MANPRINT

U.S. ARMY MANPRINT PROGRAM

SPRING / SUMMER 2009

DIRECTOR'S CORNER

Dr. Michael Drillings, Director, MANPRINT

The next MANPRINT Practitioners' Workshop will be held on 23-24 March 2010 at the Double Tree Hotel on Army-Navy Drive in Arlington, Virginia, which is where we've held recent workshops. Please mark your calendars. A formal announcement will soon be issued, but I wanted to give you early notice so that you can begin to think of appropriate papers to submit and of nominations for MANPRINT awards.

...How will these changes affect MANPRINT and our community of scientists and analysts?...

Many of you are aware that here have been some large changes in the acquisition world. The prime example is the new DODI 5000.02. These changes were motivated by the widespread feeling within Congress and OSD that "acquisition was broken." A major cause of that perception was the record of significant cost overruns on many projects and because there is a tendency for requirements to grow during the acquisition process.

How will these changes affect MANPRINT and our community of scientists and analysts? As I reported in an earlier newsletter, overall, the changes are very much aligned with our goals. The use of HSI in acquisition is better supported with the new policy. In fact, I think that HSI will be more routinely applied at earlier points in the acquisition cycle. Because the policy encourages multiple prototypes, there may be more systems to assess and assist at earlier stages. The reforms are directed toward helping the government better track the progress of projects as they develop

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DOD SHOWCASES HSI ACTIVITIES

On 23 – 24 April 09, the Air Force, Army, Navy and Office of the Secretary of Defense joined together in a Joint Human Systems Integration (HSI) display at the Pentagon to showcase Human Systems Integration activities within the Department of Defense.

It has been demonstrated that when Human Systems Integration is applied early in the design and development phases of system acquisition, it increases the total system success across the life cycle. Each Service demonstrated how integration of the "human element" in the systems engineering process improves total systems performance and reduces life-cycle costs.

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CONTACTS

Articles, comments, and suggestions are welcomed and may be submitted to the manprint contractor:

MANPRINT NEWSLETTER

THOMAS ASSOCIATES INC., 1009 Butterworth Court, Stevensville, MD 21666; TEL (410) 643-2255, FAX (410) 643-0888, E-mail: DancasterC3@conus.army.mil; MANPRINT Web site: http://www.manprint.army.mil

POLICY

DEPARTMENT OF THE ARMY, G-1, ATTN: DAPE-MR, 300 Army Pentagon, Washington, DC 20310-0300; DSN 225-5853, COM (703) 695-5853

DIRECTORY OF DESIGN SUPPORT METHODS: Defense Technical Information Center, DTIC–A San Diego, NAS North Island, Box 357011, San Diego, CA 92135-7011; COM (619) 545-7384, E-mail: dticasd@dticam.dtic.mil; Web site: http://www.dtic.mil/dticasd/ddsm

MANPRINT DOMAIN POCs

HUMAN RESEARCH AND ENGINEERING DIRECTORATE: Michael Golden, AMSRD-ARL-HR (Bldg. 459) Room 138, Aberdeen Proving Ground, MD 21005-5425; TEL (410) 278-5865, DSN 298-5865, FAX (410) 298-9516, E-mail: , michael.golden@arl.army.mil; Hope E.J. Nesteruk, ARL-HRED Industrial Engineer, Assessment Team Lead; TEL (410) 278-5920, DSN 298-5920, FAX (410) 278-3988

SYSTEM SAFETY

DAC James Patton or DAC Graham Walker, Office of the Chief of Staff, Army Safety Office, ATTN: DACS-SF, 223 23rd Street, Room 980, Arlington, VA 22202; COM (703) 602-4458 or (703) 602-3660, DSN 322-4458 or 322-3660, FAX (703) 601-2417; E-mail: jim-patton@us.army.mil or Graham.Walker@hqda.army.mil

HEALTH HAZARDS

Dr. Timothy Kluchinsky, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), ATTN: CHB-TS-OHH, 5158 Blackhawk Road, Bldg. E1570, Aberdeen Proving Ground, MD 21010-5403; DSN 584-2925, COM (410) 436-2925, FAX (410) 436-1016; E-mail: timothy.kluchinsky@apg.amedd.army.mil

