RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 2002

BUDGET ACTIVITY: 07 - Operational System Development

PE NUMBER AND TITLE: 0708612F Computer Resources Support Improvement Program

PROJECT: 4851

COST ($ in Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4851	Embedded Comp Res Spt Prog Impr	3,237	2,353	2,094	2,250	2,312	2,349	2,374	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

(U) A. Mission Description

This program improves the support of mission-critical software intensive systems. It encompasses automation and standardization of support processes, advanced support methodologies, tools and environments, and readiness support to facilitate rapid turnaround of software in response to changing mission and/or changing threat requirements.

(U) FY 2001 ($ in Thousands)

(U) $345 Continued developing adaptive software technologies. Developed and validated a design architecture for the embedded avionics application domain. Completed development of an application design methodology to integrate commercial and emerging technologies into platform-independent, resource adaptive applications. Conducted technology demonstrations in designated platforms. Transferred adaptive technologies to weapon systems to support embedded software that can respond to both mission profile changes and dynamic mission events.

(U) $165 Developed technologies and methodologies to upgrade legacy systems. Validated and matured specific proven technologies that will enable cost-effective, incremental improvements to fielded embedded information systems, allowing the affordable integration of legacy systems with other weapon systems and command and control platforms. Incorporated the use of open system standards in these technologies and methodologies.

(U) $340 Completed development of Reconfigurable Aerospace Computer Emulators to improve the reliability and maintainability of aging/obsolete on-board aerospace computers. Validated developed technologies to replace on-board computers with commercial microprocessor-based computer emulation technology. Demonstrated the methodologies developed to implement the incremental upgrades of on-board computers with new commercial-off-the-shelf processors, and demonstrated their backward compatibility with existing mission critical software.

(U) $75 Continued supporting the development of the Real-Time Defense Information Infrastructure Common Operating Environment. Developed and tested technical approaches to integrate reuse and commonality to improve the effectiveness of systems performing real-time command and control missions.

(U) $250 Continued developing a Virtual Engineering Environment (VEE) for software development. Developed a test environment incorporating new

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
07 - Operational System Development	0708612F Computer Resources Support Improvement Program	4851

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

		technologies, commercial-off-the-shelf components, and existing technologies. Evaluated the capabilities of the VEE to significantly improve embedded software development and testing, and to reduce facility acquisition and maintenance costs. Demonstrated the effectiveness of VEE in supporting current and next generation weapon systems software development and test environments.
(U)	$750	Completed development of the Weapon System Open Architecture (WSOA). Developed a 'virtual backplane' with an Open System Architecture to bridge the different embedded avionics and command, control, communications, and intelligence (C3I) systems across multiple aircraft platforms. Demonstrated and tested the ability of the WSOA to support multiple requests for imagery, targeting data, and other situational information between fighter aircraft and an airborne C3I platform.
(U)	$0	Developed technologies to implement Assured Middleware for Real-Time Embedded Systems (AMRES). Conducted trade-off studies and technical and cost benefit analyses between different real-time, fault-tolerance, and security concepts to implement an adaptable AMRES. Designed the AMRES environment using the Real-Time Common Object Request Broker Architecture to integrate the components and concepts selected from the analyses.
(U)	$55	Continued the Embedded Systems Interoperability Demonstration. Continued maturing the technologies developed under the WSOA to implement an interface between embedded systems operating on multiple tactical platforms with the C2 battlespace infosphere.
(U)	$60	Continued development of the Embedded Information System Re-engineering Technology. Continued design and development of an automated re-engineering capability to evolve software for embedded information systems. Continued development of the software tools to implement re-engineering technologies.
(U)	$220	Continued Real-Time (RT) Java for Embedded Systems to investigate RT Java applicability to the infosphere and embedded information system applications, in the context of open systems concepts, processes, and tools. Evaluated the capabilities and applicability of RT Java to the areas of architecture, distributed processing, and interoperability.
(U)	$977	Developed air resources rapid reallocation tools to support the real-time automated allocation of embedded resources in a dynamic battlespace environment. Conducted requirements analyses to prioritize the development of reallocation technologies. Completed the system design and architecture using open system standards. Identified pilot programs to demonstrate the reallocation tools.
(U)	$3,237	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
07 - Operational System Development	0708612F Computer Resources Support Improvement Program	4851

