UAV Crew Systems Research at Ft. Huachuca

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Future Combat Systems (FCS) and Objective Force Warrior programs (OFW) entail a greater emphasis on unmanned systems (UMS) at every echelon for future US Army force structures. These systems promise improved battle space sensing, force multiplication, and greater human survivability. However, these systems will not be introduced without cost. In the worst case, because of increased demands on the operator they may increase workload, reduce overall situation awareness, and result in unacceptable system losses. This paper will summarize lessons learned from 10 years of crew systems related research conducted by researchers at Ft. Huachuca and discuss their implications in terms of the future force. Two soldier-in-the-loop simulation studies conducted at Redstone Arsenal for 72-hour operational tempos indicated fatigue, human engineering, workload, and safety problems with various crew configurations for tactical unmanned aerial vehicles (UAV). In particular, single crew configurations with impoverished interfaces resulted in a number of simulated “crashes.” There were also some indications of circadian rhythm problems that although intermittent may have significant impact in combat (Barnes A Matz, 1998). Barnes, Knapp, Tillman, Walters, and Velicki (2000) used a variety of human engineering tools (Job Assessment Software System (JASS), Enhanced Computer Aided Testing (ECAT), and Micro Saint to address crew issues for future UAV systems. Data from 70 soldiers and experts from Ft. Huachuca Arizona, Fort Hood and Hondo Texas were collected as part of this effort. No evidence was found to support a requirement for rated aviators in future Army missions, but the use of cognitively oriented embedded training simulators was suggested aid novices to develop the cognitive skills evinced by experts. Additional imagery expertise for the UAV crews was suggested as well. In a follow on study, fatigue, circadian rhythm, and vigilance issues were examined using various Micro Saint modeling tools (Walters, Huber, French & Barnes, 2002). Twelve different crew configurations were examined for the Tactical Operations Center (TOC) an dthe Launch/Recovery Station (LRS), ranging in size from 8 to 15 crew members. The conclusions from executing the models and interviewing subject matter experts (using both 12 and 18 hour missions) indicate that reducing the number of Aerial Vehicle Operators (AVOs) and Mission Payload Operators (MPOs) in the TOC may result in (a) more aerial vehicle mishaps during emergencies, (b) an increase in the time it takes to search for targets, and (c) a decrease in the number of targets detected. For example, compared to six AVOs/MPOs in the TOC, adding two crew members resulted in only slight performance gains of a 6% increase in target detection and a 4% decrease in target search time; whereas, subtracting two crew members (four AVOs/MPOs in the TOC) resulted in substantive performance losses of 20% decrease in target detection and a 15% increase in target search time. Based on the trade-off study, crew size estimates were generated for combined operations of the LRS and TOC ground stations. The presentation will also review current UAV plans and discuss research implications for the future force.