Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	42.208	30.446	21.042	0.000	21.042	20.001	20.459	20.887	21.312	0	197.397
H70: *HUMAN FACT ENG SYS DEV*	17.290	18.508	21.042	0.000	21.042	20.001	20.459	20.887	21.312	Continuing	Continuing
J21: *HUMAN FACTORS APPLIED RESEARCH CA*	24.918	11.938	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this program element (PE) is applied research on aspects of human factors engineering that impact the capabilities of individual and teams of Soldiers operating in complex, dynamic environments. The results of the research will enable maximizing the effectiveness of Soldiers and their equipment for mission success. The aspects of human factors that will be studied include sensing, perceptual and cognitive processes, ergonomics, biomechanics and the tools and methodologies required to manage interaction within these areas and within the Soldiers' combat environment. Research is focused on decision-making; human robotic interaction; crew station design; improving Soldier performance under stressful conditions such as time pressure, information overload, information uncertainty, fatigue, on-the-move and geographic dispersion; and enhancing human performance modeling tools (project H70). Project J21 funds congressional special interest items.Work in this PE is related to, and fully coordinated with, efforts in PE 0602601A (Combat Vehicle and Automotive Advanced Technology), PE 0602786A (Warfighter Technology), PE 0602120A (Sensors and Electronic Survivability), PE 0602784A (Military Engineering Technology), PE 0602783A (Computer and Software Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0602785 (Manpower/Personnel/Training Technology), PE 0603005A (Combat Vehicle and Automotive Technology), PE 0603710A (Night Vision Advanced Technology), PE 0603015A (Next Generation Training and Simulation), and PE 0603007A (Manpower, Personnel, and Training Advanced Technology). The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work in this project is performed by the Army Research Laboratory (ARL), Aberdeen Proving Ground, MD.

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	42.208	18.605	19.254	0.000	19.254
Current President's Budget	42.208	30.446	21.042	0.000	21.042
Total Adjustments	0.000	11.841	1.788	0.000	1.788
• Congressional General Reductions		-0.159			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		12.000			
• Congressional Directed Transfers					
• Reprogrammings	0.698	0.000			
• SBIR/STTR Transfer	-0.698	0.000			
• Adjustments to Budget Years	0.000	0.000	1.788	0.000	1.788

Change Summary Explanation

FY10 Congressional directed increases.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H70: *HUMAN FACT ENG SYS DEV*	17.290	18.508	21.042	0.000	21.042	20.001	20.459	20.887	21.312	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is applied research on human factors to maximize the effectiveness of Soldiers in concert with their equipment. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks, and Soldier training and manpower requirements to improve equipment operation and maintenance. Application of this research will yield reduced workload, fewer errors, enhanced Soldier protection, user acceptance, and allows the Soldier to extract the maximum performance from the equipment. Major efforts in this project include research to identify sources of stress, potential stress moderators, intervention methods, adaptive learning, and supporting information technology to reduce uncertainty and improve decision quality for leaders and teams engaged in Command and Control (C2) planning and execution; enhancement of human performance modeling tools to optimize Soldier machine interactions and the collection of empirical data on human perception (vision and hearing) to support the development and validation of human and system performance models; investigations on the effects on Soldier performance from integration of advanced concepts in crew stations designs; identification, assessment, and mitigation of the effects of vehicle motion on Soldier performance; investigations to determine interface design solutions for brigade combat teams (BCT) information systems that enhance situational understanding and decision cycle performance; identification and quantification of human performance measures and methods to address future warrior performance issues; and improvement of human robotic interaction (HRI) in a full mission context.Work in this project is conducted in cooperation with the Tank Automotive Research, Development, and Engineering Center (TARDEC); Natick Soldier Research, Development, and Engineering Center (NSRDEC); Communications-Electronics Research, Development, and Engineering Center (CERDEC); Simulation and Training Technology Center (STTC); Engineer Research and Development Center (ERDC); Army Research Institute for the Behavioral and Social Sciences (ARI); and Army Materiel Systems Analysis Activity (AMSAA).The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work is performed by the Army Research Laboratory (ARL), Aberdeen, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	3.855	4.479	5.003	0.000	5.003
Adaptive Learning: Identify sources of usability deficiencies and mismatches between Soldier capabilities and technological advances and provide tools to enable adaptive learning, reduce uncertainty, and increase situational awareness to improve decision quality for leaders and teams engaged in C2 planning and execution. In FY09, determined methods to identify and monitor neural and behavioral markers of pending performance drops; considered correlations such as fatigue and system reliability issues. Incorporated these methods into the					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
cognitive fight-ability model-based evaluation tool for use within the acquisition and system design process as a candidate information system to recommend design modifications before prototypes are developed. In FY10, assess performance of Soldiers executing multiple tasks simultaneously when using integrated technologies under differing conditions of task priority. In FY11, will develop a Soldier-organization-information modeling capability for use in real-time military simulation exercises. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Human Performance Modeling: Enhance human performance modeling tools to optimize Soldier machine interactions. Collect empirical data on human perception (vision and hearing) to support human and system performance models. In FY09, verified and distributed linked basic task, cognitive and human motion models to the human systems integration community and platform developers; validated approach to modeling body size increase due to clothing; transitioned data to Army Night Vision and Electronic Sensors Directorate to verify metrics for the evaluation of algorithms for fusing imagery from multiple-waveband sensors.In FY10, link manpower and personnel tradeoff tools such as Improved Performance Research Integration Tool (IMPRINT) with Army/DoD personnel cost tools; develop tradeoff tool for multimodal interface design; evaluate the use of head-mounted displays for sniper localization; quantify differences in human spatial vision sensitivity from	2.574	3.031	3.678	0.000	3.678

