

## UNCLASSIFIED

PE NUMBER: 0401119F  
PE TITLE: C-5 Airlift Squadrons

Exhibit R-2, RDT&E Budget Item Justification								DATE February 2005		
BUDGET ACTIVITY 07 Operational System Development					PE NUMBER AND TITLE 0401119F C-5 Airlift Squadrons					
Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	325.907	330.049	226.479	149.591	50.926	0.000	0.000	0.000	0.000	1,711.094
4495 Avionics Modernization Program	67.385	10.926	0.000	0.000	0.000	0.000	0.000	0.000	0.000	373.773
4835 Reliability Enhancement & Reengining Program	258.522	319.123	226.479	149.591	50.926	0.000	0.000	0.000	0.000	1,337.321

(U) **A. Mission Description and Budget Item Justification**

674495: Avionics Modernization Program (AMP): Phase I of an Air Force planned two-phase modernization effort for the C-5 [Phase II is the Reliability Enhancement and Re-engining Program (RERP)]. AMP implements communication, navigation, surveillance/air traffic management (CNS/ATM) [formerly, Global Air Traffic Management (GATM)] and navigation/safety capability and the All Weather Flight Control System (AWFCS). It installs Deputy Secretary of Defense (DepSecDef) directed navigation/safety equipment: Terrain Awareness and Warning System (TAWS) and Traffic Alert and Collision Avoidance System (TCAS), reducing the threat of controlled flight into terrain and mid-air collisions. CNS/ATM capability requirements will be incorporated into the aircraft to meet current and future International Civil Aviation Organization (ICAO)/Federal Aviation Administration (FAA) requirements and to progress towards free flight capability. The AWFCS portion of AMP replaces low reliability line replaceable units (LRUs) in the automatic flight control system and replaces aging, non-supportable mechanical instruments in the engine and flight systems. Connectivity to mobility command and control capabilities will also be incorporated in the AMP design. The TCAS portion was accelerated ahead of the rest of the AMP mod and was completed 31 Oct 02. Two AMP RDT&E test articles were funded in FY99 for installation and flight test in FY02/03/04/05. AMP's first flight occurred in Dec 02. The final software build, which is required to address system effectiveness & suitability, is expected to complete in CY 05 with operational testing to follow. Avionics capability required for modernization that is not complete at the end of AMP development will be captured and funded in RERP, which is Phase II of the C-5 modernization program. The C-5 modernization program was approved in FY04 to use the contractor supported weapon system (CSWS) support concept. Initial spares in support of CSWS will be purchased with 3010, BP11 funds instead of 3010, BP16 funds. This project is comprised of low technical risk efforts supporting fielded weapons systems and, therefore, was assigned to Budget Activity 7, Operational Systems Development.

674835: Reliability Enhancement and Re-engining Program (RERP): Phase II of an Air Force planned two-phase modernization effort for the C-5 (Phase I is the Avionics Modernization Program (AMP)). RERP is a comprehensive modernization effort to improve aircraft reliability, maintainability and availability. RERP will enable the C-5 to achieve wartime mission requirements by increasing fleet availability (mission capable rate, departure reliability) while reducing total ownership costs (TOC). This effort centers around replacing TF39 engines with a more reliable, commercially Off-the-Shelf (COTS) turbofan engine with increased takeoff thrust and stage three noise compliance. These new engines (along with new pylons, wing attach fittings and upgrades, and thrust reversers) increase payload capability and access to communication, navigation, surveillance/air traffic management (CNS/ATM) airspace. The modification also decreases aircraft time to climb, increases engine-out climb gradient for takeoff, improves transportation system throughput, and decreases engine removals. Additionally, numerous other system modifications will be performed (e.g., auxiliary power units, electrics, hydraulics, fuel system, fire suppression system, pressurization/air conditioning system, landing gear, and airframe) to increase fleet availability and reduce TOC. Three RDT&E test articles were funded in FY04 for installation and flight test in FY05/06/07. RERP's Preliminary Design Review (PDR) completed in Jan 03 and the Air-vehicle Critical Design Review (CDR) completed in Mar 04. Avionics capability required

R-1 Shopping List - Item No. 212-2 of 212-13

Exhibit R-2 (PE 0401119F)

