. *Note: HOG E is at zero wind conditions and zero airspeed at 6K/95degF.

(U) Requirement Source:

Sponsor(s): United States Army

1. Capability Development Document, *ITEP CDD*

Validated By: Joint Requirements Oversight Council, July 24, 2017

Notes

All KPPs are expected to meet threshold as documented in modeling and simulation. KPPs will be verified through testing and log demo events.

Performance Deviation Explanation

None

(U) Acquisition Budget Estimate**(U) Total Acquisition Estimates and Quantities**

Category (\$M) Base Year: 2019	Development Chg 1 (Current) 3/13/2023 CY\$ obs Objective / Threshold		Current Estimate PB 2024 CY\$ obs / TY\$ obs	
	RDT&E	1,983.0	2,181.3	2,113.1
Procurement	10,030.5	11,033.6	10,653.6	18,848.2
MILCON	0.0	0.0	-	-
O&M	74.9	82.4	97.1*	175.6
R&MF	0.0	0.0	-	-
Total Acquisition	12,088.4	-	12,863.8	21,440.9
Program Acquisition Unit Cost	1.932	2.125	2.056	3.426
Average Procurement Unit Cost	1.621	1.783	1.721	3.045
Program End-Item Quantity				
Development	69		69	
Procurement	6189		6189	
O&M-Acquired	-		-	

* Baseline Deviation

Budget Notes

ITEP has experienced the following funding turbulence since achieving Milestone B in January 2019: GE has been awarded requested equitable adjustments (REA) for FY 2020 (\$11M) and FY 2021 (\$4.63M) and is expected to submit additional REAs totaling \$12.7M for FY 2022-2024.

GE has requested labor rate escalation and inflation impacts. Since contract award, the EMD contract has incurred ~\$74M in DCMA approved labor rate increases.

Costs continue to escalate on the EMD contract and are the primary result of: 1. GE's inability to manage quality and manufacturing defects that require rework at suppliers and 2. mounting labor rate increases.

The following rescission and marks have occurred:

FY 2020 \$49.5M rescission

FY 2021 \$8M mark

FY 2022 \$15M mark

FY 2024 \$12.141 mark

The Army returned \$32.5M in FY 2022 (\$24.5M rescission above proposed ATR; \$8M mark) and re-phased FY 2019 RDTE ATR funding into FY 2023 (\$17.5M) & FY 2024 (\$17.5M). (Note: Though funding has since been restored, the FY 2020 \$49.5M rescission and FY 2021 \$8M mark caused a six (6) month delay for AH-64E and H-60 Developmental Testing (DT), original resulting in moving the MS C from July 2024 to the threshold of January 2025.)

As part of the Aviation Rebalancing Initiative, the Army reduced RDTE in FY 2025 and eliminated APA in PB25 AF3.2 as of February 13, 2024 delaying production. Future procurement is subject to

future production decisions and availability of funding. A revised estimate will be provided upon completion of a program rebaseline.

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.

Cost Baseline Deviation Explanation

Parameter	Explanation
Acquisition Cost (O&M)	Change in policy on how Core Civilians are accounted for this Appropriation: Acquisition O&M.

(U) Risk and Sensitivity Analysis

Current Procurement Estimate Risks (12/31/2023)	
1	2023 MSAR supports current Acquisition Program Baseline approved in March 2023. However, in February 2024, the Army decided to delay ITEP production, the PM will submit a Program Deviation Report to the Milestone Decision Authority. Future procurement is subject to future production decisions and availability of funding.
Current Baseline Risks (3/13/2023)	
(1) The Current Baseline Estimate is based on the 2019 Milestone B Army Cost Position. The PB FY 2021-2025 fully funds the EMD program. (2) The Improved Turbine Engine Program Original Baseline was established by the Army Acquisition Executive on January 29, 2019. The Milestone B Army Cost Position was used to establish the APB. The most significant cost drivers in the estimate were the projected engine unit price and aircraft platform integration costs.	
Original Baseline Risks (8/26/2019)	
(1) The Current Baseline Estimate is based on the 2019 Milestone B Army Cost Position. The PB FY 2021-2025 fully funds the EMD program. (2) The Improved Turbine Engine Program Original Baseline was established by the Army Acquisition Executive on January 29, 2019. The Milestone B Army Cost Position was used to establish the APB. The most significant cost drivers in the estimate were the projected engine unit price and aircraft platform integration costs.	

