

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

BUDGET ACTIVITY 5 - System Development and Demonstration		PE NUMBER AND TITLE 0604647A - Non-Line of Sight Cannon					PROJECT F58			
COST (In Thousands)	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 Cost	
F58 NON LINE OF SIGHT CANNON	108689	136929	89841	71396	43222	28775			478852	

A. Mission Description and Budget Item Justification: This NLOS-C PE contains the development effort associated with NLOS-C unique work. The MGV common sub components for NLOS-C and MGV are included in FY07 PE0604645 Project F57, and in FY08 and out, in the new PE, 0604660 Project FC1.

The Army established NLOS-C as the lead MGV of the FCS Family of Systems (FoS). Five prototypes are being delivered in calendar year 2008 with the remaining 3 to be delivered in calendar year 2009. The initial 5 prototypes, delivered in calendar year 2008, will be the 24 ton MGV configuration as previously discussed with Congress. The 3 remaining calendar year 2009 prototypes will be updated to the 27 ton configuration allowing for more pertinent valuable test data to be obtained which, ultimately could reduce final configuration prototype testing costs.

The NLOS-C is the Army's first fully automated 155-mm howitzer, 38 caliber cannon, that provides automated, 24/7, all-weather, precision fire support to the FCS (BCT) commander. It will be organic to and provide networked, extended-range (30kms), responsive and sustained precision attack of point and area targets in support of the FCS (BCT). The NLOS-C will provide close support and destructive fires for tactical standoff engagement during both offensive and defensive operations in concert with line-of-sight, beyond line-of-sight and other NLOS, external and joint capabilities in combat scenarios spanning the spectrum of ground combat. The NLOS Cannon's fully automated ammunition handling system and real-time digital operating environment enables two soldiers to perform the tasks which require four to five soldiers on current force systems. The cannon will be able to move rapidly, stop quickly, and deliver lethal first round effects on target in record time largely due to the fully automated gun laying, ammunition handling, and fuse setting of all current and precision guided 155mm artillery rounds. The NLOS-C will have a multiple round simultaneous impact (MRSI) capability, unmatched sustained rate of fire of six-rounds per minute, and precision fires, through the XM982 Excalibur, to provide unprecedented effects on target from a smaller number of systems. The NLOS-C features transformational technologies that will be common to all FCS MGVs, including hybrid-electric drive and drive-by-wire capabilities that enable the system to move rapidly, stop quickly, and deliver lethal first round effects in record time. Integration with the FCS program allows us to provide maximum commonality between variants which impacts the maintainability and sustainability of the fleet. In fact, NLOS-C will be 70 to 80 percent in common with the MGV fleet. The cannon, like all MGV variants, can rapidly rearm and refuel, and its system weight makes it uniquely deployable. Fully automated handling, loading, and firing will be another centerpiece of the NLOS-C. The NLOS-C balances deployability and sustainability with responsiveness, lethality, survivability, agility, and versatility. The NLOS-C will be designed to minimize its logistic and maintenance footprint in the theater of operation and to employ advanced maintenance approaches to increase availability and to support sustainability.

<u>Accomplishments/Planned Program:</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
INTEGRATED DESIGN - FY07 - Early prototypes completed Design Review 3 to support the delivery of the first pre-production NLOS-C's to be delivered in May 2008. Based on completion of the design review, long lead procurement of the MGV common components of the NLOS-C: core vetronics, environmental control system, suspension, and propulsion cooling subsystems began. Integration of Global Positioning System (GPS)/Inertial Navigation System (INS) which enables the NLOS-C to fire accurate and precision fires was tested. FY07 prototype 1 mission equipment integration began March 07. Prototype chassis integration begins August 07. Continue development of unique configuration item development specifications. Continue development of system/subsystem design documents. Continue solid-	20497		

