Blast Exposure Analysis

Warrior Health Avatar Technology

Personalized medicine has the potential to create customized healthcare with medical decisions and treatments tailored to the individual patient. In the last few years remarkable progress has been achieved in personalized medicine, wearable physiological and activity sensors, mobile computing, bioinformatics, and computational medicine; however, there remain few objective measures of the health status of a deployed Service Member. Furthermore, in spite of significant progress in wearable, non-invasive biomedical sensor technology, which can collect large amounts of physiological, physical activity, and environmental data, there are limited established methods to utilize this data in a predictive fashion. Therefore, there is great interest in developing technology that can be used in the field to noninvasively measure current health status and also predict future changes in the health status of an individual. To begin to address these concerns, the Department of Defense (DoD) Small Business Innovation Research (SBIR) program funded three Phase I projects in response to the FY16 topic "Warrior Health Avatar."

1. **Vigilant Cyber Systems Inc.** received funding for the Phase I SBIR project titled "Vigilant Warrior Health Avatar." The goal of this project is to develop a simulation framework and physiology based modeling tools of a Service Member's body that could enable definitive assessment of health status, physical and physiological performance, as well as physiological responses to various injuries including blast waves, ballistics, and blunt impacts. The system will collect physiological data from wearable sensors and convert this information into audio and visual representations of the health status of the individual. The simulation framework and user interface will be designed to be intuitive and easy to interpret. Because of their complexity, the models and software tools will first be developed on conventional computers with the ultimate goal to transition to mobile computing platforms. The initial stages of the project will focus on formulating and designing the simulation framework, its key functionalities, main components, communication with wearable sensors, and the user interface. The Vigilant Warrior Health Avatar System will enable Service Members to assess their own health status, permit medics and command leadership to assess individual and unit health status, and allow scientists to study the health of Service Members to improve models of Service Members' health.

2. **CFD Research Corporation Inc. (CFDRC)** received funding for the Phase I SBIR project titled "Personalized Warrior Health Avatar." The goal of this project is to design, develop, demonstrate, and deploy the "Warrior Health Avatar," a simulation framework and physiology based modeling tool of a human body that enables a definitive assessment of the individual's current health status, physical and physiological performance, and possible injury trajectory. The Warrior Health Avatar will be developed as a user friendly, personalized "App" on mobile platforms that collects and visualizes data obtained from wearable monitoring sensor systems for use by Service Members, Veterans, and medics as well as engineers and scientists involved in Service Member protection and combat casualty care. The

platform will enable the user friendly setup of an individual's body anthropometric parameters and basic physiological vitals. Existing computational modelling tools will be used to create quick and interactive simulations of human physiological responses to common environmental stressors, physical activities, and injuries. Overall, capabilities such as the Warrior Health Avatar will help the DoD reduce healthcare costs, encourage a proactive role in an individual's health, and ensure Service Members' fitness.

3. **Chimaera Science, LLC** received funding for the Phase I SBIR project titled "Warrior Shadow: Holographic Health Avatar for Predictive & Preventative Medicine." The purpose of this project is to develop a demonstration-grade prototype of a modeling and simulation tool that translates raw physiological data into a visual, holographic representation that can be experienced via mixed reality. This tool will combine physiological data derived from wearable, biometric sensor technology with personalized characteristics such as past health records in order to develop individualized predictions of responses to common battlefield injuries and outcomes of specific medical treatments. This integration of physiological measurements and personal characteristics with information visualization and predictive modeling and simulation technologies can be leveraged to support immediate care on the battlefield as well as long-term predictive and preventative medical interventions.