(U) Unit Costs

(U) Current Estimate Compared with Current Baseline

Category (CY\$M) Base Year: 2019	Current Baseline 03/13/2023	Current Estimate PB 2024	% Change
Program Acquisition Unit Cost			
Acquisition Cost	12,088.4	12,863.8	
Program Quantity	6,258	6,258	
PAUC	1.932	2.056	6.41%
Average Procurement Unit Cost			
Procurement Cost	10,030.5	10,653.6	
Procurement Quantity	6,189	6,189	
APUC	1.621	1.721	6.21%

(U) Current Estimate Compared with Original Baseline

Category (CY\$M) Base Year: 2019	Original Baseline 08/26/2019	Current Estimate PB 2024	% Change
Program Acquisition Unit Cost			
Acquisition Cost	12,088.4	12,863.8	
Program Quantity	6,258	6,258	
PAUC	1.932	2.056	6.40%
Average Procurement Unit Cost			
Procurement Cost	10,030.5	10,653.6	
Procurement Quantity	6,189	6,189	
APUC	1.621	1.721	6.19%

(U) Cost Growth Details

Actions taken or Proposed to Control Future Cost Growth

Status of Each Major Contract and Significant Factors Contributing to Cost and Schedule Variance; Projected Effects on Future Program Costs

See Contracts section.

Notes

APUC and PAUC remain below reportable breach levels.
 Per DAVE Help Desk April 3, 2024: Differences in percent change are due to rounded values for PAUC and APUC in the Original APB. The percent change between the Original Baseline and Current Estimate actually matches the percent change between the Current Baseline and Current Estimate.

(U) Life-Cycle Costs

(U) Operating and Support and Disposal Cost Estimates Compared with Baseline

Category (\$M) Base Year: 2019	Development Chg 1 (Current) 3/13/2023 CY\$ obs Objective / Threshold		Current Estimate CY\$ obs / TY\$ obs	
	Total O&S	11,276.0	12,403.6	10,786.7
Total Disposal	-	-	-	-

(U) Current Cost Estimate Sources

Operating and Support Cost

Type: Program Office Estimate

Approved by: Army - PEO AVN - PPR&P G8, January 18, 2024

Note: Updated current estimate is reflected.

ACE Session: ITEP POE for G8 review 2024-01-04.acem

ACEIT Inflation Tables: US Government Indices for FY 2024, March 05, 2024.

Disposal/Demilitarization Cost

Type: No estimate. Not Applicable

Operating and Support Baseline Deviation Explanation

None

Cost Notes

There are no O&M costs tracked in the APB. ITEP will deliver a sub-component to other weapon systems: 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.

(U) Operating and Support Variance with Prior Estimate

(CY\$M) Base Year: 2019	Estimate	
Prior Estimate (12/14/2023)	11,208.6	
Current Estimate	10,786.7	
Category	Variance	Explanation
Unit-Level Manpower	0.0	N/A

(CY\$M) Base Year: 2019	Estimate	
Unit Operations	437.6	Unit Operations (Petro, Oil, and Lube + Systems Engineering/MGMT + Training) cost more in POE now than in 2019 ICE, based on revised requirements scope fuel cost increase, and increased shipping / labor on fuel.
Maintenance	-1,110.5	Maintenance (Repl Spares (Reprables) + Repl Repair Parts (Cons)) is expecting to cost less today due to improved engine design. Also realigned costs to Support Category.
Sustaining Support	217.3	Realigned existing/revised requirements/cost with this Support Category. Adjustments made to the cost estimate structure to align with the Army Cost Analysis Manual 2020, Army Cost Estimating Structure (ACES) and additional requirements realigned into Sustainment Support Category.
Continuing System Improvements	33.7	ICE had Software (PPSS) very high based on unknowns at the time as compared to POE that has greater clarity on requirements. Enhanced Component Improvement Program (CIP) with Continuing System Improvements (CSI) based on cleared requirements and methodology to be relevant and for use as an analogous program.
Other	0.0	N/A
Not Categorized	0.0	

(U) Operating and Support Cost Element Structure Estimates by Acquired System

(CY\$M) Base Year: 2019							
System	Unit-Level Manpower	Unit Operations	Maintenance	Sustaining Support	Continuing System Improvements	Other	Total
Improved Turbine Engine	-	6,307.0	4,071.3	217.3	191.1	-	10,786.7
Program	-	6,307.0	4,071.3	217.3	191.1	-	10,786.7

(U) Annual Operating and Support Costs per Unit Compared with Antecedent System

No Data

(U) Operating and Support Cost Estimate Assumptions

No Data

Additional O&S Estimate Assumptions

N/A

Antecedent Estimate Assumptions

General Electric, 701D Engine. No antecedent system estimates are available at this time.

O&S Annual Cost Calculation Memo

None

(U) Technologies and Systems Engineering**(U) Current Significant Technical Risks and Risks Identified at Milestones/Decisions**

Event	Date	Description
Current	9/1/2026	Operability Surge Margin If GE does not maintain surge free operation throughout the operating envelope, then a redesign will be required to meet the SRD surge requirement. Date provided is forecasted resolution date.
Current	6/1/2026	Additive M-Line Development M Line is a system created specifically for metal additive production. If M Line machine readiness and subsequent T901 Front Frame part development to manufacture production class hardware on the M Line is delayed, then a combination of increased unit cost for production engines and significant reduction in engine delivery for 6-12 months may be incurred. Date provided is forecasted resolution date.
Current	9/17/2024	Operability Surge Margin If GE and suppliers do not adequately mature manufacturing development and quality performance, then continued delays to hardware delivery will delay the Preliminary Flight Rating, Developmental Testing, and Program Milestones from 6 to 12 months, resulting in a delay to MS C. Date provided is forecasted resolution date.