## Exhibit R-2, RDT&amp;E Budget Item Justification

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0401119F C-5 Airlift Squadrons

for modernization that is not complete at the end of AMP development will be captured and funded in RERP. The C-5 modernization program was approved in FY04 to use the contractor supported weapon system (CSWS) support concept. Initial spares in support of CSWS will be purchased with 3010, BP11 funds instead of 3010, BP16 funds. This project is comprised of low technical risk efforts supporting fielded weapons systems and, therefore, was assigned to Budget Activity 7, Operational Systems Development. As described above, RERP includes a new start effort for avionics capability required for modernization, but which may not be complete at the end of AMP development.

(U) **B. Program Change Summary (\$ in Millions)**

	<u>FY 2004</u>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>
(U) Previous President's Budget	356.570	332.982	317.664	208.106
(U) Current PBR/President's Budget	325.907	330.049	226.479	149.591
(U) Total Adjustments	-30.663	-2.933		
(U) Congressional Program Reductions	0.000			
Congressional Rescissions	-3.029	-2.933		
Congressional Increases				
Reprogrammings	-15.746			
SBIR/STTR Transfer	-11.888			

(U) **Significant Program Changes:**

FY06 PB:

FY06 has been reduced by \$91.2M since the FY05 PB submittal. This funding reduction was made in the reliability enhancement and re-engining program (RERP) to fund higher priority Departmental requirements.

FY07:

FY07 has been reduced by \$58.5M since the FY05 PB submittal. This funding reduction was made in the reliability enhancement and re-engining program (RERP) to fund higher priority Departmental requirements.

## Exhibit R-2a, RDT&amp;E Project Justification

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BUDGET ACTIVITY 07 Operational System Development					PE NUMBER AND TITLE 0401119F C-5 Airlift Squadrons			PROJECT NUMBER AND TITLE 4495 Avionics Modernization Program		
Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
4495 Avionics Modernization Program	67.385	10.926	0.000	0.000	0.000	0.000	0.000	0.000	0.000	373.773
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

(U) **A. Mission Description and Budget Item Justification**

674495: Avionics Modernization Program (AMP): Phase I of an Air Force planned two-phase modernization effort for the C-5. It implements communication, navigation, surveillance/air traffic management (CNS/ATM) [formerly, Global Air Traffic Management (GATM)] and navigation/safety capability and the All Weather Flight Control System (AWFCS). It installs Deputy Secretary of Defense (DepSecDef) directed navigation/safety equipment: Terrain Awareness and Warning System (TAWS) and Traffic Alert and Collision Avoidance System (TCAS), reducing the threat of controlled flight into terrain and mid-air collisions. CNS/ATM capability requirements will be incorporated into the aircraft to meet current and future International Civil Aviation Organization (ICAO)/Federal Aviation Administration (FAA) requirements and to progress towards free flight capability. The AWFCS portion of AMP replaces low reliability line replaceable units (LRUs) in the automatic flight control system and replaces aging, non-supportable mechanical instruments in the engine and flight systems. Connectivity to mobility command and control capabilities will also be incorporated in the AMP design. The TCAS portion was accelerated ahead of the rest of the AMP mod and was completed 31 Oct 02. Two AMP RDT&E test articles were funded in FY99 for installation and flight test in FY02/03/04/05. AMP's first flight occurred in Dec 02. The final software build, which is required to address system effectiveness & suitability, is expected to complete in CY05 with operational testing to follow. Avionics capability required for modernization that is not complete at the end of AMP development will be captured and funded in RERP, which is Phase II of the C-5 modernization program. The C-5 modernization program was approved in FY04 to use the contractor supported weapon system (CSWS) support concept. Initial spares in support of CSWS will be purchased with 3010, BP11 funds instead of 3010, BP16 funds. This project is comprised of low technical risk efforts supporting fielded weapons systems and, therefore, was assigned to Budget Activity 7, Operational Systems Development.

