



Human Systems Community of Interest (HS Col) Newsletter



Mar 2020

Senior Leader Perspective: The Human Systems Col continues to make progress on coordinating, integrating, and synchronizing the broad portfolio of research across the Department that ensures our warfighters maintain an unfair advantage in all domains. Many thanks to Dr. Zbylut and her team at Army Research Institute for the Behavioral and Social Sciences (ARI) for hosting the Steering Committee on March 2nd. It was a great opportunity to learn about ARI's impactful research portfolio and engage in much needed discussion on Col business.

This quarter, I'd like to highlight the critical role of Human Systems Integration (HSI) and contributions of HSI technical experts throughout the Research and Development enterprise. Warfare is an inherently human activity and the insights derived from Human Systems research are essential to ensuring our warfighting systems enable, enhance, and extend the capabilities of their human operators. This is particularly relevant as the Department advances and leverages machine learning capabilities across the Joint Force. The Joint Artificial Intelligence Center recognizes the importance of incorporating human-centered design principles in its AI products, and is seeking human factors engineers who are interested in detail assignments to help ensure consideration of human factors in all of their products.

Finally, I would like to put in a plug for the upcoming Human Factors Engineering (HFE) Technical Advisory Group (TAG) annual meeting. Established in 1976, the HFE TAG provides the only Federal forum for HFE professionals who are embedded throughout the Services to convene, communicate best practices, discuss challenges and gaps, and communicate to OUSD(R&E) Proponent HSI issues that can inform modifications to DoD policy or future research priorities. Scheduled for May, recent COVID-19 travel restrictions have postponed the event to 20-24 July at the Naval Surface Warfare Center (NSWC), Port Hueneme Division in California. The theme is, "Resilience 2020: Are we ready?". Members of NSWC's In-Service Engineering Agent (ISEA) of the Future Team will share how they align efforts to address human performance challenges among the Services and provide solutions to promote operational readiness and resilience. Online registration is open until April 24th. View at: <https://einvitations.afit.edu/inv/anim.cfm?i=496863&k=066844017D54>.

TAG leadership is ensuring success of the upcoming meeting. I commend the Chair, Dr. Tom Alicia, for his leadership on this year's meeting serving as the Operating Board and Executive Committee Chair and overseeing the formation of committees, SubTAGs, and Special Interest Groups. Ms. Marianne Paulsen, Vice Chair, has developed the agenda for the annual TAG meeting and identified and invited plenary speakers. Mr. John Plaga, Immediate Past Chair, continues to provide helpful advice and guidance. Finally, Dr. Liana Algarín, my liaison to the TAG Operating Board, has created an attendee survey targeted to improve each annual meeting and help us to highlight outcomes and success stories to senior OUSD (R&E) leadership. Questions about the DoD HFE TAG, please visit: <https://rt.cto.mil/ddre-rt/dd-rtl/hfetag/meetings/>.

Dr. Ben Petro, Director of Human Systems, HS Col OSD Chair



HUMAN SYSTEMS Col

<https://defenseinnovationmarketplace.dtic.mil/communities-of-interest/human-systems/>

Vision: Develop & deliver technologies to enable, sustain, enhance and quantify human performance for measurably improved mission effectiveness

Mission: Enhance mission effectiveness through: 1) Integrated simulations for mission training and experimentation, 2) Human-machine designs for mission effectiveness, 3) Assessment of operator effectiveness, 4) Operating through battlespace stresses, and 5) Mastering the PMESII battle space.

Key Products: Integrated service roadmaps; Col taxonomy, budget & programs; seedling and tri-service ARAP proposals, collaboration opportunities; success stories.

