

**UNCLASSIFIED**

PE NUMBER: 0603845F

PE TITLE: Transformational SATCOM (TSAT)

<b>Exhibit R-2, RDT&amp;E Budget Item Justification</b>	DATE <b>February 2007</b>
---	------------------------------

<b>BUDGET ACTIVITY</b> <b>04 Advanced Component Development and Prototypes (ACD&amp;P)</b>	<b>PE NUMBER AND TITLE</b> <b>0603845F Transformational SATCOM (TSAT)</b>
---	--

Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	416.813	732.661	963.585	1,227.784	1,972.504	2,625.118	2,467.029	2,157.843	Continuing	TBD
4944 ADVANCED WIDEBAND SYSTEM	416.813	732.661	963.585	1,227.784	1,972.504	2,625.118	2,467.029	2,157.843	Continuing	TBD

Note: FY08-11 funds for qualification/productization of radiation-hardened (RADHARD) components for USAF/DoD space programs have been transferred from PE 63430F, Advanced EHF MILSATCOM (Space), to PE 63845F, Transformational SATCOM. Additionally, PE 63845F funds FY12/13 RADHARD efforts.

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

The Transformational Satellite Communications System (TSAT) will provide DoD with high data rate Military Satellite Communications (MILSATCOM) and Internet-like services as defined in the Transformational Communications Architecture (TCA). TSAT is essential to global net-centric operations. As the spaceborne element of the Global Information Grid (GIG), it will extend the GIG to users without terrestrial connections providing improved connectivity and data transfer capability, vastly improving satellite communications for the warfighter. TSAT's Internet Protocol (IP) routing will connect thousands of users through networks rather than limited point-to-point connections. Additionally, TSAT will enable high data rate connections to Space and Airborne Intelligence, Surveillance, and Reconnaissance (SISR, AISR) platforms.

The TSAT program consists of a five satellite constellation (a sixth satellite will be procured to ensure mission availability), TSAT satellite operations centers (TSOC) for on-orbit control, TSAT Mission Operations Systems (TMOS) to provide network management, and ground gateways. The TMOS single contract was awarded in January 2006. In FY08, the TMOS overall efforts will include the development/update of design documentation, Interface Control Documents, and Integration and Test plans. The contractor will also continue to support TSAT interface and integration activities, related risk mitigation, TSAT system level requirement maturation, and will continue design efforts and synchronization with the selected Space Segment contractor in preparation for the TSAT Delta System Design Review.

TSAT will incorporate radio frequency (RF) and laser communications links to meet defense and intelligence community requirements for high data rate, protected communications. The space segment will make use of key technology advancements that have proven mature by independent testing of integrated subsystem brass boards to achieve a transformational leap in SATCOM capabilities. These technologies include but are not limited to: single and multi-access laser communications (to include wide field-of-view technology), Internet protocol based packet switching, bulk and packet encryption/decryption, battle command-on-the-move antennas, dynamic bandwidth and resource allocation techniques, and protected bandwidth efficient modulation. Technology maturation activities are on schedule with the prime contractors and numerous directed technology development contractors. In FY08, the main focus of the technology efforts will be multi-access lasercom and improved processor technology. These technologies will support Block B (satellites 3 - 6). In FY08, the space segment will continue two Risk Reduction/System Definition phase contractors on the path to the TSAT Preliminary Design Review (PDR) in parallel with source selection, culminating with award of the single space segment development and production contract. The space segment contractor will then complete the Delta Space Segment System Design Review and Integrated Baseline Review. Following contract award, the space segment contractor will complete key hardware/software demonstrations in preparation for the PDR. First

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

DATE

February 2007

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&amp;P)

PE NUMBER AND TITLE

0603845F Transformational SATCOM (TSAT)

launch is 1QFY16.

The Department of Defense is committed to the restructured TSAT program (i.e., block delivery approach) as the best way to ensure delivery of critical net-centric capabilities to tomorrow's warfighter. This strategy reduces risk in the product development phase by implementing a more incremental fielding approach that reduces the complexity/capacity of the two driving technologies (i.e., lasercom and next-generation processor router) on the first two satellites (Block A). Capacities for the remaining three satellites plus spare (Block B) are higher, resulting in a constellation that meets all Key Performance Parameter requirements. Additionally, the program is funded at a higher cost confidence level (CL) vice prior 50/50% cost CL.

Funds are in Budget Activity 4, Advanced Component Development and Prototypes, since it funds TSAT technology development and engineering design activities including risk reduction and system definition.

