ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE
5 - System Development and Demonstration	**0604663A - FCS Unmanned Ground Vehicles**

COST (In Thousands)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Cost to Complete	Total Cost
FC4 FCS UNMANNED GROUND VEHICLES	78826	102976	125616	Continuing	Continuing

A. Mission Description and Budget Item Justification: There are three products covered by the Unmanned Ground Vehicle (UGV) Program Element: the family of Multifunction Utility/Logistics Equipment (MULE) platforms, the Small Unmanned Ground Vehicle (SUGV) platform, and the Autonomous Navigation System (ANS).

Multifunction Utility/Logistics Equipment (MULE) vehicle is a 3.5-ton UGV that will support dismounted and mounted operations. The MULE consists of three major components: Common Mobility Platform, Autonomous Navigation System (ANS), and three mission equipment packages (MEPs)/variants. The MULE has 3 variants sharing the common mobility platform; MULE-Transport (MULE-T), MULE-Countermine (MULE-CM), and the Armed Robotics Vehicle-Assault-Light, (ARV-A (L)). The MULE-T will carry 1,900 lbs of equipment and rucksacks for two dismounted infantry squads with the mobility needed to follow squads in complex terrain. Beginning in FY 2010, the MULE-T platform will be deleted from the FCS program. The MULE-CM will provide the capability to detect, mark, and neutralize individual anti-tank mines by integrating a mine detection mission equipment package from the Ground Standoff Mine Detection System (GSTAMIDS) program to support force mobility. The ARV-A (L) is a mobility platform with an integrated weapons and target acquisition package to support the dismounted infantry and mounted operations possessing the capability to locate and destroy enemy platforms and positions. The MULE platforms are CH-47 transportable and designed to maintain hard surface road-speeds of up to 65 KPH. The ARV-A (L) and MULE-CM will be fielded as part of the Threshold-Infantry Brigade Combat Team (T-IBCT).

Small Unmanned Ground Vehicle (SUGV), designated as the XM-1216, is a lightweight, man-portable, DC powered UGV capable of conducting Military Operations in Urban Terrain (MOUT) to include tunnels, sewers, and caves. The SUGV provides an unmanned capability for those missions that are manpower intensive or high-risk such as Urban Intelligence, Surveillance, and Reconnaissance (ISR) missions in a MOUT environment and Chemical/Toxic Materials reconnaissance missions without exposing soldiers directly to the hazard. Weighing 32 pounds, it is capable of carrying up to 4 lbs of payload weight. The SUGV will have the following capabilities: tether payload, manipulator arm, Chemical, Biological, Radiological, Nuclear (CBRN) capabilities and the potential for integrating future technologies for Sense Through the Wall (STTW) and Mine/Unexploded Ordnance (UXO)/Improvised Explosive Device (IED) detection ability. It can operate up to 6 hours on a single charge.

The Army has included the non-threshold SUGV (Block 1) configuration into FCS Increment E-IBCT. Currently, SUGV technologies do not meet FCS threshold requirement, but the Army believes that the current level of technology will still greatly enhance our Soldiers capabilities on the battlefield. The SUGV (Block 1) features a FCS chassis with the COTS sensor head and radio (not full FCS threshold capability). The procurement and fabrication of the SUGV prototypes for testing were purchased as part of this development effort in FY08. Fully compliant threshold SUGV will be included in FCS Increment T-IBCT.

Autonomous Navigation System (ANS) is the mission payload package that will be integrated on the MULE to provide robotic semiautonomous capability and the MGV to support indirect driving. ANS provides Global Positioning System (GPS)/Inertial Navigation System (INS) for core navigation, targeting support and timing. The ANS primary system components are: LADAR Imaging Perception Module (LIPM), Imaging Perception Module (IPM), Millimeter Wave Radar (MMWR), GPS/INS, Precision Timing Module, and the ANS Computer System (ACS). ANS provides the sensors and software processing for unmanned operations for day, night all weather conditions and the platform mobility control for on/off roads, cross country and complex terrain. MMWR provides tracking in rain, smoke, or fog along with an early warning for approaching vehicles with high closing rates. ACS provides SoSCOE interface, path planning, video processing, hardware sensor processing, object processing and speed and curvature

commands. The ANS software development baseline is a phased approach consisting of three builds. Build 1 supports simulation and early prototypes using external waypoints at limited speeds. Build 2 supports emulator and prototype operational hardware to support entry into Mule IQT in 2013. Build 3 will meet all ANS threshold requirements for platform speed, terrain types and operational modes: semiautonomous and leader-follower. ANS for unmanned platforms will be incorporated into T-IBCT. Beginning in FY10, the ANS effort associated with MGV integration is to be deleted from the FCS program.

The MULE will include the following C4ISR systems: Joint Tactical Radio System (JTRS)/Ground Mobile Radio (GMR) radios, Integrated Computer System (ICS), Combat Identification, Medium Range EO/IR sensor and the Acoustic sensor. The SUGV will incorporate the following C4ISR systems: HMS radios, ICS, EO/IR sensor, Laser Target Designator (LTD) and Chemical, Radiological & Nuclear (CBRN) sensor. These are funded by PE 0604665A FC6 (Networks).