(U) **B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2004</u>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>
(U) System Engineering/Program Management	13.395	1.156		
(U) AMP Kit Design/Development/Contractor Test	40.970	5.540		
(U) Prototype Fabrication/Install	2.871	0.966		
(U) Mission Support	3.108	0.515		
(U) Government Flight Test Cost	7.041	2.749		
(U) Total Cost	67.385	10.926	0.000	0.000

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

	<u>FY 2004</u> <u>Actual</u>	<u>FY 2005</u> <u>Estimate</u>	<u>FY 2006</u> <u>Estimate</u>	<u>FY 2007</u> <u>Estimate</u>	<u>FY 2008</u> <u>Estimate</u>	<u>FY 2009</u> <u>Estimate</u>	<u>FY 2010</u> <u>Estimate</u>	<u>FY 2011</u> <u>Estimate</u>	<u>Cost to</u> <u>Complete</u>	<u>Total Cost</u>
(U) AF RDT&E										
(U) Other APPN										
(U) Aircraft Procurement, AF,	76.894	96.630	69.296	49.600	27.785	4.138			340.108	800.127

Project 4495

R-1 Shopping List - Item No. 212-4 of 212-13

Exhibit R-2a (PE 0401119F)

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0401119F C-5 Airlift Squadrons

PROJECT NUMBER AND TITLE

4495 Avionics Modernization Program

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

BA-5, C-5 Mods, Avionics  
Modernization Program,  
BP-11

(U)	BA-5, C-5 Mods, Avionics Modernization Program, BP-16	11.522							11.522
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(U)	Aircraft Procurement, AF, BA-5, C-5 Mods, Reliability Enhancement and Re-engining Program, BP-11	20.001	141.144	435.208	631.960	764.980	869.731	6,842.840	9,705.864
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(U) **D. Acquisition Strategy**

Avionics Modernization Program: Program acquisition strategy establishes a single integrating contractor (Lockheed Martin Aeronautics Company) to modify and qualify integrated Commercial Off-the-Shelf (COTS) line replaceable units (LRUs) and software to meet C-5 performance and communication, navigation, surveillance/air traffic management (CNS/ATM) requirements; update existing C-5 engineering and technical data; develop interface control specifications based on performance requirements; prototype the new system; and support flight testing. AMP contract awarded to the Lockheed Martin/Honeywell team on 22 January 1999. \$9.7M in FY99 procurement was added in the FY00 PB to accelerate Traffic Alert and Collision Avoidance System (TCAS) installations ahead of the rest of AMP. The AMP modification is planned for the entire C-5 fleet.

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## Exhibit R-3, RDT&amp;E Project Cost Analysis

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4495 Avionics Modernization Program

(U) Cost Categories (Tailor to WBS, or System/Item Requirements) (\$ in Millions)	<u>Contract Method &amp; Type</u>	<u>Performing Activity &amp; Location</u>	<u>Total Prior to FY 2004 Cost</u>	<u>FY 2004 Cost</u>	<u>FY 2004 Award Date</u>	<u>FY 2005 Cost</u>	<u>FY 2005 Award Date</u>	<u>FY 2006 Cost</u>	<u>FY 2006 Award Date</u>	<u>FY 2007 Cost</u>	<u>FY 2007 Award Date</u>	<u>Cost to Complete</u>	<u>Total Cost</u>	<u>Target Value of Contract</u>
(U) <u>Product Development</u>														
Lockheed Martin Aeronautics Co	CPAF		265.787	57.236	Oct-03	7.662	Oct-04	0.000		0.000		0.000	330.685	298.700
N/A													0.000	
Subtotal Product Development			265.787	57.236		7.662		0.000		0.000		0.000	330.685	298.700
Remarks:														
(U) <u>Support</u>														
WR-ALC/LT			7.580	1.492		0.000							9.072	9.072
ASC/GRA			11.769	1.616		0.515							13.900	13.900
N/A													0.000	
Subtotal Support			19.349	3.108		0.515		0.000		0.000		0.000	22.972	22.972
Remarks:														
(U) <u>Test &amp; Evaluation</u>														
418 Test Squadron (Edwards AFB)			10.326	7.041		2.749							20.116	20.116
N/A													0.000	
Subtotal Test & Evaluation			10.326	7.041		2.749		0.000		0.000		0.000	20.116	20.116
Remarks:														
(U) <u>Management</u>													0.000	
Subtotal Management			0.000	0.000		0.000		0.000		0.000		0.000	0.000	0.000
Remarks:														
(U) Total Cost			295.462	67.385		10.926		0.000		0.000		0.000	373.773	341.788

