M&S Newsletter

PUBLISHED BY THE DOD MODELING AND SIMULATION COORDINATION OFFICE **(M&SCO)**

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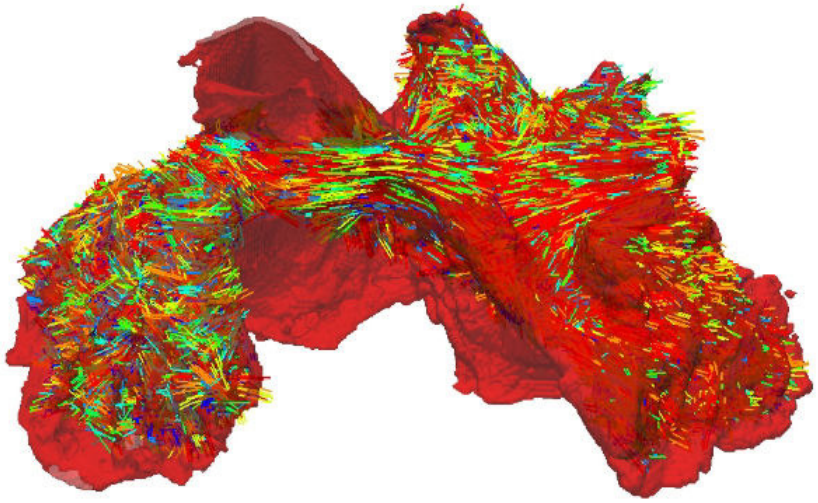
WELCOME TO THE FEBRUARY 2013 EDITION *of the M&S Newsletter. In this issue we present stories on simulated missions to Mars, pilots who train in helicopter simulators, and how simulating a heart helps cure heart defects.*

Among the articles included in this issue, we highlight the publication of the latest issue of the M&S Journal. *The Winter issue of the* M&S Journal *focuses on M&S interoperability. Also included here is a list of upcoming events within the M&S Community. We hope this edition of the M&S Newsletter "sheds new light" on M&S technologies.*

Please note that the full articles are available through the links provided. We hope you enjoy this issue and welcome your comments.

—M&S Newsletter Staff

Virtual Heart Sheds New Light on Heart Defect



A VIRTUAL HEART, DEVELOPED AT THE UNIVERSITY OF MANCHESTER [ENGLAND], is revealing new information about one of the world's most common heart conditions.

Researchers at the School of Physics and Astronomy used cutting edge technology to build an advanced computational model of an anatomically correct sheep's heart. It was made by taking a series of very thin slices of the heart, imaging them in 2D and then using a computer programme to render them into a 3D model.

—Article continued on page two

Photo Credit University of Manchester

In This Issue

Virtual Heart Sheds New Light

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The reconstruction includes details of the complex fibre structure of the tissue, and the segmentation of the upper chambers of the heart into known distinctive atrial regions. Single-cell models that take into account information about the electrical activity in different atrial parts of regions the heart were then incorporated into the model. The virtual heart was then used to investigate the condition atrial fibrillation (AF).

Professor Henggui Zhang led the research and explains why they wanted to study AF: "Atrial fibrillation (AF) affects approximately 1.5% of the world's population. In the UK more than 500,000 patients have been diagnosed with the condition which causes an irregular heart rate. It is also known to increase the risk and severity of stroke. Despite its prevalence very little is known about what causes AF. We hoped our model would allow us to understand the mechanisms of this condition to ultimately help create better treatments."

AF occurs when abnormal electrical impulses suddenly start firing in the upper chambers of the heart. These impulses override the heart's natural pacemaker, which can no longer control the rhythm of the heart. This desynchronises the heart muscle contraction and reduces the heart's efficiency and performance.

Professor Zhang and his team focussed on the pulmonary vein which is a common area that initially triggers AF. They simulated erratic electrical waves passing through the vein and the surrounding atrial tissue, and then studied the impact this had on the rest of the heart.

What they found was that regional differences in the electrical activity across the tissue of the heart, known as electrical heterogeneity, is key to the initiation of AF. The largest electrical difference was between the pulmonary vein and the left atrium which may go some way to explaining why the pulmonary vein region is a common source of irregular heartbeats.

The scientists also identified that the fibre structure of the heart plays an important role in the development of AF. There were directional variations in the conduction of electrical waves along and across the fibres, this is known as anisotropy. The fibre structure in the left atrium is much more organised compared with the complex structures of the pulmonary vein region. The sudden variation in conduction at the junction between the left atrium and the pulmonary vein regions appeared to contribute to the development of AF.

