DTIC Current Awareness: September 2003

Adler, L. E. (2002*). Impaired Auditory Sensory Gating: Effects of Long and Short Deployments on Army Combat Readiness.* Fitzsimmons, CO: Colorado University at Fitzsimmons – Aurora Health Sciences Center. (DTIC No. ADA416269)

http://handle.dtic.mil/100.2/ada416269

Abstract: We will evaluate whether objective neurophysiological parameters (brain wave recordings) can measure the impact of long (90 days or greater) and short (30-45 days) deployments on soldiers and assess correlations with military biological and psychological measures of performance under stress. Many combat casualties in the Persian Gulf War were attributed to friendly fire. We hypothesize that this tragedy was not due to inadequate training, but transient breakdown of information processing, especially sensory gating, which begins during the stress of deployment. This study will evaluate 120 soldiers responsible for crew-served weapons or army aviation, divided into three groups: long-deployers, short-deployers, and nondeployers with a non-invasive technique to assess brain neurophysiology/ auditory sensory gating. The non-deployers, matched by age and military occupational specialty (MOS), will serve as a comparison group for the deployers. P50 auditory sensory gating is a recently developed physiological measure of the brain's availability to screen out distracting stimuli. It correlates with the ability to maintain sustained attention and to make accurate decisions. We hypothesize, based on recent neurobiological investigations, that P50 auditory sensory gating will be transiently impaired upon re-deployment when compared to pre-deployment measures. We will examine the association of brain wave changes with performance measures, especially Threat Test-Identify Friend or Foe (Threat Test-IFF) and performance on neuropsychological measures of information processing currently in use by the FAA (CogScreen-AE). Biological measures of stress will include: plasma-free catecholamines, heart rate, blood pressure and respiratory rate. We will also assess associated anxiety and stress on a validated self-report scale (SCL-90-R).

Barrett, J. (2003). *Minimising Side Effects of Virtual Environments (Report No. DSTO-TN-0478).* Salisbury, Australia: Defence Science and Technology Organisation - Information Sciences Lab. (DTIC No. ADA415884)

http://handle.dtic.mil/100.2/ada415884

Abstract: For some individuals participation in virtual environments (VEs) can result in side effects, including symptoms of nausea, disorientation, postural instability or eyestrain. The incidence and severity of symptoms are influenced by a number

of factors related to the design of the VE, the task being performed, and the susceptibility of the participant. Thus taking these factors into account when designing the VE and tasks, and specifying what is required of participants, can reduce side effects. This report lists the relevant factors, and makes general recommendations to ensure that side effects in VEs are avoided or minimised. Particular consideration is given to the wide screen display of the Future Operations Centre Analysis Laboratory (FOCAL), where factors needing empirical investigation are identified.

Cheuvront, S. N., Carter, R. and Sawka, M. N. (2003). *Fluid Balance and Endurance Exercise Performance (Report No. M03-24).* Natick, MA: Army Research Institute of Environmental Medicine - Thermal and Mountain Medicine Division. (DTIC No. ADA416197)

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Abstract: Dehydration alters cardiovascular, thermoregulatory, central nervous system, and metabolic functions. One or more of these alterations will degrade endurance exercise performance when dehydration exceeds 2% of body weight. These performance decrements are accentuated by heat stress. To minimize the adverse consequences of body water deficits on endurance exercise performance, it is recommended that fluid intake be sufficient to minimize dehydration to < 2% of body weight loss. This can usually be achieved with fluid intakes of < 1 L-h-1.

Cymerman, A., Young, A. J., Francis, T. J. R., Wray, D. D. and Ditzler, D. T. (2002). *Subjective Symptoms and Postural Control During a Disabled Submarine Simulation.* Natick, MA: Army Research Institute of Environmental Medicine - Thermal and Mountain Medicine Division. (DTIC No. ADA416091)

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Abstract: To simulate conditions aboard a disabled submarine, seven submariners were confined for 5 days to a normobaric environment of 16.75% oxygen (O2), 2.5% carbon dioxide (CO2), 4 degrees C, and 85% relative humidity (RH). After 2 control days and 1 day of hypoxia, the remaining environmental conditions were imposed for the next 5 days, followed by 1 additional day of just hypoxia. Daily morning symptoms were assessed using the Environmental Symptoms Questionnaire (ESQ). Postural stability was determined on four occasions using a computerized balance system: control period, after 2.7 and 4.7 days of steady-state test conditions, and after 5.7 days (with return to normal ambient temperature, RH, and CO2). Three balance tests were performed with eyes open,

eyes closed, and as a dynamic test. Results show that postural stability deteriorated after 2.7 days (87% eyes open P<0.001, and 26% eyes closed P=0.01). ESQ symptom subsets for acute mountain sickness, exertion, fatigue, alertness, and ear/nose/throat were not significantly different. Cold symptom subsets were increased after 3-7 days (P<0.001), and distress and muscle discomfort subsets increased after 7 days (P=0.02). Continued exposure to the combination of cold and hypoxia elicited subjective symptom changes and disturbances in postural stability that are statistically significant. These observations may be of practical importance when tasks aboard a disabled submarine involve balance and mobility.