SOLDIER SURVIVABILITY

Mr. Richard Zigler, U.S. Army Research Laboratory, ATTN: AMSRD-ARL-SL-BE, Bldg. 328, Room 228, Aberdeen Proving Ground, MD 21005-5068; DSN 298-8625, COM (410) 278-8625, FAX (410) 278-9337; E-mail: rzigler@arl.army.mil

MANPRINT CENTRAL CONTACT INFORMATION

HQDA (DAPE-MR) 300 Army Pentagon, Washington, DC 20310-0300; Fax: (703) 695-6997, E-mail: MANPRINT@hqda.army.mil

E-MAIL	DSN	COMMERCIAL
Dr. Michael Drillings michael.drillings@us.army.mil	225-6761	703-695-6761
Dr. Beverly G. Knapp beverly.knapp@hqda.army.mil	225-6817	703-695-6817
L. Taylor Jones taylor.jones@hqda.army.mil	788-9558	256-842-9558
Teresa Hanson teresa.hanson1@us.army.mil	225-5853	703-695-5853
Dr. John Warner john.warner1@us.army.mil	225-5820	703-695-5820
Janine Bourgault (*Contractor*) janine.bourgault@us.army.mil	225-5848	703-695-5848

The MANPRINT Newsletter is an official bulletin of the Deputy Chief of Staff, G-1, Department of the Army. The Manpower and Personnel Integration (MANPRINT) Program (AR 602-2) is a comprehensive management and technical initiative to enhance human performance and reliability during weapons system and equipment design, development, and production. MANPRINT encompasses seven key domains: manpower, personnel, training, human factors engineering, system safety, health hazards, and soldier survivability. The focus of MANPRINT is to integrate technology, people, and force structure to meet mission objectives under all environmental conditions at the lowest possible life-cycle cost. Information contained in this bulletin covers policies, procedures, and other items of interest concerning the MANPRINT Program. Statements and opinions expressed are not necessarily those of the Department of the Army. This bulletin is prepared twice yearly under contract for the MANPRINT Directorate, G-1, under the provisions of AR 25-30 as a functional bulletin.

ROVATTS™ PREDATOR SIMULATOR SYSTEM

By Kathi MacLeod

711TH HUMAN PERFORMANCE WING
HUMAN PERFORMANCE INTEGRATION DIRECTORATE

REMOTELY OPERATED VEHICLE ADAPTABLE TRACKING/ TRAINING SYSTEM

The ROVATTS™ Predator simulator system, produced by SDS International, provides an affordable PC-based simulation capability with a reconfigurable architecture that allows the development of air-, ground-, or sea-based Unmanned Aerial Systems (UAS) simulations. The Predator simulator provides a realistic environment to support United States Air Force (USAF) research, individual/team training, and mission rehearsal applications.

711 HPW/HP

711 Human Performance Wing, Human Performance (HP) Integration Directorate

The HP Directorate's primary focus areas are human performance optimization and human performance sustainment through the application of Human Systems Integration (HSI). HP utilizes ROVATTS™ to support USAF research efforts to assess the unique physiological, psychological, and environmental stressors inherent in UAS operations.

The ROVATTS™ configuration utilized by HP includes both pilot and sensor operator stations that incorporate the following:

- *A high-fidelity MQ-1 aerodynamics package*
- *DIS/HLA connectivity*
- *various head-up displays (HUDs)*
- *functioning head-down displays*
- *electro-optical / infrared sensor imagery portrayed on high-fidelity terrain scenes provided by SDS AAcuityR PC-IG*
- *map-tracking displays*
- *record/playback capabilities*
- *data-capture/analysis capabilities*

ROVATTS™ allows the researcher to control the run-time simulation environment. Through an integrated Visual Basic scripting interface, system malfunctions, and special effects (such as marker smoke, wind, fog, and other environmental effects)

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DOD Showcases...
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Highlights of the Joint Human Systems Integration display

The Air Force Human Systems Integration Office/711th Human Performance Wing had its Remotely Operated Vehicle Adaptable Tracking/Training System (ROVATTS™) Predator simulator system available for visitors to operate. ROVATTS™ allows the researcher to control the run time simulation environment, collect human performance data and compare that data to known standards. These results help optimize human operation of remotely controlled vehicles.