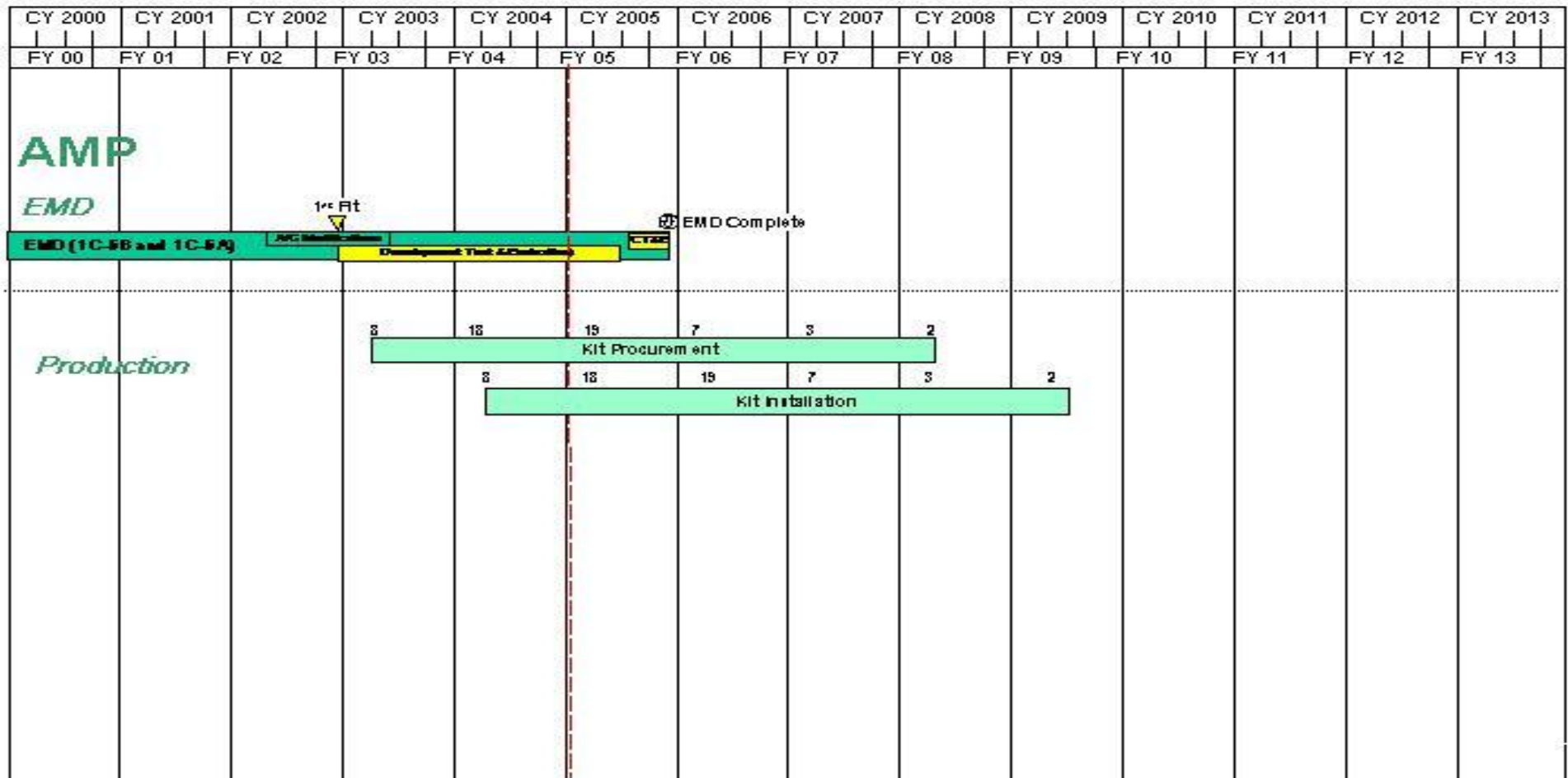
## Exhibit R-4, RDT&amp;E Schedule Profile

