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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)								DATE February 1999			
BUDGET ACTIVITY 7 - Operational System Development				PE NUMBER AND TITLE 0203752A Aircraft Engine Component Improvement Program				PROJECT D106			
COST (In Thousands)		FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
D106	Aircraft Engine Component Improvement Program (CIP)	2756	6901	2900	2946	3132	3202	3382	3463	Continuing	Continuing
<p><b>A. Mission Description and Budget Item Justification</b> Aircraft Engine Component Improvement Program (CIP) develops, tests, and qualifies improvements to aircraft engine components to correct service revealed deficiencies, improve flight safety, enhance readiness and reduce operating and support (O&amp;S) costs. In addition, CIP provides the test vehicles for the testing and qualification efforts required as a part of the Army's Flight Safety Parts program. CIP is included in the RDTE budget vice procurement appropriations in accordance with congressional direction.</p> <p><b>FY 1998 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 663 <b>T700 Engine:</b> Completed qualification of improved oil sump to reduce O&amp;S costs. Develop improved high temperature connector for Speed &amp; Torque sensor cables to reduce maintenance costs. Begin analysis for the update of the life limits for the -701C turbine rotor to improve readiness and increase flight safety. Install field performance monitors on four Blackhawk aircraft to gather mission data to increase accuracy of life limit updates. Developed repair procedures to allow use of scrapped high-dollar hardware and reduce O&amp;S costs.</li> <li>• 992 <b>T55 Engine:</b> Continued to develop bearing improvements to improve reliability and fatigue life while reducing O&amp;S costs. Began development of redesigned tailpipe which will improve reliability and readiness while reducing performance losses, extending service life and reducing O&amp;S costs.</li> <li>• 189 <b>T53 Engine:</b> Completed qualification testing of an improved N2 Accessory Drive Carrier that will improve reliability by preventing bearing race spinning and assembly sensitivities. This design also includes a METCO coated spur gear which dampens engine vibrations and prevents known gear fracture problems in order to resolve a known flight safety issue. Completed qualification of an improved output reduction gear box (RGB) with an integral torque meter ring that increases reliability by correcting misalignment problems which increases gear wear. RGB improvement also removes thorium from the front cover and includes new gear profile/silver plated planetary gears for improved lubricity.</li> <li>• 425 <b>GTCP 36 APU:</b> Evaluated potential for commonality of parts between Blackhawk, Apache, and Air Force APUs to reduce O&amp;S cost. Compared life cycle cost benefits of Mar-M turbine wheel and dual alloy turbine wheel for use on both Apache and Blackhawk, and initiated design of an erosion resistant common dual alloy turbine wheel with an improved stress rupture life to extend service life and reduce O&amp;S cost. Investigated Longbow clutch cold oil leak problem, and initiated testing of various possible solutions to improve readiness and reduce O&amp;S cost.</li> <li>• 446 <b>Navy:</b> To increase support of field data gathering program for UH-60 Blackhawk.</li> <li>• 41 <b>In-House:</b> In-house support for the component improvement program engineers.</li> </ul> <p>Total 2756</p>											
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<b>FY 1999 Planned Program:</b>		
•	1260	<b>T700 Engine:</b> Continue development of repair procedures to allow use of scrapped high-dollar hardware. Continue gathering data from installed field performance monitors. Perform materials analysis of power turbine (PT) disks to develop safe operating life limits. Develop and test engine auto-relight capability for UH-60 to improve flight safety. Develop improved installed engine diagnostic methods to preclude "no fault found" LRU removals and decrease O&S costs. Develop and test new material for Woodward Governor HMU Temperature sensor to increase service life and reduce O&S costs.
•	1030	<b>T55 Engine:</b> Complete the development and testing of redesigned tailpipe to improve reliability and readiness and extend service life while reducing performance losses and O&S costs. Begin development of depot/field level repair techniques for high-dollar hardware to reduce O&S costs and improve readiness. Complete testing of the improved bearings which will increase life and reduce O&S costs. Design optimized plumbing system to reduce maintenance costs and weight while improving reliability.
•	300	<b>GTCP 36 APU:</b> Complete design of a common dual alloy turbine wheel for use on both Apache and Blackhawk. Initiate design of a common ECU box capable of running the Apache, Apache Longbow, and Blackhawk auxiliary power units (APUs). Teardown and analyze high-time Blackhawk APUs to determine incipient failures/identify need for redesign to extend service life and reduce O&S cost. Perform 200 hour engine test to qualify improved hardware developed in previous CIP efforts. Investigate service revealed difficulties arising during the course of the year to improve readiness.
