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#### 65088 - Data Storytelling

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Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 5:00 PM
Start Date: 6/13/2023	Start Time: 10:00 AM	End Time: 12:00 PM
Authors: Mr. Brian Morgan: Karen Bichey Mislick		

Abstract: The Data Storytelling course is tailored to early- to mid-career practitioners in the national security analytic profession who utilize operations research techniques to enhance decision-making. The practitioner must clearly and logically communicate their analysis for the decision maker to trust the insights and/or act upon the recommendations; analysis will only make a difference if it is communicated well. Attendees will learn tenets of visual perception, to include Gestalt Principles and pre-attentive attributes, and how humans interact with and create order out of visual stimuli. Special attention is given to practical skills and considerations necessary to logically construct a presentation that aligns with storytelling and data visualization instructional concepts. At the conclusion of their analysis appropriate for an executive-level forum and provide constructive, insightful comments on a presentation in peer review discussions.

Location: TH322 Classification: UNCLASSIFIED Working Group: CEU

## 65413 - Antifragility and Future Conflict: A Tutorial

<b>U</b>		
Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 10:30 AM
Authors: William Buppert		
Abstract: Operations research nee	eds to acquaint itself with the limits	of modeling and the pitfalls of
insufficient and misguided asymmetrical evidentiary bars. Antifragility offers not only an explanatory		

insufficient and misguided asymmetrical evidentiary bars. Antifragility offers not only an explanatory framework of black swan events but creates opportunities for organizations to build themselves from the ground up to be adaptable and resilient in the face of crisis and conflict.

This tutorial will introduce the novice to the concepts of antifragility and how the model may create new ways of looking at future conflict, achieve adaptive frameworks, improve conflict forecasting and better explain ways to build military organizations that respond to violence and capability degradation in a way that parallels the stressor strength improvement in complex systems.

This brief will discuss how the adoption of antifragility models to template conflict dynamics and build resilient learning organizations that improve with stress optimizes the western ability to survive peer and near-peer conflicts in the future. Problem structuring methods (PSM), morphological analysis and other operations research methodologies will be used to tackle the wicked problem sets in antifragility.

## 65683 - Emerging Complexity Techniques for Operations Research

Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 5:00 PM
Authors: Dr. John Thomas Hanley		
Additions. Dr. John montas Hanley, Jr, PhD		
Abstract: Part I:		
- a history of applied mathematics	s that provided the origins for ope	rations research in world war if
- advances in OR techniques durin	ig the war	
- the establishment of OR as a dis	cipline following wwwil	
- the institution of systems analys	is and growth in computer simula	tion in Dod
Part II:		
- concepts of play and games		
- the evolution of games with the	evolution of mathematics	
- the origins of war games and iss	ues in gaming over the past two co	enturies
- the role of war games in U.S. Na	vy and Wehrmacht campaigns of I	earning up to World War II
Death III.		
Part III:		
- new applications of mathematic	s following World War II	
- computers and the origins of art		
- games, game theory, and artifici	al intelligence	
Dout 11/1		
Part IV:	o to ob n i ou o o	
Introduction to complexity science techniques		
- Deterministic chaos		
- non-linear dynamical systems		
- agent-based models		
Location: TH224		
working Group: Tutoriai		

## 66258 - Large Language Models and their Applications for Defense

Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 12:00 PM
Authors: Dr. Onur Savas		
Abstract: In recent years, large lar	nguage models (LLMs) such as GPT-	3, BERT, and Transformer-XL
have shown remarkable success in a variety of natural language processing (NLP) tasks, including		
language generation, translation, and question answering. However, LLMs are not limited to just NLP		
applications and have great poten	tial for use in defense-related tasks	s as well.
This tutorial will provide an overview of LLMs and their architecture, followed by a discussion of their		
applications for defense. Specifically, we will examine how LLMs can be used for natural language		

understanding, knowledge graph construction, and threat detection in defense scenarios. For instance, LLMs can be used for automatic translation and interpretation of foreign language documents, enabling analysts to quickly identify and respond to potential threats. Additionally, LLMs can be used to analyze social media feeds and other online sources to identify sentiment, assess the public perception of an issue or event, and identify potential unrest or threats to national security.

