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Day 1: 16 October 2018

Bayesian Validation of Aerosol Chamber Homogeneity

Kendal Ferguson
Dugway Proving Ground
kendal.h.ferguson.civ@mail.mil
1300 to 1330
Room 5
Working Group 4

To ensure their adequacy for test and evaluation purposes, test chamber capabilities require a formal validation. An example of this requirement is the need to produce concentration homogeneity throughout the interior of a test chamber to be used for testing aerosol detectors. Based on the approach used for a recently validated chamber, we use simulated data to illustrate a test method and statistical model for such a validation.

The test method involves multiple phases with Bayesian updating of model parameters. During each phase, aerosol samplers are used to measure concentration at specified locations. Based on the collected test data and Bayesian "priors", a statistical model is fitted to account for the different factors and sources of error that contribute to concentration variability. "Nuisance" variability (such as that obtained from sampler measurement error) is then removed from total variability such that an estimate of the magnitude of only the relevant sources of variability remains. This variability is directly used to determine the extent of actual homogeneity within the chamber.

By incorporating all trials into a single model and appropriately accounting for all important sources of variability, the described method provides a single, statistically defensible conclusion regarding chamber homogeneity.

Novel Theory to Include Hyper Acute GPS Information Into Coriolis Error Compensation

Jennifer Forsythe
AMSAA/MSB/Lethality
Jennifer.L.Forsythe2.Civ@mail.mil
1330 to 1400
Room 5
Working Group 4
Compensating for the earth's rotation has generally been seen as a minor error that does not impact the results greatly for large caliber munitions. The effect of the earth's rotation is dependent on wind velocity and important as the armor force presses for ever greater ranges to engage the enemy. At greater ranges the effect is expected to increase. The rotation of the earth is seen in weather phenomenon such as the spin direction of hurricanes and is defined as the Coriolis force. The Coriolis effect is variable dependent on the direction firing, hemisphere, and latitude on earth. A rule of thumb is that at 1000 meters it may be 0.07 meters off from the center of the target in Sacramento, CA. Modern tanks have sophisticated hyper acute Global Positioning System sensors as well as embedded calculations to determine the direction the turret is pointing. This novel theory promotes the inclusion of an equation to make use of information already embedded in modern tanks to increase the accuracy of large caliber munitions. The impact of the equation will be presented so decision makers can understand the return on investment.

**Operationally Relevant Electrical Power Prediction Modeling**

Timothy Pohland  
AMSAA  
timothy.g.pohland.civ@mail.mil  
Co-Authors: Bradley Frounfelker  
1400 to 1430  
Room 5  
Working Group 4

The demand for ground vehicle electrical power on the Battlefield continues to grow as Soldiers are equipped with newer technologies and capabilities. Previous attempts to predict operationally relevant power demands in support of major Army acquisition studies have been limited by low fidelity/resolution models due to the lack of power profiles. As a result, those studies were unable to substantially inform decision makers. This briefing discusses a new approach of leveraging existing surrogate data as well as capturing new operationally relevant power loads to serve as inputs into a power prediction Modeling and Simulation (M&S) tool. The power prediction tool will provide simulation-based test bed to analyze a range of vehicles/configurations within operationally relevant scenarios. The modeling capability developed will support decisions throughout the acquisition life cycle.
AMSAA Probability of Hit and Kill Simulation (APHAKS) Armor Tile Methodology

Michael Booth-Neades
AMSAA
michael.d.boothneades.civ@mail.mil
1430 to 1500
Room 5
Working Group 4

The AMSAA Probability of Hit and Kill Simulation (APHAKS) is an Item-level effectiveness model developed with the intent to make it more-readily adaptable to address new analytical questions. Like other effectiveness models, APHAKS assumes that a target is undamaged each time a threat impacts the target. This assumption is reasonably sound for homogeneous metallic armors, but it does not hold for modern ceramic armors. These armors are much less ductile and tend to fracture rather than deform when struck by a threat. As such, ceramic armors are typically applied as armor tiles that can be replaced when damaged by either a direct hit, or following a hit to a nearby tile.

