

Report Title

Final Report: 18th U. S. Army Conference on Applied Statistics

ABSTRACT

About ACAS

The U.S. Army Conference on Applied Statistics (ACAS) is a forum for the presentation and discussion of theoretical and applied papers related to the use of probability and statistics in solving defense problems. The conference provides an invaluable opportunity for interaction among academic, industry, and defense scientists. It also serves a nurturing role in the elevation of statistical competence among defense researchers in other disciplines who find themselves statistical practitioners because of the compelling benefits statistical science brings to defense research, development, and testing.

The conference is structured as follows. General sessions offer invited presentations on emerging topics in statistics. Special sessions focus attention on Army problem areas in which the role of statistical science can be more fully explored. Contributed sessions include papers ranging from new methodology to interesting statistical application. In the clinical sessions, a distinct feature of the conference, presenters can seek guidance from a panel of experts for problems that have not been completely or satisfactorily solved. Defense and security context is strongly encouraged as the motivation or as a potential application for all work presented, but the focus is to be statistics.

Two other important events take place at the conference. A tutorial on a statistical topic believed to be important in defense application precedes each conference. The Army Wilks Award is given periodically at this conference to an individual who has made significant contributions to the practice of statistical science in the Army through research in statistics and application of statistics in the solution of Army problems.

ACAS was established in 1995 by six sponsoring activities: the U.S. Army Research Laboratory, the U.S. Army Research Office, the U.S. Military Academy, the Walter Reed Army Institute of Research, the National Institute of Standards and Technology, and TRADOC Analysis Center-White Sands Missile Range. The U.S. Army Research Laboratory took the lead role in administering the conference, with support provided from numerous personnel in these organizations and others across the Army and academia. In 2005, ACAS became a conference of the Interface Foundation of North America, a move intended to provide greater autonomy and reach for the meeting. ACAS is the successor to the Conference on the Design of Experiments in Army Research, Development, and Testing, a historic series of meetings that formally concluded in 1994 after 40 years of service to the Army.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

<u>Received</u>	<u>Paper</u>
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TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

<u>Received</u>	<u>Paper</u>
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TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

see attachment SF-298-Cont-ACAS2012.docx

Number of Presentations: 51.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received Paper

TOTAL:

Number of Manuscripts:

Books

Received Book

TOTAL:

Received Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

Wilks Army Medal awarded

Graduate Students

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
FTE Equivalent:	
Total Number:	

Names of Post Doctorates

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
FTE Equivalent:	
Total Number:	

Names of Under Graduate students supported

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
FTE Equivalent:	
Total Number:	

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields: 0.00

Names of Personnel receiving masters degrees

<u>NAME</u>
Total Number:

Names of personnel receiving PHDs

<u>NAME</u>
Total Number:

Names of other research staff

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
FTE Equivalent:	
Total Number:	

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

The grant supported the ACAS 2012 scientific meeting.

Technology Transfer

Program is designed to encourage and facilitate interactions among DoD scientists, ARO grantees, industrial visitors, and students. See attachment for complete program and short course offerings.

ACAS 2012 24-26 October, 2012
Interface Foundation of North America, Inc., EIN 54-1522706

Executive Summary

About ACAS

The U.S. Army Conference on Applied Statistics (ACAS) is a forum for the presentation and discussion of theoretical and applied papers related to the use of probability and statistics in solving defense problems. The conference provides an invaluable opportunity for interaction among academic, industry, and defense scientists. It also serves a nurturing role in the elevation of statistical competence among defense researchers in other disciplines who find themselves statistical practitioners because of the compelling benefits statistical science brings to defense research, development, and testing.

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Program in Brief

The 2012 program for the Army Conference on Applied Statistics in brief:

- **Welcome:**
 - Vice Admiral Daniel T. Oliver (Retired), President, Naval Postgraduate School

- **Short Course:**

- **Statistics for Spatio-Temporal Data**

- Prof. Christopher K. Wikle of the University of Missouri will present a free short course for registered conference attendees, "Statistics for Spatio-Temporal Data", prior to the conference on October 22 & 23. This state-of-the-art presentation of spatio-temporal processes bridges classic ideas with modern hierarchical statistical modeling concepts.