Furthermore, LLMs can be used for automatic summarization and text classification, making it easier for analysts to process large volumes of data and quickly identify key information. For example, LLMs can be used to summarize news articles, social media posts, or other online content, enabling analysts to quickly gain insights into a developing situation. LLMs can also be used to classify documents and identify patterns in the data, enabling analysts to quickly identify potential threats and respond proactively.

Despite their potential benefits, using LLMs in defense-related tasks also presents challenges and limitations. One major concern is privacy, as the use of LLMs can potentially infringe on individual rights and freedoms. Adversarial attacks, where an attacker tries to manipulate the input to fool the LLM, are also a concern. Additionally, LLMs may be biased based on the data they are trained on, which can lead to inaccurate or discriminatory results.

Overall, this tutorial aims to provide a comprehensive understanding of how LLMs can be used in defense-related tasks and the potential benefits and drawbacks associated with their use. Whether you are a researcher, practitioner, or just curious about the field of natural language processing, this tutorial will provide you with the knowledge and insights necessary to explore LLMs' applications in defense.

Location: TH347 Classification: UNCLASSIFIED Working Group: Tutorial

# 66660 - Modeling with Streamed Sensor Data – "What to do when your data is a curve."

Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 9:30 AM
Authors: Dr. Thomas A. Donnelly		

Abstract: Sensors that record sequences of measurements are now embedded in many systems. There is information in the shapes of the sensor stream that is highly predictive of the likelihood of a system failure or performance. These data are often being used inefficiently due to lack of knowledge and tools for how to leverage it properly. In this presentation we will show how to fit various basis functions – but especially wavelets - to data streams and extract features called functional principal component scores. Then, we use these features as inputs into machine learning models like neural networks. Answering a wide variety of questions becomes a two-step process of functional feature extraction followed by modeling using those features as inputs. Additionally, it will be shown how when combined with Design of Experiments, one can then model the principal component scores to predict the shapes of data streams as functions of the factors in the design. The DOE analysis can be reversed to determine what factor settings would yield a target curve.

Location: TH348

#### 66035 - Operations Assessments Tutorial

Start Time: 8:30 AM	End Time: 12:00 PM
alysts are commonly called on to go s limited in number of courses and or the conduct of operations assess t. Experienced practitioners in opera s. Planned topics include: the purpor measures, the linear additive functi aign planning and phases, and data	uide operations assessments, but scope of material. This tutorial ments. The tutorial structure will rations assessments are welcome oses of operations assessments, on and weight selection, collection and management
	Start Time: 8:30 AM salysts are commonly called on to gu s limited in number of courses and s or the conduct of operations assess t. Experienced practitioners in oper s. Planned topics include: the purpor measures, the linear additive functi aign planning and phases, and data

Working Group: Tutorial

#### 65615 - Probabilistic modeling and statistical inference: algorithms for OR practitioners

Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 5:00 PM
Authors: Dr David Rushing Dewhurst		

Abstract: The OR community uses probability and statistics every day. Well-known tests and models such as t-tests, ANOVA, linear regression, and decision trees are simple yet powerful tools that drive value for diverse OR communities, from logistics and sustainment, e.g., did the part waiting time significantly deviate from historical trends?, to strategic wargaming , e.g., did Red team exhibit significantly higher probability of successful mission than Blue team when confronted with unexpected novelty? However, in messy, real-world environments, the assumptions of such tests and models are often badly violated; more powerful and flexible algorithms are needed to help OR practitioners address the issues raised in today's operational environments.

In this tutorial, we will cover some subset of the following listed topics. The focus will be primarily algorithmic; while theory will be introduced, we will concentrate on implementation of probabilistic models and inference algorithms to solve difficult practical problems. Crucially, each topic will be accompanied by code snippets to demonstrate implementation of the concepts discussed in commonly used programming languages. We will make accessible a code repository containing the complete source code so that attendees may revisit the examples.

Probability basics: discrete vs. continuous probability distributions; Summary statistics and functions applied to distributions, e.g., moments and quantiles. Sampling from distributions in theory and in practice.

Probabilistic modeling basics: definition and examples of data generating processes or DGP; choosing probability distributions for your DGP; sampling from the DGP; time and memory complexity

considerations; Bayes' theorem and its implications; equivalence of some DGPs and graphical models; stochastic control flow and open-world models

Statistical inference basics: definition and discussion of what inference means; families of inference algorithms; exact inference via conjugacy and variable elimination; message passing; sampling-based algorithms, including Markov Chain Monte Carlo and relationship with stochastic optimization.