The UGV program has been changed due to the restructuring of the MGV portion of the FCS program and the refocusing of the FCS program to spin out FCS technologies faster to the IBCT. The accomplishments, funding, and schedule reflected in this budget justification are based on preliminary analysis of the new direction and reduced program budget. Upon further resolution and detailed planning, adjustments may occur which could potentially change planned accomplishments, funding requirements, and program schedule. The program schedule reflects the current FCS program.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE
5 - System Development and Demonstration	**0604663A - FCS Unmanned Ground Vehicles**

B. Program Change Summary	FY 2008	FY 2009	FY 2010
Previous President's Budget (FY 2009)	90091	96918	64744
Current BES/President's Budget (FY 2010)	78826	102976	125616
Total Adjustments	-11265	6058	60872
Congressional Program Reductions		-342	
Congressional Recissions			
Congressional Increases		6400	
Reprogrammings	-8744		
SBIR/STTR Transfer	-2521		
Adjustments to Budget Years			60872

Change Summary Explanation: Funding: FY 10 - The increase of $61M in FY10 is caused by 1) Army procuring SUGV earlier than planned in FY08 to support SO, 2) Army delayed SUGV work from FY08 to FY10 due to no additional FY08 funds, 3) Increase to cost due to loss of efficiency from delays noted from FY08 to FY10.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
5 - System Development and Demonstration	**0604663A - FCS Unmanned Ground Vehicles**	**FC4**

COST (In Thousands)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	Cost to Complete	Total Cost
FC4 FCS UNMANNED GROUND VEHICLES	78826	102976	125616	Continuing	Continuing

A. Mission Description and Budget Item Justification: Please see Exhibit R-2.

Accomplishments/Planned Program:	FY 2008	FY 2009	FY 2010
MULE Engineering & Program Mgt FY08 - Completed MULE system Preliminary Design Review (PDR) December 2007. Began CDR design activities in January 2008. Completed Prime Item Development Specifications (PIDS), containing 2068 RIDS for all three variants, requirements flow-down, and released all four subsystem Configuration Item Development Specifications. Completed system level ARV-A(L) timelines and error budgets. Completed system architecture design and behavioral analysis. Completed M240 Remote Operating Kit (ROK) CDR. Reviewed and approved 318 PDR artifacts and burned down all 2822 action items. Identified cost reduction initiatives to meet Average Unit Production Cost (AUPC) targets. Completed 32 trade studies. Completed preliminary structural, thermal, and dynamic analyses. Completed MULE subsystem Preliminary Design Reviews (PDRs) except thermal management. Began detail design activities. Provided Design Producibility analysis to support trade studies.	13852		
MULE Engineering & Program Mgt FY09 - Continue preparation for CDRs, including 938 drawings, on MULE-Transport, MULE-Countermine, and ARV-A (L). Drawings include 434 drawings for the Common Mobility Platform, 75 for the MULE-T, 280 for ARV-A(L), and 144 for the MULE-C. Complete MULE Subsystem CDRs. Tweel Testing with Engineering Evaluation Unit (EEU). Complete Manufacturing Plan and Prototyping Facilities upgrade. Complete Producibility Assessments for the chassis, equipment bay, Mission Equipment Packages (MEPs), Power Distribution management System (PDMS), Vehicle Management System (VMS), cabling, connectors, and harnesses. Engineering and Manufacturing Readiness Level (EMRL) 2 assessment of production planning maturation activities to support CDR, and development of Production Plans for vehicle integrator and major subtier suppliers to include schedules and capacity planning. Identify Key Characteristics. Implemented Cost Reduction Initiatives such as Lean, Structured Improvement Activities (SIA), Process Failure Modes and Effects Analysis (PFMEA), and producibility trades to improve affordability. Update Make or Buy Plan and identify long lead material and equipment. Initiate design of special inspection and test equipment. Complete Thermal Management System PDR. Complete final structural, thermal, and dynamic analyses. Release hardware detailed drawing package with 938 drawings. Progress detailed design toward 2nd QTR FY10 CDR. Design Verification Testing. Complete Design Producibility analysis and incorporation into trade studies.		20700	
MULE Engineering & Program Mgt FY10 - Conduct CDRs on MULE-Transport, MULE-Countermine, and ARV-A (L) and burn down action item list. Implement manufacturing plan. Complete Engineering and Manufacturing Readiness Level (EMRL) 2 assessments and update Industrial Capabilities Assessment (ICA) to support CDR. Prototype Pilot line development to include work instruction development, and acceptance test procedure development. Continue implementation of cost reduction initiatives such as Lean, Structured Improvement Activities (SIA), Process Failure Modes and Effects Analysis (PFMEA), and manufacturing yield improvements. Implement upgrades from design verification testing. Finalize production flow and facilitize Assembly, Integration, and Test (AI&T) areas for prototypes. Production planning maturation activities to support Production Readiness Reviews/Engineering and Manufacturing Readiness Level (EMRL) 3 assessments. Complete vehicle final assembly top level drawings and any remaining detail part drawings.			29892