(U) Performing Activities and Contracts

(U) External Government Activities

None

(U) Contracts and Efforts

Contract Title	Contract Number / Effort	Contractor	Phase
Engine EMD Contract	W58RGZ-19-C-0003	General Electric Company	Development

(U) Contract and Effort Identification, Price, Quantity and Performance

Contract Number:	W58RGZ-19-C-0003	Order Number:	-
Contract Title:	Engine EMD Contract	Strategy:	FAR 15: Negotiated Contracts
CAGE:	99207 - General Electric Company	Contracting Office:	Army Contracting Command (ACC) - Redstone
City, State/Province:	Lynn, MA		
Effort Number:	-	Supported Phase:	Development
Type:	Cost Plus Incentive Fee (Cost Based)	Award Date:	February 1, 2019
Latest Modification Date:	March 14, 2024	Definitization Date:	February 1, 2019
Latest Modification No.:	P00073	Work Start Date:	February 1, 2019
Technical Data Rights:	Government Purpose License Rights		

Notes: The quantities shown in previous SAR submissions reflected the values shown in the Milestone B APB. These quantities were established prior to contract award. The quantities on contract are lower due to the proposed process by the vendor and accepted by the government. As deliveries occur, it is imperative that deliveries are gauged against what is on contract, not what is in the APB. The previous SAR submissions reported contract ceiling and target price that included multiple option fixed price CLINs and development/EMD CLINs combined. The fixed price CLINs are removed from the contract ceiling and target price to eliminate distorting the earned value data for the development effort.

Initial Price (TY\$M) Target / Ceiling		Current Price (TY\$M) Target / Ceiling		Estimate at Completion (TY\$M) Contractor / PM		Initial Quantity	Current Quantity	Delivered Quantity
506.9	540.0	525.7	789.3	780.1	789.3	30	30	2

Work Completed (%):	73.13%
Cost Variance (TY\$M):	-89.9
Schedule Variance (TY\$M):	-37.6

Factors Contributing to Cost Variance and Projected Effects on Program Costs

The unfavorable cumulative cost variance is due to manufacturing development and quality hardware issues,

challenges in additive manufacturing and increased labor rates. Program costs remain within APB cost thresholds.

Factors Contributing to Schedule Variance and Projected Effects on Program Schedule

ITEP is funded to the MS B Army Cost Position (ACP) but is proceeding with continued risk due to: 1) manufacturing development and quality issues at GE and suppliers requiring rework and increasing costs and 2) prior congressional marks / rescissions.

(U) Production**(U) Low-Rate Initial Production**

	Original LRIP Determination	Current LRIP Determination
Total LRIP Quantity	255	255
Date	1/19/2019	3/13/2023
Reference	Milestone B Acquisition Decision Memorandum	Acquisition Decision Memorandum March 2023
LRIP Period	FY 2024 - 2026	FY 2026 - 2028
Total Procurement Quantity	6,189	6,189
LRIP Percentage of Total	4.1%	4.1%

Rationale if LRIP Quantity Exceeds 10% of Total Procurement Quantity (Current Determination)

None

LRIP Notes

Milestone C has not been completed.

(U) Deliveries and Expenditures**(U) Acquisition Funding**

	Total Estimate	Actual to Date	Actual, Percent Complete
Years Appropriated	71	13	18.3%
Appropriations (TY, \$M)	21,440.9	1,570.7	7.3%
Expenditures (TY, \$M)	21,440.9	1,421.3	6.6%

(U) End Items Delivered

	Total Required	Planned to Date	Actual to Date	Actual, Percent Complete
Development	69			
Improved Turbine Engine		2	2	
Procurement	6,189			
Total	6,258	2	2	0.0%

Notes

None

(U) International Program Aspects

General Memo

No IPA considerations exist. The Program is in EMD Phase and future FMS Customers will be considered upon successful Milestone C Decision.

Exportability and Business Issues

None. Program is Pre-Milestone C. Exportability will be determined in the future.