- **Invited Speakers:**

- C.F. Jeff Wu (Georgia Institute of Technology)
Keynote: Three-Phase Optimal Design of Sensitivity Experiments
 - Ofer Harel (University of Connecticut)
How to Complete the Incomplete: A Statistical Antidote for Incomplete Data Sets
 - Thomas E. Love (Case Western Reserve University)
Designing Observational Studies to Avoid Being Misled
 - Ji Zhu (University of Michigan)
Extracting Communities from Networks

- **Banquet Speaker:**

- Lt. General Robert G. Gard (Retired) (Monterey Institute of International Studies)

- **Special Sessions:**

- **Reliability Growth**
Organizer: Arthur Fries (Institute for Defense Analyses)

Angelo Christino, Robert N. Tamburello, and Michael J. Cushing (Army Evaluation Center)
Lessons Learned during the Test and Evaluation of Reliability Growth Programs

Owen S. Martin (RSA Group)
A Dynamic Competing Risk Model and Its Implications

Ananda Sen (University Michigan)
Statistical Inference for a Parametric Model for Repairable Systems under Multiple Failure Modes

- **Simulation Experiments & Efficient Design**

Organizer: Tom Donnelly (SAS Federal)

Peter Qian (University of Wisconsin)
Demystifying Kriging Models with Massive Data

Susan Sanchez, Thomas W. Lucas, Paul J. Sanchez, Alejandro Hernandez
(Naval Postgraduate School)
Recent Breakthroughs in Large-Scale Simulation Studies

Brian Williams (Los Alamos National Laboratory)
Sequential Importance Sampling for Rare Event Estimation with Computer Experiments

- **Design & Analysis of Observational Studies**

Organizers: Allyson Wilson (Institute for Defense Analyses) and Yevgeniya K. Pinelis (Center for Naval Analysis)

Wei Pan (Duke University)
Propensity Score Analysis: Concepts, Issues, and Examples

Michael Baiocchi (Stanford University)
Designing Observational Studies to be More Like Randomized Experiments

- **Contributed Sessions:**

- **Stochastic Optimization & Modeling (1)**

Organizer: Janet Spoonamore (US Army Research Office)

Lookahead or Lookback: A Hybrid Architecture to Approximate Dynamic Programming

Haitao Li and Keith Womer (University of Missouri, St. Louis)

Made-to-Order Production Scheduling using Bayesian Updating

Keith Womer, J. Camm, C. Osterman, and Haitao Li (University of Missouri, St. Louis)

Uncertainty Quantification using Soft Information and Exponential Epi-splines

Johannes O. Royset, Naval Postgraduate School & Roger J-B Wets (University of California, Davis)

- **Stochastic Optimization & Modeling (2)**

Organizer: Janet Spoonamore (US Army Research Office)

Threshold Boolean Reformulation of Probabilistic Constraints with Multi-Row Random Technology Matrix Miguel Lejeune (George Washington University)

and Alexander Kogan (Rutgers University)

An Integrated Model for Locating and Dispatching Ambulances

Laura A. McLay and Sardar Ansari (Virginia Commonwealth University)

Characterizing Probability Distributions Using Econometric Concentrations

Nozer D. Singpurwalla (George Washington University)

○ **Mathematical Modeling of Neural Processes in Decision Making**

Organizer: Janet Spoonamore (US Army Research Office)

Divisive Normalization in Neural Circuits Drives Context-Dependent Choice

Kenway Louie and Paul W. Glimcher (New York University)

The Role of Incentive Schemes in Probability Assessment under Uncertainty

Adam S. Goodie (University of Georgia)

Neurally-Informed Graph-Based Transductive Models for Rapid Decision Making

Paul Sajda (Columbia University)

Modeling Real and Artificial Neurons for Robot Control

Holly Yanco and Abraham Shultz (University of Massachusetts)

• **Contributed Speakers:**

○ *Achieving the First Reliability Benchmark of a Reliability Program Plan*

Nathan Herbert (US Army Materiel Systems Analysis Activity)

○ *Detection of Changes in Resilience and Level of Coordination in Terrorist Groups*

Vasanthan Raghavan, Aram Galstyan and Alexander G. Tartakovsky (University of Southern California)

○ *A Bayesian Approach to Evaluation of Land Warfare Systems*

Lee S. Dewald (Virginia Military Institute), Robert Holcomb (Institute for Defense Analyses), Sam Parry (Consultant, Institute for Defense Analyses), Alyson G. Wilson (IDA Science and Technology Policy Institute)

○ *Confidence Intervals for Binary Responses - R50 & the Logistic Model*

Arnon Hurwitz (Edwards Air Force Base)

○ *DaViTo: An Open-Source Mapping, Graphics, and Analysis Tool*

Sam Buttrey (Naval Postgraduate School), James Henry (US Army), Lyn R. Whitaker (Naval Postgraduate School), Arnold Buss (Naval Postgraduate School)