Probabilistic programming: separation of modeling and inference concerns; querying models; interfacing with external codebases; language choice and implementation considerations.

Location: TH327 Classification: UNCLASSIFIED Working Group: Tutorial

#### 65734 - Wargaming Counternarcotics in Central and South America via First Stop

Start Date: 6/12/2023	Start Time: 8:30 AM	End Time: 12:00 PM
Authors: Mr. Jeffrey Dan Havlicek; Franklin Kenter		
Abstract: It is actimated that over 2,000 metric tens of sessing is transported toward North America		

Abstract: It is estimated that over 2,000 metric tons of cocaine is transported toward North America. The main obstacle for narcotic traffickers is law enforcement interdiction during the first transit from the source zone in northern South America into Central America. This transit is the focus of interdiction law enforcement agencies as once shipments reach Central America, the shipments are divided into smaller movements for northward distribution.

One of the major considerations in this scenario is the cooperation required to interdict narcotic traffickers. No one country can tackle the issue of narcotic trafficking on their own as the sheer size of the geographical domain; the minimal number of detection, monitoring, and interdiction assets; and the number of sovereign nations traversed make interdiction a challenge. The Joint Interagency Task Force - South aims to catalyze this cooperation between U.S. Government Agencies and Partner Nations for successful interdiction and detention pending prosecution as well.

We have developed First Stop a narcotics transport wargame to emulate this scenario emphasizing the with emphasis on the diplomatic and tactical operational aspects of the mission. This game differs from traditional wargaming as cooperative predator dynamics are pitted against a well-resourced and well-concealed prey.

This game features three truly asymmetric sides: BLUE, GREEN and RED representing the US, Partner Nations, and narcotics cartels, respectively. The design goal of this game is to emphasize the operational and cooperative aspects of Western Hemisphere operations in the Eastern Pacific Ocean especially for new partners to the JIATF-S mission. Indeed, a version of this game is planned for use during employee orientation at JIATF-S.

This game is designed for play with 5-6 players. A tutorial demo will be offered for 3 hours with included time for rules explanation at the start and participant feedback at the end.

Location: TH304/306 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66202 - Design of Experiments for Stochastic Simulation Modeling

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Start Date: 6/12/2023	Start Time: 9:30 AM	End Time: 12:00 PM
Authors: Dr. Averill Martin Law		

Abstract: Simulation models often have many input factors, and determining which ones have a significant impact on performance measures (responses) of interest can be a difficult task. The common approach of changing one factor at a time is very often incorrect, because for many models factors interact to impact on the responses. In this tutorial we present an introduction to design of experiments specifically for stochastic simulation modeling, whose major goals are determining important factors and predicting model responses for factor-level combinations that were not actually simulated due to execution-time or setup-time constraints, or because predictions are needed in real time. Traditional experimental designs such as two-level factorial, two-level fractional factorial, and central composite often do not work well because responses are typically nonmonotonic functions of the factor levels and because three-factor (or even higher) interactions may be present. We then discuss Latin hypercube designs that are often more appropriate for the complex response surfaces seen in simulation models. This is followed by a presentation of metamodels (surrogate models) based on regression and neural networks.

Location: TH342 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66661 - Exploratory Data Analysis and Root Cause Analysis – "What Can You Do When You Don't Have a Designed Experiment?"

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Start Date: 6/12/2023	Start Time: 9:30 AM	End Time: 10:30 AM
Authors: Dr. Thomas A. Donnelly		
Abstract: This tutorial demonstrat	tes how to explore data and do roo	t cause analysis for any data set.
Analysis is often straightforward v	when data come from a designed ex	xperiment. But when they don't,
and the data are messy, and pote	ntial predictors are highly correlate	ed, there are still robust
approaches to finding what are th	ne dominant factors. This tutorial e	xplores both graphical and
statistical tools for getting to the	root cause of a process. Methods o	demonstrated include:
Dynamically linking graphs and fil	tering responses to find correlation	s. Using easy to understand data
mining methods like decision tree	es. Finding the best design of experi	ment subset of data within an
historical haphazardly collected d	ata set. Using Penalized Regression	n methods (e.g. LASSO) to do
variable selection among correlat	ed factors and reduce the dimension	onality of the process space.
Location: TH348		
Classification, UNICLASSIFIED		