Complete tooling and test equipment design, fabrication, and proofing. Begin planning efforts to support T-IBCT.			
MULE Prototype FY08 - Delivered one Engineering Evaluation Unit (EEU) to conduct proof of principle testing and analysis.	14221		
MULE Prototype FY09 - Began Long Lead Items procurement of subsystems (engine and suspension) to support FY10 build and delivery of 16 prototypes including 5 MULE-T, 5 MULE-CM, and 6 ARV-A(L). Complete chassis and electrical harness mockup activities. Conduct MULE/ANS integration software and hardware risk reduction on Engineering Development Unit (EEU). Begin final integration and checkout of common mobility platform (chassis). Conduct Tweel design risk reduction on EEU.		11554	
MULE Prototype FY10 - Continue procurement of prototype hardware and services to support build of 5 MULE-CM, and 6 ARV-A(L) prototypes. Based on SecDef guidance, MULE-T prototypes will be deleted, but hardware procured in prior years will be used as spare parts during testing. Complete fabrication of detail parts. Complete fabrication of special test equipment. Receive initial subsystem deliverables. Integration includes BAE Power and Propulsion System, Advanced Integrated Systems Remote Operating Kit, and Millen Works suspension. Conduct final integration and checkout of common mobility platform (chassis) and begin integration and assembly of first Integrated Qualification Test (IQT) vehicle.			19974
MULE Test FY08 - Six M240 Machine guns (Government Furnished Equipment (GFE)) were delivered to Lockheed on October 22, 2007. Completed M240 Test Firings and Javelin mechanical interface tests. Completed Draft Verification and Integration Plan (VIP). Completed Draft Master Test Plan (MTP) for Integrated Qualification Test (IQT).	3656		
MULE Test FY09 - Continue test planning to support FY11 IQT. Complete Javelin initial integration testing to support final weapon system design of Javelin Vehicle Launcher (JVL). Begin Hardware In The Loop (HWIL) testing to support Build 2 software. Conduct Firing test, temperature, vibration and high humidity on ballistic panels. Conduct cable submersion testing, Centralized Controller (CC) development testing, and TWEEL performance testing.		5321	
MULE Test FY10- Prepare subsystem Acceptance Test Plans (ATPs). Conduct development testing of detail parts and Line Replaceable Units (LRUs). Complete subsystem qualification testing. Begin horizontal integration of C4ISR, ANS & CC software in HWIL.			12471
MULE Software Development FY08 - Prepared to conduct Life Cycle Objectives (LCO) and Life Cycle Architecture (LCA) for Build 2 Software in 2008. Continued development and integration of Build 2 Software. Prepared Software Artifacts to support Critical Design Review (CDR) scheduled for 1st qtr, FY10. Completed Virtual Simulation (VSIM) for Integrated Mission Test (IMT) 1. Began testing IMT1 in System of Systems Integration Laboratory (SoSIL).	3618		
MULE Software Development FY09 - Complete software development for manual sensor control, mine neutralization and executing vehicle mission plans for prototype integration. Complete ARV-A (L) simulation interim Technical Readiness Review (iTRR) and interim Functional Qualification Test (iFQT) for Integrated Mission Test (IMT) 1 and delivery to SoSIL. Begin HWIL integration and performance testing in May 2009. Begin Integration Verification (IV) 2 VSIM integration in May 2009. Continue regression testing to support software and simulation deliveries. Begin software development to support HWIL testing and delivery of 16 prototypes beginning June 2011. Conduct LCO and LCA for Build 2 software. Build 2 addresses: Power up and Initialization; Command Maneuver Plan (Validate/Resume/Suspense/Terminate); Command /Control (Fast Brake/Initiate Manual Control/Maneuver/Terminate/Articulation); Shutdown; Control Driving/Pose Change; Load Mission Plan; Manage Mode Transition; Monitor Health Data/Supply Data/System Usage Data. Begin requirement definition for Build 3.		3821	
MULE Software Development FY10 - Complete virtual simulation for IMT to support T-IBCT. FQT for Build 2 Software. Begin support to IMT testing. Continue requirement definition and development for Build 3 and conduct LCO and LCA. Build 3 addresses: Control Mine Search Operations; Control Arm/Safe Weapon/Check Fire; Manage CBRN Data; Control End Engagement; Manage Javelin			5633