- *Accelerated Test Methods for Reliability Prediction*
David H. Collins (Los Alamos National Laboratory), Jason K. Freels (Air Force Institute of Technology), Aparna V. Huzurbazar (Los Alamos National Laboratory), Richard L. Warr (Air Force Institute of Technology), Brian P. Weaver (Los Alamos National Laboratory)
- *Reliability Growth Projection Applicable to Multiple Units Under Test*
Paul Ellner (US Army Materiel Systems Analysis Activity), Martin Wayne (US Army Materiel Systems Analysis Activity)
- *On the "No-Internal-Zeros Conjecture" for System Signatures in Reliability*
Francisco Samaniego (University of California-Davis)
- *Africa Knowledge, Data Source, and Analytic Effort Exploration*
MAJ Thomas Deveans (US Army TRADOC Analysis Center (TRAC) – Monterey)
- *Operational Risk Analysis: New Analysis Methods for Numerical and Non-numerical Survey Responses*
Michele Wolfe (US Army TRADOC Analysis Center (TRAC))
- *Measurement System Analysis and Applications to Improvements in Body Armor Testing*
Sandra Meiselwitz and Barbara J. Gillich (US Army Aberdeen Test Center)
- *Speed vs. Accuracy, the Shooter's Dilemma*
MAJ Benjamin Thirey and MAJ Christopher E. Marks (United States Military Academy)
- *Continuous Updating Procedure for Flow Field Forecasting*
Kyle Caudle (South Dakota School of Mines & Technology), Michael Frey (Bucknell University)
- *Statistical Models for Combining Information: Stryker Reliability Case Study*
Rebecca Dickinson (Virginia Tech University), Laura Freeman and Alyson Wilson (Institute for Defense Analyses)
- *Computing POD for Structural Health Monitoring Systems*
Christine M Schubert Kabban (Air Force Institute of Technology), Mark M. Derriso (Air Force Research Laboratory), Brandon Greenwell (Air Force Institute of Technology)
- *Recognition of Microcalcifications in Mammograms: Feature Extraction*
Ben Riggan & Wesley Snyder (North Carolina State University), Robert Basilico, Rita Freimanis, & Joseph Mammarappallil (Wake Forest School of Medicine)

REPORT DOCUMENTATION PAGE (SF 298 Continuation Sheet)

- *Developing Joint Model of Repeated Measure and Survival Outcome*
Jason Zhou and Harry Ji (Digital System, Inc.), Yuanzhang Li (U.S. Army Medical Research and Materiel Command)
 - *Regression Trees for Censored Data with Applications to Subgroup Identification*
Wei-Yin Loh (University of Wisconsin)
 - *Verifying System Performance Using Designed Simulation Experiments*
Terril N Hurst, Allan T Mense, and Colin Pouchet (Raytheon Missile Systems)
 - *Measuring R50 in Aircraft Radar Blip Scan Data: Lessons Learned in Increasing Analysis Rigor*
Todd Remund & Jeff Weisz (Edwards AFB, Colorado)
 - *Discrete Approximations of Controlled Stochastic Systems with Memory*
Mou-Hsiung (Harry) Chang (U.S. Army Research Office)
 - *Consensus, Control and Minority Opinion*
Bruce J. West (U.S. Army Research Office)
 - *Comparative Testing*
Jacob J. Warren (Marine Corps Operational Test and Evaluation Activity – MCOTEA)
 - *F-16 Radar Performance Analysis: Do Bayesian Hierarchical Models Provide Better Insight into System Characterization than Standard Techniques?*
James Brownlow (Edwards Air Force Base)
 - *Applications of Clustered Designs*
Selden Crary (NewallStreet, Inc.)
 - *Geographical Trends in Cancer Mortality: Using Spatial Smoothers and Methods for Adjustment*
Karen Kafadar (Indiana University)
 - *DOE and Tolerance Design for Antenna Design*
William C. Thomas (Raytheon Missile Systems)
 - *A Robotic Trenching Capability Experiment*
Barry A. Bodt, U.S. Army Research Laboratory
- **Events:**
 - Social: Tuesday, October 23, Casa Munras
 - Wilks Award Banquet: Wednesday, October 24, Casa Munras

Short Course:

Statistics for Spatio-Temporal Data

October 22 & 23

- Prof. Christopher K. Wikle, University of Missouri
- This state-of-the-art presentation of spatio-temporal processes bridges classic ideas with modern hierarchical statistical modeling concepts. From understanding environmental processes and climate trends to developing new technologies for mapping public-health data and the spread of invasive species, there is a high demand for statistical analyses of data that takes spatial and/or temporal information into account.

Prof. Wikle's course will consider a systematic approach to key quantitative techniques for the statistical analysis of such data that features hierarchical (empirical and Bayesian) statistical modeling, with an emphasis on dynamical spatio-temporal models.

This training will cover material from the 2011 text "Statistics for Spatio-Temporal Data, 2nd ed." by Cressie & Wikle.

The short course is a free service offered to conference registrants. No additional fees are required beyond conference registration.