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February 2005

BUDGET ACTIVITY  
07 Operational System DevelopmentPE NUMBER AND TITLE  
0401119F C-5 Airlift SquadronsPROJECT NUMBER AND TITLE  
4495 Avionics Modernization  
Program

### C-5 Summary Schedule Avionics Modernization Program (AMP)



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## Exhibit R-4a, RDT&amp;E Schedule Detail

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PROJECT NUMBER AND TITLE

4495 Avionics Modernization  
Program(U) **Schedule Profile**FY 2004FY 2005FY 2006FY 2007

(U) Production Installation Start (FY04/3)

3Q

(U) AMP Flight Test Complete (FY06/1)

1Q

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BUDGET ACTIVITY 07 Operational System Development					PE NUMBER AND TITLE 0401119F C-5 Airlift Squadrons			PROJECT NUMBER AND TITLE 4835 Reliability Enhancement & Reengining Program		
Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
4835 Reliability Enhancement & Reengining Program	258.522	319.123	226.479	149.591	50.926	0.000	0.000	0.000	0.000	1,337.321
Quantity of RDT&E Articles	3	0	0	0	0	0	0	0		

(U) **A. Mission Description and Budget Item Justification**

674835: Reliability Enhancement and Re-engining Program (RERP): Phase II of an Air Force planned two-phase modernization effort for the C-5. It improves aircraft reliability, maintainability and availability. RERP will enable the C-5 to achieve wartime mission requirements by increasing fleet availability (mission capable rate, departure reliability) while reducing total ownership costs (TOC). This effort centers around replacing TF39 engines with a more reliable, commercially Off-the-Shelf (COTS) turbofan engine with increased takeoff thrust and stage three noise compliance. These new engines (along with new pylons, wing attach fittings and upgrades, and thrust reversers) increase payload capability and access to Global Air Traffic Management (GATM) airspace. The modification also decreases aircraft time to climb, increases engine-out climb gradient for takeoff, improves transportation system throughput, and decreases engine removals. Additionally, numerous other system modifications will be performed (e.g., auxiliary power units, electrics, hydraulics, fuel system, fire suppression system, pressurization/air conditioning system, landing gear, and airframe) to increase fleet availability and reduce TOC. Three RDT&E test articles were funded in FY04 for installation and flight test in FY05/06/07. RERP's Preliminary Design Review (PDR) completed in Jan 03 and the Air-vehicle Critical Design Review (CDR) completed in Mar 04. Avionics capability required for modernization that is not complete at the end of AMP development will be captured and funded in RERP. The C-5 modernization program was approved in FY04 to use the contractor supported weapon system (CSWS) support concept. Initial spares in support of CSWS will be purchased with 3010, BP11 funds instead of 3010, BP16 funds. This project is comprised of low technical risk efforts supporting fielded weapons systems and, therefore, was assigned to Budget Activity 7, Operational Systems Development. As described above, RERP includes a new start effort for avionics capability required for modernization, but which may not be complete at the end of AMP development.

(U) **B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2004</u>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>
(U) Systems Engineering/Program Management	22.491	21.201	16.093	10.620
(U) RERP Design/Development	129.946	166.575	123.148	81.266
(U) Prototype Fabrication/Install	97.460	115.089	70.670	46.635
(U) Mission Support	5.258	7.946	6.409	5.690
(U) Government Test Support	3.367	8.312	10.159	5.380
(U)				
(U) Total Cost	258.522	319.123	226.479	149.591



## Exhibit R-2a, RDT&amp;E Project Justification

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PROJECT NUMBER AND TITLE

4835 Reliability Enhancement &  
Reengining Program(U) **C. Other Program Funding Summary (\$ in Millions)**

	<u>FY 2004</u>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) AF RDT&E										
(U) Other APPN										
(U) Aircraft Procurement, AF, BA-5, C-5 Mods, Reliability Enhancement and Re-engining Program, BP-11			20.001	141.144	435.208	631.960	764.980	869.731	6,842.840	9,705.864
(U) Aircraft Procurement, AF, BA-5, C-5 Mods, Avionics Modernization Program, BP-11	76.894	96.630	69.296	49.600	27.785	4.138			340.108	800.127
(U) Aircraft Procurement, AF, BA-5, C-5 Mods, Avionics Modernization Program, BP-16		11.522								11.522