Feedback: Please send comments to our Newsletter Editor: Alan.Livada.ctr@us.af.mil

Key Personnel
OSD Chair: Dr. Ben Petro, USD (R&E)
COI Chair: Dr. Michelle Zbylut, ARI
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Air Force Lead: Dr. Kevin Geiss, AFRL
Army Lead: Dr. Corde Lane, ARL
Army Lead: Dr. Robb Wilcox, ARL
SOCOM Rep: Ms. Lisa Sanders, SOCOM
WG Chair: Dr. Kelly Ervin, ARI
PAE&T Lead: Dr. Kendy Vierling, USMC
SICP Lead: Dr. Mark Draper, AFRL
PSWP Leads: Dr. Peter Squire, ONR Dr. Mike LaFiandra, ARL



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Hails/Farewells & News

Hail - Dr. Frederick Gregory, International Program Manager, Human Dimension Acting Program Manager, Neurophysiology of Cognition Combat Capabilities Development Command (CCDC) Army Research Laboratory, Atlantic RAF Blenheim Crescent HA4 7HB United Kingdom. He'll be a welcome addition to the SICP sub area team.

Farewell - Steering Group member Dr. Patrick Baker is now Director of CCDC's Army Research Laboratory - congratulations and many thanks for your support to the Col!

News - A little dated, but we wanted to formally congratulate Dr. Ben Petro for becoming the OSD Chair to our Col back in late 2019. Dr. Petro has continued the practice of providing excellent insights to our community on OSD policy and taskers.

News - Congratulations to Dr. Mason as Chair of the new Biotechnology Col! We look forward to what should be many successful collaboration opportunities in the future. A write up on the new Col is included later in the newsletter.

Col Highlights - Past Events

Applied Research for the Advancement of S&T Priorities (ARAP) Call. Both the HS and Autonomy Cols submitted the same project as their candidate 2020 ARAP White Paper to OSD. The project, titled "Human and Autonomous System Teaming Ecosystem (HASTE)", unfortunately wasn't one of the 4 selected for further review. No specific date given for announcing the winner. POC: [Katie Smith Stilling, Strategic Analysis, kstilling@sainc.com](mailto:kstilling@sainc.com)

Reliance 21 Col Update. OSD held their 2020 S&T Strategic Overview on 28-30 Jan at DARPA. The S&T Executive Committee and Defense organizations with S&T funding were able to share information on programs and priorities and discuss the Department's S&T budget request and out-year investments. In addition, our Col Chair Dr. Michelle Zbylut delivered a very successful Annual Update briefing on our recent accomplishments and future direction. Key take-aways from senior leaders were there will be increased peer review for quality science, and with more requests for information regarding the use of foreign nationals in labs and academia we should expect greater visibility on this over the next year. POC: [Katie Smith Stilling, Strategic Analysis, Inc. kstilling@sainc.com](mailto:kstilling@sainc.com)

Major Annual Events/Activities 2020	
Reliance 21 Annual Overview	Jan
NDIA Human Systems Conference & Ft Belvoir Steering Group Meeting	Mar
NDIA S&ET Conference	Apr
Human Factors Engineering TAG	May
Seedling Proposal Data Call	Jun
COL Steering Group/All Hands Meeting	TBD
I/ITSEC	Nov



NDIA Human Systems Division Conference. NDIA's HS Division, in partnership with our government representatives from the HS Col, held their annual conference in Arlington, VA on March 3-4, 2020. This year's theme, "Human Systems within Multi-Domain Operations", highlighted ongoing and emerging challenges in joint agency coordinated responses across domains as the US continues to plan, train, and execute their missions. Over 100 attendees heard included engaging talks from BG Stephen L.A. Michael, Deputy Commanding General of US Army Combined Arms Center – Training; Col Michael McGurk, Director, Research and Analysis Directorate CIMT; Dr. Holly Handley of Old Dominion; Joe Parson, Jr., Sr. Tech Advisor for the Synthetic Training Environment Cross Functional Team, US Army Futures Command; and Nic Adams, National Security Advisor to US Senator Joni Ernst (R - IA). In addition, attendees had the pleasure of hearing from MG James Boozer, (Ret), Executive VP of NDIA on the importance of Human Systems within the NDIA community.