Schedule at a Glance

Wednesday, October 24

0745 – 0815 Registration (Andalucía Ballroom)

0815 – 0830 Call to Order (Andalucía Ballroom)

Allan Mense, Conference Chair, Raytheon Missile Systems

Welcome: Vice Admiral Daniel T. Oliver (Ret.), President, Naval Postgraduate School

0830 – 0915 General Session I (Keynote Address) (Andalucía Ballroom)

Chair: Allan Mense, Raytheon Missile Systems

0915 – 0930 Break

0930 – 1100 Special Session I, Reliability Growth (Andalucía Ballroom)

Organizer & Chair: Arthur Fries, Institute for Defense Analyses

1100 – 1115 Break

1115 – 1215 Contributed Session I (Andalucía-1) (Parallel Session)

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REPORT DOCUMENTATION PAGE (SF 298 Continuation Sheet)

Chair: Charles E White, Walter Reed Army Institute of Research

1115 – 1215 Contributed Session II (Andalucía-2) (Parallel Session)

Chair:

1215 • 1330 Lunch

1330 – 1500 Contributed Session III (Andalucía-1) (Parallel Session)

Chair: Scott Hunter, Dugway Proving Ground

1330 – 1500 Contributed Session IV (Andalucía-2) (Parallel Session)

Chair: Jock Grynovicki, U.S. Army Research Laboratory

1500 – 1515 Break

1515 • 1715 Contributed Session V, (Andalucía-1) (Parallel Session)

Chair: Karen Kafadar, Indiana University

1515 • 1715 Contributed Session VI, (Andalucía-2) (Parallel Session)

Chair: Lee Dewald, Virginia Military Institute

1830 • 2100 Wilks Award Banquet (Marbella)

1830 – Social

1930 – Dinner

2015 – Banquet Address: Lt. General Robert G. Gard (Ret.), Monterey Institute of International Studies

2045 – Wilks Award

Thursday, October 25

0830 – 0915 General Session II (Andalucía Ballroom)

Chair: COL Andrew Glen, United States Military Academy, West Point

0915 – 0930 Break

0930 – 1100 Special Session II, Simulation Experiments and Efficient Design (Andalucía Ballroom)

Organizers: Tom Donnelly, SAS Federal; Alyson G. Wilson, IDA Science and Technology Policy Institute; David Webb, U.S. Army Research Laboratory

Chair: Tom Donnelly, SAS Federal

1100 – 1115 Break

1115 – 1200 General Session III (Andalucía Ballroom)

Chair:

1200 – 1315 Lunch

1315 – 1415 Special Session III, Design and Analysis of Observational Studies (Andalucía-1) (Parallel Session)

Organizers: Alyson G. Wilson, IDA Science and Technology Policy Institute and Yevgeniya K. Pinelis, Center for Naval Analysis

Chair: Art Fries, Institute for Defense Analyses

1315 – 1415 Contributed Session VII (Andalucía-2) (Parallel Session)

Chair: William C. Thomas, Raytheon Missile Systems

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1415 - 1430 Break

1430 - 1600 Contributed Session VIII, (Andalucía-1) (Parallel Session)

Chair: Arthur Fries, Institute for Defense Analyses

1430 - 1600 Contributed Session IX, Stochastic Optimization & Modeling 1 (Andalucía-2) (Parallel Session)

Organizer: Janet Spoonamore, US Army Research Office

Chair: Haitao Li, University of Missouri, St. Louis

1600 - 1615 Break

1615 - 1745 Contributed Session X, (Andalucía-1) (Parallel Session)

Chair: Yuanzhang Li, U.S. Army Medical Research and Materiel Command

1615 - 1715 Contributed Session XI, (Andalucía-2) (Parallel Session)

Chair: Lee Dewald, Virginia Military Institute

Friday, October 26

0800 - 0845 General Session IV (Andalucía Ballroom)

Chair: Yuanzhang Li, Walter Reed Army Institute of Research

0845 - 0900 Break

0900 - 1030 Contributed Session XII, Stochastic Optimization & Modeling 2 (Andalucía Ballroom)

Organizer: Janet Spoonamore, Army Research Office

Chair: Laura A. McLay, Virginia Commonwealth University

1030 - 1045 Break

1045 - 1245 Contributed Session XIII, Mathematical Modeling of Neural Processes in Decision Making (Andalucía Ballroom)

Organizer: Janet Spoonamore, US Army Research Office

Chair: Holly Yanco, University of Massachusetts

1245 Adjourn

ABSTRACTS

Tutorial

Monday/Tuesday: October 22 and 23, 2012

Statistics for Spatio-Temporal Data

Prof. Christopher K. Wikle, University of Missouri

This tutorial will include a presentation of state-of-the-art spatio-temporal processes, bridging classic ideas with modern hierarchical statistical modeling concepts. From understanding environmental processes and

Enclosure 2

climate trends to developing new technologies for mapping public-health data and the spread of invasive-species, there is a high demand for statistical analyses of data that takes spatial and/or temporal information into account. Prof. Wikle's course will consider a systematic approach to key quantitative techniques for the statistical analysis of such data that features hierarchical (empirical and Bayesian) statistical modeling, with an emphasis on dynamical spatio-temporal models. This training will cover material from the text *Statistics for Spatio-Temporal Data* by Cressie & Wikle. The book by Cressie & Wikle will be available for purchase at a conference discount.