Is design for international exportability planned?	No	Industry/Partner Exportability Cost-Sharing?	No
If not, has the MDA approved an exportability waiver for a U.S.-only design?	Not Applicable		

Program Protection: Technology Security and Foreign Disclosure Issues

None

(U) Agreements

No International Agreements have been defined for ITEP



UNCLASSIFIED

**Modernized
Selected Acquisition Report
Supplement**

**Improved Turbine Engine Program
(ITEP)**

FY 2025 President's Budget
As of: December 31, 2023

UNCLASSIFIED

MSAR Supplement Sections

Program Description

Program Use of the Adaptive Acquisition Framework

Technologies and Systems Engineering

Funding Sources (Acquisition)

Funding Sources (Operating and Support)

Acquisition Estimate and Quantity Summary

Annual Acquisition Estimates by Appropriation Account

Acquired System Annual End-Item Quantities by Appropriation Account

Nuclear Costs

Operational Fielding Plan

O&S Independent Cost Estimate

Annual Operating and Support Estimates by Cost Element

Program Description

Full Name

Improved Turbine Engine Program

Short Name

ITEP

PNO

487

Lead Component

Army

AAF Pathway

MCA

Acquisition Type

MDAP

Acquired Systems

Improved Turbine Engine

Related Programs

Full Name	PNO	Pathway	Type	ACAT/ BCAT	Acquisition Status	Costs in SAR?	
						Acq	O&S

Program Use of the Adaptive Acquisition Framework

ITEP is a Major Capability Acquisition.

ITEP's Milestone B was achieved in January 2019 and the program is currently in the Engineering and Manufacturing Development Phase. The Acquisition Strategy, schedule, and decision points are in alignment with the tenets expressed in Adaptive Acquisition Framework guidelines.

Technologies and Systems Engineering

Improved Turbine Engine Program

Major Software Efforts

Title	Status	Fielding Date	Description

Major Engineering Changes

Title	Original Need Date	Fielding Date	Description, Rationale and Program Impacts

Funding Sources (Acquisition)

Acquisition Funding Notes

As part of the Aviation Rebalancing Initiative, the Army reduced RDTE in FY 2025 and eliminated APA in PB25 AF3.2 as of February 13, 2024 delaying production. Future procurement is subject to future production decisions and availability of funding. The costs in the MSAR represent the validated POE current estimate before the funding cuts. A revised estimate will be provided upon completion of a program rebaseline.

Improved Turbine Engine Program

Category	Account	BA	Line Item	Program Element	RDT&E Project	Shared	Sunk
RDT&E	2040A	07	0607139A - Improved Turbine Engine Program	0607139A	ES6 - Improved Turbine Engine Program		
Procurement	2031A	01	7063A05210 - Improved Turbine Engine Program	0210101A	-		

Funding Sources (Operating and Support)

Note: Budget lines fund activities executed by the Program Office or Sustainment Office.

Operating and Support Funding Notes

Improved Turbine Engine Program

Category	Account	BA	Line Item	Program Element	RDT&E Project	Shared	Sunk
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Acquisition Estimate and Quantity Summary

Improved Turbine Engine Program

Acquisition Estimates

Category	PB 2025	TY (\$M)	Current Base Year	Original Base Year	Report Fiscal Year
			CY2019 (\$M)	CY2019 (\$M)	CY2024 (\$M)
RDT&E		2,417.1	2,113.1	2,113.1	2,531.8
Procurement		18,848.2	10,653.6	10,653.6	12,764.9
MILCON		-	-	-	-
O&M		175.6	97.1	97.1	116.4
Total Acquisition		21,440.9	12,863.8	12,863.8	15,413.2
PAUC		3.426	2.056	2.056	2.463
APUC		3.045	1.721	1.721	2.063

Acquisition End-Item Quantities

System	PB 2025	Development	Procurement
Improved Turbine Engine		69	6,189
Total		69	6,189

Unit Description

ITEP T901-GE-900 Turbine Engine

As part of the Aviation Rebalancing Initiative, the Army reduced RDTE in FY 2025 and eliminated APA in PB25 AF3.2 as of February 13, 2024 delaying production. Future procurement is subject to future production decisions and availability of funding. The costs in the MSAR represent the validated POE current estimate before the funding cuts. A revised estimate will be provided upon completion of a program rebaseline.

Current and Future Years Defense Program Summary, TY(\$M)

Appropriation	Prior	2024	2025	2026	2027	2028	2029	To Complete	Total
RDT&E	1,460.2	200.1	191.5	199.3	134.8	93.8	61.9	75.5	2,417.1
Procurement	-	-	2.7	361.7	536.4	490.1	590.6	16,866.7	18,848.2
MILCON	-	-	-	-	-	-	-	-	-
O&M	10.6	3.5	3.6	3.7	3.8	3.8	3.9	128.1	161.0
PB 2025 Total	1,470.9	203.6	197.7	564.7	675.0	587.8	656.4	17,070.2	21,426.2

Annual Acquisition Estimates by Appropriation Account

(Aligned to Budget Position: PB 2025)

Improved Turbine Engine Program

Source for TY\$-CY\$ Conversion: ASN FMB-6 Inflation Rates and Outlay Factors for DA, DoN and DW accounts: 17 Jan 2024