Members of the community shared strategic perspectives and innovative advances in Human Systems with the audience, and our Roundtable event included insightful discussions on key elements for the community across the four domain interest areas: Personalized Assessment, Education and Training; Performance, Sustainment and Warfighter Performance; System Interfaces and Cognitive Processes; and Human Systems Metrics. A dedicated poster and demo session allowed attendees to engage with one another on tools, techniques, and ongoing research within the Human Systems community. Thank you to all Government, Industry, and Academia representatives who attended for your involvement throughout our two day event. POC: Dr. Kelly Hale, Division Deputy Chair, NDIA HS Division, khale@draper.com

Site Visit to Army Research Institute. A Steering Group site visit was added to facilitate senior leader attendance at the NDIA event. After Dr. Zbylut gave an overview of the Col, the Steering Group heard from a broad coalition of ARI researchers on topics such as: Team Assignment and Performance, Data Science for Talent Management, Measuring Small Team Cohesion in Isolated and Extreme Environments, and Unit Resilience Measurement Development/Validation. There was also discussion about developing a Human Systems strategic document that could help OSD understand better who we are, our unique capabilities, and the value of the outstanding work we do. POC: [Katie Smith Stilling, Strategic Analysis, Inc. kstilling@sainc.com](mailto:kstilling@sainc.com)



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Col Highlights - "Next Up"

Department of Defense Human Factors Engineering (HFE) Technical Advisory Group (TAG) 74 Meeting. See Dr. Petro's Senior Leader Perspective for a great summary of the importance of this meeting and some logistics if you want to attend. Reminder: the HFE TAG event is postponed to 20-24 July. POC: Dr. Liana Algarin, OSD, liana.m.algarin.ctr@mail.mil

From Our Stakeholders and Partners

OUSD(R&E) Biotechnology Col. Established in December 2019 with Dr. Patrick Mason serving as the Chair, the Biotechnology Col will expand and accelerate the Department's modernization in this area by focusing on 1) Department investments in technology maturation, 2) raising awareness among capability-focused Cols of potential applications, and 3) recommending biotechnology S&T policy and guidelines to enable biotechnology products. The initial Sub Areas are: Enhancing Warfighting Systems; Optimizing Warfighter Performance; Ethical, Legal, Social, and Environmental Issues; and Science and Technology Operations. The Col will coordinate efforts to achieve the goal of providing biotechnology products and biotechnology-enabling data and tools that will ensure a competitive advantage. The new Biotechnology Col is looking forward to outstanding interactions with the Human Systems Col! POC: Dr. Algarin, liana.m.algarin.ctr@mail.mil

Human Performance Optimization Technology and Educational Digest (TED). Initiated last November, the TED is a monthly publication to raise awareness of scientific progress and advances in human performance optimization. Research articles and other scientific publications are highlighted under four main topic areas: optimizing physical performance, optimizing cognitive performance, human-machine interfaces, and stress resilience. If you'd like to communicate recent advances in human performance optimization to the TED, our POC is Teddy van Opstal at edward.j.vanopstal.ctr@mail.mil

International Corner

Human Factors and Medicine Panel (HFM) - 322 Workshop On "Meaningful Human Control (MHC) of AI-based Systems". Scheduled for 18-20 May 20 in Berlin Germany, this workshop will include discussions on key characteristics, influencing factors, and design considerations. The core objective is not to duplicate ongoing efforts at the national and international level in the legalities and ethics of MHC, but to learn from them. We will also apply a perspective to the problem squarely rooted in human factors and cognitive science understanding and distill a set of practical human-centered guidelines to inform future NATO actions in this increasingly important area.