In order to model hits and damage to armor tiles, an optional behavior was added to APHAKS that allows the model to generate an array of hexagonal armor tiles overlaid on a cell-by-cell target. Hits to the armor tiles are tracked during the simulated engagement. Being hit during the engagement puts an armor tile and a user-defined number of adjacent armor tiles into a damaged state; hits to damaged tiles and number of tiles damaged are also tracked. This methodology was developed to support the Army Studies Program studies "Impact on Crew Protection - Vehicle Survivability due to Armor Multi-Hit Performance" in FY16 and FY17 based on test data from armor certification testing.

Dynamic Visualization Dashboards Using Shiny

John Burt
USACE ERDC
John.R.Burt@erdc.dren.mil
Co-Authors: Josh Church
1515 to 1545
Room 5
Working Group 4
Traditional data analytics and visualization dashboards are tied to specific datasets and can be difficult to construct generalized presentations for varying groups. Shiny, an open-source web application framework, allows individuals to develop graphical, analytical, and statistical-based visualization tools, as well as collaborative dashboards. Shiny web applications make it easy to build interactive toolkits that combine the computational power of the R programming language with the flexibility and interactivity of web technologies. These dashboards apply data filtering and visualization techniques to generate custom dashboards for traditional tradespaces. The dynamic customization of these dashboards allows users to quickly add filters and see these changes in real-time. We will showcase the ability to import tradespace data, apply filters to the dataset, and demonstrate the potential Shiny offers for data visualization and analytics.

**Automating Training Readiness Data Collection and Visualization using R**

MAJ Melissa Sayers  
Center for Army Analysis  
melissa.l.sayers.mil@mail.mil  
Co-Authors: Catherine Rivers  
1545 to 1615  
Room 5  
Working Group 4

In support of the Chief of Staff of the Army Cost of Training Readiness effort, we are supporting fellow Operations Research Analysts at Department of the Army Military Operations - Training (DAMO-TR) in automating the capture, analysis, and visualization of Army training readiness data. Current enterprise software tools for capturing Army training readiness data are limited in what data they capture and are often not intuitive for operational units to enter robust data. We will discuss tools and methods for capturing, analyzing, and visualizing data using online SharePoint InfoPath forms as a CAC enabled collection tool and using R for automated processing and visualization. We will discuss how these tools are then being used to testbed training metrics for future enterprise software tool changes.

**Stochastic Modeling in R - A Simple Example**

LTC Jeffrey Dayton  
Center for Army Analysis
The operations research community uses R as a tool to process, analyze, and visualize data. This presentation capitalizes on these uses, while also expanding into exploring the benefits R provides as a programming language. The analysis packages within R permit different approaches to developing inputs and the programming aspect of R allows for the building of custom models. This approach explores different means to develop inputs and apply them to a model that projects a ground vehicle life cycle. With this expandable sample application, deterministic and stochastic approaches are used to formulate a robust solution set for the forecasted vehicle life cycle end date.

Day 2: 17 October 2018

Just in Time Geospatial Analytics

Ryan Smith
Radiant Solutions
ryan.smith@radiantsolutions.com
1245 to 1315
Room 5
Working Group 4

Geospatial data sets are rapidly growing in data size, resolution and refresh rate causing analysts to have to make difficult analytic tradeoffs to execute all the data pre-processing steps (i.e. Extract Transform Load) and then computing the analytics via standard desktop processing workflows. These tradeoffs might include only using a subset of the data, artificially limiting the geographical size/resolution of the analysis, and having limited time to iteratively refine the analysis to deliver it in relevant timeframes. This talk will present the results of building a software tool that leverages the Graphical Processing Unit (GPU) on a computer to accelerate typical geospatial analytic workflows. It will describe the results of benchmarking the tool on a typically expensive analysis pipeline for Cross Country Mobility Modeling and discuss the benefits this approach can enable since the speedup is fast enough to move from preprocessing the CCM’s as a pre-calculated static input to calculating it on the fly as user’s make requests. This can enable
significantly more capability in a smaller hardware footprint, exposing analytic capabilities in an offline laptop (with an nVidia GPU) that would typically take a significant number of non-GPU based servers or a cloud environment to enable.