2040A - Research, Development, Test & Eval, Army					
fiscal year		Other/ Unallocated	Total TY(\$M)	Weighted Rate	Total CY2019 (\$M)
Total		2,417.1	2,417.1	-	2,113.1
2012		7.711	7.7	0.909583	8.5
2013		16.585	16.6	0.925049	17.9
2014		79.922	79.9	0.942870	84.8
2015		49.328	49.3	0.958700	51.5
2016		49.137	49.1	0.968886	50.7
2017		111.638	111.6	0.989509	112.8
2018		167.529	167.5	1.007415	166.3
2019		124.094	124.1	1.023971	121.2
2020		148.414	148.4	1.057078	140.4
2021		232.159	232.2	1.101553	210.8
2022		250.499	250.5	1.152357	217.4
2023		223.206	223.2	1.197938	186.3
2024		200.101	200.1	1.226312	163.2
2025		191.469	191.5	1.252535	152.9
2026		199.289	199.3	1.278838	155.8
2027		134.807	134.8	1.305694	103.2
2028		93.815	93.8	1.333114	70.4
2029		61.897	61.9	1.361109	45.5
2030		37.018	37.0	1.389692	26.6
2031		28.865	28.9	1.418876	20.3
2032		9.580	9.6	1.448672	6.6

Annual Acquisition Estimates by Appropriation Account

(Aligned to Budget Position: PB 2025)

Improved Turbine Engine Program

Source for TY\$-CY\$ Conversion: ASN FMB-6 Inflation Rates and Outlay Factors for DA, DoN and DW accounts: 17 Jan 2024

2031A - Aircraft Procurement, Army									
fiscal year	End Item Recurring Flyaway	Non-End Item Recurring Flyaway	Non-Recurring Flyaway	Initial Spares	Depot Activation	Other/ Unallocated	Total TY(\$M)	Weighted Rate	Total CY2019 (\$M)
Total	15,074.0	2,942.5	-	678.7	152.9	-	18,848.2	-	10,653.6
2012							-	0.916948	-
2013							-	0.933255	-
2014							-	0.947379	-
2015							-	0.962301	-
2016							-	0.976126	-
2017							-	0.995876	-
2018							-	1.018190	-
2019							-	1.050788	-
2020							-	1.093887	-
2021							-	1.143822	-
2022							-	1.187463	-
2023							-	1.218926	-
2024							-	1.245842	-
2025		2.663					2.7	1.272147	2.1
2026	208.813	113.459		9.579	29.894		361.7	1.298862	278.5
2027	365.165	78.059		16.891	76.304		536.4	1.326138	404.5
2028	335.476	92.572		15.312	46.744		490.1	1.353987	362.0
2029	432.577	138.608		19.391			590.6	1.382421	427.2
2030	423.656	145.887		19.056			588.6	1.411452	417.0
2031	467.246	165.889		20.803			653.9	1.441092	453.8
2032	463.785	122.590		20.733			607.1	1.471355	412.6
2033	465.742	97.061		20.758			583.6	1.502253	388.5
2034	470.736	86.307		20.972			578.0	1.533801	376.9
2035	474.912	86.215		21.142			582.3	1.566011	371.8
2036	480.282	87.222		21.317			588.8	1.598897	368.3
2037	485.616	81.473		21.521			588.6	1.632474	360.6
2038	491.144	82.552		21.751			595.4	1.666756	357.2
2039	497.143	83.681		22.002			602.8	1.701757	354.2
2040	503.563	84.858		22.273			610.7	1.737494	351.5
2041	510.368	86.078		22.561			619.0	1.773982	348.9
2042	517.527	87.340		22.865			627.7	1.811235	346.6
2043	521.704	88.576		23.137			633.4	1.849271	342.5
2044	529.443	89.067		23.470			642.0	1.888106	340.0
2045	507.591	89.812		23.386			620.8	1.927756	322.0
2046	507.355	85.974		23.624			617.0	1.968239	313.5
2047	518.396	86.442		23.985			628.8	2.009572	312.9
2048	527.382	84.429		24.357			636.2	2.051773	310.1

Improved Turbine Engine Program

Source for TY\$-CY\$ Conversion: ASN FMB-6 Inflation Rates and Outlay Factors for DA, DoN and DW accounts: 17 Jan 2024

2031A - Aircraft Procurement, Army									
fiscal year	End Item Recurring Flyaway	Non-End Item Recurring Flyaway	Non-Recurring Flyaway	Initial Spares	Depot Activation	Other/ Unallocated	Total TY(\$M)	Weighted Rate	Total CY2019 (\$M)
2049	494.134	77.895		22.659			594.7	2.094860	283.9
2050	501.067	78.957		22.969			603.0	2.138853	281.9
2051	533.441	83.968		25.503			642.9	2.183768	294.4
2052	566.547	85.351		25.966			677.9	2.229628	304.0
2053	576.540	86.689		26.397			689.6	2.276450	302.9
2054	586.306	88.060		26.840			701.2	2.324255	301.7
2055	596.323	89.462		27.295			713.1	2.373065	300.5
2056	366.368	51.898		16.249			434.5	2.422899	179.3
2057	77.075	24.991		2.509			104.6	2.473780	42.3
2058	55.355	15.719		1.395			72.5	2.525729	28.7
2059	15.262	12.726					28.0	2.578769	10.9