(From left to right): Dr. Michael Drillings, Director, U.S. Army MANPRINT Program, G-1; Gen. William M. Fraser III, Vice Chief of Staff, U.S. Air Force; Charneta Samms, ARL, HRED

The Army G-1 MANPRINT Directorate and the US Army Research Lab (ARL) Human Research and Engineering Directorate (HRED) display featured the Improved Performance Research Integration Tool (IMPRINT). IMPRINT is a dynamic, stochastic, discrete event network modeling tool designed to help assess the interaction of the Warfighter and the materiel system. IMPRINT is used throughout the system acquisition process—from concept and design to field testing and system upgrades.

The Naval Human System Integration Office (N151)/SYSCOMs presented the Navy HSI Personnel Integration (NAVPRINT) policy, showing how requirements are identified and implemented in the Joint Capabilities Integration Development System (JCIDS) for DoD Acquisition. The Human Analysis Requirements Planning System (HARPS) was also demonstrated. HARPS is a web-based database and tool designed to track HSI requirements throughout the systems lifecycle. HSI Success stories from the DDG-1000, VA Class Submarine, E-2D, and GCCS-M systems were also displayed.

(From left to right): Charneta Samms, ARL, HRED; Lieutenant General Rochelle; Deputy Chief of Staff G-1, U.S. Army; Dr. Michael Drillings, Director for U.S. Army MANPRINT Program, G-1

ROVATTS™...

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may be introduced based on mission time and/or waypoint crossing information. HP data can be collected and compared to a known standard.

A review of UAS mishaps indicated that human-machine interface design and lack of crew- member situational awareness factors were frequent causes of crew-related errors. Landing mishaps resulting from nosewheel-first landings have been a frequent and recurrent problem.

The UAS crew consists of pilots and sensor operators operating from a Ground Control Station built into a single 30-foot trailer. Field operating units task the UAS crew to link imagery or real-time video back to the field units. Lack of visual reference to the outside world makes the Predator UAS inherently difficult to land given the constraints on, and limitations of, human perception.

Pilots currently use an egocentric ("local awareness") HUD symbology; however, studies identified the need for a new exocentric ("global awareness") UAS HUD symbology to compensate for current UAS pilot lack of visual reference to the outside world.

Researchers in HP successfully utilized ROVATTS™ to develop a prototype HUD symbology set to allow landings without visual reference to the outside world. The symbology set provides an integrated display of roll, pitch, yaw, airspeed, and height above touchdown as well as other pertinent information required for landing, to include localizer and glideslope deviation, runway distance, and landing-gear position in relation to the runway surface. The study demonstrated that it is feasible to develop a HUD symbology that enables pilots to land without visual reference to the outside world and without requiring modification to the system hardware—an example of optimizing human performance through HSI.