Video; Weapon Aim/Firing/Selection; Sensor Alignment; Meteorological Data; Deconflict Fires; Situation Awareness; Low Latency EO/IR Laser Range Finder; Laser Designation/Target Tracking; Anti Tamper and Counter-Measures Deployment.			
SUGV Engineering & Program Mgt FY08 - SUGV Preliminary Design Review (PDR) was conducted in 4th QTR FY08. The PDR involved development and review of PDR artifacts to include system design, software development, and interface design documents. Took delivery of the SUGV Prime Item Development Specification (PIDS) in FY08. Completed identification of cost reduction initiatives to meet AUPC targets. Began integration and design activities for the Electro-Optic Infrared (EOIR) sensors, the Embedded Tactical Engagement Simulation System (E-TESS) training sensors and the Ground Platform Communication System (GPCS) for the SUGV. Began development of the Interface Control Drawings (ICDs) for the ICS Type VIII, common payload port, GPCS, and payloads to include the Laser Target Designator (LTD) and Chemical/Radiological/Nuclear (CRN) detector.	12127		
SUGV Engineering & Program Mgt FY09 - Continue SUGV design effort leading up to the SUGV Critical Design Review (CDR) in 2nd qtr FY10. Develop design and program artifacts to support the CDR to insure that the SUGV CDR design meets the PIDs requirements. Continue the effort to integrate the EOIR and other components into the SUGV design prior to the CDR. Quantity of drawings is expected to exceed 300 drawings. Conduct Engineering and Manufacturing Readiness Level (EMRL) 2 assessment of production planning maturation activities for the SUGV system to support CDR and development of Production Plans to include schedules and capacity planning. Implementation of Cost Reduction Initiatives such as Lean and producibility trades to meet AUPC targets. Complete design of the SUGV system leading up to the SUGV CDR in 2nd qtr FY10 to include completing the E-TESS sensor design and completion of all ICDs. Contracts for the LTD and CRN will be put in place to begin payload development. Design Verification Testing planning will be initiated. Complete Design Producibility analysis and incorporation into trade studies. Develop engineering changes to support lessons learned from field testing with SUGV Block 1 units.		10086	
SUGV Engineering & Program Mgt FY10 - Prepare for and conduct the SUGV CDR, scheduled for 2nd QTR FY10. Continue to develop design and program artifacts to support the CDR. Evaluate artifacts to insure that the SUGV CDR design meets the PIDs requirements. Completion of EMRL level 2 assessments to support CDR. Develop the Prototype Production Pilot line. Continue implementation of cost reduction initiatives such as Lean Manufacturing and manufacturing yield improvements. Production planning maturation activities to support Production Readiness Review/Engineering and Manufacturing Readiness Level (EMRL) 3 assessments. All design engineering activities will be completed in FY10. Implement "fixes" that are identified during CDR and initial testing to improve the platform. Begin planning efforts to support T-IBCT.			10883
SUGV Prototype FY08 - Completed Pre-Prototype Development, Build and Testing. The Pre-prototype SUGVs are Early Developmental Assets (EDAs). The pre-prototypes (EDAs) are developed in three rounds. Each "Round" consists of pre-prototype vehicles. Round 1 - Designed, built and tested major sub assemblies (flippers, neck, head, etc.). Round 2 - Combined major sub assemblies from Round 1 to form the complete robot and performed capability and environmental testing. Round 3 - Integrated improvements generated from Round 2 testing and requirements changes and re-tested to full specification. FY08 completed the development, build, and test of Pre-prototype Round 3.	1330		
SUGV Prototype FY 10 - Upgrade and refurbish the 22 prototypes that were provided to the AETF and Aberdeen Test Center (ATC) in FY09. Refurbishment includes upgrades to software, repairing broken parts, and test/checkout to make sure the units are functional.			511
SUGV Test FY08 - Conducted early capability testing on the Round 3 prototype systems. This testing included initial fording test, battery endurance testing, and mobility control software.	781		
SUGV Test FY09 - Continue internal testing of SUGV components leading up to the CDR in 2nd qtr FY10. These components include		741	

drive motors, circuit cards, head and neck assembly, Manipulator Arm and the Fiber Optic Tether payloads. Also test the new functionality and design upgrades associated with PDR closeout.			
SUGV Test FY10 - E-IBCT will undergo a MSC event in 1QFY10. Follow-on IQT testing will be conducted after a successful MSC to insure that the changes made to the systems after the FY09 testing and integrated into the 15 follow-on units delivered to Ft. Bliss are working as expected. Conduct initial testing of the SUGV integrated system prior to releasing the 6 prototypes for IQT testing. This testing will be functionality testing to insure that all the components are integrated properly and communicate properly prior to entering IQT testing and will be conducted at an iRobot facility. Test planning will begin for the IQT testing to be conducted in FY11 and FY12.			493
SUGV Software Development FY08 - Developed integrated SUGV Platform Simulations. Updated Simulations for SUGV Build 1 to SoSIL. Began requirements Definition for Software Build 2. Conducted LCO review for Build 2 Software. Capabilities included in this build of software includes vehicle states and modes, battery management, tether/spooler control, laser target designator, manipulator arm, and payload control. Also included health and status monitoring.	554		
SUGV Software Development FY09 - Continue development of the Build 2 software for SUGV. Conduct LCA review for Build 2 Software. Build 2 Test Readiness Review (TRR) will be conducted in 4th qtr FY09. Build 2 simulation software will be delivered in 4th qtr FY09. Begin integration of Build 2 Final (B2F) software with SUGV prototypes. Build 2 Final (B2F) capabilities include: power up and initialization, configure SUGV Network Elements, establish SUGV Control, control Integrated SUGV Maneuver, Flippers, Head Neck and pose change, Mode Transition/basic maintenance, Basic manual EO/IR, Imagery collection and begin requirement definition for Software Build 3. Begin requirement definition for Build 3.		486	
SUGV Software Development FY10 - SUGV E-IBCT will utilize software developed by iRobot for the E-IBCT program. This software will be used until the T-IBCT software (Build 2/3) is developed and integrated into the SUGV Spinout program to support the NSA certified radio and associated waveform. Build 2 emulation/operational software will be delivered and integrated. FQT Software Build 2. Testing with the C4 components will take place to insure that the software/hardware is integrated/functioning properly. The SUGV software will be integrated into prototypes in early 4th qtr FY10 and 1st qtr FY11. Conduct LCO and LCA for Software Build 3. Build 3 Early capabilities include: Control Laser Designation/Laser Range Finder, Manage CBRN data, Control SUGV Manipulator Arm Operations, Control SUGV Audio Operations, Handoff Control, Render Useless, Manage SUGV Assignments.			1105
ANS Engineering & Program Mgt FY08 - Conducted PDR November 15, 2007. Over 180 artifacts and data items were submitted and reviewed. Successful closeout achieved less than four months later. Began CDR design activities in November 2007. Continued update of requirements for both MULE and MGV flow-downs. Continued Interface Control Documentation efforts between ANS and GPS/INS, MULE and MGV. Identified cost reduction initiatives to meet Average Unit Production Cost (AUPC) targets. Began EMRL 2 production planning maturation activities to support CDR, development of Production Plans and to include schedules. Selected GPS/INS vendor. Weight management team/plan developed. Conducted concept studies on different IPM camera types and configurations, integrated MULE-ANS armor concepts and integrated MULE/ANS cooling concepts studied.	9371		
ANS Engineering & Program Mgt FY09 - Continue analysis and modifications resulting from evolving requirement changes. Continue to conduct weight reduction initiative to address size, weight and power allocation challenges. Tailored GPS/INS strategy to compensate for budget shortfalls. Finalize coordination of ICD efforts. Expect over 190 artifacts and data items to be submitted for the CDR review. Approximately 250 drawings with an average of four revisions each are anticipated for the system. Finalize Make/Buy plan and identify Long Lead items. Implement design changes from EDU testing. Identify key Characteristics. Implement Cost reduction initiatives such as Lean and producibility trades to meet AUPC targets. EMRL level 2 assessments and ICA update to support CDR. Facilitize final integration and test site for prototype Pilot line development. Complete thermal and armor analyses. Release hardware detailed drawing		14855	