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

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	429.244	867.102	1,536.032	2,051.074
(U) Current PBR/President's Budget	416.813	732.661	963.585	1,227.784
(U) Total Adjustments	-12.431	-134.441		
(U) Congressional Program Reductions		-131.659		
Congressional Rescissions	-0.009	-2.782		
Congressional Increases				
Reprogrammings	-2.100			
SBIR/STTR Transfer	-10.322			

(U) **Significant Program Changes:**

FY06: Reprogram for higher Air Force priorities. FY07 Congressional mark drove a slip of first launch from 4QFY14 to 1QFY15. FY08/09 reductions fund higher Department of Defense priorities resulting in first launch delay from 1QFY15 to 1QFY16 and adjusted cost confidence (ie., from 80% to 60%) prior to Critical Design Review. TSAT program is funded at 80% cost confidence post CDR.

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

DATE

February 2007

BUDGET ACTIVITY		PE NUMBER AND TITLE						PROJECT NUMBER AND TITLE		
<b>04 Advanced Component Development and Prototypes (ACD&amp;P)</b>		<b>0603845F Transformational SATCOM (TSAT)</b>						<b>4944 ADVANCED WIDEBAND SYSTEM</b>		
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
4944 ADVANCED WIDEBAND SYSTEM	416.813	732.661	963.585	1,227.784	1,972.504	2,625.118	2,467.029	2,157.843	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

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

The Transformational Satellite Communications System (TSAT) will provide DoD with high data rate Military Satellite Communications (MILSATCOM) and Internet-like services as defined in the Transformational Communications Architecture (TCA). TSAT is essential to global net-centric operations. As the spaceborne element of the Global Information Grid (GIG), it will extend the GIG to users without terrestrial connections providing improved connectivity and data transfer capability, vastly improving satellite communications for the warfighter. TSAT's Internet Protocol (IP) routing will connect thousands of users through networks rather than limited point-to-point connections. Additionally, TSAT will enable high data rate connections to Space and Airborne Intelligence, Surveillance, and Reconnaissance (SISR, AISR) platforms.

The TSAT program consists of a five satellite constellation (a sixth satellite will be procured to ensure mission availability), TSAT satellite operations centers (TSOC) for on-orbit control, TSAT Mission Operations Systems (TMOS) to provide network management, and ground gateways. The TMOS single contract was awarded in January 2006. In FY08, the TMOS overall efforts will include the development/update of design documentation, Interface Control Documents, and Integration and Test plans. The contractor will also continue to support TSAT interface and integration activities, related risk mitigation, TSAT system level requirement maturation, and will continue design efforts and synchronization with the selected Space Segment contractor in preparation for the TSAT Delta System Design Review.

TSAT will incorporate radio frequency (RF) and laser communications links to meet defense and intelligence community requirements for high data rate, protected communications. The space segment will make use of key technology advancements that have proven mature by independent testing of integrated subsystem brass boards to achieve a transformational leap in SATCOM capabilities. These technologies include but are not limited to: single and multi-access laser communications (to include wide field-of-view technology), Internet protocol based packet switching, bulk and packet encryption/decryption, battle command-on-the-move antennas, dynamic bandwidth and resource allocation techniques, and protected bandwidth efficient modulation. Technology maturation activities are on schedule with the prime contractors and numerous directed technology development contractors. In FY08, the main focus of the technology efforts will be multi-access lasercom and improved processor technology. These technologies will support Block B (satellites 3 - 6). In FY08, the space segment will continue two Risk Reduction/System Definition phase contractors on the path to the TSAT Preliminary Design Review (PDR) in parallel with source selection, culminating with award of the single space segment development and production contract. The space segment contractor will then complete the Delta Space Segment System Design Review and Integrated Baseline Review. Following contract award, the space segment contractor will complete key hardware/software demonstrations in preparation for the PDR. First launch is 1QFY16.

The Department of Defense is committed to the restructured TSAT program (i.e., block delivery approach) as the best way to ensure delivery of critical net-centric

**Exhibit R-2a, RDT&E Project Justification**

DATE  
**February 2007**

BUDGET ACTIVITY <b>04 Advanced Component Development and Prototypes (ACD&amp;P)</b>	PE NUMBER AND TITLE <b>0603845F Transformational SATCOM (TSAT)</b>	PROJECT NUMBER AND TITLE <b>4944 ADVANCED WIDEBAND SYSTEM</b>
--	---	--

capabilities to tomorrow's warfighter. This strategy reduces risk in the product development phase by implementing a more incremental fielding approach that reduces the complexity/capacity of the two driving technologies (i.e., lasercom and next-generation processor router) on the first two satellites (Block A). Capacities for the remaining three satellites plus spare (Block B) are higher, resulting in a constellation that meets all Key Performance Parameter requirements. Additionally, the program is funded at a higher cost confidence level (CL) vice prior 50/50% cost CL.