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based model design-3D models/drawing/equipment layout diagrams. Size, weight, power, cooling, reliability, and cost allocations estimates updated. Implemented MGV modeling standards. Conducted MGV weight reduction initiatives, ensuring weight allocations were achieved while maintaining critical capabilities. Continue performing specialty engineering analysis (reliability, maintainability, logistics, human factors engineering, system survivability, etc.). Continue performing transportability analysis & ensuring three MGV vehicles can be transported on a C-17 and in emergency situations the vehicles can be flown by C-130s.		
MISSION SOFTWARE - FY07 - MGV Common Software Build 1 entered Formal Qualification Testing (FQT) in 3rd qtr FY07. This was the final test event for software at the Configuration Item (CI) level for Build 1. MGV common software Build 1 entered Package Integration Testing (PIT) in 4th qtr FY07. PIT is the final software test for the common software as a package for Build 1. The MGV Software Build Definition Checkpoint (BDC) was performed for Build 2 in 4th qtr FY07. The BDC represents the start of requirements analysis for Build 2 and defines the incremental development goal for this software build. NLOS-C Build 1 software delivered as part of the NLOS-C Firing Platform 1st qtr FY07. This version of the mission software is currently being used on the NLOS-C firing platform for safety and durability testing of the NLOS-C mission equipment at Yuma Proving Ground (YPG) through 1st qtr FY09 Updated variant Software Architectures products.	6347	
PROTOTYPE VEHICLE - FY07 - Prototype 1 mission equipment integration began in March. Prototype chassis integration began in August. Firing platform started test 1st qtr FY07, one month ahead of schedule and will continue through 1st qtr FY09. Continued development of the NLOS-C, early prototype common physical architecture, in particular, resolution of any physical issues between common platform hardware.	51092	
SYSTEM ENGINEERING & PROGRAM MANAGEMENT - FY07 - Sub-contracts continued to be awarded for the design, procurement, and integration of traction drive system, generator inverter, environmental control system, suspension, and propulsion cooling subsystems. Increment 1- NLOS-C completed its System Functional Review (SFR) in coordination with the rest of the FCS and MGV systems allocating system requirements and baselining a concept. NLOS-C early prototype Design Review 2 (DR2), completed Nov 05. Reviewed and approved preliminary design of mission equipment and four major common subsystems on the threshold path (propulsion, suspension, vtronics, and architecture environmental control system) - Received approval to begin early prototype detailed design. NLOS-C firing platform reviews 3 & 4 completed. Obtained decision to proceed with hardware procurement and fabrication for the surrogate chassis. Provided high level summary of the firing platform capabilities, and design & fabrication. Review state of mission equipment Hardware/Software development and integration. Approve FP assembly and test plans. Completed NLOS-C SFR to demonstrate convergence on and achievability of the system requirements and readiness to initiate system design. Completed baseline system and software architecture. Documented baseline software requirements. Initiated Initial Interface Control Documents (ICDs) for internal and external interfaces. Received design concept approval for NLOS-C and common systems. Started preliminary design for NLOS-C. NLOS-C Early Prototype Design Review 2 and Design Review 3 (DR3). Review and approve detailed design of mission equipment and four major common subsystems on the threshold path. Environmental control system - approval to begin early prototype material procurement and start of IAT&C. FY07 - DR3 Delta Review Completed for Incr. 0 NLOS- C.	26574	
SYSTEM TECH ENGINEERING - FY07- Continued NLOS-C Increment 1 Preliminary Design activities. Completed NLOS-C integration in PIVOT. Initiated NLOS-C firing platform demonstration of all zones and rate of fire capabilities. Completed MGV IPR. Matured Interface Control Documents (ICDs). Updated risks/associated mitigation plans. Developed the Preliminary Design Configuration (PDC) Concept and supporting analysis, ensuring that concept is sufficiently mature to enter preliminary design phase.	4179	
INTEGRATED DESIGN - FY08 - Complete NLOS-C integration in Program Integration, Validation and Test Lab (PIVOT). Complete design efforts required to deliver 27-ton chassis configuration for the last three NLOS-C pre-production vehicles in CY 2009. Continue to		19025