General Session I

Wednesday AM, October 24, 2012

Keynote Address: Three-phase optimal design of sensitivity experiments

C. F. Jeff Wu, Georgia Institute of Technology

Abstract: In sensitivity testing the test specimens are subjected to a variety of stress levels to generate response or non-response. These data are used to estimate the critical stimulus (or threshold) level of the experimental object. Because of its versatile applications, several sensitivity testing procedures have been proposed and used in practice. There remains the outstanding question of finding an efficient procedure, especially when the sample size is small and the interest lies in the extreme percentiles. In the paper, we propose a novel three-phase procedure, dubbed 3pod, which can be described as a trilogy of "search-estimate-approximate". A core novel idea is to choose the stress levels to quickly achieve an overlapping data pattern which ensures the estimability of the underlying parameters. Simulation comparisons show that 3pod outperforms existing procedures over a range of scenarios in terms of efficiency and robustness. (Joint work with Yubin Tian.)

Special Session I, Reliability Growth

Wednesday AM, October 24, 2012

Lessons Learned during the Test and Evaluation of Reliability Growth Programs

Mr. Robert N. Tamburello and Dr. Michael J. Cushing

United States Army Evaluation Center

Abstract: The U.S. Army implemented policy to improve reliability in December 2007 which required major U.S. Army programs to have a comprehensive reliability growth strategy with a reliability growth planning curve in the Test and Evaluation Master Plan (TEMP). The U.S. Department of Defense followed with a reliability policy in 2008 and an update in March 2011. As well, the U.S. Army updated its reliability policy in June 2011, which requires the reliability growth planning curve to also be included in the Systems Engineering Plan and the Engineering Manufacturing and Development contract in addition to the TEMP. The U.S. Army reliability policy directs each program manager to perform design-for-reliability activities prior to acquisition Milestone B in order to mitigate the risk of failing to demonstrate reliability requirements. These policies have driven a marked rise in the application of reliability growth principles to programs undergoing test and evaluation. Over time, the number of reliability growth programs has increased from just a handful to about twenty currently in testing. Additionally, roughly twenty more reliability growth programs are in the planning stage. Early test results are in for many of the programs now undergoing reliability growth testing. In this presentation, we discuss the general trends observed in the reliability growth programs, including the reasons why many programs are struggling to achieve their goals. As well, we propose improvements to the engineering and acquisition processes to simultaneously manage government and developer risks and improve the likelihood that U.S. Army programs will achieve their reliability requirements.

A Dynamic Competing Risk Model and Its Implications

Owen S. Martin

RSA Group

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Abstract: In the problem of modeling the growth or change in reliability of a system that undergoes debugging, we have found a class of new avenues to explore in creating models. This class, the Poisson mixture of M failure times, has appeared in the literature before but actually begets paradox with respect to infallability. We explore this potential paradox and propose a few methods to resolving it.

Statistical Inference for a parametric model for repairable systems under multiple failure modes

Ananda Sen

University of Michigan

Abstract: The focus of this talk is on failure history of a repairable system for which the relevant data comprise successive event times for a recurrent phenomenon along with an event count indicator. I shall report an investigation for analyzing failures from repairable systems that are subject to multiple failure modes. The context discussed is the parametric framework of the Army Material Systems Analysis Activity (AMSAA) model that has found considerable attention in modeling the failure process of defense systems. I will highlight some interesting and non-standard inference results that ensue. Findings from extensive simulation will be reported. An extension to the case where the specific cause of failure may be missing will be indicated. I shall discuss the application of the methodology on data on recurrent failures of a vertical boring machine that documents the specific component responsible for failure.

Contributed Session I (parallel session)

Wednesday AM, October 24, 2012

Measuring R_{50} in Aircraft Radar Blip Scan Data: Lessons Learned in Increasing Analysis Rigor

Todd Remund and Jeff Weisz

Edwards AFB, CA

Abstract: A series of tests are run to portray windmill effects on aircraft radar systems. Three questions are posed for analysis of the data. In reference to radar detection distance of R_{50} , or range at which there is 50% detection probability, the questions are:

1. For three increasing distances from windmills where two head to head aircraft are in a direct approach vector to the windmills, is there a difference among test conditions in radar detection distance, R_{50} ?
2. For four head to head encounters of two aircraft in a horizontally shifted approach vector to the windmills, is there a difference among test conditions in R_{50} ?
3. Is there a difference between radar moving target rejection settings 55 and 110 in R_{50} ?