package containing 250 drawings.			
ANS Engineering & Program Mgt FY10 - ANS CDR planned for 1st qtr FY10. Complete final assembly and detail part drawing release and revision of the remaining 250 drawings. Begin planning efforts to support T-IBCT. Complete Physical Configuration Audit (PCA) of all prototype hardware components. Continue implementation of cost reduction initiatives such as Lean and manufacturing yield improvements. Finalize coordination of ICD efforts including Part II ICDs and complete review of 94 artifacts and 29 data items in preparation for CDR. Continue production planning maturation activities to support PRR/EMRL Level 3 assessments and updates to the ICA. Begin tooling design, fabrication and proofing.			11373
ANS Prototype FY08 - Engineering Design Unit (EDU) development began with a pre-prototype of the Imaging Perception Module (IPM), LADAR and ANS Computer System (ANS) subsystems.	8413		
ANS Prototype FY09 - Begin ANS Emulator deliveries. Began prototype long lead item procurement. A total of fourteen emulators are to be produced: five ANS emulators without cameras are to be delivered to the MGV SIL, six ANS emulators without cameras to the MULE SIL, and three ANS emulators with (18) cameras to be delivered to the MGV SIL. Seventy GPS/INS Phase II units to be procured as long lead items per GPS/INS CIDS requirements necessary for MULE and MGV IQT's.		12486	
ANS Prototype FY10 - Continue long lead time procurement of hardware and begin fabrication/assembly to support prototype builds for delivery in FY11. ANS will deliver eleven ANS prototype sets (IPMs, LIPMs, GPS/INS, and ACS) for MULE in FY11. Implement Manufacturing Plan for ACS, IPM, and LIPM enclosures; internal cabling; and integration of long lead items. Conduct assembly, integration and developmental testing of detail parts.			4318
ANS Test FY08 - Conducted ANS Robotic Convoy Experiment Phase IIa at WSMR which addressed high speed obstacle avoidance, high speed teleoperation, and lane following using map registration data. Conducted hardware environmental testing (thermal cycling, shock and vibration testing of component parts). Supported Robotic Vehicle Control Architecture (RVCA) testing and integration of an ANS prototype on the TARDEC (Crusher) platform. Completed Verification and Integration Plan (VIP). Conducted MULE/ANS integration testing on the Mule EEU test bed.	2579		
ANS Test FY09 - Conduct ANS Robotic Convoy Experiments IIb and IIc at WSMR to incorporate algorithm updates, leader-follower activities with up to three vehicles, continuous operations, night time human detection exercises, negative obstacle detection experiments, and negotiations of slopes and hills. Support TARDEC's RVCA soldier-operated testing of ANS equipment/software on surrogate platform. Begin ANS Integration and Test on Emulators.		6019	
ANS Test FY10 - ANS Emulator/Prototype tests begin. Begin ANS hardware and software integration on MULE prototypes. Begin contractor testing of prototype components and systems. Initiate planning and support for the IQT scheduled in FY11.			14443
ANS Software Development FY08 - Provided Software Build I System Integration Lab (SIL) Test Support. Completed testing and delivery of Software Build 1C. Conducted preparation, development, integration and test for ANS Engineering Phase (EP) 10 through 12 of Build 2 ANS Software Development. Updated and delivered ANS Simulation to MULE. Build 2 Life Cycle Objective (LCO) complete. Build 2 Life Cycle Architecture (LCA) document submittals begun. Completed testing and delivery of Software Build 1D.	8324		
ANS Software Development FY09 - Begin production and delivery of three ANS Emulators plus 18 cameras for the Infantry Carrier Vehicle (ICV) SIL, Mounted Combat System (MCS) SIL, and the Non-Line of Sight-Cannon (NLOS-C). Produce and begin delivery of 12 ANS Emulators without cameras for the MULE Transport SIL, Command and Control Vehicle (C2V) SIL, FCS Recovery and Maintenance Vehicle (FRMV) SIL, the Medical Vehicle (MV) SIL, the NLOS Mortar (NLOS-M) SIL, and the Reconnaissance Scout Vehicle (RSV) SIL. Completing plan to change Build 2 focus from Simulation to Operational. Plan to complete Build 2 Operational		14023	