This article originally appeared on the University of Manchester website. For the complete article, **click here.**

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Officer Training Goes Virtual, Mobile

DEVELOPERS ARE MOVING A LEADERSHIP TRAINING SIMULATOR for officers from an immersive trainer to a laptop, making the technology both more mobile and less expensive.

A proof-of-concept demonstration at the University of Southern California on Oct. 4 was the first attempt to shrink the Emergent Leader Immersive Training Environment, or ELITE, from a full-room simulator to a laptop version.

ELITE is a project from USC's Institute for Creative Technologies; it currently consists of a life-size virtual human that is projected onto a wall, recreating an office-type scenario. A student can interact with the virtual human and attempt to provide counseling or mediate a problem.

The program is meant to teach leadership and communication skills to officers, who are often responsible for moderating such disputes. Using a virtual entity means consistent interpersonal training without having to hire a role player.

While one student interacts with the human, an entire class of students can follow along and select their own answers using remote controls. An instructor then leads an after-action review and helps the students recognize the best method of confronting subordinates.

The laptop version of ELITE will lose the life-size human and instructor, but gain portability and individualized training.

This article originally appeared on the Training and Simulation Journal (TSJ) website. For the complete article, **click here.**

82nd CAB Pilots Hone Skills in Helicopter Simulator

THE WEATHER OUTSIDE THE COCKPIT LOOKED FRIGHTFUL for CH-47 Chinook Pilots, Capt. Ron Braasch and Chief Warrant Officer 2 Ryan Drouin as they approached Simmons Army Airfield, here, Jan 10.

Once they had safely landed and logged their flight hours, the two 82nd Combat Aviation Brigade, or CAB, aviators stepped into the parking lot where the weather was bright and sunny -- a far cry from the fog, rain, snow and ice they encountered during their flight.

Chief Warrant Officer 2 Ryan Drouin (right), and Capt. Ron Braasch (left), pilot a CH-47 Chinook simulator through snow at the Southeast Regional Flight Simulation Training Center on Simmons Army Airfield at Fort Bragg, N.C., Jan. 10, 2013.

Pilots throughout the Pegasus brigade use the Southeast Regional Flight Simulation Training Center at Simmons Army Airfield to help maintain and enhance their aviation skills.

"Our facility has CH-47 Chinook, AH-64 Apache Longbow and UH-60 Black Hawk helicopter simulators for pilots stationed at Fort Bragg and throughout the southeast. We also have an Aviation Combined Arms Tactical Trainer, or AVCATT, which can be reconfigured to represent different aircraft and help train a unit for tactical operations," said retired Chief Warrant Officer 5 Jack Dalton, the senior simulator instructor operator for the center.

With their recent redeployment from Afghanistan, the 82nd CAB faces some limitations on operational aircraft as they go through maintenance phases and reset their equipment for their upcoming mission to support the global response force.

"These simulators allow four additional pilots to hone their skills every day. The training is really good to practice using the aircraft instruments, which are the same as they are in the actual aircraft," said Braasch, a Jacksonville, Fla., native, who serves with Company B, 3rd General Support Aviation Battalion.

Based on the input scenario, these instruments adjust to reflect the weather, altitude and other conditions these military aircraft might encounter.

"They can pick up things they would in the real world, like Humvees, Howitzers and other military equipment they may be expected to carry via sling load," said retired Chief Warrant Officer 4 Pat Trotter, retired, a simulator instructor operator for the Chinook simulator.

As the Chinook pilots challenged their ability to lift heavy loads and support ground troops, there was a gunfight going on in the simulator down the hall as the 82nd CAB Apache pilots conduct their crew qualification training for next month's aerial gunnery range.

"We're simulating the engagement we will see at actual ranges and preparing our tactics, techniques and procedures for the ranges without actually using live ammunition," said Capt. Jeremy Irvine, an Apache pilot and commander of Company B, 1st Attack and Reconnaissance Battalion, 82nd CAB.

While Irvine, of Leavenworth, Kan., and his copilot, Chief Warrant Officer 2 Matthew Baden, were preparing for events they will see through their actual cockpit, the center also offers training that is unrealistic in the actual aircraft.

This article originally appeared on the U.S. Army website. For the complete article, **click here.**

Photo Credit: Staff Sgt. April Campbell

520-Day Simulated Mission to Mars Reveals Critical Data About Sleep and Activity Needs for Astronauts

IN THE FIRST STUDY OF ITS KIND, a team of researchers led by faculty at the Perelman School of Medicine at the University of Pennsylvania and the Baylor College of Medicine, has analyzed data on the impact of prolonged operational confinement on sleep, performance, and mood in astronauts from a groundbreaking international effort to simulate a 520-day space mission to Mars. The findings, published online-first in the Proceedings of the National Academy of Sciences, revealed alterations of life-sustaining sleep patterns and neurobehavioral consequences for crew members that must be addressed for successful adaption to prolonged space missions.