Old methods of measuring this distance proved inadequate due to lack of rigor in analysis between R_{50} values from different groups. While it is possible to achieve an estimate of the R_{50} value from old methods, it is difficult to infer statistical significance in the estimate as well as bounding it with a confidence interval. It is yet more difficult to achieve a confidence interval on the difference between two R_{50} values from different test conditions. Using new applications of logistic regression and bootstrapping techniques, statistical rigor can be added to analysis of blip scan data. This paper will present the analysis of radar data where the R_{50} values are not only estimated but compared across different test conditions. Direct analysis and confidence intervals are computed to address the question of difference in the previously stated analysis instead of comparing confidence intervals from each R_{50} at the different test conditions with one another. This method is known to be inefficient and is discussed in the paper. This application will open the door of consideration for more rigorous and efficient statistical analysis techniques in flight test.

Confidence Intervals for Binary Responses – R50 and the Logistic Model

**Arnon Hurwitz
Edwards AFB, CA**

Abstract: Logistic regression is a non-linear method for modeling a binary response variable. For example, $y = \{\text{success, failure}\}$ for blip-scan radar detections. Such responses cannot be modeled using regular linear regression. In our work, many applications of logistic regression present themselves. Models allowing independent slopes and independent intercepts are considered for comparing multiple groups of measures. The question that we consider here is the construction of a confidence interval about the difference in the Range 50 (R50) values for two such curves with each value (R1, R0) arising from the separate curve. R50 represents the range at which radar achieves 50% detection probability. This problem is akin to the problem of prediction of the LD50 ('lethal dose 50%') value in medical science. We approach the problem analytically and check our results using bootstrap simulation. A feature is the use of 'inverse prediction' or calibration methods.

Contributed Session II (parallel session)

Wednesday AM, October 24, 2012

Detection of Changes in Resilience and Level of Coordination in Terrorist Groups

**Vasanthan Raghavan, Aram Galstyan and Alexander G. Tartakovsky
University of Southern California**

Abstract: We are interested in developing models for the activity profile of a terrorist group, detecting sudden spurts and downfalls in this profile, and in attributing spurts to either an increased resilience in the organizational dynamics or an increased level of coordination between different sub-groups in the group or both of these aspects. For this, a d -state hidden Markov model (HMM) that captures the latent states underlying the dynamics of the group is proposed. The simplest setting of $d = 2$ corresponds to the case where the dynamics are coarsely quantized as *Active* and *Inactive*, respectively. It is shown that a state estimation strategy based on the Viterbi algorithm detects sudden spurts in the activity profile and tracks them over a period of time very well. Aided by a majorization theory-based framework, spurts are then classified into those corresponding to increased resilience or increased level of coordination. Case studies with real terrorism data are provided to illustrate the performance of the proposed methodologies.

Consensus, Control and Minority Opinion

**Bruce J. West
U.S. Army Research Office**

Abstract: A few years ago I helped initiate a program to understand networked decision making and which reestablishes connections that had been severed by the boundaries separating the physical and human sciences. A particularly significant outcome of this research has been the statistical Decision Making Model (DMM) for complex networks that undergoes a phase transition at a critical value of the coupling parameter. The DMM has provided insight into the information exchange between complex networks and why inflexible minorities can dominate the behavior of complex social networks; possible mechanisms to explain the Arab Spring and the Occupy Wall Street movement. DMM dynamics self-organize linked elements on a simple two-dimensional lattice through a phase transition to generate a scale-free interdependent topological structure with an inverse power-law exponent of 1.0 and an inverse power-law distribution of consensus times with index 1.5. The DMM dynamics are sensitive to internally committed minorities and to internal minorities that are externally controlled. These minorities are unresponsive to the host network and are shown to either stabilize or induce social crisis.

Contributed Session III (parallel session)

Wednesday PM, October 24, 2012

A Bayesian Approach to Evaluation of Land Warfare Systems

Lee S. Dewald, Sr., (VMI), Robert Holcomb (IDA), Sam Parry (IDA), Alyson Wilson (IDA)

Abstract: For some time there has been a general dissatisfaction with the statistical analyses used in operational testing of land warfare systems. In this paper we review the current paradigm; critique perceived deficiencies with the current methodology; and demonstrate how a Bayesian approach could be applied to the planning, conduct, and analysis of land warfare systems under test by utilizing data from previous field tests and simulations to assist in designing the next field test to take advantage of prior information. We first apply this approach to the analysis of Blue Survivors and Red Killed as univariate measures of effectiveness (MOE) in the operational testing of digitized and non-digitized forces from AWE testing of a mechanized force and the subsequent DCX exercises. We conclude by illustrating a Bayesian approach using hierarchical modeling to the analysis of the Loss-Exchange Ratio (LER) from AWE testing, DCX exercises, and simulation runs of JCATS.