Given the multi-faceted nature of MHC, six themes were chosen for deep-dive investigation:

- ◆ HSI & Organizational/Operational Considerations of MHC
- ◆ Human-System Inspired Design Guidelines to Achieve MHC
- ◆ Systems Engineering Methods & Metrics to Validate MHC
- ◆ Adversary Tactics to Counter/Undermine MHC
- ◆ Socio-Technical System of Systems & Theoretical Considerations
- ◆ Machine Ethics and Computational Models of Human Morality

Workshop results will directly inform focused follow-on activities that inform NATO on how to identify, achieve, maintain, and regain MHC across a wide range of AI applications. POC is Dr. Mark Draper, AFRL 711 HPW, mark.draper.2@us.af.mil

Col Accomplishments

Editor's Note: We had many great success stories in both our November 2019 HS Col Roadmap briefing to OSD and poster used at the March 2020 NDIA Human Systems Division Conference. Please visit the Defense Innovation Marketplace at <https://defenseinnovationmarketplace.dtic.mil/communities-of-interest/human-systems/> to see them! Other Col's are on the Marketplace as well. Below are a few other important efforts we're also proud of:

Ft. Sill Warfighter Augmented Reality (WAR) Virtual Trainer (JVT) Demonstration. On 9-10 December 2019, Fire Support Marines conducted training on the WAR training system and JVT at Ft. Sill with ten Marines, eight instructors and three entry level Marines. The gear was intuitive and they quickly understood how to employ it. Overall, they agreed this system could be used in entry level training, qualification training, and sustainment training in the operating forces. Both systems were left with the detachment for further evaluation. POC: Dr. Peter Squire, ONR, peter.squire@navy.mil





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Col Accomplishments (continued)

711 Human Performance Wing's Gaming Research for Integration Learning Laboratory (GRILL®) team participated in inaugural Iron Dev Challenge. Held at the Inter-service/Industry Training, Simulation and Education Conference, the event was based on competitive cooking shows where teams are given a challenge and "secret ingredient." The challenge here was to develop a training solution to improve warfighter readiness with bonus points awarded for using some of the events sponsor's provided equipment. The teams received the challenge: "Winning the War of Cognition" with the secret ingredient of "Iron Man." The intentionally vague prompt provided opportunities for each team to interoperate differently; however, this open-endedness resulted in additional challenges such as the team struggling with the lack of direction or that the teams' individual solutions were impossible to compare. The 711 HPW team selected a SERE (survival, evasion, resistance, escape) task as the challenge to solve, which involved using a topographical map to identify a training participant's position and the location of an adversary. After identifying the correct coordinates, the participant could call in an air strike on the adversary. At the conclusion of the competition, the teams presented their solutions to the judges and discussed their solutions with interested audience members. The GRILL team won the "Most Innovative Solution."

POC: Mr. Jonathan Diemunsch, AFRL 711 HPW, jonathan.diemunsch.1@us.af.mil

Techniques for Soldier-Exoskeleton Analysis (T for SEA). Products from this 6.2 research line transition to both Combat Capabilities Development Command Soldier Center Exoskeleton research lines and Aberdeen Test Center Warfighter Directorate T&E. Technologies/Benefits include:

- Providing preliminary recommendations for assessment tasks and measurement approaches to inform CCDC Exoskeleton technology demos
- Preliminary characterization of human movement variability to support CCDC Soldier Center's 6.2 Exoskeleton Human-In-The-Loop Controls Optimization and Movement Initiation & Intent line of effort
- Establishing human movement database framework & availability of initial data to guide Exoskeleton system development.



POC: Dr. Michael LaFiandra, _michael.e.lafiandra.civ@mail.mil

711 Human Performance Wing/RH Accomplishes First Desktop Integration Demo of COG Pack™ with Lockheed Martin Einstein-Open Systems Architecture (E-OSA). Signals from a PHYSIO Garment were processed by COG Pack™ and sent to a simulated Pilot-Vehicle Interface (PVI) developed by Lockheed Martin's Skunk Works Advanced Development Programs team via a 'live coding' update. By adding a setting to a COG Pack™ configuration file, an additional signal was sent to E-OSA and displayed on the PVI. This quick turn around would not have been possible without COG Pack's config-file based capability and well-defined signal format and structure. The integration of these technologies will enable physiological monitoring and alerting of the pilot via the F-35 cockpit display with a 'realm of the possible' demonstration of In-Cockpit physiological monitoring slated for mid-March 2020. POC: Allen Dukes, AFRL 711 HPW, allen.dukes.2@us.af.mil

Publications

Editor's Note: This is a new section the Newsletter is trying to increase collaboration opportunities among Col subject matter experts and others interested in the Human Systems arena.