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design the threshold configuration for the FCS Core program to support FY09 PDR.			
INTEGRATED DESIGN -FY09 - Complete all design and integration activity required to support NLOS-C and MGV SoS PDR in 2nd quarter FY09. PDR will cover all system and subsystems required for the integration and testing of the Increment 1 (threshold configuration) NLOS-C for delivery in 2011, subsystems will include: mission equipment, vetronics, environmental control systems, propulsion, suspension, distributed sensors, and C4ISR systems.			14770
MISSION SOFTWARE - FY08 - Complete Build 1 Software Development and Integration (FQTD) in 1st qtr FY08 and will be the software running on the May 2008 delivery of the first pre-production cannon. Complete Software Build 2 Life Cycle Objective (LCO) and Life Cycle Architecture (LCA) reviews for all vehicle/common subsystems		5751	
MISSION SOFTWARE - FY09 - Software: Build 2 initial drop for system integration, Build 3 LCO. Modeling and Simulation: Build 3 FSE available from MS&I. Software Build 2 TRR, Build 3 RBR and Build 2 ongoing, Build 3 begins. Build 2 is the current targeted software for the NLOS-Cs scheduled for delivery in 4th qtr 2010 as part of the eighteen systems required for start of fielding in 2010.			3964
PROTOTYPE VEHICLE - FY08 - Fabrication, integration, and delivery of five early prototype NLOS-C systems for limited user and developmental testing in CY 2008. Automotive Test Rig (ATR) fabrication & assembly starts. Begin Procurement of Long Lead hardware required for 27 Ton configuration. The five 24 Ton NLOS-C prototypes are scheduled for delivery in May, July, Oct., Nov., Dec. of 2008.		71208	
PROTOTYPE VEHICLE - FY09 - Fabrication, integration, and delivery of three additional 27-ton (MGV threshold) early prototype NLOS-C systems for limited user and developmental testing in FY10. Integration and delivery of ATR. The 3 - 27 ton NLOS-C prototypes are scheduled for deliveries in Oct., Nov., and Dec. of 2009.			36045
SYSTEM ENGINEERING & PROGRAM MANAGEMENT -FY08 - Continue Preliminary Design Activities leading to Preliminary Design Review of Inc 1 NLOS-C in 2QFY09. Initiate design and development of the P7 and P8 NLOS-C systems to migrate towards Inc 1 capabilities and functionality. Final design and integration of adding JTRS radios to the Inc 0 prototypes in early 2009. Continue Firing Platform testing to support an Interim Safe Service Life and Interim Safe Fatigue Life ratings for the XM324 Ultra-Light Weight Cannon and Tube in early 2009.		28493	
SYSTEM ENGINEERING & PROGRAM MANAGEMENT -FY09 - Conduct PDR of FCS Core Threshold design and CDR of MGV Initial Production platforms to achieve delivery and fielding of NLOS-C to the AETF in 2010. Begin Critical Design Activities for FCS Core threshold platforms.			28802
SYSTEM TECH ENGINEERING - FY08 - NLOS-C Increment 1/Continue Preliminary Design Review Activities. Conduct effective full charge rate of fire and Battlefield Day rate of fire testing on the Firing Platform at YPG. Conduct Excalibur compatibility testing and design refinement on the Firing Platform.		8620	
SYSTEM TECH ENGINEERING - FY09 - Prepare primary vehicle technical data packages for main FY09 NLOS-C weapon, ammunition handling, gun mount. Increment 1, mission module, structure, main weapon, peripherals, design B development complete. NLOS-C Increment 1 preliminary design continues. Firing platform available to test. NLOS-C weapon, ammunition handling, gun mount. Platform preliminary design reviews. Readiness to proceed into system level fabrication, demonstration, and IQT. Variant training product development and training task analyses. MGV early prototype testing underway. ATR automotive, mobility and reliability testing. System Integration Lab (SIL) integration and certification for IV2 integration and test.			6260
Small Business Innovative Research/Small Business Technology Transfer Programs.		3832	

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Total

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136929

89841

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<u>B. Program Change Summary</u>	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	110998	137802	89189
Current BES/President's Budget (FY 2009)	108689	136929	89841
Total Adjustments	-2309	-873	652
Congressional Program Reductions		-873	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	815		
SBIR/STTR Transfer	-3124		
Adjustments to Budget Years			652

<u>C. Other Program Funding Summary</u>	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	To Compl	Total Cost
0604660A FCS Manned Grd Vehicles & Common Grd Vehicle Components		592254	774257	785575	358641	214207	103230	Continuing	Continuing
0604661A FCS System of Systems Engr & Program Management		1497321	1413945	1874987	1916207	1290308	1027816	Continuing	Continuing
0604662A FCS Reconnaissance (UAV) Platforms		43388	34379	14296	9235	4556	1336	Continuing	Continuing
0604663A FCS Unmanned Ground Vehicles		90091	96918	64744	43601	26855	3580	Continuing	Continuing
0604664A FCS Unattended Ground Sensors		10929	12967	18968	16754			Continuing	Continuing
0604665A FCS Network Hardware & Software		647649	539145	334085	365287	290790	169526	Continuing	Continuing
0604646A Non Line of Sight - Launch System	313981	253075	200099	40043	5957			Continuing	Continuing
0604647A Non Line of Sight - Cannon	108689	136929	89841	71396	43222	28775		Continuing	Continuing
0604666A FCS Spin Outs	27900	64385	64900	67021	51026	56287	14637	Continuing	Continuing
0603639A FCS MRM		44294	45866	71451	56296	106353	50757	Continuing	Continuing
0604715A STRICOM/NAWCTSD Support		378	388	398	406	415	426	Continuing	Continuing
WTCV G86100 FCS Core Program		80932	154583	148028	677820	2175327	5744649	Continuing	Continuing
WTCV G86200 FCS Spin Out Program		19987	176667	367962	550821	766274	944999	Continuing	Continuing