(U) **D. Acquisition Strategy**

Reliability Enhancement and Re-engining Program (RERP): The approved FY02 acquisition strategy called for the modification of the entire C-5 aircraft fleet starting with the 50 B-models first. System Development & Demonstration (SDD) includes 1 C-5A and 2 C-5Bs. The program acquisition strategy is to consider every opportunity to use commercially available components and processes to modernize C-5 products and processes to meet or exceed required system performance and support, so as to renew the weapon system until 2040. The program acquisition strategy also seeks to construct a government/industry partnership to identify solutions, assign responsibility, and execute to achieve AMC requirements. Fleet availability, ownership cost, and system performance will be used to balance solutions against program cost. Lockheed Martin Aeronautics Co has been selected as the prime contractor through a sole source arrangement. Lockheed has selected General Electric (Powerplant), Goodrich (Pylon), and Honeywell (Avionics) as the major subcontractors.

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## Exhibit R-3, RDT&amp;E Project Cost Analysis

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## PROJECT NUMBER AND TITLE

4835 Reliability Enhancement &  
Reengining Program

(U) <u>Cost Categories</u> (Tailor to WBS, or System/Item Requirements) (\$ in Millions)	<u>Contract</u> <u>Method &amp;</u> <u>Type</u>	<u>Performing</u> <u>Activity &amp;</u> <u>Location</u>	<u>Total</u> <u>Prior to FY</u> <u>2004</u> <u>Cost</u>	<u>FY 2004</u> <u>Cost</u>	<u>FY 2004</u> <u>Award</u> <u>Date</u>	<u>FY 2005</u> <u>Cost</u>	<u>FY 2005</u> <u>Award</u> <u>Date</u>	<u>FY 2006</u> <u>Cost</u>	<u>FY 2006</u> <u>Award</u> <u>Date</u>	<u>FY 2007</u> <u>Cost</u>	<u>FY 2007</u> <u>Award</u> <u>Date</u>	<u>Cost to</u> <u>Complete</u>	<u>Total Cost</u>	<u>Target</u> <u>Value of</u> <u>Contract</u>
(U) <u>Product Development</u>														
Lockheed Martin Aeronautics Co (Pre-EMD)	FFP		46.738									0.000	46.738	46.738
Lockheed Martin Aeronautics Co (SDD)	CPAF		264.392	249.897	Oct-03	302.865	Oct-04	209.911	Oct-05	138.521	Oct-06	50.435	1,216.021	1,216.021
													0.000	
Subtotal Product Development			311.130	249.897		302.865		209.911		138.521		50.435	1,262.759	1,262.759
Remarks:														
(U) <u>Support</u>														
WR-ALC/LT			6.598	0.172		3.178		2.544		2.130		0.100	14.722	14.722
ASC/GRA			6.888	5.086		4.768		3.865		3.560		0.391	24.558	24.558
N/A													0.000	
Subtotal Support			13.486	5.258		7.946		6.409		5.690		0.491	39.280	39.280
Remarks:														
(U) <u>Test &amp; Evaluation</u>														
418 Test Squadron (Edwards AFB)			8.064	3.367		8.312		10.159		5.380		0.000	35.282	35.282
N/A													0.000	
Subtotal Test & Evaluation			8.064	3.367		8.312		10.159		5.380		0.000	35.282	35.282
Remarks:														
(U) <u>Management</u>														
Subtotal Management			0.000	0.000		0.000		0.000		0.000		0.000	0.000	0.000
Remarks:														
(U) Total Cost			332.680	258.522		319.123		226.479		149.591		50.926	1,337.321	1,337.321