Doane, S. (2003). *New Measures of Complex Cognitive Abilities: Relating Memory Processes to Aviation Flight Situation Awareness Abilities.* Mississippi State, MS: Mississippi State University – Department of Psychology. (DTIC No. ADA416315)

http://handle.dtic.mil/100.2/ada416315

Abstract: The present research sought to develop new tests of cognitive abilities that would be related to later flight situation awareness (SA) performance, to relate the new measures to existing measures of cognitive ability, to examine the effects of pilot stress on the measures, and to give the measures to the Navy for further investigation as personnel classification tools. Year I funding out of the 3 applied for was granted, and stress studies were not performed. The role of working memory (WM) capacity and long-term working memory (LTWM) skill in complex task performance was examined as a function of expertise. WM Capacity scores for novices and experts did not differ, suggesting that individual differences in resources available to process and store information in WM are independent of acquired skills. Experts had higher LTWM skills, suggesting that experts have a better ability to encode domain specific information into and retrieve it from long-term memory rapidly. LTWM skill and WM capacity were not correlated, suggesting they are distinct constructs. WM capacity predicted novice control selection error whereas LTWM skill predicted expert SA task performance. Implications for theories of memory and pilot selection are discussed.

Manocha, D. (2003). *Accurate Boundary Evaluation and Interactive Display of Complex Datasets.* Chaple Hill, NC: North Carolina University at Chapel Hill – Department of Computer Science. (DTIC No. ADA415909)

http://handle.dtic.mil/100.2/ada415909

Abstract: We are addressing some fundamental research issues in modeling, display and simulation for computer-aided design and virtual environments. Our emphasis is to develop better algorithms and software systems and to demonstrate their applications. We are utilizing a number of techniques from algebraic geometry, approximation theory, computational geometry, numerical analysis, computer-aided geometric design and computer graphics to investigate the underlying mathematical concepts and to develop more efficient and robust geometric algorithms. This includes algorithms and systems for computing boundary representations of constructive solid geometry models composed of spline primitives and their Boolean combinations. We have developed novel algorithms for boundary computation, model simplification, fast display and interference detection. These include use of exact arithmetic for robust and accurate boundary computation, development of an interactive solid modeler using parallel algorithms and implementations, simplification with guaranteed error bounds for large polygonal models, occlusion culling, interactive display of large spline models and efficient collision detection between general polygonal models. The resulting algorithms and systems have been applied to a number of applications and the technology has been transferred to a number of research and DOD labs as well as commercial vendors We are addressing some fundamental research issues in modeling, display and simulation for computer-aided design and virtual environments. Our emphasis is to develop better algorithms and software systems and to demonstrate their applications. We are utilizing a number of techniques from algebraic geometry, approximation theory, computational geometry, numerical analysis, computer-aided geometric design and computer graphics to investigate the underlying mathematical concepts and to develop more efficient and robust geometric algorithms.

O'Donnell, A., Morgan, C. A., Jovanov, E., Andrasik, F. and Prevost, M. C. (2002). *The Warfighter's Stress Response: Telemetric and Noninvasive Assessment.* Pensacola, FL: Naval Aerospace Medical Research Lab. (DTIC No. ADA416090)

http://handle.dtic.mil/100.2/ada416090

Abstract: The authors' investigations into the effects of stressful military training have shown that individuals exhibiting superior performance differ significantly from individuals exhibiting poor performance in their psychological and biological responses to stress. Stress-hardy individuals retain mental focus and clarity of memory under stress, commit fewer errors during stress, experience less burnout, demonstrate better navigational skills, and are able to stay physiologically calmer during potentially life-threatening events and during uncontrollable stress. To ascertain individual differences in stress responses, they investigated the effects of stressful military training on physiological and cognitive functioning of armed forces members. Noninvasive saliva sampling was used to assess hormonal stress levels, and novel telemetric technology was

developed for untethered measurements of heart rate variability (HRV). Hormonal responses to stress were studied in Aviation Preflight Indoctrination (API) students reporting to the Naval Operational Medicine Institute (NOMI) in Pensacola, FL, for water survival training; Special Forces members and aircrew reporting to Brunswick Naval Air Station (NAS) and Ft. Bragg for Survival Resistance Evasion and Escape (SERE) training; and military members across the services reporting to the Combat Diver Qualification Course (CDQC) at Trumbo NAS, Key West, FL. They compare these physiological measures with training performance, cognitive performance, and measures of psychological stress. The results show that assessment of HRV provides a noninvasive means of evaluating the neural systems intimately involved in the capacity to attend to and respond to a threat. These findings linking HRV to cognitive performance robustly support the utility of HRV in the assessment of human performance. Due to Institutional Review Board delays no human subject data are available for this report. A 6-month extension has been requested.