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AMMO E88103					24634	47624	61762	Continuing	Continuing
0604645 F52 UAV Recon & Sensors	26360							Continuing	Continuing
0604645 F53 UGV	106516							Continuing	Continuing
0604645 F54 UGS	10612							Continuing	Continuing
0604645 F55 SUSTAINMENT	106517							Continuing	Continuing
0604645 F57 MANNED GROUND VEHICLES	563946							Continuing	Continuing
0604645 F61 SoS Engineering and Program Management	2142970							Continuing	Continuing

Comment:

D. Acquisition Strategy The Original FCS Contract was awarded to the Lead Systems Integrator 30 May 2003 and definitized 10 Dec 2003, to Boeing. LSI contracted with its One Team Partner, BAE Systems, doing business through its Ground Systems Division of their Land Operating Group in Santa Clara, CA and Yuma, PA to execute the SDD contract to build the Non-Line of Site _ Cannon. A series of prototype cannons were developed in FY2008 and will continue into FY2009 to meet the Congressional mandate to develop eight prototypes. Additionally, fabrication and integration will occur with the Non-Line of Sight _ Cannon Block 0 initial production units.

ARMY RDT&E COST ANALYSIS (R3)

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BUDGET ACTIVITY			PE NUMBER AND TITLE							PROJECT		
5 - System Development and Demonstration			0604647A - Non-Line of Sight Cannon							F58		
I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Integration Design	FAR	THE BOEING COMPANY, ST. LOUIS, MO. - See Remarks 1, 2, 3	71743	26104	1-3Q	19025	1-3Q	14770	1-3Q	Cont.	Cont.	
Mission Software	FAR	THE BOEING COMPANY, ST. LOUIS, MO - See Remarks 1, 2, 3	38570	6978	1-3Q	5751	1-3Q	3964	1-3Q	Cont.	Cont.	
Prototype Vehicle	FAR	THE BOEING COMPANY, -ST. LOUIS, MO., See Remarks 1, 2, 3	131288	42981	1-3Q	71208	1-3Q	36045	1-3Q	Cont.	Cont.	
System Engineering & Program Management	FAR	THE BOEING COMPANY, ST. LOUIS, MO -See Remarks 1, 2, 3	49792	27769	1-3Q	28493	1-3Q	28802	1-3Q	Cont.	Cont.	
System Tech Engineering	FAR	THE BOEING COMPANY, ST. LOUIS, MO - See Remarks 1, 2, 3	2646	4373	1-3Q	8620	1-3Q	6260	1-3Q	Cont.	Cont.	
GFX		PM FCS (BCT), St, Louis, MO		484	1-3Q					Cont.	Cont.	
Subtotal:			294039	108689		133097		89841		Cont.	Cont.	

Remarks: Remark 1 - Subcontractor: BAE Armament Systems Division, Minneapolis, MN
 Remark 2 - Subcontractor: BAE Ground Systems Division, Santa Clara, CA
 Remark 3 - Subcontractor: General Dynamics Land Systems, Sterling Heights, MI

All MGV common hardware and software costs are accounted for in MGV project FC1.

II. Support Costs	Contract Method &	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award	FY 2008 Cost	FY 2008 Award	FY 2009 Cost	FY 2009 Award	Cost To Complete	Total Cost	Target Value of

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	Type				Date		Date		Date			Contract
SBIR/STTR	Direct	OSD				3832	2-3Q				Cont.	Cont.
Subtotal:						3832					Cont.	Cont.
III. Test And Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal:												
IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2007 Cost	FY 2007 Award Date	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal:												
Project Total Cost:			294039	108689		136929		89841		Cont.	Cont.	