Annual Acquisition Estimates by Appropriation Account

(Aligned to Budget Position: PB 2025)

Improved Turbine Engine Program

Source for TY\$-CY\$ Conversion: ASN FMB-6 Inflation Rates and Outlay Factors for DA, DoN and DW accounts: 17 Jan 2024

2020A - Operation & Maintenance, Army					
fiscal year		Other/ Unallocated	Total TY(\$M)	Weighted Rate	Total CY2019 (\$M)
Total		175.6	175.6	-	97.1
2012			-	0.907049	-
2013			-	0.919576	-
2014			-	0.934085	-
2015			-	0.943416	-
2016			-	0.960299	-
2017			-	0.976469	-
2018			-	0.996044	-
2019		1.259	1.3	1.018705	1.2
2020		1.769	1.8	1.046603	1.7
2021		1.950	2.0	1.097799	1.8
2022		2.316	2.3	1.152182	2.0
2023		3.340	3.3	1.193670	2.8
2024		3.508	3.5	1.221840	2.9
2025		3.606	3.6	1.247930	2.9
2026		3.680	3.7	1.274137	2.9
2027		3.758	3.8	1.300894	2.9
2028		3.837	3.8	1.328212	2.9
2029		3.917	3.9	1.356105	2.9
2030		3.999	4.0	1.384583	2.9
2031		4.083	4.1	1.413659	2.9
2032		4.169	4.2	1.443346	2.9
2033		4.257	4.3	1.473656	2.9
2034		4.346	4.3	1.504603	2.9
2035		4.437	4.4	1.536200	2.9
2036		4.531	4.5	1.568460	2.9
2037		4.626	4.6	1.601398	2.9
2038		4.723	4.7	1.635027	2.9
2039		4.822	4.8	1.669363	2.9
2040		4.923	4.9	1.704419	2.9
2041		5.027	5.0	1.740212	2.9
2042		5.132	5.1	1.776757	2.9
2043		5.240	5.2	1.814068	2.9
2044		5.350	5.4	1.852164	2.9
2045		5.462	5.5	1.891059	2.9
2046		3.098	3.1	1.930772	1.6
2047		1.265	1.3	1.971318	0.6
2048		1.292	1.3	2.012715	0.6

Improved Turbine Engine Program

Source for TY\$-CY\$ Conversion: ASN FMB-6 Inflation Rates and Outlay Factors for DA, DoN and DW accounts: 17 Jan 2024

2020A - Operation & Maintenance, Army					
fiscal year		Other/ Unallocated	Total TY(\$M)	Weighted Rate	Total CY2019 (\$M)
2049		1.319	1.3	2.054982	0.6
2050		1.347	1.3	2.098137	0.6
2051		1.375	1.4	2.142198	0.6
2052		1.404	1.4	2.187184	0.6
2053		1.433	1.4	2.233115	0.6
2054		1.464	1.5	2.280010	0.6
2055		1.494	1.5	2.327891	0.6
2056		1.526	1.5	2.376776	0.6
2057		1.558	1.6	2.426689	0.6
2058		1.590	1.6	2.477649	0.6
2059		1.624	1.6	2.529680	0.6
2060		1.658	1.7	2.582803	0.6
2061		1.693	1.7	2.637042	0.6
2062		1.728	1.7	2.692420	0.6
2063		1.765	1.8	2.748961	0.6
2064		1.802	1.8	2.806689	0.6
2065		1.839	1.8	2.865629	0.6
2066		1.878	1.9	2.925807	0.6
2067		1.917	1.9	2.987249	0.6
2068		1.958	2.0	3.049982	0.6
2069		1.999	2.0	3.114031	0.6
2070		2.041	2.0	3.179426	0.6
2071		2.084	2.1	3.246194	0.6
2072		2.127	2.1	3.314364	0.6
2073		2.172	2.2	3.383966	0.6
2074		2.218	2.2	3.455029	0.6
2075		2.264	2.3	3.527584	0.6
2076		2.312	2.3	3.597917	0.6
2077		2.360	2.4	3.668989	0.6
2078		2.410	2.4	3.740062	0.6
2079		2.461	2.5	3.811134	0.6
2080		2.512	2.5	3.882207	0.6
2081		2.565	2.6	3.953279	0.6

Acquired System Annual End-Item Quantities by Appropriation Account

(Aligned to Budget Position: PB 2025)

Improved Turbine Engine Program

2040A - Research, Development, Test & Eval, Army				
fiscal year	Improved Turbine Engine			Total
Total	69			69
Undistributed				-
2019	1			1
2020	2			2
2021	17			17
2022	26			26
2023				-
2024				-
2025	23			23

