Proposal Title: Convergence Accelerator Phase I (RAISE): Learning Environments with Advanced Robotics for Next-generation Emergency Responders (LEARNER)
Institution: Virginia Polytechnic Institute and State University
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The NSF Convergence Accelerator supports team-based, multidisciplinary efforts that address challenges of national importance and show potential for deliverables in the near future.

The broader impact/potential benefit of this Convergence Accelerator Phase I project is to generate technology-based solutions that can support and augment the performance and safety of emergency response (ER) personnel. Academic researchers, core-technology developers, stakeholders and an advisory board constituted of leaders from industry and government will come together to assess opportunities and challenges related to the use of human augmentation technologies that can transform the process of foundational, use-inspired solution-finding for ER work, and in a way that is transferable to other work contexts as well. This will involve the development of technology prototypes including semi-autonomous ground robots, wearable robots (powered exoskeletons) and augmented reality interfaces tailored for ER work; and building and evaluating a mixed-reality learning environment with physical, augmented, and virtual reality components, for users to learn to work effectively with multiple augmentation technologies. Our effort will also contribute to better conceptualization of convergence research and serve as a model for other research communities that can benefit from working across traditional disciplinary boundaries in engineering and computer science. We will share our methods, learnings and findings with the ER community and the wider world through an open-source knowledge sharing platform and appropriate dissemination channels.

This Convergence Accelerator Phase I project will significantly advance ER operations and training through the development and prototyping of an adaptive, personalized mixed-reality learning platform that enables integrating advanced technologies for human augmentation in ER work, and the creation of principled human-robot team strategies. Our work will substantially advance the knowledge and state-of-the-art in exoskeleton control, human-robot interaction, and human-computer interaction through use-inspired technology design and development of adaptive human-in-the-loop control to facilitate learning. Furthermore, an opportunity to field these technologies and develop effective learning platforms has significant transformative potential as semi-autonomous ground robots, exoskeletons and AR will enable users to formulate fundamentally new work strategies at the individual and team levels that are only afforded by their newly extended physical and perceptual capabilities. Finally, our work will advance learning by creating a replicable platform that increases the speed for the integration of innovative and emerging technologies for training future worker. Our transdisciplinary approach combines and enhances the existing knowledge from the disciplines of learning science, computer science, virtual and augmented realities, human factors, cognitive psychology, and systems engineering to create a framework

that integrates training course design, innovative and emerging technology implementation, and new techniques of work.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.