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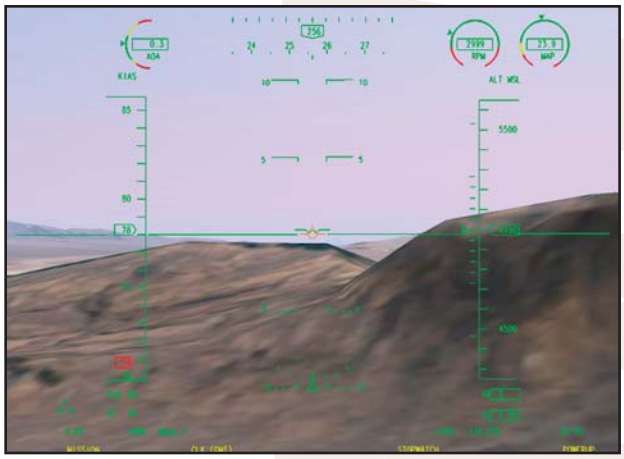
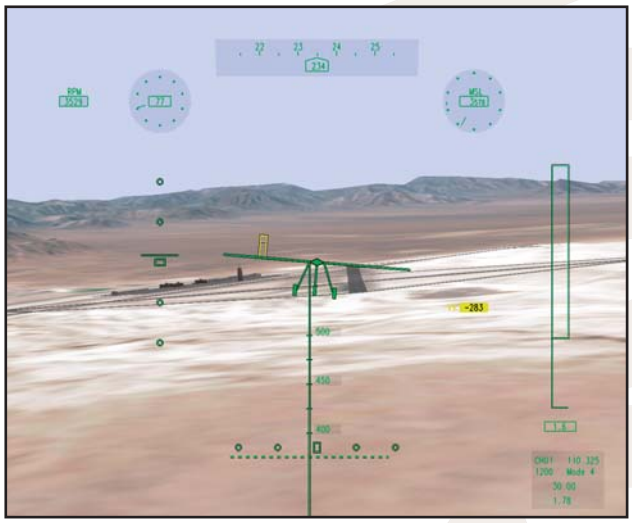
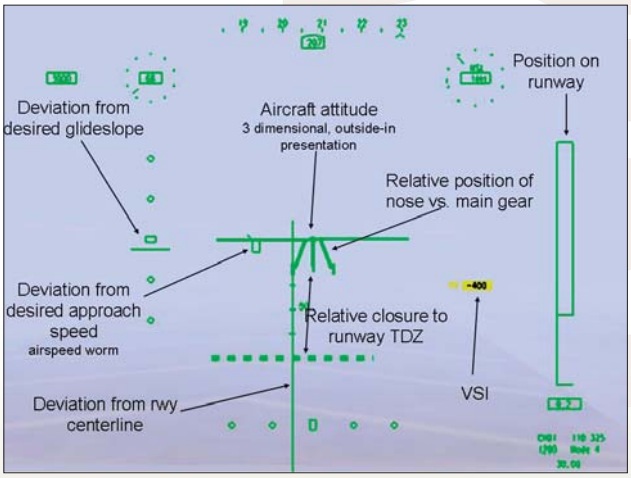


Egocentric ("local awareness") UAV HUD Symbology



Prototype Exocentric ("Global Awareness") HUD Symbology with Graphics Overlay



Prototype Exocentric HUD Symbology

AH-64D APACHE AIRCREW WORKLOAD DURING MANNED-UNMANNED (MUM) TEAMING

Jamison S. Hicks and David B. Durbin

U.S. Army Research Laboratory, Human Research and Engineering Directorate

Fort Rucker, AL

As Army Aviation begins to team Unmanned Aircraft Systems (UASs) with manned helicopters during missions, a significant MANPRINT concern has been: Can aircrews effectively employ UASs without experiencing excessive workload? This concern has been voiced at many levels within the Army because excessive workload can reduce mission effectiveness and survivability on the battlefield.

To address this concern, the U.S. Army Research Laboratory (USARL) Human Research and Engineering Directorate (HRED) worked with the AH-64D Apache Longbow Program Management Office (PMO) and the Training and Doctrine Command (TRADOC) Capabilities Manager Reconnaissance/Attack and conducted two assessments that evaluated Apache aircrew workload when they employed a UAS during missions. The assessments supported development of 1) AH-64D aircraft that have the capability to receive streaming video from UASs (and which were recently deployed to southwest Asia) and 2) AH-64D aircraft that will have the capability to receive streaming video from UASs and allow aircrews to control the UAS sensor and air vehicle.

The assessments were the first comprehensive AH-64D aircrew workload evaluations conducted for MUM teaming and consisted of operational missions conducted by trained aircrews in an AH-64D simulator. The missions were an air assault into a Southwest Asia urban environment and close combat operations against a light armored force. The aircrew used the UAS to aid in target detection and identification.