Pinkus, A. R., Task, H. L., Dixon, S. A., Barbato, M. H. and Hausmann, M. A. (2003). *Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio.* Dayton, OH: Task Consulting. (DTIC No. ADA416335)

http://handle.dtic.mil/100.2/ada416335

Abstract: For over twenty years, the Crew System Interface Division (HEC; www.hec.afrl.af.mil) of the Air Force Research Laboratory (AFRL), located at Wright-Patterson Air Force Base OH, has advanced night vision technology. This technology includes investigations into visual acuity through night vision goggles (NVGs), night vision imaging system (NVIS) cockpit lighting compatibility, wide field-of-view night vision devices, NVG measurement methodologies, plus human factors and aircraft integration issues. This document is a compilation of the complete text of selected publications and reports produced by AFRL/HEC addressing these various areas of night vision technology. It also includes a listing of relevant patent abstracts and a bibliography of other Division publications related to night vision technology.

Retsky, M. (2002). *Testing a Display Device Invention for Digital Mammography Workstations.* Trumbull, CT: Electron Optics Development Corp LLC. (DTIC No. ADA415994)

http://handle.dtic.mil/100.2/ada415994

Abstract: Purpose: Investigator was to test an invention in electron optics that might allow development of a very high-resolution cathode ray tube (CRT) suitable for

digital mammography workstations. Scope: The invention solves a very old problem in electron optics and is patented. The invention allows deflection of a wide beam into large angles using electric fields with little or no acquired aberrations. Major findings: This project was successfully completed. The invention worked as predicted and results have been published in Journal Vacuum Science and Technology - B 20(6): 2678-81, Nov/Dec 2002. Results and Significance: While it is now technically possible to develop such a CRT display device1 a new flat panel display was announced by IBM that seems to fulfill the mammography application needs. Thus while this project was a technical success, this particular application has been fulfilled by another company's product. We are now looking for other applications where our technology can make a contribution. Fortunately, there are many opportunities ranging from electron beam lithography to isotope separation and mass spectrometry.

Smith, B. G. (2003). *Operator's Manual for the Ballistic Data Acquisition System (BDAS) (Report No. ARL-MR-0555).* Aberdeen Proving Ground, MD: Army Research Lab. (DTIC No. ADA416264)

http://handle.dtic.mil/100.2/ada416264

Abstract: The U.S. Army Research Laboratory (ARL) purchased hardware and software from National Instruments, Inc., to improve its existing data collection system in support of ballistic testing of military systems. The hardware and software have been configured with a personal computer to create a stand-alone, computer-controlled, data acquisition system with real-time data display. The data acquisition system is called "BDAS," an acronym for ballistic data acquisition system. The first priority was to establish a reliable capability that met ARL's existing and near future needs. ARL is already planning improvements for EDAS: 1) to add the capability to measure accelerometers and strain gauges, and 2) to move the instrumentation into the field to reduce the length of the signal cables. The purpose of this manual is to provide the intended user with a basic understanding of how to set up and use this system, not to document the actual software coding. This report describes how to use the EDAS software to properly configure the data collection channels, to create and calibrate probe files, to use the system to verify data channels and probes before testing, and to acquire and save test data.

Stanney, K. M., Graeber, D. and Milham, L. (2003). *SLEP VELCAC, IFE II Build Usability Evaluation Report.* Oviedo, FL: Design Interactive Inc. (DTIC No. ADA415915)

http://handle.dtic.mil/100.2/ada415915

Abstract: A usability evaluation of SLEP (Service Life Extension Plan) VELCAC (Virtual Environment Landing Craft Air Cushion) was undertaken at IFE II in San Antonio, TX in mid February of 2003. This evaluation focused on a SLEP VELCAC system that is currently under development, but had a functional Craftmaster/Operator station and a partially functional Engineer station; the Navigator's station was not interactive at the time of evaluation. The SLEP VELCAC system is designed to provide differences training for those certified LCAC (Landing Craft Air Cushion) crewmembers that are transitioning from the traditional LCAC to the SLEP LCAC. The system is also designed to allow mission rehearsal or practice flights to work on crew coordination, cockpit familiarization, rehearsal of select emergency procedures, and practice with craft features unique to the SLEP upgrade.