Funds are in Budget Activity 4, Advanced Component Development and Prototypes, since it funds TSAT technology development and engineering design activities including risk reduction and system definition.

(U) <b>B. Accomplishments/Planned Program (\$ in Millions)</b>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Continue System Definition and technology development for key areas to include laser communications (including enhanced wide field-of-view multi access laser comm), antenna design, encryption technologies, dynamic bandwidth and resource allocation, bandwidth efficient modulation, network operations, and networking protocols; conduct Integration/Concept of Operations (CONOPS) demonstrations	56.924	94.393	94.663	110.669
(U) Provide Technical Support	35.305	53.825	56.874	58.581
(U) Provide Program Support	8.537	8.601	8.645	8.690
(U) Continue engineering design activities including risk reduction, and complete system design review for the first TSAT satellite	233.088	398.733	107.527	
(U) Award space segment contract and begin preliminary design development			481.948	804.636
(U) Continue TSAT Mission Operations System ground segment and network management/operations management software	52.005	125.694	136.446	165.091
(U) Continue systems engineering and integration support	30.954	51.415	56.083	58.311
(U) Continue qualification and production of radiation-hardened components for USAF/DOD space programs			21.399	21.806
(U) Total Cost	416.813	732.661	963.585	1,227.784

(U) <b>C. Other Program Funding Summary (\$ in Millions)</b>	<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>FY 2012</u>	<u>FY 2013</u>	<u>Cost to Complete</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>								
(U) RDT&E, AF										
(U) PE 0603854F, Project 644870, CCS-C, R-52	19.216	6.634	19.213	12.606	13.402	10.024	9.168	6.629	Continuing	TBD
(U) PE 0603854F, Project 644811, WGS, R-52	78.502	30.896	0.000	0.000	0.000	0.000	0.000	0.000		304.818

<b>Exhibit R-2a, RDT&amp;E Project Justification</b>	DATE <b>February 2007</b>
--	------------------------------

<b>BUDGET ACTIVITY</b> <b>04 Advanced Component Development and Prototypes (ACD&amp;P)</b>	<b>PE NUMBER AND TITLE</b> <b>0603845F Transformational SATCOM (TSAT)</b>	<b>PROJECT NUMBER AND TITLE</b> <b>4944 ADVANCED WIDEBAND SYSTEM</b>
---	--	---

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

(U) Other APPN

(U) MPAF, PE 0303600F, WGS, P-19,20	71.349	412.520	325.183	22.796	36.702	42.117	30.005	24.265	Continuing	TBD
(U) OPAF, PE 0303600F, CCS-C	0.285	0.000	0.535	0.000	0.000	0.000	0.000	0.000		17.664
(U) OPAF, PE 0303600F, WGS	0.000	0.000	0.000	0.000	1.724	1.724	0.000	0.000		55.448
(U) MILCON, PE 0303602F, TSAT	0.000	0.000	0.000	0.000	5.322	50.212	7.817	4.946	Continuing	TBD

(U) **D. Acquisition Strategy**

On 20 January 2004, the TSAT program entered Phase B, Risk Reduction and Design Development. Phase B space segment contracts (Cost Plus Fixed Fee) were awarded to Lockheed Martin and Boeing in late January 2004. However, on 20 June 2006, the Milestone Decision Authority rescinded KDP-B approval in order to appropriately align TSAT program activity with the revised National Security Space Acquisition Policy (NSS 03-01). The update to NSS 03-01 revised the space acquisition framework to make it more consistent with critical systems engineering events that must inform acquisition decisions. One result of the revision was the realignment of Key Decision Point B (KDP-B) with completion of a space program's System Design Review (SDR). Following completion of SDR in FY07, the Defense Space Acquisition Board will convene for a new KDP-B approval, scheduled 1QFY08. In 1QFY08, after a full and open competition, the final space segment development contractor will be selected.

In October 2003, after a full and open competition, a Systems Engineering and Integration (SE&I) contract was awarded to Booz Allen Hamilton. The SE&I function spans end-to-end TSAT systems analysis and simulation, architecture refinement, requirements development, interface management and system integration.

TMOS Program Research and Development Announcement (PRDA) contracts were awarded to Raytheon, Lockheed Martin, and Northrop Grumman in November 2003. In January 2006, after a full and open competition, a single TSAT Mission Operations System (TMOS) development contract was awarded to Lockheed Martin.

