

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Defense Advanced Research Projects Agency	DATE: April 2013
--	-------------------------

APPROPRIATION/BUDGET ACTIVITY					R-1 ITEM NOMENCLATURE							
0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 2: <i>Applied Research</i>					PE 0602304E: <i>COGNITIVE COMPUTING SYSTEMS</i>							
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013[#]	FY 2014 Base	FY 2014 OCO ^{##}	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
Total Program Element	-	46.020	30.424	16.330	-	16.330	0.000	0.000	0.000	0.000	Continuing	Continuing
COG-02: <i>COGNITIVE COMPUTING</i>	-	11.360	9.542	3.503	-	3.503	0.000	0.000	0.000	0.000	Continuing	Continuing
COG-03: <i>COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES</i>	-	34.660	20.882	12.827	-	12.827	0.000	0.000	0.000	0.000	Continuing	Continuing

[#] FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

^{##} The FY 2014 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.

UNCLASSIFIED

Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Defense Advanced Research Projects Agency	DATE: April 2013
--	-------------------------

APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602304E: <i>COGNITIVE COMPUTING SYSTEMS</i>
--	---

B. Program Change Summary (\$ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	49.365	30.424	24.405	-	24.405
Current President's Budget	46.020	30.424	16.330	-	16.330
Total Adjustments	-3.345	0.000	-8.075	-	-8.075
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-2.000	0.000			
• SBIR/STTR Transfer	-1.345	0.000			
• TotalOtherAdjustments	-	-	-8.075	-	-8.075

Change Summary Explanation

FY 2012: Decrease reflects reductions for the SBIR/STTR transfer and internal below threshold reprogrammings.

FY 2014: Decrease reflects completion of the Transformative Apps and Autonomous Robotic Manipulation Programs in FY 2014.

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Defense Advanced Research Projects Agency										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 0400: Research, Development, Test & Evaluation, Defense-Wide BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602304E: COGNITIVE COMPUTING SYSTEMS				PROJECT COG-02: COGNITIVE COMPUTING			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 [#]	FY 2014 Base	FY 2014 OCO ^{##}	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
COG-02: COGNITIVE COMPUTING	-	11.360	9.542	3.503	-	3.503	0.000	0.000	0.000	0.000	Continuing	Continuing
[#] FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 ^{##} The FY 2014 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 2012	FY 2013	FY 2014
Title: Autonomous Robotic Manipulation (ARM) 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 2012 Accomplishments: - Developed a bi-manual manipulator platform by adding a second arm to the existing manipulator system, and demonstrated operation within a larger workspace and handling of articulated objects such as pliers and scissors. - Developed algorithms that enable head tracking of the task objects to accelerate completion time and increase robustness to change. FY 2013 Plans:										11.360	9.542	3.503

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Defense Advanced Research Projects Agency		DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602304E: <i>COGNITIVE COMPUTING SYSTEMS</i>	PROJECT COG-02: <i>COGNITIVE COMPUTING</i>
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013
<ul style="list-style-type: none"> - Develop and demonstrate algorithms for autonomous grasping of complex objects, such as the handle of an impact driver. - Develop and demonstrate algorithms for autonomous bimanual manipulation, such as zipping open a satchel bag and extracting an object. <p><i>FY 2014 Plans:</i></p> <ul style="list-style-type: none"> - Develop 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		11.360	9.542
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.			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Defense Advanced Research Projects Agency										DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 0400: Research, Development, Test & Evaluation, Defense-Wide BA 2: Applied Research					R-1 ITEM NOMENCLATURE PE 0602304E: COGNITIVE COMPUTING SYSTEMS				PROJECT COG-03: COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES			
COST (\$ in Millions)	All Prior Years	FY 2012	FY 2013 [#]	FY 2014 Base	FY 2014 OCO ^{##}	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
COG-03: COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES	-	34.660	20.882	12.827	-	12.827	0.000	0.000	0.000	0.000	Continuing	Continuing
[#] FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012 ^{##} The FY 2014 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. The suite of programs under this project will significantly advance the military's ability to successfully deal with complex situations in operational environments.												
B. Accomplishments/Planned Programs (\$ in Millions)										FY 2012	FY 2013	FY 2014
Title: Transformative Apps										19.471	20.882	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 2012 Accomplishments:												
- Expanded operational trial in theater to 2,300 users with operational requests for more units.												
- Conducted evaluation with secure network infrastructure and demonstrated interoperability with military-grade encryption.												
- Enhanced middleware and services for apps.												
- Demonstrated apps code screening and vetting processes.												
- Developed tools enabling non-experts to create apps on smartphone platforms.												
FY 2013 Plans:												