Statistical Models for Combining Information: Stryker Reliability Case Study

Rebecca Dickinson (Virginia Tech), Laura Freeman (IDA), Alyson Wilson (IDA)

Abstract: Reliability is an essential element of system suitability in the Department of Defense. It often takes a prominent role in both the design and analysis of operational tests. However, in the current era of reducing budgets and increasing reliability requirements, it is challenging to verify reliability requirements during an initial operational test (IOT). This talk illustrates the benefits of using parametric statistical models to combine information across multiple test events. Both Bayesian and Non-Bayesian inference techniques are employed and contrasted to illustrate different statistical methods for combining information. We apply these methods to both developmental and operational test data for Stryker Armored Vehicle. We illustrate how the conclusions of the reliability analysis would have differed if these parametric models had been used at the conclusion of the IOT.

F-16 radar performance analysis- do Bayesian hierarchical models provide better insight into system characterization than standard techniques?

James Brownlow

Edwards AFB, CA

Abstract: Radar system analysis addresses a variety of system performance parameters. Target detection range is one of the most common measures of performance. Typically, detection range is specified as a probability (ref 1)- R.50- the range at which the probability of detecting a target is 0.5. Methods for estimating R.50, based on blip-scan data, include averaging range-to-target bin data, logistic regression generalized linear models (GLMs), and Bayesian hierarchical models. This paper presents the background and analysis advantages of using Bayesian hierarchical logistic- and arc sine regression models. Arcsin models in particular may offer the advantage of lower overall root mean square errors. This paper presents an analysis of F-16 R.50 radar detection using (unclassified) flight test data and a variety of generalized linear models to estimate R.50. That is, $\text{prob}(\text{Detection}=1|\text{range, test run number})$ is modeled using logit, cloglog, probit, and cauchit generalized linear models. The same data are analyzed with Bayesian hierarchical models, using both logit and arcsine links. Model comparisons are made using information likelihood (AIC) methods. Shortcomings of the GLM models include possible over dispersion and the inability to identify (in some rigorous sense) "atypical" flight test runs. The two Bayesian hierarchical models (logit, and arcsin) are shown to provide additional insight into R.50 estimation.

Contributed Session IV (parallel session)

Wednesday PM, October 24, 2012

DaViTo: An Open-Source Mapping, Graphics, and Analysis Tool

Sam Buttrey (NPS), James Henry (US Army), Lyn R. Whitaker (NPS), Arnold Buss (NPS)

Abstract: Analysts in contemporary military operational environments accumulate vast amounts of data. These include data on, for example, incidents like IEDs; vehicle tracking; surveys; local economics; and demographics. Much of this will include a spatio-temporal component. Visualizing, exploring, and understanding this data reveals insights about our own forces' behavior as well as patterns within the environment. The Data Visualization Tool (DaViTo) merges several open-source software packages to create a single data exploration tool capable of uncovering these insights and patterns. The tool provides a suite of data exploration methods (current focused on point processes) that can be applied to the data by military analysts, who will be experts in operations rather than statistics. DaViTo's power derives from the capabilities of the open-source software upon which it has been built: OpenMap, JFreeChart, and R. Statisticians can provide additional functionality through R and its packages without Java programming. DaViTo is government-owned software, built solely with open-source tools, which may be run from a CD even in secure computing environments.

Africa Knowledge, Data Source, and Analytic Effort Exploration

MAJ Thomas Deveans

U. S. Army TRADOC Analysis Center (TRAC)

Abstract: The TRADOC Analysis Center (TRAC), Naval Postgraduate School, and other Department of Defense organizations are conducting large data capture and analysis efforts on areas all around the world. As efforts in the US Central Command Area of Responsibility (AOR) - particularly in Iraq and Afghanistan - draw down, many senior decision makers expect future efforts will be focused on the US African Command (AFRICOM) AOR. The Africa Knowledge, Data Source, and Analytic Effort Exploration will build an assessment framework focused on the AFRICOM AOR to identify the ideal data to be gathered and measured in a COIN environment. Then, by actually gathering the data points from multiple sources, gaps in the available data will be identified in comparison to the ideal. This effort will concurrently develop the necessary software within the Data Visualization Tool (DaViTo) - an open source, government owned exploratory data analysis tool - to allow the end user to construct an assessment framework using a customized weighting scheme and the ability to display results. Finally, this project will develop an irregular warfare scenario methodology and a small proof-of-principle use case in Nigeria by conducting factor analysis of survey data. It will use generalized linear models, both linear and multinomial logistic regression, to predict future issue stance scores, and the population's observed attitudes and behaviors, which will directly support TRAC's Irregular Warfare Tactical Wargame (IW TWG).