requirements analysis and design and conduct Build 2 Operational LCA in 2nd Qtr. Will start Build 2 Operational design and complete Build 2 SIM design and conduct Build 2 Simulation LCA in 3rd Qtr. Start Build 2 Simulation construction in 3rd Qtr. The ANS Build 2 addresses: Basic power up and self test; Simple/basis PS-MRS report status; GPS/INS encryption key entry; Initial render useless emulation; Navigation state reporting; Remote operations; Blind waypoint following; Obstacles avoidance; Obstacles negotiation and Follow Vehicle leader.			
ANS Software Development FY10 - Build 3 LCA document submittals to begin 1st qtr. Build 3 Test Readiness Review (Simulation and Operational) planned for 4th qtr. ANS Emulator deliveries complete. Complete Build 2 Simulation construction. Build 2 Simulation Test Readiness Review (TRR) scheduled for 2nd Qtr. Build 2 Simulation FQT scheduled for 3rd Qtr. Will complete Build 2 Operational design and construction with TRR and FQT scheduled for 4th Qtr. Plan to complete Build 3 Operational requirements analysis and submit Build 3 Operational LCO documents in 2nd Qtr, and LCA documents in 3rd Qtr. Will start Build 3 Operational Construction 3rd Qtr. The ANS Build 3 addresses: Follow Dismounted Soldier; Nights ops (autonomous); Complex terrain; Use of prior geospatial terrain data; L1F/SDM/SU/PS-MRS interfaces; Use of COP updates; Degraded ops; Safe road ops; Render useless and Maintenance. Continue delivery of ANS emulators.			14520
Small Business Innovative Research/Small Business Technology Transfer Programs		2884	
Total	78826	102976	125616

B. Other Program Funding Summary	FY 2008	FY 2009	FY 2010	To Compl	Total Cost
0604660A FCS Manned Grd Vehicles & Common Grd Vehicle Components	635846	782664	368557	Continuing	Continuing
0604661A FCS System of Systems Engr & Program Management	1292514	1414756	1067191	Continuing	Continuing
0604662A FCS Reconnaissance (UAV) Platforms	42772	57190	68701	Continuing	Continuing
0604664A FCS Unattended Ground Sensors	22007	17011	26919	Continuing	Continuing
0604665A FCS Network Hardware & Software	724397	556301	749182	Continuing	Continuing
0604646A Non Line of Sight - Launch System	246071	208009	88660	Continuing	Continuing
0604647A Non Line of Sight - Cannon	133139	89545	58216	Continuing	Continuing
0604666A FCS Spin Outs	84111	111032		Continuing	Continuing
0603639A FCS MRM	43068	40731		Continuing	Continuing
WTCV G86100 FCS Core Program	78932	154127		Continuing	Continuing
WTCV G86200 FCS Spin Out Program	1370	67268	327921	Continuing	Continuing
0605625A - Manned Ground Vehicles			100000	Continuing	Continuing

Comment: Comp Programs:

ASTAMIDS, GSTAMIDS, WIN-T, JTRS-HMS, JTRS-GMR, JTRS-AMF, STARLite SAR/GMTI, JAVELIN, JCADS, JSLSCAD, DCGS-A, FBCB2, OneTESS, OneSAF

C. Acquisition Strategy The original FCS Contract was awarded to the Lead Systems Integrator, Boeing Company 30 May 2003 and definitized, 10 Dec 2003. The LSI contracted with its One Team Partners, Lockheed Martin Missiles, to produce the Multifunction Utility/Logistics and Equipment Countermine and Transport MULE-T and Armed Robotic Vehicle - Assault (light) (ARV-A (L)), iRobot Corporation, Burlington (MA) producing the Small Unmanned Ground Vehicle (SUGV), and General Dynamics Robotics Systems, Westminster (MD) producing the Autonomous Navigation System (ANS). The non threshold SUGV (Block 1) will be included in the initial Spin Out to the IBCT. The MULE-T effort will be terminated as part of the program restructuring in FY10.

ARMY RDT&E COST ANALYSIS (R3)

May 2009

BUDGET ACTIVITY
5 - System Development and Demonstration

PE NUMBER AND TITLE
0604663A - FCS Unmanned Ground Vehicles

PROJECT
FC4

I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Small Unmanned Ground Vehicle (SUGV)	FAR	The Boeing Company, St Louis, MO see remark 1		14792	1-3Q	11313	1-3Q	12992	1-3Q		39097	
Autonomous Navigation System - Software	FAR	The Boeing Company, St Louis, MO see remark 3		28662	1-3Q	47383	1-3Q	44654	1-3Q		120699	
MULE	FAR	The Boeing Company, St Louis, MO see remark 2		35347	1-3Q	41396	1-3Q	67970	1-3Q		144713	
Subtotal:				78801		100092		125616			304509	

Remarks: Remark 1: Subcontractor: iRobot Corp. - Burlington, MA
Remark 2: Subcontractor: Lockheed Martin Missile and Fire Control - Grand Prairie, TX
Remark 3: Subcontractor: General Dynamics Robotic Systems - Westminister, MD

II. Support Costs	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
SBIR/STTR	Direct	OSD				2884	1-2Q				2884	
Adjustments to budget Year:	Direct	ABO		25	1-2Q						25	
Subtotal:				25		2884					2909	

III. Test And Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal:												

Remarks: All Test & Evaluation costs for this project are included in 0604661 FC2 SoS Engineering and Program Management project.

