Wright State University's Human Centered Research Involving Uninhabited Vehicles in Military-Focused Domains

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The command and control of remotely operated vehicles (ROV), to include unmanned aerial vehicles (UAV), requires significant human interaction. In this presentation we discuss the past, present, and planned future research within the Department of Biomedical, Industrial, & Human Factors Engineering specifically focused on human factors issues with the ROV domain in general and the UAV domain specifically. We first cover work supported by the Air Force Research Laboratory and the Ohio Board of Regents to develop a model-based approach to support human-centered automation in the command and control of remotely operated vehicles. Models were applied to the design, implementation, and evaluation of multi-modal high fidelity interfaces featuring different levels of coordination between human operators and intelligent agents in remote vehicles operated under prototypical scenarios. The first phase of this research focused on the development of a computational architecture used to rapidly emulate characteristics of the UAV domain. The second phase focused on the research and development of a unmanned combat aerial vehicle (UCAV) control station interface and simulation for controlling multiple UCAVs under a Suppression of Enemy Air Defenses (SEAD) mission. A third inter-related phase included control/coordination studies involving empirical evaluation of the effectiveness of decision aiding and levels of automation. We then cover past and present work in the area of optimization-based planning in support of UAV operations sponsored by the Air Force Unmanned Aerial Vehicle Battlelab. The development of a UAV mission routing architecture is overviewed, and its underlying algorithmic architecture is discussed and ongoing research incorporating human-based decision making into the optimization process is proposed. Finally, we will discuss the research directions we are taking for the future under the auspices of the Air Force Office of Scientific Research and the Air Force Research Laboratory. These efforts include plans for an expanded generic architecture for examining human-based issues in the control and coordination of ROVs as well as swarms of UAVs. This architecture will include facilities for rapid interface development supporting multiple human-computer interface requirements. For instance, such interfaces will support human-control studies as well as analytical studies into virtual UAV coordination algorithms or advanced UAV routing algorithms. An emerging area of interest will be examining the emergent network-versus-network warfare that will arise as the defense establishment starts to realize the systems-of-systems approach to modern warfare.