## Exhibit R-4, RDT&amp;E Schedule Profile

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BUDGET ACTIVITY

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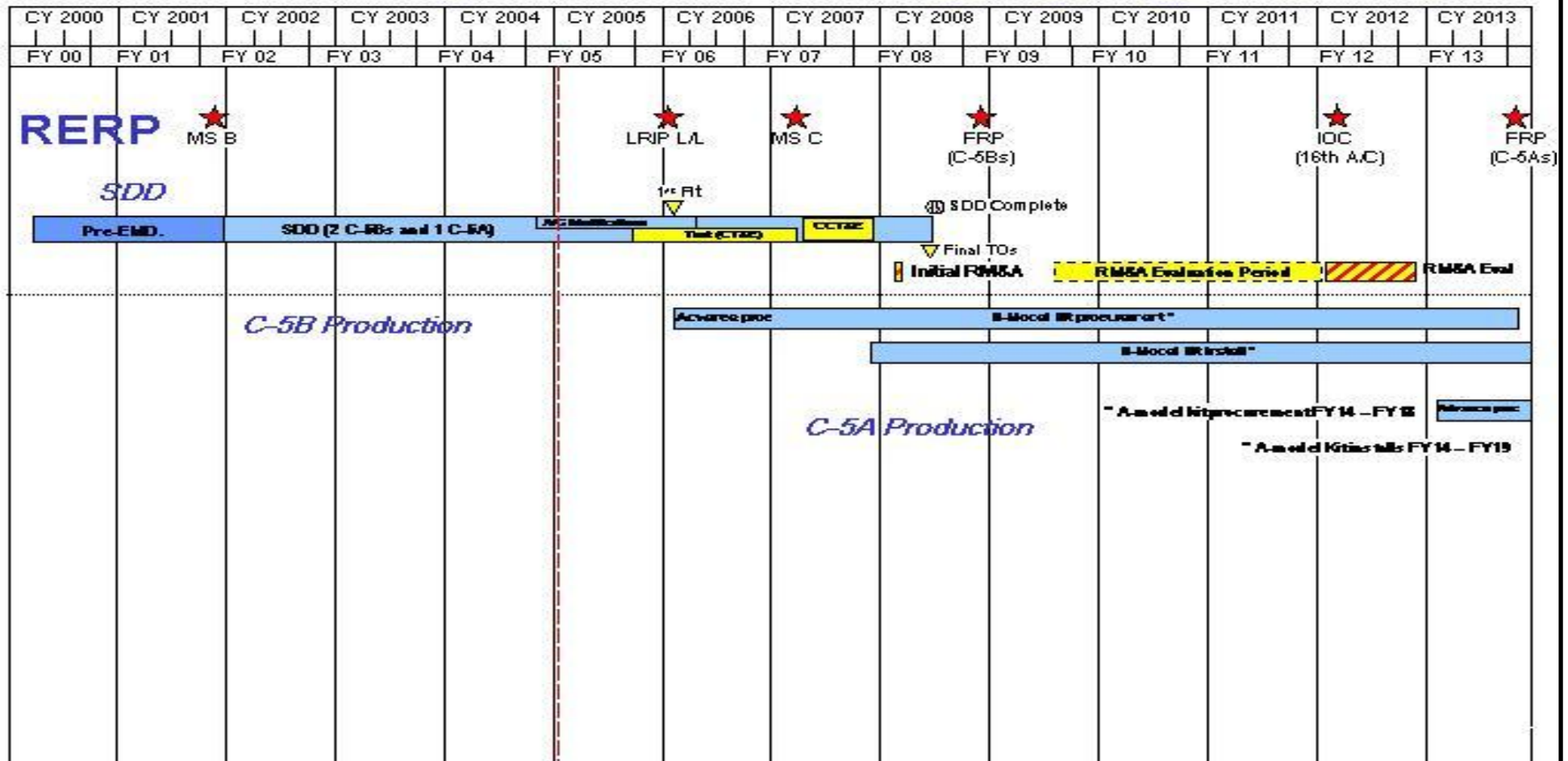
PE NUMBER AND TITLE

0401119F C-5 Airlift Squadrons

PROJECT NUMBER AND TITLE

4835 Reliability Enhancement &amp; Reengining Program

## C-5 Summary Schedule Reliability Enhancement & Re-engining Program (RERP)



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## Exhibit R-4a, RDT&amp;E Schedule Detail

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PE NUMBER AND TITLE

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PROJECT NUMBER AND TITLE

4835 Reliability Enhancement &  
Reengining Program(U) **Schedule Profile**FY 2004FY 2005FY 2006FY 2007

(U) Critical Design Review (CDR)(FY04/2)

2Q

(U) First Prototype Flight (FY06/2)

2Q

(U) MS C (FY07/2)

2Q