"The success of human interplanetary spaceflight, which is anticipated to be in this century, will depend on the ability of astronauts to remain confined and isolated from Earth much longer than previous missions or simulations," said David F. Dinges, PhD, professor and chief, Division of Sleep and Chronobiology in the Department of Psychiatry at the Perelman School of Medicine, and co-lead author of the new study. "This is the first investigation to pinpoint the crucial role that sleep-wake cycles will play in extended space missions."

The 520-day simulation, which was developed by the Institute for Biomedical Problems (IBMP) of the Russian Academy of Sciences, and sponsored in part by the European Space Agency (ESA), was initiated on June 3, 2010 when the hatches were closed on a 550-cubic-meter IBMP spacecraft-like confinement facility in Russia. The simulated mission, involving an international, six-man team of volunteers, involved more than 90 experiments and realistic scenarios to gather valuable psychological and medical data on the effects of a long-term deep space flight. The 520-day mission was broken into three phases: 250 days for the trip to Mars, 30 days on the surface, and 240 days for the return to Earth.

"As the only U.S. research team involved with the Mars 520-day simulation, the study required international coordination and strong collaborations to ensure that the experiments were conducted in a thorough and rigorous manner," said Jeffrey P. Sutton, MD, PhD, professor and director, Center for Space Medicine at Baylor College of Medicine, and senior study author. The investigators monitored the crew's rest-activity patterns, performance and psychological responses to determine the extent to which sleep loss, fatigue, stress, mood changes and conflicts occurred during the mission.

This article originally appeared on the University of Pennsylvania Perelman School of Medicine website. For the complete article, **click here.**

Modeling Missiles

Missile defense community advances its simulation capabilities

WHETHER THE TARGETS ARE LONG-RANGE BALLISTIC THREATS or portable anti-aircraft weapons, U.S. missile defense testing is increasingly relying on modeling and simulation to avoid the cost, danger and limited options of live missile firings.

"With live testing, we cannot test or simulate every type of missile threat that is out there today — not even close," said Riki Ellison, chairman and founder of the Missile Defense Advocacy Alliance, an organization with the mission to educate and advocate for the deployment and development of missile defenses.

Live ballistic missile firings cost between $100 million and $150 million, according to industry officials.

"Modeling and simulation is an absolutely critical element because it saves tremendous tax dollars that are going toward the testing of these systems," Ellison said.

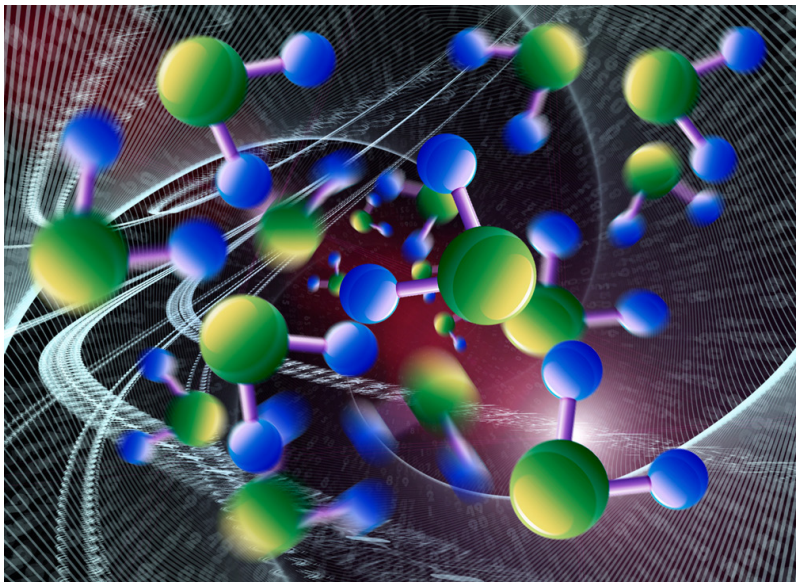
Although modeling and simulation is less expensive, it is not intended to replace live testing but to allow for the affordable testing of even more scenarios, including those that are too dangerous to test or train against live.

The U.S. Missile Defense Agency (MDA) plans to award a $595 million contract in July for the Objective Simulation Framework (OSF), a suite of software to evaluate elements of the U.S. Ballistic Missile Defense System (BMDS). BMDS is intended to destroy missiles and their warheads before they can reach their targets. Modeling and simulation allow the MDA to measure and predict the performance of BMDS elements before deployment.