**Machine Learning Algorithms for Weaponeering Calculation**

Brandon Corfman  
AMSAA  
brandon.c.corfman.civ@mail.mil  
1315 to 1345  
Room 5  
Working Group 4

The JTCG/ME develops and distributes the JMEM Weaponeering System which provides combatant commanders a multiplicity of calculation tools to support mission planning, and weaponeering activities. Packaging a large number of complex computer models, the large data sets required to drive these models, and an interface sophisticated enough for an end user to run these models is a resource intensive process. In addition, the warfighter is often working under tight time constraints to develop effective results from their weaponeering tools. Machine Learning (ML) algorithms have the potential to significantly reduce the complexity and data volume required to provide a needed "quick turn" result with real-time response rates. To investigate this potential, the JTCG/ME is developing prototype machine learning tools based on existing weapon effects data sets, and scoring them using several criteria (prediction rates, size, response times).

**Rapid Analytic Development in the DoD: Theory and Case Studies**

Ian Kloo  
Center for Army Analysis  
ian.p.kloo.civ@mail.mil  
1345 to 1415  
Room 5  
Working Group 4

As the Department of Defense (DoD) continues to struggle to operationalize data science, one thing that has become clear is that many emerging problems cannot be solved using traditional software acquisition. This presentation advocates for an alternative way forward using a process called Rapid Analytic Development (RAD).
Under the RAD concept, data scientists work directly with those who could benefit from analytic solutions (users) in an iterative prototyping model to solve problems quickly and accurately. This presentation will begin with a discussion of the theory of RAD, then present several DoD case studies demonstrating the value of the process.

**Human in the Loop Entity Resolution with R2D2**

LTC Samuel Huddleston  
Naval Postgraduate School  
shhuddle@nps.edu  
Co-Authors: Alex Ryan  
1415 to 1545  
Room 5  
Working Group 4

Entity resolution is "the process of determining whether two references to real-world objects are referring to the same, or to different, objects" and forms a key part of analyst workflow in many intelligence applications. However, given the massive amounts of data intelligence analysts are required to process, they often struggle to efficiently and accurately resolve entities of interest in bulk data stores. The authors have developed a free, open-source, server-deployed application that provides analysts the ability to perform state-of-the-art bulk record linkage and deduplication through the use of a simple web browser interface. The Resolver Revolver (R2) and Duplicate Detector (D2) tools are now available for download as a single application (R2D2) to all DoD personnel via dscoe.org.

**Building Analytics Teams in DoD Organizations**

LTC Samuel Huddleston  
Naval Postgraduate School  
shhuddle@nps.edu  
Co-Authors: Ian Kloo  
1500 to 1530  
Room 5  
Working Group 4

During the 86th MORS Symposium, more than 70 members of analytics teams across the DoD gathered to discuss the state of data science and analytics in the DoD. This
presentation will provide an overview of the key "lessons learned" articulated by this group of analysts during the Data Analytics Focus Session. Specific topics of discussion include data infrastructure and technology platforms needed; the education and development of key personnel; the adaption of existing policies to facilitate rapid analytic development; and the development of community spaces for collaboration across organizations.

An Update From The Simulation Interoperability Standards Organization (SISO) Exploration of Next Generation Technology Application to Modeling and Simulation (ENGTAM) Standing Study Group

Chris McGroarty
Simulation & Training Technology Center
christopher.j.mcgroarty.civ@mail.mil
Co-Authors: Christopher Metevier, Joseph McDonnell, Lana McGlynn
1530 to 1600
Room 5
Working Group 4

The core development of our Modeling & Simulation (M&S) and Analysis Tools is driven by need; however, there are times when a reflection on the state-of-the-art in computing can provide insights in to how we might want to evolve. Given the rapid advances in computing technologies occurring independent of our M&S and analysis tools, an exploration of the tradespace would be prudent to maximize our leveraging potential.

To that end, the Simulation Interoperability Standards Organization (SISO) established the Exploration of Next Generation Technology Applications to Modeling and Simulation (ENGTAM) Standing Study Group (SSG) to research emerging technologies with the goal of understanding how they can be adopted and adapted to support military analysts as they employ M&S as a tool. The ENGTAM SSG focuses on technology adoption, interoperability, and technology areas, such as big data, cloud computing, artificial intelligence, machine learning and mixed reality.

This presentation will discuss relevant findings from the ENGTAM SSG and what they mean to the military analytical and simulation communities.