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Defense Advanced Research Projects Agency		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 0400: Research, Development, Test & Evaluation, Defense-Wide BA 2: Applied Research	R-1 ITEM NOMENCLATURE PE 0602304E: COGNITIVE COMPUTING SYSTEMS	PROJECT COG-03: COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2012	FY 2013	FY 2014
<ul style="list-style-type: none">- Integrate and test with military tactical radio networks.- Demonstrate interoperability with Army systems on mounted platforms.- Develop the apps certification process and deploy to Army users.- Expand apps library and initiate transition to program of record. <p>FY 2014 Plans:</p> <ul style="list-style-type: none">- Demonstrate full interoperability across dismounted, mounted, and tactical ops center users.- Demonstrate training app suite for CONUS users.- Enhance situational awareness apps for use in CONUS exercises.				
<p>Title: Detection and Computational Analysis of Psychological Signals (DCAPS) - Medical</p> <p>Description: The Detection and Computational Analysis of Psychological Signals (DCAPS) program is developing automated information systems that identify group and individual trends indicative of post-traumatic stress disorder (PTSD) and traumatic brain injury (TBI) and anomaly detection algorithms that identify emerging physical and psychological crises. These will complement commercial offerings that have not focused on issues specific to the warfighter. DCAPS recognizes that security and privacy are critical to user acceptance and Health Insurance Portability and Accountability Act compliance and so incorporates strong authentication and other security mechanisms as needed to protect patient data. The program is also developing partnerships with key DoD organizations working in this area, including the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, the Defense Medical Research and Development Program, the Army Telemedicine & Advanced Technologies Research Center, and the National Center for TeleHealth and Technology. This effort is funded in PE 0602115E, Biomedical Technology beginning in FY 2013.</p> <p>FY 2012 Accomplishments:</p> <ul style="list-style-type: none">- Completed development of a mobile device psychological health application with integrated privacy safeguards.- Developed additional psychological telehealth applications that integrate multiple psychological health indicators such as so-called "honest signals".- Developed plans for user trials of mobile psychological health and telehealth applications in coordination with transition partners.		8.189	0.000	0.000
<p>Title: Graph Understanding and Analysis for Rapid Detection - Deployed On the Ground (GUARD DOG)</p> <p>Description: The Graph Understanding and Analysis for Rapid Detection - Deployed On the Ground (GUARD DOG) program developed an integrated system to provide real-time data collection and analysis of patrol-based civilian interviews and field observations to facilitate understanding of the local and regional political, social, economic, and infrastructure situation in which U.S. forces are deployed. GUARD DOG consisted of two segments: a handheld/portable digital assistant to support dismounted soldiers patrolling neighborhoods and villages; and a laptop/desktop computer system that integrates data from multiple patrols and supports battalion/brigade-level analysts. GUARD DOG provided automated support for the collect-update-analyze-prioritize</p>		7.000	0.000	0.000

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2014 Defense Advanced Research Projects Agency		DATE: April 2013		
APPROPRIATION/BUDGET ACTIVITY 0400: <i>Research, Development, Test & Evaluation, Defense-Wide</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602304E: <i>COGNITIVE COMPUTING SYSTEMS</i>	PROJECT COG-03: <i>COLLECTIVE COGNITIVE SYSTEMS AND INTERFACES</i>		
B. Accomplishments/Planned Programs (\$ in Millions) process by supporting data collection and advanced analytics to evaluate the current local/regional situation, identify gaps in the knowledge base, and generate information requirements. <i>FY 2012 Accomplishments:</i> - Enhanced algorithms to address uncertain and dynamic data. - Expanded architecture to support multiple distributed users, as well as disconnected operations. - Evaluated system on real-world data and problems.		FY 2012	FY 2013	FY 2014
Accomplishments/Planned Programs Subtotals		34.660	20.882	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.				