•	2000	<b>FDU:</b> Develop a Fuel Delivery Unit (FDU) for the Subsystem Power Unit (SPU) for the RAH-66 Comanche
•	2000	<b>FADEC:</b> Develop a Full Authority Digital Engine Control (FADEC) training device for the New Training Helicopter (NTH) Engine that will permit manual control of the engine.
•	100	<b>RTTC:</b> Initiate component and engine test capability at Redstone Arsenal in support of the Aircraft Engine Component Improvement Program.
•	30	<b>In-House:</b> In-house support for the component improvement program engineers.
•	181	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs.
Total	6901	
<b>FY 2000 Planned Program:</b>		
•	1343	<b>T700 Engine:</b> Complete engine data collection from UH-60 aircraft and analyze data to develop updated mission profiles/parts life limits. Complete materials analysis of PT disks and begin analysis of blisks. Continue development of improved on-wing LRU diagnostic methods. Continue development of new repair procedures for high-dollar hardware. Complete qualification of UH-60 auto-relight capability.
•	1200	<b>T55 Engine:</b> Qualify new plumbing system to reduce weight and O&S costs while improving reliability. Continue development of new depot/field level repair procedures to reduce O&S costs and improve readiness. Perform material life analysis for compressor and turbine parts to improve safety. Begin development of improved N2 sensor to reduce O&S costs and improve reliability.
•	300	<b>GTCP 36 APU:</b> Initiate demonstration test of APU parts identified as candidates for commonality to reduce O&S cost. Design, fabricate, and qualify a stiffer Apache planetary carrier to preclude vibration-induced planetary bearing failures in order to extend service life and reduce O&S cost.
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<p><b>FY 2000 Planned Program: (continued)</b></p> <p>Develop new depot repair techniques and extend wear limits as new failure modes and/or wear patterns are discovered in order to reduce O&amp;S cost and enhance mission readiness. Initiate development of an Apache/Longbow inlet particle separator, including concept evaluation, design and fabrication of the selected concept, and preparation of a kit for a demonstrator program; an inlet particle separator will reduce erosion, thereby improving readiness and reducing O&amp;S cost.</p> <ul style="list-style-type: none"> <li>• 57 <b>In-House:</b> In-house support for the component improvement program engineers.</li> </ul> <p>Total 2900</p> <p><b>FY 2001 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1382 <b>T700 Engine:</b> Begin development of improved oil sump to reduce coking which will reduce O&amp;S costs while improving readiness. Begin effort to eliminate rare and expensive materials from the engine to reduce O&amp;S costs while improving maintainability. Design improved durability stage 3 power turbine blades to reduce O&amp;S costs and increase engine life. Continue development of new repair procedures to allow refurbishment of high dollar hardware which will reduce O&amp;S costs while improving readiness. Complete materials analysis of blisks and begin analysis of tierod and spacer to improve flight safety. Begin acquisition of engine performance data to derive mission spectrum for Air Force H-60's to improve flight safety. Begin development of improved seal to reduce O&amp;S costs and improve reliability.</li> <li>• 1200 <b>T55 Engine:</b> Begin effort to improve the electrical shielding of the ignition system and overspeed valve to improve flight safety and readiness. Continue development of new repair procedures to reclaim unusable high dollar hardware to reduce O&amp;S costs while improving readiness.</li> <li>• 300 <b>GTCP 36 APU:</b> Continued demonstration test of APU parts identified as candidates for commonality to reduce O&amp;S cost. Continue developing new depot repair techniques and extend wear limits as new failure modes and/or wear patterns are discovered in order to reduce O&amp;S cost and enhance mission readiness. Initiate demonstration testing of a common ECU box capable of running the Apache, Apache Longbow, and Blackhawk auxiliary power units (APUs). Continue development of an Apache/Longbow inlet particle separator, including concept evaluation, design and fabrication of the selected concept, and preparation of a kit for a demonstrator program. Initiate development of a ceramic turbine nozzle which will reduce sand erosion.</li> <li>• 64 <b>In-House:</b> In-house support for the component improvement program engineers.</li> </ul> <p>Total 2946</p>		
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<b>B. Program Change Summary</b>										
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>						
Previous President's Budget ( <u>FY 1999 PB</u> )	2849	2948	3026	3098						
Appropriated Value	2940	6948								
Adjustments to Appropriated Value										
a. Congressional General Reductions	-91	-47								
b. SBIR / STTR	-70									
c. Omnibus or Other Above Threshold Reductions	-23									
d. Below Threshold Reprogramming										
e. Rescissions										
Adjustments to Budget Years Since <u>FY 1999 PB</u>			-126	-152						
Current Budget Submit ( <u>FY 2000 / 2001 PB</u> )	2756	6901	2900	2946						
<b>C. Other Program Funding Summary</b>										
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>	To <u>Compl</u>	Total <u>Cost</u>
There are no other RDTE or other Appropriation efforts.										