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
fixation to 30 degrees for incorporation into ACQUIRE target acquisition model simulations. Conduct a series of human-observer studies to characterize the situational-awareness benefits of various dynamic-range algorithms and devices. In FY11, will verify networked, collaborative versions of select Soldier centered design tools; compare spatial vision, color vision and motion sensitivity in three discrete retinal regions and translate those data for use in the ACQUIRE model. Conduct human-observer studies to examine human perceptual performance with prototype low-light cameras, monochrome displays, and objective-lens optics fabricated for: on-chip processing, high-speed video transmission, high resolution, high dynamic range and no-focus digital filtering/closed loop control. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Vehicle Mobility Systems: Develop and integrate intelligent, indirect-vision-based vehicle mobility; advanced crew stations; 360/90 degree situational awareness systems; crew and dismount scalable interfaces; and neurophysiologically- and behavior-based technologies. Implement guidelines for: sensor and data handling; algorithms for characterizing Soldier brain activity in operational contexts; real-time techniques to integrate neurally-based information into systems designs. In FY09, determined Soldier machine interface design recommendations to enable the local area security function and the optimization of performance in mixed	2.240	3.717	4.281	0.000	4.281

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
autonomous driving environments. In FY10, devise and conduct an evaluation focused on indirect vision driving and local area security workload; devise guidelines for noise-reduction and cognitive state classification algorithms; advance multi-aspect measurement of Soldier, system, and environment. In FY11, will devise potential designs to enable secure mobility with reduced manning, indirect vision and drive-by-wire systems; will devise techniques for using real-time knowledge of Soldier neuro-cognitive state in optimizing Soldier-system performance; will devise guidelines for Soldier state-based crew station design. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Improved Man-Machine Interfaces: Investigate and determine interface design solutions for maneuver team information systems that enhance situational understanding and decision cycle performance. Identify, mature, and quantify human performance measures and methods to address future warrior performance issues. In FY09, explored advanced technologies to identify improvements in dismounted squad performance; and transitioned the small arms shooter model to the Soldier Program Executive Office. In FY10, examine the effects of information content and information display on individual and team performance in an operational setting. Conduct research to identify assault rifle and optic characteristics that would improve Soldier reflexive firing performance. In FY11,	4.821	4.882	5.574	0.000	5.574

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
will examine the effects of information management and information flow on individual Soldier performance and team performance in an operational environment. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 Human-Robotic Interaction (HRI): Develop requirements and technologies for supervision and Soldier intervention for multiple semi-autonomous unmanned vehicles (UVs) in an urban environment. In FY09, devised multimodal and performance based adaptive automation interfaces to control multiple, non-heterogeneous, aerial, and ground robotic systems. In FY10, devise intuitive interface designs for supervising multiple assets; conduct baseline field evaluation for safe robotic operations in urban environments; collect Soldier performance data for marsupial small unattended ground vehicle missions at Ft. Benning. In FY11, will simulate supervisory control using ground and aerial UVs for multiple perspectives for robotic missions. Will perform Soldier robotic controller interface evaluations in realistic venues. *FY 2009 Accomplishments:* FY 2009	3.800	2.358	2.506	0.000	2.506

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 SBIR/STTR *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.041	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	17.290	18.508	21.042	0.000	21.042

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT H70: *HUMAN FACT ENG SYS DEV*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT J21: *HUMAN FACTORS APPLIED RESEARCH CA*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
J21: *HUMAN FACTORS APPLIED RESEARCH CA*	24.918	11.938	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Human Factors applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	24.918	11.938	0.000	0.000	0.000
Leonard Wood Institute (LWI) Training-Based Collaborative Research. In FY09, this Congressional Interest Item focused on training-related needs at Fort Leonard Wood and Maneuver Support Center (MANSCEN) to increase the pool of organizations that can support MANSCEN in the future, build competence for future MANSCEN collaboration, and bring technology-related deliverables not tied directly to a program manager or program executive office.					
FY 2009 Accomplishments: FY 2009					
FY 2010 Plans: FY 2010					
Base FY 2011 Plans: FY 2011 Base					
OCO FY 2011 Plans: FY 2011 OCO					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602716A: *HUMAN FACTORS ENGINEERING TECHNOLOGY*	PROJECT J21: *HUMAN FACTORS APPLIED RESEARCH CA*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Accomplishments/Planned Programs Subtotals	24.918	11.938	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.