Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Defense Advanced Research Projects Agency											Date: March 2014	

Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602304E *I COGNITIVE COMPUTING SYSTEMS*							

COST ($ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	27.538	16.330	-	-	-	-	-	-	-	-	-
COG-02: *COGNITIVE COMPUTING*	-	6.886	3.503	-	-	-	-	-	-	-	-	-
COG-03: *COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES*	-	20.652	12.827	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

The Cognitive Computing Systems program element is budgeted in the Applied Research budget activity because it is developing the next revolution in computing and information processing technology that will enable computational systems to have reasoning and learning capabilities and levels of autonomy far beyond those of today's systems. The ability to reason, learn and adapt will raise computing to new levels of capability and powerful new applications.

The Cognitive Computing project will develop core technologies that enable computing systems to learn, reason and apply knowledge gained through experience, and respond intelligently to things that have not been previously encountered. These technologies will lead to systems demonstrating increased self-reliance, self-adaptive reconfiguration, intelligent negotiation, cooperative behavior and survivability with reduced human intervention.

The Collective Cognitive Systems and Interfaces project will dramatically improve warfighter and commander effectiveness and productivity using advanced cognitive approaches that enable faster, better informed, and more highly coordinated actions than those of our enemies. This will be accomplished by developing revolutionary methods that increase our information processing capabilities, enhance our situational awareness, and enable more cohesive group action by our forces. Critical technical areas addressed in this project include automated coordinated decision support, information sharing, and ensured communications.

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2015 Defense Advanced Research Projects Agency				**Date:** March 2014	
Appropriation/Budget Activity 0400: *Research, Development, Test & Evaluation, Defense-Wide I* BA 2: *Applied Research*		**R-1 Program Element (Number/Name)** PE 0602304E *I COGNITIVE COMPUTING SYSTEMS*			
B. Program Change Summary ($ in Millions)	**FY 2013**	**FY 2014**	**FY 2015 Base**	**FY 2015 OCO**	**FY 2015 Total**
Previous President's Budget	30.424	16.330	-	-	-
Current President's Budget	27.538	16.330	-	-	-
Total Adjustments	-2.886	-	-	-	-
• Congressional General Reductions	-0.040	-			
• Congressional Directed Reductions	-2.573	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.510	-			
• SBIR/STTR Transfer	-0.783	-			

Change Summary Explanation

FY 2013: Decrease reflects Congressional reductions for Sections 3001 & 3004, sequestration adjustments, and the SBIR/STTR transfer offset by reprogrammings.

Exhibit R-2A, RDT&E Project Justification: PB 2015 Defense Advanced Research Projects Agency		Date: March 2014

Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602304E / *COGNITIVE COMPUTING SYSTEMS*	Project (Number/Name) COG-02 / *COGNITIVE COMPUTING*

COST ($ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
COG-02: *COGNITIVE COMPUTING*	-	6.886	3.503	-	-	-	-	-	-	-	-	-

The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

The Cognitive Computing project will develop core technologies that enable computing and autonomy systems to learn and apply knowledge gained through experience. These technologies will lead to systems with increased self-reliance and the capacity to operate with reduced programmer and operator intervention. In resource-limited settings, these capabilities will make the difference between mission success and mission degradation or failure, increase safety by allowing warfighters to operate systems from greater standoff distances, and reduce staffing requirements by providing greater autonomy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
Title: Autonomous Robotic Manipulation (ARM)	6.886	3.503	-

Description: The Autonomous Robotic Manipulation (ARM) program is developing advanced robotic technologies that will enable autonomous (unmanned) mobile platforms to manipulate objects without human control or intervention. A key objective is intelligent control of manipulators to independently perform subtasks over a broad range of domains of interest to the warfighter, thereby reducing operator workload, time on target, training time, bandwidth, and hardware complexity. Current manipulation systems have many limitations. For example, while they perform well in certain mission environments, they have yet to demonstrate proficiency and flexibility across multiple mission environments; they require burdensome human interaction and the full attention of the operator; and the time required to complete tasks generally exceeds military users' desires. ARM will create manipulators with a high degree of autonomy capable of serving multiple military purposes across a wide variety of application domains including, but not limited to, counter-improvised explosive device, countermine, search and rescue, weapons support, checkpoint and access control, explosive ordnance disposal, and combat casualty care (including battlefield extraction). ARM will enable autonomous manipulation systems to surpass the performance level of remote manipulation systems that are controlled directly by a human operator.