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$566	Continue the development of technologies and methodologies to incrementally upgrade legacy systems to support their cost-effective employment and sustainment. Demonstrate, in designated aircraft, the processes and tools for wrapping embedded software, real-time object request broker technology, and emulation technology in fielded weapon systems. Transition these technologies to fighter and cargo aircraft.
(U)	$80	Continue supporting the development of the Real-Time Defense Information Infrastructure Common Operating Environment. Continue developing and testing technologies to improve the effectiveness of systems performing real-time command and control (C2) missions. Evaluate the effectiveness of these approaches in implementing a seamless information exchange between the different platforms operating in the battlespace.
(U)	$334	Continue the development of Assured Middleware for Real-Time Embedded Systems (AMRES). Complete the design of the AMRES environment using commercial-off-the-shelf components and the Real-Time Common Object Request Broker Architecture to integrate all components. Mature and demonstrate the ability of AMRES to support real-time processes, fault-tolerance, and security in embedded systems.
(U)	$599	Continue the Embedded Systems Interoperability Demonstration. Continue research activities to leverage open systems hardware, software, and simulated tactical communications links to provide real-time communications between multiple tactical platforms, an airborne C2 platform, and the emerging battlespace infosphere. Conduct simulation tests to evaluate real-time communications capabilities. Conduct affordability analyses to support the demonstration.
(U)	$550	Continue developing the Embedded Information System Re-engineering (EISR) technology demonstration. Complete development of an automated re-engineering capability to evolve software for embedded information systems. Complete development of the software tools to implement re-engineering technologies. Test and demonstrate an EISR system with an established pilot program. Transition the EISR technologies to customers.
(U)	$224	Continue Real-Time (RT) Java for Embedded Systems to investigate RT Java applicability to the infosphere and embedded information system applications, in the context of open systems concepts. Demonstrate the functionality of legacy Operational Flight Programs (OFPs) implemented in RT Java. Analyze and compare the implementation of RT Java OFPs with current OFPs implemented in higher-order languages. Demonstrate the capability of RT Java OFPs to support the interoperability between the Command, Control, Communications, and Intelligence.
(U)	$2,353	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
07 - Operational System Development	0708612F Computer Resources Support Improvement Program	4851

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands)

(U) $469 Continue development of technologies and methodologies to incrementally upgrade legacy systems to support their cost-effective employment and sustainment. Conduct life cycle cost and trade-off analyses of the different technologies and methodologies. Continue demonstrating, in designated aircraft, the processes and tools for wrapping embedded software, real-time object request broker technology, and emulation technology in fielded weapon systems. Continue transition of these technologies as they are matured and validated.

(U) $60 Develop and implement enhancements to the Reconfigurable Aerospace Computer Emulators to improve the reliability and maintainability of aging on-board aerospace computers. Continue validation of developed technologies to incrementally upgrade on-board computers with commercial microprocessor-based computer emulation technology. Demonstrate the backward compatibility of these technologies and enhancements with existing mission critical software.

(U) $60 Continue development of a Virtual Engineering Environment (VEE) for software development. Continue developing test environments incorporating new technologies and commercial-off-the-shelf (COTS) components. Conduct trade-off analyses of these technologies and COTS components. Continue demonstrations to validate the effectiveness of VEE in supporting software development and sustainment for weapon systems. Transition VEE to selected weapon system programs.

(U) $525 Continue the Embedded Systems Interoperability Demonstration. Continue integration and testing of open systems hardware, software, and simulated tactical communications links. Continue simulation testing to evaluate the real-time communications capabilities of these open systems components. Complete affordability analyses. Develop test plans and procedures to conduct flight testing to evaluate the real-time communications capabilities of these components.

(U) $530 Continue development of the Embedded Information System Re-engineering (EISR) Technology. Complete development of an automated re-engineering capability to evolve software for embedded information systems. Continue development of the software tools to implement re-engineering technologies. Continue testing and demonstrations of EISR technologies with pilot programs. Transition the EISR technologies to designated software support activities.

(U) $225 Continue analyses of Real-Time (RT) Java for Embedded Systems to investigate RT Java applicability to the infosphere and embedded information system applications. Continue demonstrations of the functionality of legacy Operational Flight Programs (OFPs) implemented in RT Java. Continue analyses of the implementation of RT Java OFPs with current OFPs implemented in higher-order languages. Continue demonstrations of the capability of RT Java OFPs to support the interoperability between the Command, Control, Communications, and Intelligence.

(U) $225 Develop affordable Information Assurance and system security techniques and technologies for embedded information systems in aerospace

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2002
BUDGET ACTIVITY: 07 - Operational System Development	PE NUMBER AND TITLE: 0708612F Computer Resources Support Improvement Program
	PROJECT: 4851

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

and ground-based platforms. Conduct domain analyses to define the requirements for Information Assurance technologies. Develop and conduct prototype testing to address threats and vulnerability countermeasures relative to a tactical system operating as a node within a Command and Control environment.

(U) $2,094 Total

(U) B. Budget Activity Justification

This program is in Budget Activity 7, Operational System Development, because it provides support to operational systems.