This article originally appeared on the Training and Simulation Journal (TSJ) website. For the complete article, **click here.**

How Computers Push on the Molecules They Simulate

BECAUSE MODERN COMPUTERS HAVE TO DEPICT THE REAL WORLD with digital representations of numbers instead of physical analogues, to simulate the continuous passage of time they have to digitize time into small slices. This kind of simulation is essential in disciplines from medical and biological research, to new materials, to fundamental considerations of quantum mechanics, and the fact that it inevitably introduces errors is an ongoing problem for scientists.



Dynamic computer simulations of molecular systems depend on finite time steps, but these introduce apparent extra work that pushes the molecules around. Using models of water molecules in a box, researchers have learned to separate this shadow work from the protocol work explicitly modeled in the simulations.

Scientists at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) have now identified and characterized the source of tenacious errors and come up with a way to separate the realistic aspects of a simulation from the artifacts of the computer method. The research was done by David Sivak and his advisor Gavin Crooks in Berkeley Lab's Physical Biosciences Division and John Chodera, a colleague at the California Institute of Quantitative Biosciences (QB3) at the University of California at Berkeley. The three report their results in Physical Review X.

"Our group uses a theoretical method called nonequilibrium statistical mechanics to study molecular machines, the protein complexes essential to processes like photosynthesis and DNA repair," says Sivak. "But when we applied common algorithms to model the behavior in biological molecules, we found persistent, significant errors in the simulation results."

Sivak describes nonequilibrium statistical mechanics as "a way of understanding situations where conditions change abruptly and the system has to play catch-up," a kind of problem in which there are few exact analytical results.

How biological molecules move is hardly the only field where computer simulations of molecular-scale motion are essential. The need to use computers to test theories and model experiments that can't be done on a lab bench is ubiquitous, and the problems that Sivak and his colleagues encountered weren't new.

"A simulation of a physical process on a computer cannot use the exact, continuous equations of motion; the calculations must use approximations over discrete intervals of time," says Sivak. "It's well known that standard algorithms that use discrete time steps don't conserve energy exactly in these calculations."

"We can apply results from our calculation in a meaningful way to characterize the error and correct for it, separating the physically realistic aspects of the simulation from the artifacts of the computer method."

This article originally appeared on the Lawrence Berkeley National Laboratory website. For the complete article, **click here.**

Photo Credit: Lawrence Berkeley National Laboratory

Navy to Conduct Online, Crowd-Sourcing War Game by NWDC, ONR and NPS

TO GENERATE IDEAS FROM A BROAD FIELD OF PARTICIPANTS, the Navy Warfare Development Command (NWDC), the Office of Naval Research (ONR) and the Naval Postgraduate School (NPS) are partnering to conduct a crowd-sourcing online war game on electromagnetic maneuver (EM2) starting Feb. 4.

Electromagnetic Maneuver Massive Multiplayer Online War Game Leveraging the Internet - or em2 MMOWGLI - will be played in three one-week phases:

1) Know the EM Environment: Understanding EM Energy, from February 4, 2013, to February 10, 2013

2) Be Agile: C2 in the EM Environment, from February 18, 2013, to February 24, 2013

3) Change Our Paradigm: Tactical Employment of EM Weapons, from March 4, 2013, to March 10, 2013

To facilitate global participation, the game will be open 24-hours a day during the game phases. Interested players can request to register at **https://mmowgli.nps.edu/em2/signup**. After registration, the game can be played on any web browser.

"The electromagnetic spectrum and cyberspace are key differentiators for winning future Navy battles," said Rear Adm. Terry B. Kraft, commander, NWDC. "em2 MMOWGLI is designed to bring together a massive, distributed audience focused on helping the Navy operate in the EM environment."

"Communications, electronics, and sensor systems aboard U.S. naval ships and submarines must operate effectively in order to support the execution of military missions and operations," said Rear Adm. Matthew L. Klunder, chief of naval research. "We're looking to the experts in electromagnetic warfare from across military, government, academia, industry and think tanks to actively participate and make meaningful contributions in the game which could ultimately improve warfighter effectiveness."

Each phase of the game will start by the partners posting 'root' cards which pose questions on the topic for that phase. Players then post 'idea cards' that other players can respond to by either building on, countering, redirecting, or calling for further expertise. Points are earned based on each idea card's influence and perceived value. Individuals contributing to particularly intriguing concepts are invited to collaborate on an "Action Plan" to move that idea forward. Published action plans are awarded further points by all players providing ratings and additional comments. Significant achievements will be recognized.