Classification: UNCLASSIFIED Working Group: Tutorial

# 68340 - Ethics for Analysists and Data Scientists: From the Theoretical to Daily Application in the Workplace

Start Date: 6/12/2023	Start Time: 10:30 AM	End Time: 12:00 PM
Authors: Mr. Terrance James McKearney, FS		
Abstract: We'd all agree that ethical behavior is particularly critical in the practice of OR and data		
science; as practitioners we need to be seen as honest, forthright, and dedicated to the highest		

principles of honesty. But how do we adapt these principles and then apply them as we go about our business? In this tutorial, hosted by the MORS Ethics Committee, we will assemble some of the leaders of our profession who have not only had to wrestle with issues of professional ethical behavior in their careers, but guide others in the conduct of ethical analysis. We will review the current thinking on ethics in analysis, including the MORS Code of Ethics. Because attaining these ideals is a matter of constant practice and self-awareness, the tutorial will feature not only a presentation on current ethics regulations and concepts, but a workshop/seminar, where participants will be challenged to respond to a series of situations where ethical issues in the conduct of their daily work will be challenged. This will enhance the tutorial with a lively dialogue on the ethical challenges analysts and data scientists face as junior and senior analysts from both industry and government. Participants will be challenged to explore ethical issues and discuss the role of ethics in their efforts to provide forthright and honest assessment.

Location: TH321 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66233 - Jutland 1916, Steel Castles Clash Tutorial

Start Date: 6/12/2023	Start Time: 10:30 AM	End Time: 12:00 PM
Authors: Mr. Michael W. Garramb	oone, FS	
Abstract: The Battle of Jutland (Ge	erman) or Skagerrak (Danish) was s	ignificant for being the largest
naval battle of the First World Wa	ir and the most severe in numbers of	of lives lost. The battle engaged a
total of 100,000 men aboard some 250 warships over the course of 72 hours. It questioned the ability		
of the British navy to maintain a strategic blockade and severely diminished the German naval fleet's		
capabilities. This presentation provides background on the battle and teaches new wargamers the		
mechanics of participating in the a	adapted wargame special session.	
Location: TH341		
Classification: UNCLASSIFIED		
Working Group: Tutorial		

#### 66662 - Quickly Comparing Machine Learning Methods

Start Date: 6/12/2023	Start Time: 10:30 AM	End Time: 12:00 PM
Authors: Dr. Thomas A. Donnelly		
Abstract: Through example analys models with a range of machine lo questions like:	ses, you'll see how to build better p earning techniques. The approache	redicting and more robust s shown will help answer
<ol> <li>With so many machine learning</li> <li>How can I prevent overfitting a</li> <li>How can I find the dominant fa</li> <li>How can I find the best prediction</li> <li>How can I find a potentially mode</li> </ol>	g methods, how can I find the best on nd better trust my models - for bot ctors quickly, especially when there ing model? re interpretable model with confident wals to any model?	candidate approaches quickly? h large and small data sets? e are hundreds of factors? ence intervals?

- 6. How can I add confidence intervals to any model?
- 7. How can I visually compare multiple machine learning methods?

8. How can I do multiple model trade-space analysis or optimization?9. How can I guard against extrapolation in high dimensional factor space?10. How can I use a sensor stream of highly correlated data to make better predictions?

Featured methods will include different types of regression, neural networks, decision trees, ensemble modeling, and functional data analysis. You will also see how to use graphical and statistical comparison techniques to help choose the "best" predictive model. This presentation is for engineers and researchers interested in learning how machine learning techniques can help them use the data they have today to better predict tomorrow.

Location: TH348 Classification: UNCLASSIFIED Working Group: Tutorial

#### 65668 - Battlefield AI and Autonomy for Non-Technical Beginners

Start Date: 6/12/2023	Start Time: 1:00 PM	End Time: 5:00 PM
Authors: Mr. Jerry L. Schlabach		
Abstract: The U.S. Government, it	s military competitors, and t	he global defense industry are racing to
militarize Artificial Intelligence (Al	) and Machine Learning (ML	) for future autonomous systems. This
tutorial will:		
- Define and characterize the varie capabilities, human direction, and	ous levels of military autono I human trust.	mous systems with respect to AI/ML
<ul> <li>Dispel and re-characterize comm</li> </ul>	non misperceptions about Al	/ML and battlefield autonomy, to
include the likely technical, moral	, and operational limits to w	eaponization.