Acquired System Annual End-Item Quantities by Appropriation Account

(Aligned to Budget Position: PB 2025)

Improved Turbine Engine Program

2031A - Aircraft Procurement, Army				
fiscal year	Improved Turbine Engine			Total
Total	6,189			6,189
Undistributed				-
2019				-
2020				-
2021				-
2022				-
2023				-
2024				-
2025				-
2026	81			81
2027	156			156
2028	149			149
2029	194			194
2030	193			193
2031	212			212
2032	212			212
2033	212			212
2034	212			212
2035	212			212
2036	212			212
2037	212			212
2038	212			212
2039	212			212
2040	212			212
2041	212			212
2042	212			212
2043	212			212
2044	212			212
2045	212			212
2046	212			212
2047	212			212
2048	212			212
2049	212			212
2050	212			212
2051	212			212
2052	212			212

Improved Turbine Engine Program

2031A - Aircraft Procurement, Army				
fiscal year	Improved Turbine Engine			Total
2053	212			212
2054	212			212
2055	212			212
2056	116			116

Nuclear Costs

Improved Turbine Engine Program

No data for 2023 SAR

Program's Use of Department of Energy Resources

None

Operational Fielding Plan

Improved Turbine Engine Program

System: Improved Turbine Engine

Fielding and Inventory Notes

As part of the Aviation Rebalancing Initiative, the Army reduced RDTE in FY 2025 and eliminated APA in PB25 AF3.2 as of February 13, 2024 delaying production. Future procurement is subject to future production decisions and availability of funding. The PM will submit a Program Deviation Report to the MDA. The PM established technical knowledge points for Army Leadership to enable a production decision at the appropriate time.

Improved Turbine Engine Fielding Plan and Inventory

fiscal year	Store	Field	Expend/Loss	Decommission	Inventory
2023					
2024					-
2025					-
2026					-
2027		-			-
2028		81			81

O&S Independent Cost Estimate

Improved Turbine Engine Program

Independent and Current Cost Estimate Comparison

Category	CY2019 (\$M)	Independent Cost Estimate 1/16/2019	Current Estimate 1/18/2024	Variance with ICE (%)
Unit-Level Manpower		-	-	-
Unit Operations		5,869.4	6,307.0	7%
Maintenance		5,181.8	4,071.3	-21%
Sustaining Support		-	217.3	-
Continued System Improvements		157.4	191.1	21%
Other				-
Total O&S		11,208.6	10,786.7	-4%

Independent Cost Estimate Source

Event: ITEP MSB ICE Approval Package 190116.pdf (BY\$19)
Type: Component Cost Position
Approved by: OSD Cost Assessment & Program Evaluation, January 16, 2019

Current Cost Estimate Source

Type: Program Office Estimate
Approved by: Army PEO AVN PPR&P G8, January 18, 2024
Note: ACE Session: ITEP POE for G8 review 2024-04-02.acem
ACEIT Inflation Tables: US Government Indices for FY 2024, 05Mar2024.

Cost Estimate Variance Explanation

+ ICE was the Army Cost Position (ACP) performed by DASA-CE in 2019, the Cost Estimate (ITEP POE) was completed Jan 2024 along with validation with PEO AVN G8 in Jan 2024. Much more is known about the product/program and has been incorporated into the revised estimate.

+ Unit Operations (Petro, Oil, and Lube + Systems Engineering/MGMT + Training) cost more in POE now than in 2019 ICE, based on revised requirements scope fuel cost increase, and increased shipping / labor.

+ Maintenance (Repl Spares (Reprables) + Repl Repair Parts (Cons)) is expecting to cost less today due to improved engine design. Also realigned cost to Support Category.

+ Realigned existing/revised requirements/cost with this Support Category. Adjustments made to the cost estimate structure to align with the Army Cost Analysis Manual 2020, Army Cost Estimating Structure (ACES) and additional requirements realigned into Sustainment Support Category.

+ ICE had Software (PPSS) very high based on unknowns at the time as compared to POE that has greater clarity on requirements. Enhanced Component Improvement Program (CIP) with Continuing System Improvements (CSI) based on cleared requirements and methodology to be relevant and for use as an analogous program.

In February 2024, the Army decided to delay ITEP production. The Program Manager has established technical knowledge points for Army leadership to make a production decision at the appropriate time.