<b>D. Acquisition Strategy:</b> Improved designs will be implemented via Engineering Change Proposal (ECP) and follow-on procurement or modification to a production contract to introduce the improved hardware.										
<b>E. Schedule Profile</b>										
	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
T700 – Perform materials analysis of PT disks, develop and qualify auto-relight capability for Blackhawk, develop improved diagnostic methods for LRU's, design and qualify new WGC HMU Tem sensor material, develop auto-relight capability for UH-60				4Qtr						
T700 – Perform materials analysis of blisks, develop improved diagnostic methods for LRU's, qualify auto-relight capability for UH-60					4Qtr					
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E. Schedule Profile	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
T700 – Design improved oil sump, begin elimination of rate/expensive materials, design improved stage 3 blades, complete materials analysis of blisks, begin gathering Air Force H-60 engine data, develop improved seal						4Qtr				
T55 – Design improved bearings, develop improved tailpipe			4Qtr							
T55 – Complete testing of improved tailpipe, begin development of repair procedures for high cost hardware, complete qualification of improved bearings, develop optimized plumbing system				4Qtr						
T55 – Complete qualification of optimized plumbing system, continue development of repair procedures for high cost hardware, evaluation of new material for PT disks and shaft, design improved N2 sensor system					4Qtr					
T55 - Complete testing of new material for PT disk and shaft						4Qtr				
APU – Evaluated potential for commonality of parts between Blackhawk, Apache, and Air Force APUs, initiated design of an erosion resistant common dual alloy turbine, investigated Longbow clutch cold day oil leak problem			4Qtr							
APU – Initiated testing of various possible clutch oil leak solutions, complete design of a common dual alloy turbine wheel, initiate design of a common ECU box capable of running the Apache, Apache Longbow, and Blackhawk APUs, teardown and analyze high-time Blackhawk APUs to determine incipient failures/identify need for redesign, perform 200 hour engine test to qualify improved hardware developed in previous CIP efforts.				4Qtr						

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<b>E. Schedule Profile</b>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
APU – Initiate demonstration test of APU parts identified as candidates for commonality; design, fabricate, and qualify a stiffer Apache planetary carrier to preclude vibration-induced planetary bearing failures; develop new depot repair techniques and extend wear limits as new failure modes and/or wear patterns are discovered; initiate development of an Apache/Longbow inlet particle separator, including concept evaluation, design and fabrication of the selected concept, and preparation of a kit for a demonstrator program					4Qtr					
APU – Continue demonstration test of APU parts identified as candidates for commonality to reduce O&S cost, continue development of new depot repair techniques and extend wear limits as new failure modes and/or wear patterns are discovered, initiate demonstration testing of a common ECU box, continue development of an Apache/ Longbow inlet particle separator, initiate development of a ceramic turbine nozzle which will reduce sand erosion						4Qtr				

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ARMY RDT&E COST ANALYSIS (R-3)										DATE February 1999		
BUDGET ACTIVITY 7 - Operational System Development				PE NUMBER AND TITLE 0203752A Aircraft Engine Component Improvement Program						PROJECT D106		
I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. T700	SS/CPFF	General Electric Lynn, MA	40623	1079	Jan 99	1343		1382		Cont	44427	44427
b. T55	SS/CPFF	Allied Signal Phoenix, AZ	19217	1030	Jan 99	1200		1200		Cont	22647	22817
c. APUs	MIPR	Kelly AFB, TX	13200	300	Dec 98	300		300		Cont	14100	14100
d. T700/T55/T53/APUs	TBD		0	2000	TBD						2000	2000
e. T700/T55/T53/APUs	TBD		0	2000	TBD						2000	2000
Subtotal Product Development:			73040	6409		2843		2882			85174	
II. Support Costs	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. T53 Engine	SS/CPFF	Allied Signal Phoenix, AZ	352	0	0	0	0	0	0		352	352
Subtotal Support Costs:			352								352	
III. Test and Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. RTTC	N/A	Redstone Arsenal, AL	0	100	Jan 99	0	0	0	0	0	100	100
IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. AMCOM In-house	N/A	Redstone Arsenal, AL	10491	30		57		64		Cont	10642	10662
Subtotal Management Services:			10491	30		57		64			10642	
Project Total Cost:			83883	6901		2900		2946		10342	106630	

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