- Introduce at a conceptual level the AI and ML fields, with example applications.

- Explain the extraordinary dependency of modern Deep-Learning ML upon the acquisition and conditioning of large amounts of training data (or synthetic models).

- Frame the likely military utility of integrating AI/ML into military systems at the various levels of the cognitive domain (Bloom's Taxonomy). Identify which cognitive tasks are likely to remain with humans, and which are candidates for machine reasoning.

- Highlight and discuss select OR analytic implications from battlefield AI/ML integration with respect to traditional paradigms such as Commander's Intent and decision-making.

- Outline select AI/ML issues related to the future of warfare.

Jerry Schlabach is an Engineering Fellow at Raytheon Missiles and Defense in Tucson, who also cochairs MORS Working Group (#35), "AI and Autonomous Systems." He has a Master's degree in Computer Science (AI) from the University of Illinois at Urbana-Champaign, as well as a Bachelor's degree in Physics from the United States Military Academy at West Point. In addition to a 22-year Army career in Military Intelligence, he has over 25 years' experience at integrating AI into C4ISR prototypes. The 2023 Symposium will be the fifth year Jerry has presented this tutorial in some form, with the assistance of other WG-35 co-chairs.

Location: TH304/306 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66663 - Custom DOE – Making Your Experimental Design Fit the Problem

Start Date: 6/12/2023	Start Time: 1:00 PM	End Time: 2:00 PM
Authors: Dr. Thomas A. Donnelly		

Abstract: This tutorial will present solutions to real-world Design of Experiment (DOE) problems. Nearly all solutions listed below cannot be achieved using classic textbook DOE. If textbook designs are your only resource experimenters will often change their problem to fit the available designs. It is highly recommended that experimenters instead make their design fit their real-world problem. This tutorial will show how to treat separately and in-combination, factors of the following types: continuous/quantitative, categorical/qualitative, discrete numeric, mixture, covariate, blocking, and hard-to-change. It will demonstrate how to constrain design regions and disallow certain factor level combinations. It will show how to augment or add onto existing experiments. By using both augmentation and constraints it will show how to repair a broken design. It will show how to design for special knowledge of the model. Algorithmic custom DOE is the most efficient way to develop accurate and useful models of real-world processes.

Location: TH348 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66215 - Front Line Operational Analyst Training (FLOAT): a taste from the UK

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Start Date: 6/12/2023	Start Time: 1:00 PM	End Time: 3:00 PM
Authors: Mr Richard Peter Hoves		

Abstract: This tutorial provides a highly interactive sample of the larger training the UK provides to our deployable analysts and invite our partner nations to attend. The session centers on being effective in an unknown or new environment – ensuring you have the key skills to add value and become that force multiplier a deployed analyst can be. This session focusses less on the specific analytical techniques needed and more on the problem structuring, analytical design and communication.

In the UK we deploy Civilian Operational Research analysts into military Operations (and UK crises) to provide analytic and scientific support to senior decision making. These analysts may deploy anywhere the UK military go and work any type of task. We hold these civilian analysts at Readiness and send them out to the "front line" in support of senior decision makers with minimal notice (24 hrs to 30 days notice). We must ensure they are effective as possible when they arrive. To do this we have a rigorous selection and training program leading to their certification as suitable to deploy. Whilst the training needs analysis completed to design our program's syllabus is focused on our deployed staff, the tutorial should be useful insights (and be fun) for any one working as an analyst or with analysts in a high paced environment.

Location: TH328 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66709 - Managing Change for Analytical Professionals

Start Date: 6/12/2023	Start Time: 1:00 PM	End Time: 5:00 PM
Authors: Ms. Jennifer Ferat; Mr. Walt DeGrange		

Abstract: Change can often be wrought with uncertainty, but analytics professionals are wellequipped to drive successful outcomes. The analytics professional has the tools and the insight required to anticipate and navigate change when designing, developing, and implementing analytical solutions. With our course on Managing Change for Analytical Solutions, analytics pros have access to valuable resources that will guide them through any changes as they develop their analytics projects. We provide step-by-step guidance backed by years of research and experience in analytics management so analytics experts can effectively manage change from start to finish. This course is a must-have for analytics professionals looking to confidently handle change when developing analytics solutions. Join us now for the knowledge you need to make sure your analytics projects succeed!