The missions were conducted according to established tactics, techniques and procedures and required the aircrew to employ the UAS by coordinating with a UAS operator on the ground. The UAS operator assisted the aircrew with area surveillance and targeting and handed over control of the UAS sensor and air vehicle to the aircrew at different times during the missions.

Eighteen pilots from the 3-101 Aviation Regiment, 1-10 Aviation Regiment, 21st Cavalry Brigade, Directorate of Evaluation and Standardization (Fort Rucker, AL), Forces Command (FORSCOM) HQ, and the AH-64D Apache Longbow PMO participated in the workload assessments. USARL HRED collected workload data using the Bedford Workload Rating Scale (BWRS); situational awareness (SA) data using the Situation Awareness Rating Technique (SART); crew coordination data by observation; crewstation interface data via a Pilot-Vehicle Interface (PVI) questionnaire; switch actuations by software data collection; simulator sickness information us-

Eye tracker, Pupil/Camera Monitors, and Control Panel Interface

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AH-64D Apache...
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ing a Simulator Sickness Questionnaire (SSQ); visual workload (gaze and dwell times) using a head-eye tracker; audio-video; and tactics, techniques and procedures data. Additionally, subject matter experts (SMEs) observed each mission and provided independent assessments of crew workload, crew SA, crew coordination and mission success.

MUM Teaming of an AH-64D and UAS

The results of the assessments were very similar. In both assessments, the pilots successfully completed their missions and reported that workload levels were acceptable. The workload ratings provided by the pilots and SMEs were lower than the workload ratings requirements contained in the AH-64D Capability Development Document (CDD). The CDD is the AH-64D requirements document and workload ratings were incorporated in the CDD as a MANPRINT metric.

While workload levels were acceptable, employing the UAS increased overall task workload for the aircrew. However, the SA provided by the UAS sensor decreased the workload required to detect and engage targets and decreased overall target engagement timelines. The increased SA was because of the "God's Eye" view that the UAS sensor video provided during the missions. This was an advantage over the shallow view provided by the onboard AH-64D sensor and which required the aircraft to be within "line of sight" of potential targets. The UAS sensor video also provided pilots with good SA early in the missions because they often received the UAS streaming video prior to or just after take-off of their aircraft. The early SA data allowed the aircrews to observe the route and target areas and make any needed tactical changes.

While aircrew workload was acceptable and the missions were successful, several MANPRINT issues were identified during the assessments. The issues included software interface problems (e.g., the need for improved UAS symbology) and hardware interface problems (e.g., the need for an improved data entry keyboard). USARL HRED worked with the AH-64D PMO to resolve the issues. To date, more than 30 MANPRINT-related issues have been addressed and resolved through the PMO's Integrated Product Team process. Resolution of these issues has helped reduce aircrew workload and improve system effectiveness.

MUM teaming will be a vital part of Army Aviation's success on future battlefields. The ability to provide increased situational awareness to aircrews without degrading their ability to operate the aircraft provides a tremendous capability to Army Aviation.

The workload assessments helped answer the question about whether aircrews will be able to effectively employ a UAS on the battlefield and resulted in several design enhancements to the aircrew interface. The AH-64D MANPRINT program will continue to ensure that MUM teaming addresses and optimizes the aircrew interface to enhance overall system effectiveness.

Directors Corner

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and better identify problems that are likely to cause growth both in programs and requirements. The goals of the reforms are to acquire systems faster, not by eliminating checks and assessments, but by augmenting the review process, so that fewer errors are made and less rework is needed.

One consequence of the new policy might be changes in how MANPRINT is performed. But the actual changes are as yet unclear, particularly with respect to whether policy changes will be required. Therefore, I intend to continue the staffing of the revised AR 602-2, MANPRINT, rather than delay it any longer.

As you are probably aware, the President's new budget has the effect of stopping the further development of FCS manned ground vehicles. Our community should be very proud of the excellent work that was done in support of FCS. Several contributions have been recognized at previous MANPRINT Practitioners' Workshops. Certainly, our work is one of the success stories within the overall FCS history. I am sure that we will use much of what we learned in other evolving and future systems.

ROVATTS™...