In an effort to balance higher DoD priorities and sustain an increased cost confidence in the TSAT program, the Department of Defense has adjusted the budget cost confidence from 80% to 60% prior to Critical Design Review (CDR) and maintains an 80% confidence level after CDR and throughout satellite production. Cost growth due to unexpected technical problems usually occurs after CDR.

UNCLASSIFIED

**Exhibit R-3, RDT&E Project Cost Analysis**

DATE  
**February 2007**

BUDGET ACTIVITY										PE NUMBER AND TITLE		PROJECT NUMBER AND TITLE			
<b>04 Advanced Component Development and Prototypes (ACD&amp;P)</b>										<b>0603845F Transformational SATCOM (TSAT)</b>		<b>4944 ADVANCED WIDEBAND SYSTEM</b>			
<u>(U) Cost Categories</u> (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 2006 Cost</u>	<u>FY 2006 Cost</u>	<u>FY 2006 Award Date</u>	<u>FY 2007 Cost</u>	<u>FY 2007 Award Date</u>	<u>FY 2008 Cost</u>	<u>FY 2008 Award Date</u>	<u>FY 2009 Cost</u>	<u>FY 2009 Award Date</u>	<u>Cost to Complete</u>	<u>Total Cost</u>	<u>Target Value of Contract</u>	
<u>(U) Product Development</u>															
Architecture Studies	CPAF	Various	14.900										14.900		
Lockheed Martin: Technology Maturation/Risk Reduction & Program System Definition	CPFF	Sunnyvale, CA	161.616	116.544	Oct-05	199.367	Dec-06	53.764	Dec-07				531.290		
Boeing: Technology Maturation/Risk Reduction & Program System Definition	CPFF	El Segundo, CA	161.616	116.544	Oct-05	199.367	Dec-06	53.764	Dec-07				531.290		
Booz Allen Hamilton: System Engineering & Integration	Time & Materials w/ IF	El Segundo, CA	61.780	30.954	Oct-05	51.415	Dec-06	56.083	Dec-07	58.311	Dec-08	Continuing	TBD		
TMOS PRDAs	FFP	Various	52.454	2.685	Dec-05								55.139		
TMOS: Lockheed Martin Integrated Systems and Solutions	CPAF	San Jose, CA		49.320	Jan-06	125.694	Dec-06	136.446	Dec-07	165.091	Dec-08	Continuing	TBD		
Risk Reduction: Technology Maturation (Space Segment) Lockheed Martin	Various CPFF	Various Sunnyvale, CA	284.427	56.924	Nov-05	94.393	Dec-06	94.663	Dec-07	110.669	Dec-08	Continuing	TBD		
Risk Reduction: Technology Maturation (Space Segment) Boeing	CPFF	El Segundo, CA	27.651										27.651		
Space Segment Development	TBD	TBD						481.948	Dec-07	804.636	Dec-08	Continuing	TBD		
Radiation Hardened Parts Developers	Various	Various						21.399	Dec-07	21.806	Dec-08	Continuing	TBD		
Subtotal Product Development			792.095	372.971		670.235		898.066		1,160.513		Continuing	TBD	0.000	
Remarks:															
<u>(U) Support</u>															
Technical Support	Various		68.470	35.305	Nov-05	53.825	Dec-06	56.874	Dec-07	58.581	Dec-08	Continuing	TBD		
Program Support	Various		17.703	8.537	Nov-05	8.601	Dec-06	8.645	Dec-07	8.690	Dec-08	Continuing	TBD		
Subtotal Support			86.173	43.842		62.426		65.519		67.271		Continuing	TBD	0.000	
Remarks:															
<u>(U) Test &amp; Evaluation</u>															
None													0.000		
Subtotal Test & Evaluation			0.000	0.000		0.000		0.000		0.000		0.000	0.000	0.000	
Remarks:															
<u>(U) Management</u>															
None													0.000		
Subtotal Management			0.000	0.000		0.000		0.000		0.000		0.000	0.000	0.000	
Remarks:															
<u>(U) Total Cost</u>			878.268	416.813		732.661		963.585		1,227.784		Continuing	TBD	0.000	

R-1 Line Item No. 49

Page-6 of 8

Project 4944

Exhibit R-3 (PE 0603845F)