Role of Microbiota in Stress-induced Myeloid Immune Cell Trafficking. Brain Behavior and Immunity. Van de Wouw, M., Lyte, J.M., Boehme, M., Sichetti, M., Moloney, G., Goodson, M.S., Kelley-Loughnane, N., Dinan, T.G., Clarke, G., and Cryan, J.F. doi: 10.1016/j.bbi.2019.12.003. [Epub ahead of print]

Abstract: There's convincing evidence the microbes that live in and on us, our microbiome, affect our physiology and psychology. This study investigated the involvement of the gastrointestinal microbiome in the development of stress-related disorders. Results indicate the gut microbiome influences the priming and recovery of the innate immune system to an acute stressor, thus gut microbiota modulation could alter stress-induced immune activation in stress-related disorders.

POC: Dr. Michael Goodson, AFRL 711 HPW, michael.goodson.4@us.af.mil



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Publications (Continued)



Interactive Task Learning: Humans, Robots, and Agents Acquiring New Tasks through Natural Interactions. Dr. Kevin Gluck from 711 Human Performance Wing is lead editor with Dr. John Laird, U of Michigan on this recently released book in the Strüngmann Forum Series. The book is an exploration of challenges, open questions, and implications from multiple scientific disciplines for achieving a future in which people and artificial agents can quickly teach and learn completely new tasks through natural interaction with each other. In their introductory chapter, the editors emphasize the issues of pace, persistence, and partnering that emerged in the Forum discussions and writing of the book, as well as the deep challenge of understanding. Available through MIT Press.

POC: Dr. Kevin Gluck, AFRL 711 HPW, Kevin.Gluck@us.af.mil

Cognitive Agents to Train Negotiation Skills. Christopher Stevens*†, Jeroen Daamen, Emma Gaudrain, Tom Renkema, Jakob Dirk Top, Fokke Cnossen and Niels A. Taatgen. Frontiers in Psychology 19 Feb 18 | <https://doi.org/10.3389/fpsyg.2018.00154>

Abstract: Training negotiation is difficult because it is a complex, dynamic activity that involves multiple parties. It's often not clear how to create situations in which students can practice negotiation or how to measure students' progress. Some have begun to address these issues by creating artificial software agents with which students can train. These agents have the advantage that they can be "reset," and played against multiple times which allows students to learn from their mistakes and try different strategies. However, these agents are often based on normative theories of how negotiators should conduct themselves, not necessarily how people actually behave in negotiations. Here, we take a step toward addressing this gap by developing an agent grounded in a cognitive architecture, ACT-R. This agent contains a model of theory-of-mind, the ability of humans to reason about the mental states of others. It uses this model to try to infer the strategy of the opponent and respond accordingly. In a series of experiments, we show that this agent replicates some aspects of human performance, is plausible to human negotiators, and can lead to learning gains in a small-scale negotiation task.

POC: Dr. John Schlager, AFRL 711 HPW, john.schlager@us.af.mil

Fatigue Incident Antecedents, Consequences, and Aviation Operational Risk Management Resources.

Morris, Megan B.; Wiedbusch, Megan D.; Gunzelmann, Glenn. Aerospace Medicine and Human Performance, Volume 89, Number 8, August 2018, pp. 708-716(9)

Abstract: Flight crew fatigue is an important factor in aviation, leading organizations to implement fatigue risk management programs to reduce risk. The U.S. Air Force Air Mobility Command has implemented the Aviation Operational Risk Management (AvORM) program to aid mission schedulers and flight crews in mitigating flight risks and identifying appropriate levels of risk. The AvORM program uses a scheduling tool and underpinning biomathematical fatigue model. This study examined self-reported fatigue-related incidents within AMC, which provided some indirect and anecdotal evidence as to the effectiveness of the scheduling tool. POC: Dr. John Schlager, AFRL 711 HPW, john.schlager@us.af.mil

Another Article on Fatigue. Bedi, S. (2019, December). Retrieved from <https://www.af.mil/News/Article-Display/Article/2047256/air-force-studies-fatigue-sleep-to-enhance-readiness/> Air Force Surgeon General Public Affairs.

