Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Office of Secretary Of Defense	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603745D8Z: *Synthetic Aperture Radar (SAR) Coherent Change Detection (CDD)*

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	7.296	4.825	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
P745: *Synthetic Aperture Radar (SAR) Coherent Change Detection (CDD)*	7.296	4.825	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Synthetic Aperture Radar (SAR) Coherent Change Detection (CCD) Initiative encompasses four phases to develop deployable systems capable of achieving SAR with real time Coherent Change Detection for tactical intelligence. The first phase, completed in FY 2008, validated utility of existing small SAR sensors for use as a CCD platform. CCD post processing was used to establish current SAR capabilities for change detection thresholds. Phase Two demonstrated real-time CCD on a manned, SAR-equipped, platform. This real time enhancement is capable of being retro fitted on existing manned SAR platforms. Phase Three has developed the engineering enhancements necessary to integrate a real time SAR CCD capability on a small Unmanned Aerial Vehicle (UAV). All necessary software has been developed during Phase Three. The fourth phase (FY 2010) will extend the capability to an affordable small unmanned aircraft with a miniaturized SAR system. The goal is to develop a deployable system with a SAR sensor capable of achieving near real time CCD on a small UAV to be operated by the tactical commander and at a cost goal of $500K per SAR CCD sensor package.

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	7.940	4.864	0.000	0.000	0.000
Current President's Budget	7.296	4.825	0.000	0.000	0.000
Total Adjustments	-0.644	-0.039	0.000	0.000	0.000
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.039			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	-0.428	0.000			
• SBIR/STTR Transfer	-0.216	0.000			

Exhibit R-2A, RDT&E Project Justification: PB 2011 Office of Secretary Of Defense			DATE: February 2010
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COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
P745: *Synthetic Aperture Radar (SAR) Coherent Change Detection (CDD)*	7.296	4.825	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Synthetic Aperture Radar (SAR) Coherent Change Detection (CCD) Initiative encompasses four phases to develop deployable systems capable of SAR with real time CCD processing to provide over the horizon alerts for terrain changes above a given threshold. The focus is on increasing the situational awareness of small dispersed units operating in large areas.

Phase One validated the performance of existing lightweight SAR systems using CCD for detecting a variety of human activities through rigorous testing.

Phase Two demonstrated near real-time CCD on a manned SAR-equipped platform used to determine functional requirements and developed a system concept of operations (CONOPS).

Phase Three has developed the engineering enhancements necessary to integrate a real time SAR CCD capability on a small UAV. All necessary software was developed during this phase.

Phase Four (FY 2010) will extend the capability to an affordable small unmanned aircraft with a miniaturized SAR system. Phase Four will also decrease procurement costs of a small SAR with a real time CCD capability to a cost goal of $500 thousand per sensor package. This compares to a current cost of approximately $1.2 million for a spot SAR system.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Demonstration of a Manned Platform System	2.146	0.000	0.000	0.000	0.000
Phase Two demonstrated near real-time CCD on a manned SAR equipped platform and accomplished the following:					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
- Engineering of algorithms necessary to exploit complex SAR imagery - Initial development of a ground based software package to cue user to tactically significant changes in the area of interest - Demonstration of near real-time SAR CCD capability on a manned aircraft - Concept of Operations (CONOPS) development SAR with real-time CCD has the ability to detect the following activities that were determined and verified during Phase One: - Vehicle tracks caused by a vehicle recently driving off-road, such as across a median strip, or the dirt shoulder adjacent to a road. - Signs of human activity through footprints in soil, changes in underbrush having recently traversed a path on soft soil, underbrush or vegetation. - Detection of linear structures newly-emplaced, such as a small diameter pipe. - Ground displacement due to trenching or the movement of dirt along a path. - The addition or subtraction of a significant object visible to the sensor, covering a half square meter, or providing a significant change in radar cross section (reflectivity). - Ground displacement due to digging operations, or digging and soil replacement, or repaving operations, where the ground area of the displaced earth covers a square meter or more. - The displacement of guard barriers, or other objects, due to manual manipulation, or vehicle crashes. - Ground level subsidence due to underground excavation activities when the surface subsidence amounts to a few millimeters. The first phase validated the utility of small SAR sensors for use in CCD processing. Phase One also determined the current actual capabilities of CCD in tactical change detection.					

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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: Demonstrated a near real-time CCD capability on a manned SAR platform system with a radar and processing capability that can produce near real-time SAR CCD, together with a design for a deployable objective system.					
Development of Engineering Enhancements Phase Three accomplished the following engineering enhancements: - Miniaturization of a SAR CCD sensor package capable of deployment on a tactical sized UAV - Further enhancements to the front-end software package user experience - Refinement of the CONOPS initially developed in Phase Two *FY 2009 Accomplishments:* Phase Three has developed the necessary reduction in SAR component size necessary to facilitate integration of near real-time CCD systems into a small UAV.	5.150	0.000	0.000	0.000	0.000
Extend Capability Phase Four will accomplish the following: - A robust CONOPS - A front-end software package with a rich user experience - A near real-time SAR CCD capability integrated on to a tactical sized UAV with a sensor package cost of not more than $500K *FY 2010 Plans:* This phase of the program will integrate a SAR with real time CCD capability onto a small UAV for $500K per sensor package.	0.000	4.825	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	7.296	4.825	0.000	0.000	0.000

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C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

This project will have developed a deployable system with a SAR sensor capable of achieving real time CCD on a small UAV tested by the tactical commander and at a cost of $500K per SAR CCD sensor package by the end of FY10.