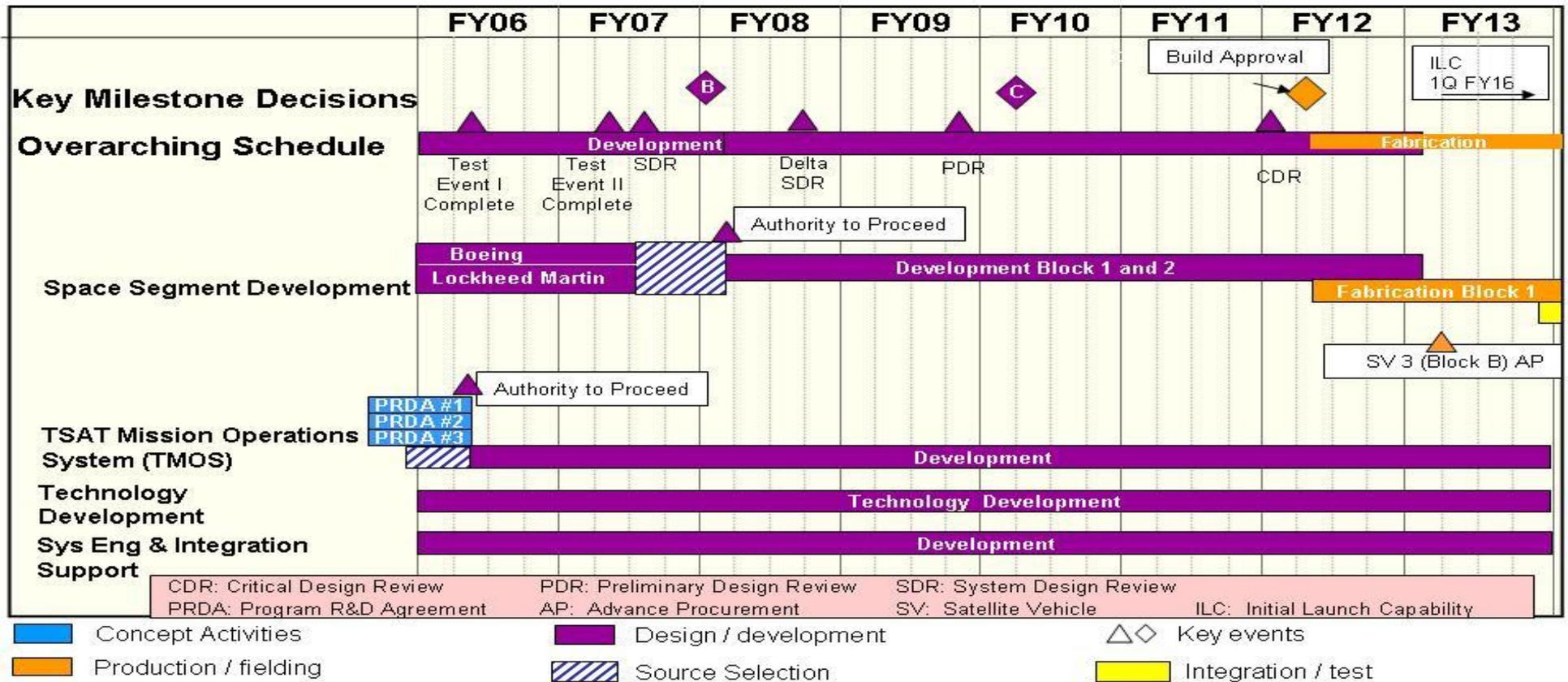
Exhibit R-4, RDT&E Schedule Profile

DATE  
February 2007

BUDGET ACTIVITY  
04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE  
0603845F Transformational SATCOM (TSAT)

PROJECT NUMBER AND TITLE  
4944 ADVANCED WIDEBAND SYSTEM



UNCLASSIFIED

<b>Exhibit R-4a, RDT&amp;E Schedule Detail</b>	DATE <b>February 2007</b>
--	------------------------------

<b>BUDGET ACTIVITY</b> <b>04 Advanced Component Development and Prototypes (ACD&amp;P)</b>	<b>PE NUMBER AND TITLE</b> <b>0603845F Transformational SATCOM (TSAT)</b>	<b>PROJECT NUMBER AND TITLE</b> <b>4944 ADVANCED WIDEBAND SYSTEM</b>
---	--	---

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) <b>Schedule Profile</b>				
(U) TMOS Segment Design Development Contract Award	2Q			
(U) Technology Maturation -- Processor Router and Lasercom to Technology Readiness Level 6 (last of key critical technologies)		3Q		
(U) System Design Review		3Q		
(U) Key Decision Point B (KDP B)			1Q	
(U) Space Segment Contract Award			1Q	
(U) Delta System Design Review			3Q	
(U) Preliminary Design Review				4Q