ARMY RDT&E COST ANALYSIS (R3)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
5 - System Development and Demonstration	**0604663A - FCS Unmanned Ground Vehicles**	**FC4**

IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 2008 Cost	FY 2008 Award Date	FY 2009 Cost	FY 2009 Award Date	FY 2010 Cost	FY 2010 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal:												
Remarks: All Management Services costs for this project are included in 0604661 FC2 SoS Engineering and Program Management project.												
Project Total Cost:				**78826**		**102976**		**125616**			**307418**	

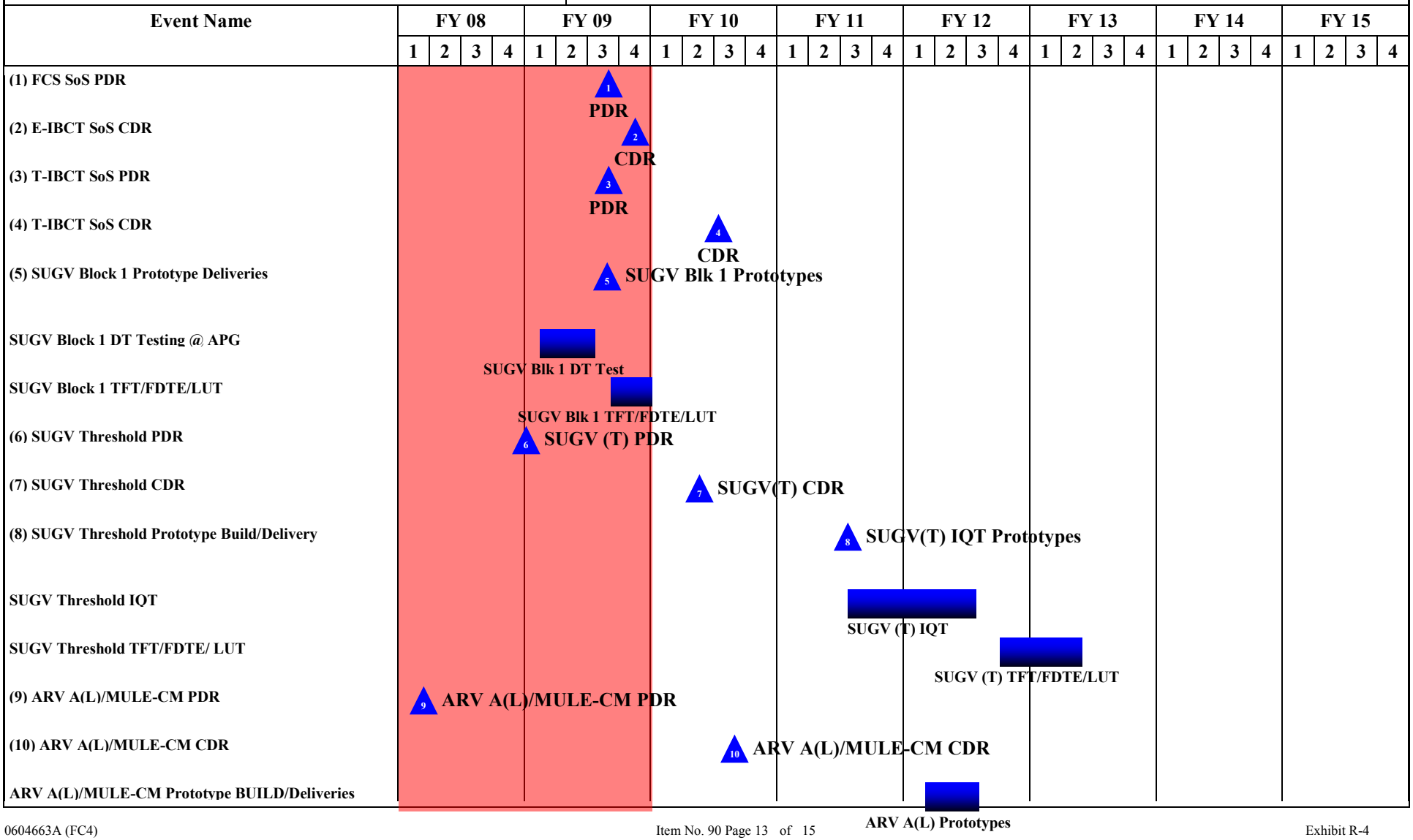
Schedule Profile (R4 Exhibit)