(U) C. Program Change Summary ($ in Thousands)

		FY 2001	FY 2002	FY 2003	Total Cost
(U)	Previous President's Budget	3,326	2,376	2,432	TBD
(U)	Appropriated Value	3,356	2,376		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions		-23		
	b. Small Business Innovative Research	-57			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	-32			
	e. Rescissions	-30			
(U)	Adjustments to Budget Years Since FY 2002 PBR			-338	
(U)	Current Budget Submit/FY 2003 PBR	3,237	2,353	2,094	TBD

(U) Significant Program Changes:

In FY 2001, funding was moved to this PE from PE 0708611F, Project 673090.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 2002

BUDGET ACTIVITY: 07 - Operational System Development

PE NUMBER AND TITLE: 0708612F Computer Resources Support Improvement Program

PROJECT: 4851

(U) D. Other Program Funding Summary ($ in Thousands)

		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
(U)	AF RDT&E									
(U)	Other APPN									
(U)	PE 0708611F/3080									4,593
(U)	PE 0708611F/3400									
(U)	PE 0708612F/3080	2,138	2,328	2,094	2,148	2,187	2,279	2,334	Continuing	Continuing
(U)	PE 0708612F/3400	13,988	14,462	8,879	9,151	8,962	9,423	9,357	Continuing	Continuing

(U) E. Acquisition Strategy

All major contracts within this Program Element were awarded after full and open competition.

(U) F. Schedule Profile

		FY 2001				FY 2002				FY 2003			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	Adaptive Software Technology Development			*									
(U)	Incremental Upgrade of Legacy Systems		*					X				X	
(U)	Reconfigurable Aerospace Computer Emulator				*						X		
(U)	Real-Time DII COE Support **		*					X					
(U)	Virtual Engineering Environment			*								X	
(U)	Weapon System Open Architecture			*									
(U)	Assured Middleware for Real-Time Embedded Systems						X						
(U)	Embedded Systems Interoperability Demonstration				*			X			X		
(U)	Embedded Information Systems Re-engineering		*					X				X	
(U)	Real-Time Java for Embedded Systems			*				X			X		
(U)	Air Resources Rapid Reallocation Tools				*								
(U)	Embedded Information Systems Assurance										X		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2002
BUDGET ACTIVITY: 07 - Operational System Development	PE NUMBER AND TITLE: 0708612F Computer Resources Support Improvement Program
	PROJECT: 4851

(U) F. Schedule Profile Continued

	FY 2001				FY 2002				FY 2003			
	1	2	3	4	1	2	3	4	1	2	3	4

X Denotes planned event

* Denotes completed event

** DII COE: Defense Information Infrastructure (DII) Common Operating Environment (COE)

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 2002

BUDGET ACTIVITY: 07 - Operational System Development

PE NUMBER AND TITLE: 0708612F Computer Resources Support Improvement Program

PROJECT: 4851

(U) A. Project Cost Breakdown ($ in Thousands)

		FY 2001	FY 2002	FY 2003
(U)	Adaptive Software Technology Development	345	0	0
(U)	Incremental Upgrade of Legacy Systems	165	566	469
(U)	Reconfigurable Aerospace Computer Emulator	340	0	60
(U)	Real-Time Defense Information Infrastructure Common Operating Environment Support	75	80	0
(U)	Virtual Engineering Environment	250	0	60
(U)	Weapon System Open Architecture	750	0	0
(U)	Assured Middleware for Real-Time Embedded Systems	0	334	0
(U)	Embedded Systems Interoperability Demonstration	55	599	525
(U)	Embedded Information Systems Re-engineering	60	550	530
(U)	Real-Time Java for Embedded Systems	220	224	225
(U)	Air Resources Rapid Reallocation Tools	977	0	0
(U)	Embedded Information Systems Assurance	0	0	225
(U)	Total	3,237	2,353	2,094

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

(U) Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 2001	Budget FY 2001	Budget FY 2002	Budget FY 2003	Budget to Complete	Total Program
Product Development Organizations										
SAIC	DO	Various	N/A	N/A		250	50	0	Continuing	TBD
TRW	DO	Various	N/A	N/A		285	220	0	Continuing	TBD
Boeing	DO	Various	N/A	N/A		1,906	891	1,070	Continuing	TBD
Lockheed-Martin	DO	Various	N/A	N/A		721	992	824	Continuing	TBD
Raytheon	DO	Various	N/A	N/A			200	200	Continuing	TBD

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

DATE: February 2002

BUDGET ACTIVITY: 07 - Operational System Development

PE NUMBER AND TITLE: 0708612F Computer Resources Support Improvement Program

PROJECT: 4851

(U) Performing Organizations Continued:

Product Development Organizations									
Other (RT DII COE)	Various	N/A	N/A		75	0	0	Continuing	TBD
Support and Management Organizations									
Test and Evaluation Organizations									

(U) Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date		Total Prior to FY 2001	Budget FY 2001	Budget FY 2002	Budget FY 2003	Budget to Complete	Total Program
Product Development Property										
Support and Management Property										
Test and Evaluation Property										

Subtotals	Total Prior to FY 2001	Budget FY 2001	Budget FY 2002	Budget FY 2003	Budget to Complete	Total Program
Subtotal Product Development		3,237	2,353	2,094	TBD	TBD
Subtotal Support and Management						
Subtotal Test and Evaluation						
Total Project		3,237	2,353	2,094	TBD	TBD