Annual Operating and Support Estimates by Cost Element

Improved Turbine Engine Program

System: Improved Turbine Engine

Source for TY-CY Conversion:

ACEIT Inflation Tables: Us Government Indices for FY 2024, 05Mar2024, from ACEIT Session:
PEO Validated: ITEP POE for G8 review 2024-01-04.acem

Operating and Support Cost Elements							
fiscal year	1.0 Unit-Level Manpower	2.0 Unit Operations	3.0 Maintenance	4.0 Sustaining Support	5.0 Continuing System Improvements	Other	Total CY2019 (\$M)
Total	-	6,307.0	4,071.3	217.3	191.1	-	10,786.7
2016	-	-	-	0.402	-	-	0.4
2017	-	-	-	0.402	-	-	0.4
2018	-	-	-	0.402	-	-	0.4
2019	-	-	-	0.402	-	-	0.4
2020	-	-	-	0.402	-	-	0.4
2021	-	-	-	0.402	-	-	0.4
2022	-	-	-	0.402	-	-	0.4
2023	-	-	-	0.402	-	-	0.4
2024	-	-	-	0.402	-	-	0.4
2025	-	-	-	0.402	-	-	0.4
2026	-	-	-	0.402	-	-	0.4
2027	-	-	-	0.402	-	-	0.4
2028	-	3.236	0.190	0.402	-	-	3.8
2029	-	8.712	0.457	0.402	-	-	9.6
2030	-	13.946	0.620	0.402	-	-	15.0
2031	-	21.070	0.869	0.402	-	-	22.3
2032	-	28.193	1.091	0.402	-	-	29.7
2033	-	36.159	39.470	0.402	0.615	-	76.6
2034	-	44.125	46.374	0.402	0.749	-	91.7
2035	-	52.091	52.930	0.402	0.883	-	106.3
2036	-	60.703	59.593	0.402	1.029	-	121.7
2037	-	69.476	66.093	0.402	1.178	-	137.1
2038	-	78.249	72.377	0.402	1.326	-	152.4
2039	-	87.023	78.480	0.402	1.475	-	167.4
2040	-	95.796	84.428	0.402	1.624	-	182.3
2041	-	104.569	90.241	0.402	1.772	-	197.0
2042	-	113.343	95.935	0.402	1.921	-	211.6
2043	-	122.116	101.521	0.402	2.070	-	226.1
2044	-	130.889	107.011	0.402	2.218	-	240.5
2045	-	139.611	112.148	0.402	2.367	-	254.5
2046	-	148.332	117.213	0.402	2.516	-	268.5
2047	-	156.602	119.957	0.402	2.664	-	279.6

System: Improved Turbine Engine

Source for TY-CY Conversion: ACEIT Inflation Tables: Us Government Indices for FY 2024, 05Mar2024, from ACEIT Session:
PEO Validated: ITEP POE for G8 review 2024-01-04.acem

Operating and Support Cost Elements							
fiscal year	1.0 Unit-Level Manpower	2.0 Unit Operations	3.0 Maintenance	4.0 Sustaining Support	5.0 Continuing System Improvements	Other	Total CY2019 (\$M)
2048	-	164.756	122.127	0.402	2.813		290.1
2049	-	172.909	124.306	0.402	2.962		300.6
2050	-	181.062	127.307	0.402	3.111		311.9
2051	-	189.216	130.301	0.402	3.259		323.2
2052	-	197.369	133.289	0.402	3.408		334.5
2053	-	205.523	136.271	0.402	3.557		345.8
2054	-	210.441	137.098	0.402	3.649		351.6
2055	-	213.118	136.346	0.402	3.704		353.6
2056	-	216.037	135.853	8.046	3.763		363.7
2057	-	217.067	134.155	8.046	3.791		363.1
2058	-	214.384	130.833	8.123	6.712		360.1
2059	-	206.418	124.705	8.123	6.792		346.0
2060	-	198.452	118.576	8.123	6.658		331.8
2061	-	190.486	112.448	8.123	6.524		317.6
2062	-	181.874	106.038	8.123	6.378		302.4
2063	-	173.100	99.556	8.123	6.229		287.0
2064	-	164.327	93.075	8.123	6.081		271.6
2065	-	155.554	86.594	8.123	5.932		256.2
2066	-	146.780	80.113	8.123	5.783		240.8
2067	-	138.007	73.632	8.123	5.635		225.4
2068	-	129.234	67.150	8.123	5.486		210.0
2069	-	120.461	60.669	8.123	5.337		194.6
2070	-	111.687	54.188	8.123	5.189		179.2
2071	-	102.966	47.950	8.123	5.040		164.1
2072	-	94.244	41.712	8.123	4.891		149.0
2073	-	85.974	37.599	8.123	4.743		136.4
2074	-	77.821	34.033	8.123	4.594		124.6
2075	-	69.667	30.468	8.123	4.445		112.7
2076	-	61.514	26.902	8.123	4.297		100.8
2077	-	53.361	23.336	8.123	4.148		89.0
2078	-	45.207	19.770	8.123	3.999		77.1
2079	-	37.054	16.205	8.123	3.850		65.2
2080	-	28.900	12.639	4.305	3.702		49.5
2081	-	20.747	9.073	1.938	3.553		35.3
2082	-	12.593	-	0.077	3.404		16.1
2083	-	4.440	-	0.077	3.256		7.8