Location: TH341 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66115 - Rapid Development of Good Enough Machine Learning Models

Start Date: 6/12/2023	Start Time: 1:00 PM	End Time: 5:00 PM
Authors: MAJ lain Cruickshank		
Abstract: Abstract: Are you intered don't want to spend too much tim latest zero-shot and low-shot mad tutorial will show you how to quid using no-train and limited labeled text, image, and text-and-image n of the tutorial, you will be able to feasibility of using machine learnin building work.	sted in trying out machine learning ne and resources on them? Do you chine learning techniques in your ar ckly implement machine learning so data approaches. Specifically, we w nodels and how to fine-tune them f quickly implement these machine l ng before investing in expensive da	solutions for your problems but want to learn how to use the nalysis and workflows? This plutions for real-world problems will cover how to use zero-shot for specific use cases. By the end learning solutions to evaluate the ta collection, labeling, and model
Length of Tutorial: 3 Hours		
Level of the Tutorial: Intermediate oriented programming, and shoul learning, and familiarity with data with Pytorch and HuggingFace wil	e. Students must know python prog d have some familiarity with the da programming tools in Python like I II allow students the best use of cor	gramming, to include object- ata science workflow, deep Numpy, Pandas. Being familiar ntent of this tutorial.
Description and Outline: The tuto corresponding to the core data m - Block 1: Text - Zero-shot labeling for a text co - Fine-tuning pre-trained model - Block 2: Image - Using language-image multi-m - Creating a custom image-text - Block 3: Advanced topics - Using Large Language Models - Zero-shot object detection	rial will be conducted in 3 blocks of odalities. orpus ls. nodal models multi-modal model	instruction, roughly
Location: TH344		

#### 66664 - Modern Screening Design of Experiments to Get More Information from Fewer Trials

Authors: Dr. Thomas A. Donnelly	

Abstract: This tutorial is meant to expose testers to the most effective Design of Experiments (DOE) screening methods introduced in the last decade. Attendees will learn about recently published methods for not only efficiently screening factors but for using the data to more rapidly develop second-order predictive models. Definitive Screening Designs (DSDs) will be shown to not only detect main effects and curvature in each factor, but in many cases also two-factor interactions. DSDs when first published in 2011 could support only continuous factors. Over the last decade methods have been developed to support 2-level categorical factors and blocking. Furthermore, a new way to take advantage of the inherent fold-over structure of row pairs allows for robust modeling of first-order and second-order effects when less than half the factors are active. When the number of significant factors is small, a Definitive Screening design can collapse into a 'one-shot' design capable of supporting a response-surface model with which accurate predictions can be made about the characterized process.

A case study will be shown in which a 10-factor process is optimized in just 24 trials. Checkpoint trials at predicted optimal conditions show the process yield increased by more than 20%. In cases where more than a few factors are significant and the design can't collapse into a one-shot design, the existing trials can economically be augmented to support a response-surface model in the important factors. Graphical comparisons between these alternative methods and traditional designs will show the new ones to yield more information in often fewer trials.

Location: TH348 Classification: UNCLASSIFIED Working Group: Tutorial

## 66665 - Efficient Modeling & Simulation Using Design of Experiments

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Start Date: 6/12/2023	Start Time: 3:00 PM	End Time: 4:00 PM
Authors: Dr. Thomas A. Donnelly		

Abstract: This presentation will show how Design of Experiments (DOE) methods can be used to extract the most useful information from the smallest number of computer simulation runs. By sequentially running blocks of simulations, computer experimenters can conduct the overall fewest trials necessary to do sensitivity analysis of the factors being studied without over-utilizing high performance computing resources. The greatest benefit occurs when fast-running (seconds) surrogate model can be developed for long-running (hours, days or weeks) simulations. The fast surrogate model enables testers and analysts to interactively query the modeled process to find optimal operating conditions or the frontiers of the acceptable operating window. These conditions of high interest can then be run using the full simulation to both validate the surrogate model as well as increase the accuracy of prediction. Design solutions demonstrated will include the application of traditional DOE methods to discrete event and agent-based simulations, and modern space-filling designs to more complex physics-based simulations such as Computational Fluid Dynamics (CFD).