May 2009

BUDGET ACTIVITY
5 - System Development and Demonstration

PE NUMBER AND TITLE
0604663A - FCS Unmanned Ground Vehicles

PROJECT
FC4



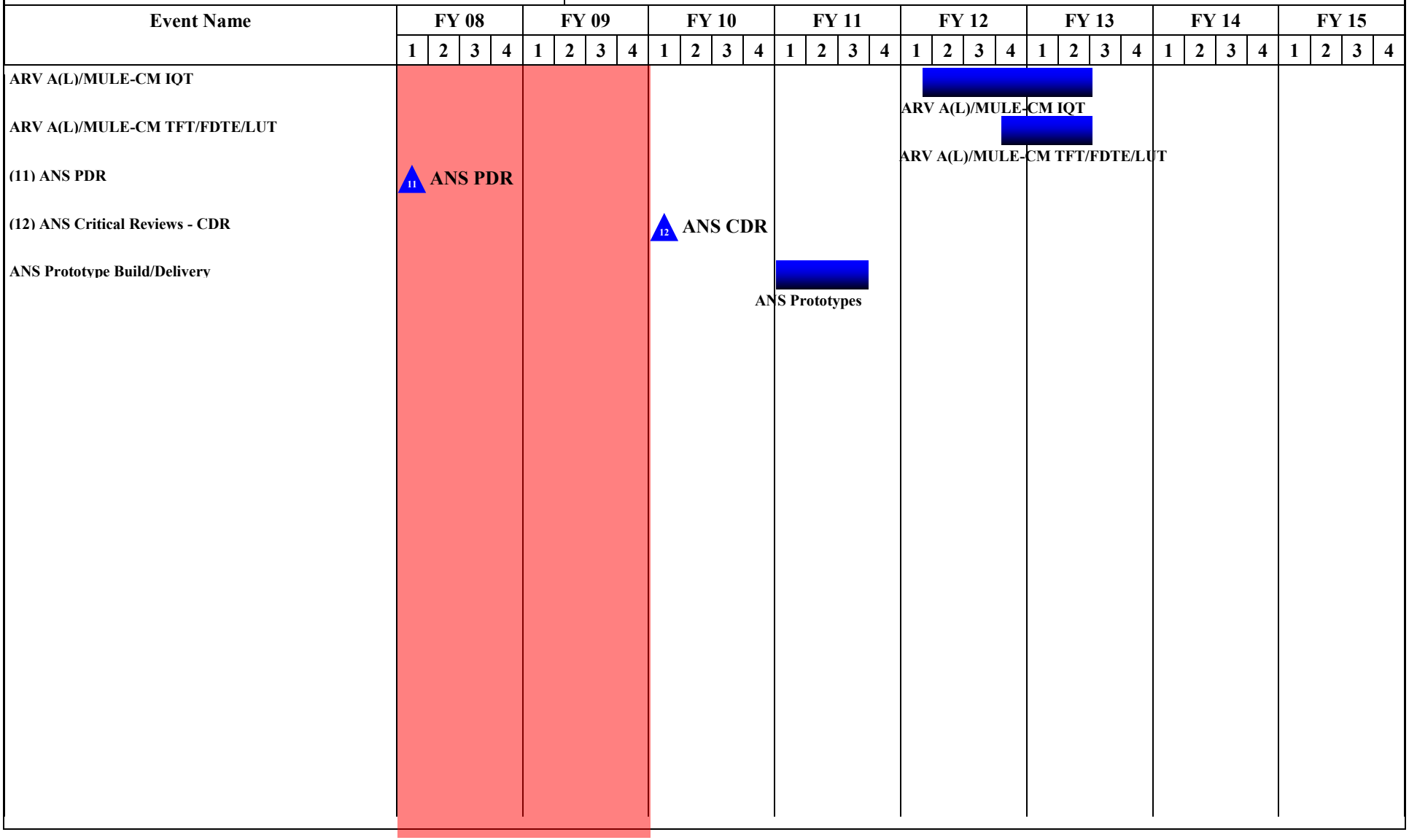
Schedule Profile (R4 Exhibit)

May 2009

BUDGET ACTIVITY
5 - System Development and Demonstration

PE NUMBER AND TITLE
0604663A - FCS Unmanned Ground Vehicles

PROJECT
FC4



Schedule Detail (R4a Exhibit)

May 2009

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
5 - System Development and Demonstration	**0604663A - FCS Unmanned Ground Vehicles**	**FC4**

Schedule Detail	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
FCS SoS PDR		3Q						
E-IBCT SoS CDR		4Q						
T-IBCT SoS PDR		3Q						
T-IBCT SoS CDR			3Q					
SUGV Block 1 Prototype Deliveries		3Q						
SUGV Block 1 DT Testing @ APG		1Q - 3Q						
SUGV Block 1 TFT/FDTE/LUT		3Q - 4Q						
SUGV Threshold PDR		1Q						
SUGV Threshold CDR			2Q					
SUGV Threshold Prototype Build/Delivery				3Q - 4Q				
SUGV Threshold IQT				3Q - 4Q	1Q - 3Q			
SUGV Threshold TFT/FDTE/ LUT					3Q - 4Q	1Q - 2Q		
ARV A(L)/MULE-CM PDR	1Q							
ARV A(L)/MULE-CM CDR			3Q					
ARV A(L)/MULE-CM Prototype BUILD/Deliveries					1Q - 3Q			
ARV A(L)/MULE-CM IQT					1Q - 4Q	1Q - 2Q		
ARV A(L)/MULE-CM TFT/FDTE/LUT					4Q	1Q - 2Q		
ANS PDR	1Q							
ANS Critical Reviews - CDR			1Q					
ANS Prototype Build/Delivery			4Q	1Q - 3Q				

The schedule reflected in this R-Form is based on preliminary analysis of the available budget. Upon further resolution and detailed planning, adjustments may occur which could potentially change the program schedule.