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Prototype exocentric HUD Symbology Prototype exocentric ("global awareness") HUD Symbology with graphics overlay.

The HP directorate also utilizes ROVATTS™ to clarify the application of HSI to address human performance capability gaps to students attending the USAF School of Aerospace Medicine.

Based upon the success of the currently fielded ROVATTS™ Predator Simulator, SDS was awarded a contract by the USAF to develop an MQ-9 Reaper version of its ROVATTS™ simulator line.

For more information about the 711 HPW/HP please call (210) 536-4457 or DSN 240-4457

Visit the 711 HPW Air Force Web site at ***http://www.wpafb.af.mil/afrl/711HPW/.***

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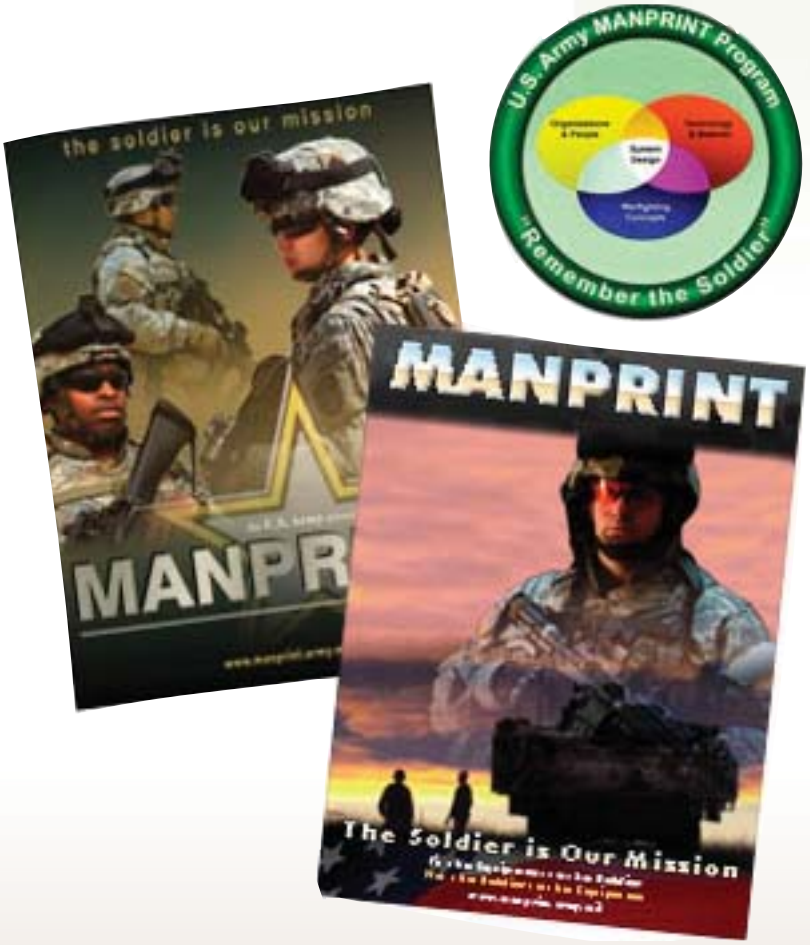

MANPRINT TRAINING

MANPRINT APPLICATIONS COURSES

Class	Start Date	End Date	Deadline	Location	POC
2009 - 708	15 Sep 2009	17 Sep 2009	31 Jul 2009	Redstone, Huntsville, AL	Pat Wilson COM (804) 765-4373, DSN 539-4373

MANPRINT FAMILIARIZATIONS COURSES

Date	Time	Location	POC
9 July 2009	9:30-12:30	Huntsville, AL	Connie Dancaster, DancasterC3@conus.army.mil
6 August 2009	9:30-12:30	Huntsville, AL	Connie Dancaster, DancasterC3@conus.army.mil

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AUSA ANNUAL MEETING & EXPOSITION
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www.ausa.org

12TH ANNUAL SYSTEMS ENGINEERING CONFERENCE
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From:

To: MANPRINT Newsletter
Thomas Associates Inc.
1009 Butterworth Court
Stevensville, MD 21666