This article originally appeared on the U.S. Navy website. For the complete article, **click here.**

Interoperability Issue of the *M&S Journal* Available Now

THE WINTER ISSUE OF THE *M&S JOURNAL* focusing on Interoperability is available now. The Guest Editor, Mr. Mike Knollmann, Assistant Deputy Under Secretary of Defense, (Joint & Coalition Operations Support) Office of the Deputy Under Secretary of Defense (Advanced Systems & Concepts), outlines the importance and challenges behind achieving interoperability. The issue includes the following articles:

- How is M&S Interoperability Different from other Interoperability Domains?
- The Live Virtual Constructive (LVC) Architecture Roadmap: Foundations from the Past and Windows to the Future
- An Open Source MSDL/C-BML Interface to VR-Forces
- Improvement of Simulation Interoperability by Introducing the CBML Benefits into the HLA World
- A Practical Application of Interoperability

Visit the M&SCO **Online Library** to access the Winter 2012/2013 Interoperability Issue of the *M&S Journal*.

The M&S Journal *is published quarterly as a print and electronic compendium of technical papers from experts in the field. The Journal serves as a forum for new ideas and emerging philosophies from the communities enabled by Modeling and Simulation.*

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FEATURED HIGH LEVEL TASK - CORONA

High level tasks are special technology-related projects that will enhance the applications of M&S throughout the DoD for the benefit of our Warfighters. By focusing on the goals stated in the "Strategic Vision for DoD Modeling and Simulation," these high level tasks are delivering solutions that will contribute to closing fundamental gaps in current M&S capabilities.

Cyber Operations Research and Network Analysis (CORONA)

THERE AREN'T ENOUGH ADEQUATE ENVIRONMENTS TO CONDUCT ROBUST CYBERSPACE EXPERIMENTATION and test & evaluation (T&E) on Department of Defense (DoD) weapon systems. Environments are inadequate because it's costly and time consuming to integrate participants who typically "stove pipe" their capabilities. The goal of CORONA is to break down these "stove pipes" by creating a modular modeling and simulating framework and environment that rapidly integrates live, virtual, and constructive (LVC) elements.

CORONA is a Modeling & Simulation Coordination Office (M&SCO) High-Level Task (HLT) managed by the Acquisition, Technology, and Logistics (AT&L) Test Resource Management Center (TRMC). CORONA is executed by Sandia National Laboratories, Defense Intelligence Agency Missile & Space Intelligence Center, and the USAF 90th Information Operations Squadron. TRMC's mission is to ensure all DoD test infrastructure is operated, improved, and sustained to meet current and future DoD requirements. Within its mission, TRMC promotes an enterprise approach to the development and sustainment of cyberspace infrastructure that links the existing open-air ranges and laboratories used to test weapon systems with cyber-focused capabilities, such as TRMC's National Cyber Range (NCR). This enterprise approach provides the framework necessary to perform cyberspace testing on weapon systems while mitigating duplication, improving efficiency and reusability, and optimizing long-range improvements and modernizations across the Department.

CORONA is a key component of this enterprise approach to DoD cyberspace infrastructure. CORONA establishes the architectural framework necessary to ensure interoperability and reduce setup and sanitation times for the Department's cyber infrastructure. This enables cost-effective system and mission effectiveness assessments of cyberspace exploits on weapon systems. CORONA also matures critical technologies to ensure a rapidly reconfigurable and operationally realistic environment for cyberspace test and experimentation. Upon maturation, these cyber technologies will be transitioned to TRMC's existing investment programs to be sustained and made available for use across the community.

For additional information, including examples of CORONA in use, please contact the CORONA Program Manager: TRMC Army Range Oversight Lead, 571.372.2725.

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M&S WHAT AND WHEN

MODELING & SIMULATION CALENDAR OF EVENTS

2013 Pacific Operational Science and Technology Conference
March 5 – 8, 2013
Honolulu, HI

2013 Spring Simulation Multi-Conference (SpringSim '13)
April 7 – 10, 2013
San Diego, CA

2013 Spring Simulation Interoperability Workshop (SIW)
April 8 – 12, 2013
San Diego, CA

DTIC Conference 2013
August 19 – 23, 2013
Fort Belvoir, VA

THE M&S NEWSLETTER

The **M&S Newsletter** is a DoD Modeling and Simulation Coordination Office (M&SCO) bi-monthly publication that provides the most recent information concerning interesting M&S articles and a calendar of events for the M&S community.

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