Article focuses on Air Force study of fatigue and sleep to enhance warfighter readiness. POC: Dr. Glenn Gunzelmann, AFRL 711 HPW, glenn.gunzelmann@us.af.mil

Marine Corps Times Publishes Article on FitForce Planner. Titled "Marine Corps launches first phase of new fitness app, ForceFit" at <https://www.marinecorpstimes.com/news/your-marine-corps/2019/11/22/marine-corps-launches-first-phase-of-new-fitness-app-forcefit/>

Abstract. The story includes comments from Director of Force Fitness Division highlighting system features and "Workout of the Day" releases to the Fleet. There has been a substantial increase in total users attributed to Marine Corps Times, Facebook, Direct to FitForce and [Fitness.marines.mil](https://fitness.marines.mil). FitForce Planner is a SBIR program and the Human Performance T&E team will continue to work with the Force Fitness Division to reach out to other Marine Corps populations. POC: Dr. Peter Squire, ONR, peter.squire@navy.mil

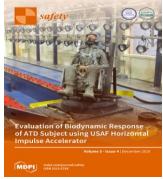


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Publications (Continued)



711 HPW Scientists Publish Collaborative Proteomics Research Proposing Mechanism for Brain Stimulation Effects. Seung Ho Jung, Candice Hatcher-Solis, Raquel Moore, Naomi Bechmann, Sean Harshman, Jennifer Martin & Ryan Jankord, "Noninvasive brain stimulation enhances memory acquisition and associated with synaptoneurosome modification in the rat hippocampus," *eNeuro*, 2019, 10.1523/ENEURO.0311-19.2019

Abstract: Dr. Candice Hatcher-Solis published a manuscript in the journal *eNeuro* which demonstrated transcranial direct current stimulation (tDCS) enhanced memory performance in combination with proteomics data, suggesting a biochemical mechanism which can potentially be utilized to develop improved strategies to augment human performance through tDCS. This manuscript highlighted a successful collaboration between basic science researchers and the newly formed Chemistry Core Team supporting Cognitive Neuroscience goals to augment cognitive state of operators. POC: Dr. Candice Hatcher-Solis, AFRL 711 HPW, candice.hatcher@us.af.mil

711 HPW/RH Paper as Cover Story in the International Journal SAFETY's 'Special Issue on Injury Biomechanics'

Chris Perry, John Buhrman, Dr. Casey Pirnstill, Dr. John McIntire, in the International Journal SAFETY's Issue on Injury Biomechanics (Volume 5, issue 4; <https://www.mdpi.com/2313-576X/5/4>)

Abstract: This technical article, called "ATD Biodynamics during Lateral Impact for USAF Neck Injury Criteria", summarizes a series of impact testing on the 50th percentile Hybrid III aerospace manikin. The effects of various seat and restraint configurations on lateral accelerations were studied. This data fills a much needed gap for development of manikin-to-human transfer functions for AFRL's Multi-Axial Neck Injury Criteria (MANIC), used for assessing aircrew probability-of-injury during ejections. POCs: Mr. Chris Perry, chris.perry@us.af.mil and Mr. John Buhrman, john.buhrman@us.af.mil, both from AFRL 711 HPW.



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Human Systems Col – SUB-AREA LEADS & MEMBERS

Personalized Assessment, Education, and Training (PAE&T)

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Protection, Sustainment and Warfighter Performance (PSWP)

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Human Systems Col – SUB-AREA LEADS & MEMBERS

System Interfaces and Cognitive Processing (SICP)

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