FY 2013 Accomplishments:
- Developed and demonstrated algorithms for autonomous grasping of complex objects, such as the handle of an impact driver to change a tire or a cutting tool to snip a wire.
- Developed and demonstrated algorithms for autonomous bimanual manipulation, such as unzipping a satchel bag to open it and extracting an object.
- Developed a set of new, low-cost robotic manipulators that were used by various platforms to test the robustness of the designs.

FY 2014 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2015 Defense Advanced Research Projects Agency		Date: March 2014
Appropriation/Budget Activity 0400 *I* 2	**R-1 Program Element (Number/Name)** PE 0602304E *I COGNITIVE COMPUTING SYSTEMS*	**Project (Number/Name)** COG-02 *I COGNITIVE COMPUTING*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
- Develop and demonstrate robust algorithms that locate and identify objects in various real-world scenarios. - Evaluate all performer autonomous algorithms through a series of experiments.			
Accomplishments/Planned Programs Subtotals	6.886	3.503	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 Specific programmatic performance metrics are listed above in the program accomplishments and plans section.

Exhibit R-2A, **RDT&E Project Justification:** PB 2015 Defense Advanced Research Projects Agency | **Date:** March 2014

Appropriation/Budget Activity 0400 / 2	R-1 Program Element (Number/Name) PE 0602304E / COGNITIVE COMPUTING SYSTEMS	Project (Number/Name) COG-03 / COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES

COST ($ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
COG-03: COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES	-	20.652	12.827	-	-	-	-	-	-	-	-	-

^{# The FY 2015 OCO Request will be submitted at a later date.}
The FY 2015 OCO Request will be submitted at a later date.

A. Mission Description and Budget Item Justification

The Collective Cognitive Systems and Interfaces project will dramatically improve warfighter and commander effectiveness and productivity using advanced cognitive approaches that enable faster, better informed, and more highly coordinated actions than those of our enemies. This will be accomplished by developing revolutionary methods that increase our information processing capabilities, enhance our situational awareness, and enable more cohesive group action by our forces. Critical technical areas addressed in this project include automated decision support, information sharing, ensured communications, and advanced informatics.

B. Accomplishments/Planned Programs ($ in Millions)

	FY 2013	FY 2014	FY 2015
Title: Transformative Apps	20.652	12.827	-

Description: Transformative Apps is creating the information infrastructure required to enable mission support and tactical applications (apps) to meet the efficiency, security, and availability requirements for use on mobile military networks. Of particular importance is development of a new data synchronization architecture between the handhelds and the backend computing/ storage nodes. Additionally, appropriate middleware services and libraries are being developed to facilitate shared capabilities such as map viewing, apps management, and collection of logs, usage statistics, and user feedback. Apps, together with handhelds and networks, are tested in different training environments as well as in deployed environments. Performance and usage are carefully tracked and user feedback collected to guide rapid enhancement of apps. The effort is creating a military apps development community by reaching out to non-traditional performers and will explore new models for software acquisition based on end-user empowerment.

FY 2013 Accomplishments:
- Integrated and tested with military tactical radio networks.
- Demonstrated interoperability with Army systems on mounted platforms.
- Developed the apps certification process and deployed to Army users.
- Expanded apps library and initiated transition to program of record.

FY 2014 Plans:
- Demonstrate full interoperability across hybrid network topologies in a range of operationally relevant contexts.
- Refine decentralized imagery processing and dissemination methods for below-brigade users.

Exhibit R-2A, RDT&E Project Justification: PB 2015 Defense Advanced Research Projects Agency		Date: March 2014
Appropriation/Budget Activity 0400 *I* 2	**R-1 Program Element (Number/Name)** PE 0602304E *I COGNITIVE COMPUTING SYSTEMS*	**Project (Number/Name)** COG-03 *I COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2013	FY 2014	FY 2015
- Investigate enhanced counter-IED and situational awareness apps for training and CONUS exercises.			
Accomplishments/Planned Programs Subtotals	20.652	12.827	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 Specific programmatic performance metrics are listed above in the program accomplishments and plans section.