When to use, and how to choose among traditional linear regression approximation methods and spatial regression interpolation methods will be discussed. The effective practice of using checkpoint simulations for determining the accuracy of surrogate model predictions will be demonstrated.

Location: TH348 Classification: UNCLASSIFIED Working Group: Tutorial

## 65754 - Introduction to Probability Management

Start Date: 6/12/2023	Start Time: 3:00 PM	End Time: 5:00 PM
Authors: Dr. Sam Savage; Mr. Phil	ip Alan Fahringer; Connor S McLem	ore

Abstract: The discipline of probability management communicates uncertainty as data that obey both the laws of arithmetic and the laws of probability. The latest open standards can express millions of stochastic simulation trials as small JSON objects stored in the cloud. Formerly siloed stochastic simulations may be assembled into collaborative networks. This tutorial will show how the results of simulations, data science, AI, and statistical applications may be used in chance-informed dashboards by non-technical decision makers in such environments as websites, native Excel models, or other downstream simulations.

Attendees are encouraged to bring their laptops with Excel as DISA approved Excel add-ins will be provided. The tutorial will explain how to create examples such as the Top Gun Maverick and Eagle Claw models available at the MORS Probability Management Community of Practice.

Location: TH347 Classification: UNCLASSIFIED Working Group: Tutorial

## 66089 - How to Validate Your Models and Simulations

Start Date: 6/13/2023	Start Time: 3:00 PM	End Time: 5:00 PM
Authors: Dr. Averill Martin Law		

Abstract: All models and simulations are surrogates for physical experimentation with the system of interest, which is usually impossible, disruptive, or not cost-effective. Thus, if a model is not reasonably "valid," then any conclusions drawn from the model results might, very well, be erroneous. In this tutorial we present a comprehensive set of techniques for building valid and credible simulation models. Ideas to be discussed include the importance of a definitive problem formulation, discussions with subject-matter experts, interacting with the decision-maker on a regular basis, development of a written "assumptions document" (not the same as a requirements document or conceptual model), structured walk-through of the assumptions document, use of sensitivity analysis to determine important model factors, comparison of model and system output data for an existing system (if any) using numerical statistics and graphical plots, and comparison of model output data with the comparable output data from another model that is thought to be "valid." Each idea will be illustrated by one or more real-world examples. We will also discuss the considerable difficulty in using formal statistical techniques (i.e., confidence intervals and hypothesis tests) to validate simulation models, due to the unavailability of model and system output data with the correct characteristics.

## 65647 - Analysis of War Games

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Start Date: 6/13/2023	Start Time: 3:30 PM	End Time: 5:00 PM		
Authors: Dr. John Thomas Hanley, Jr, PhD				
Abstract: "Gaming is a powerful method for simultaneously mastering complexity, enhancing				
communication, stimulating creativity, and contributing to consensus and a commitment to action."				
(Duke & Guertz, 2004, p. 23) However, games cannot provide proof of cause-effect relationships. The				
reasoning in games is abductive, triggering insights that require further investigation. Along with the				
invention of the game of Kriegsspiel in the early nineteenth century, the Prussians instituted a				
campaign of learning that became a model for U.S. Navy and led to success in the Pacific in World				
War II. The German Wehrmacht's even more rigorous campaign of learning between the World Wars				
provides additional lessons for gaming up and down the chain of command and interactions between				
concept generation and exploration, gaming, prototype development, and fleet/field exercises. The				
presentation will address how DoD has come to rely too heavily upon computer-based campaign				
analysis to execute its systems analysis paradigm. Also, the ability of artificial intelligence to compete				
with humans in games is a principal metric for advances in AI. Games as parts of campaigns of				
learning will become even more important with the deployment of artificial intelligence. One hour is				
required for the presentation and Q&A.				
Location: TH329				