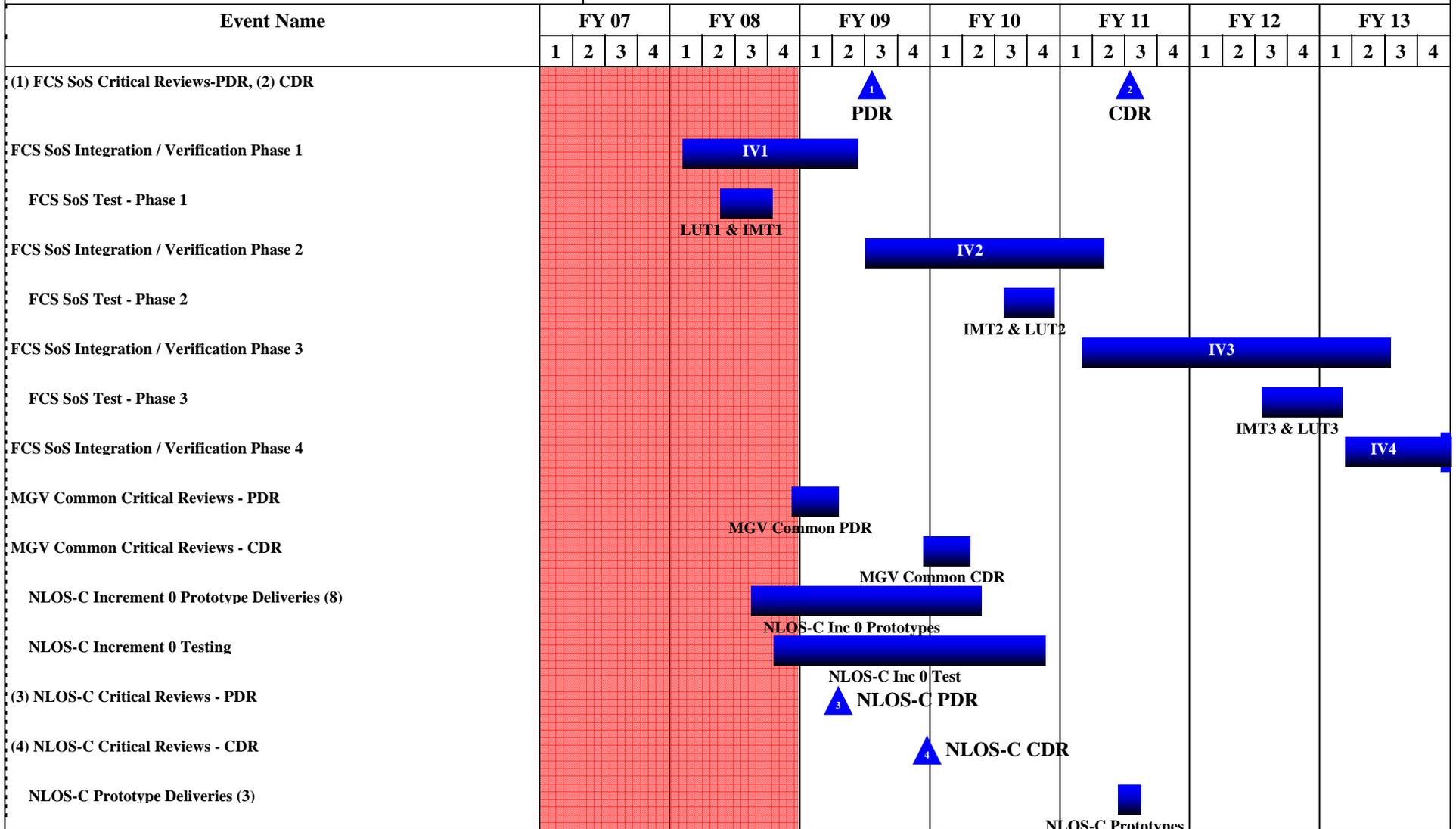
Schedule Profile (R4 Exhibit)

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Schedule Profile (R4 Exhibit)

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Event Name	FY 07				FY 08				FY 09				FY 10				FY 11				FY 12				FY 13							
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
NLOS-C Testing																																

Schedule Detail (R4a Exhibit)

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BUDGET ACTIVITY
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<u>Schedule Detail</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>
FCS SoS Critical Reviews-PDR			3Q				
CDR					3Q		
FCS SoS Integration / Verification Phase 1		1Q - 4Q	1Q - 2Q				
FCS SoS Test - Phase 1		2Q - 4Q					
FCS SoS Integration / Verification Phase 2			3Q - 4Q	1Q - 4Q	1Q - 2Q		
FCS SoS Test - Phase 2				3Q - 4Q			
FCS SoS Integration / Verification Phase 3					1Q - 4Q	1Q - 4Q	1Q - 3Q
FCS SoS Test - Phase 3						3Q - 4Q	1Q
FCS SoS Integration / Verification Phase 4							1Q - 4Q
FCS SoS Test - Phase 4							
MGV Common Critical Reviews - PDR		4Q	1Q - 2Q				
MGV Common Critical Reviews - CDR			4Q	1Q - 2Q			
NLOS-C Increment 0 Prototype Deliveries (8)		3Q - 4Q	1Q - 4Q	1Q - 2Q			
NLOS-C Increment 0 Testing		4Q	1Q - 4Q	1Q - 4Q			
NLOS-C Critical Reviews - PDR			2Q				
NLOS-C Critical Reviews - CDR			4Q				
NLOS-C Prototype Deliveries (3)					2Q - 3Q		
NLOS-C Testing					2Q - 4Q	1Q - 4Q	1Q - 2Q