Classification: UNCLASSIFIED Working Group: Tutorial

# 65456 - Art of Successful Analysis

Start Date: 6/13/2023	Start Time: 3:30 PM	End Time: 5:00 PM		
Authors: Mr. Arthur H. Barber, III, FS				
Abstract: This tutorial presentation, which was very well-attended at the 90th Symposium, will				
summarize the key steps in the end-to-end process of developing and delivering quality, successful				
analysis and then explain how to succeed at each step. These steps include defining the problem in				
terms suitable for analysis; attacking it with appropriate analytic techniques; assuring quality of the				
results; preparing the briefing of results; and delivering the briefing. It particularly emphasizes and				
provides guidelines for success in the last two of these. The presentation incorporates lessons from				
the author's 25 years of leading analysis projects and organizations in the Pentagon and 9 subsequent				
years as the Chief Analyst of a major private sector analytic provider.				
Location: TH341				

Location: TH341 Classification: UNCLASSIFIED Working Group: Tutorial

#### 65649 - Confrontation Analysis

Start Date: 6/15/2023	Start Time: 3:30 PM	End Time: 5:00 PM		
Start Date: 0/15/2025				
Authors: Dr. John Thomas Hanley, Jr. PhD				

Abstract: Confrontation Analysis is a gaming technique based upon game theory developed to account for contending sides dynamically introducing new strategic options as the situation evolves. Confrontation Analysis can be used both for anticipating the behavior of various actors involved in a contingency, or bringing actual stakeholders together, as British gamers have in conflicts in the Balkans, the Levant, and Libya. Employed by British General Rupert Smith when he served as Commander Bosnia and Herzegovina Command in 1995-1996, the technique was refined for peace operations campaigns and is broadly applicable to "gray zone" and coalition-building campaigns, and for bringing together stakeholders having different positions where there is no threat of actual violence. The technique, supported by computer software, identifies dilemmas created by the positions of the various players and provides the players opportunities to revise their positions as the other players do, leading to resolving the conflict or a better understanding of what conditions need to change to if the conflict is to be resolved. The presentation will use material from a class that explored follow on to the Joint Comprehensive Plan of Action for Iran's nuclear material following President Trump's decision to withdraw from the agreement.

Location: TH342 Classification: UNCLASSIFIED Working Group: Tutorial

#### 66204 - Depicting and Assessing Risk Correctly: The Pandemic Case

Start Date: 6/15/2023	Start Time: 3:30 PM	End Time: 5:00 PM	
Authors: Dr. Douglas A. Samuelson			

Abstract: We discuss how to assess various methods of depicting and responding to threats: risk is best expressed as neither a sum nor a product, but rather as a sum of products -- or, in more general form, a multiple Stieltjes integral. This seemingly somewhat daunting depiction greatly clarifies the problem and simplifies readily, as SIPMath <sup>™</sup> provides a quick and easy way to compute probabilities and expected values of consequences. Chancification <sup>™</sup> software, the newest breakthrough from probabilitymanagement.org, then makes it easy to display histograms of risk and locate tipping point values. Deterrent and mitigation effects are then best depicted as the difference between computed risk with and without the proposed measure. We then show how usual metrics of statistical variation can be wildly misleading when assessing risks involving rare, high-consequence events, often leading to grossly inaccurate estimates of risk. Again, proper depiction of risk avoids the pitfalls. Illustrative examples are drawn from modeling scenarios of spread and mitigation of epidemics, including how to estimate whether facilities are likely to be overwhelmed. We note that the same methods and software can be easily adapted to cybersecurity scenarios. We present and discuss how to apply SIPMath and Chancification to develop these kinds of metrics.

Location: TH347 Classification: UNCLASSIFIED Working Group: Tutorial

## 68718 - MORS Mentorship Program - MentorCity

Start Date: 6/15/2023	Start Time: 3:30 PM	End Time: 5:00 PM		
Authors: Dr. Simon Goerger; Ms Katherine Miller; Dr. David Myers				
Abstract: The MORS Mentorship Program is designed to match MORS members with a mentor that				
can help the member plan their career, become more involved in MORS, and/or improve a				
presentation or paper. The program helps MORSians achieve their professional goals by improving				
their understanding of and skills as related to the National Security Analytical Community and/or				
Society through engagements with MORSians. The programs objectives include, a) professional				
development of MORSians as members of the National Security Analytical Community, and b)				
development of MORSians as leaders of the Society. This tutorial is designed to familiarize MORSians				
with the MORS Mentorship Program, the MORS mentorship website, and the 2023 MORS MentorCity				
web-based tool that facilitates the linkage and collaboration of MORS mentors and mentees.				
Location:				
Classification: UNCLASSIFIED				
Working Group: Tutorial				