Regression trees for censored data with applications to subgroup identification

Wei-Yin Loh

University of Wisconsin

Abstract: Previous regression tree algorithms for censored response data are mostly based on the CART (Breiman et al. 1984) approach, which searches for splits that maximally reduce some node impurity function. As a result, the algorithms are biased toward selecting variables that afford more splits. Besides, since the best split must be found for every variable, the algorithms are limited in practice to fitting piecewise constant models. An alternative algorithm based on the GUIDE (Loh 2002, 2009) approach is proposed for fitting piecewise multiple-linear proportional hazards models. It uses an old trick that uses Poisson regression to

fit proportional hazards models. An importance ordering of the variables is obtained as a by-product. By utilizing the treatment variable as a linear predictor in the model at each node, the method can also be used to identify subgroups of the data that exhibit differential treatment effects. Evaluations based on real and simulated data show that the proposed method is as good or better than other tree methods and random survival forest, in terms of accuracy and computational speed in identifying the important variables.

Contributed Session V (parallel session)

Wednesday PM, October 24, 2012

Achieving the First Reliability Benchmark of a Reliability Program Plan

Nathan Herbert

US Army Materiel Systems Analysis Activity

Abstract: This paper presents reliability testing best practices and how to gain accurate assessments of the system's reliability through reliability growth modeling. Planning curves are developed in advance of the system-level reliability growth program. The design for reliability effort should eliminate debilitating failure drivers and help get the system reliability on the first benchmark of the planning curve. In order to demonstrate the reliability of the first benchmark, the testing must be operationally relevant and balanced with respect to the main stressors of the system. Such testing can produce data that are more reflective of the system's reliability under tactical use conditions. Utilizing this balanced data set and assigned fix effectiveness factors of the corrective actions, a reliability projection may be compared to the second benchmark of the planning curve in order to monitor progress of the system reliability growth. This paper illustrates the testing procedures and modeling techniques used by an actual Department of Defense acquisition program that achieved their first benchmark on the planning curve.

Accelerated Test Methods for Reliability Prediction

David H. Collins (LANL), Jason K. Freels (AFIT), Aparna V. Huzurbazar (LANL), Richard L. Warr (AFIT), Brian P. Weaver (LANL)

Abstract: Perusal of quality and reliability engineering literature indicates some confusion over the meaning of accelerated life testing (ALT), highly accelerated life testing (HALT), highly accelerated stress screening (HASS), and highly accelerated stress auditing (HASA). In addition, there is a significant conflict between testing as part of an iterative process of finding and removing defects, and testing as a means of estimating or predicting product reliability. We review the basics of these testing methods and describe how they relate to statistical methods for estimation and prediction of reliability and reliability growth. We also outline some synergies to help reconcile statistical and engineering approaches to accelerated testing, resulting in better product quality at lower cost.

Reliability Growth Projection Applicable to Multiple Units Under Test

Paul Ellner and Martin Wayne

US Army Materiel Systems Analysis Activity

Abstract: This paper presents a variant of the currently used estimation procedure for the parameters of the AMSAA Maturity Projection Model (AMPM). The AMPM model projects the reliability impact of corrective actions (termed fixes) to problem failure modes discovered in test. The original version of AMPM utilized the problem failure mode cumulative first occurrence times to estimate the model parameters. This allowed the model to be applied to corrective action strategies that employed all delayed fixes (implemented at the end of a test period), fixes implemented during the test period, or a mixture of both delayed fixes and fixes occurring sometime after the first occurrence of the failure mode and before the end of the test period. The paper presents an estimation procedure based on the first occurrence and all subsequent occurrences of failure due to each potential problem failure mode. This allows for the use of individual failure mode fix effectiveness factor assessments to be utilized, i.e., the expected reduction due to a fix in the occurrence rate of failures associated with a failure mode. The presented estimation procedure can also provide more accurate

assessments of a number of projection metrics such as the initial problem mode rate of occurrence, the rate of occurrence of new problem failure modes, and the growth potential mean-time-between failure (the value approached as the rate of occurrence of new problem failure modes approaches zero). The presented estimation procedure is especially suited to assessing the projected reliability and associated metrics for the often encountered case where multiple units of a system are undergoing reliability growth testing over test periods of different time durations that may be executed over different calendar periods. The presented estimation procedure can also be applied to the situation where due to the test schedule, corrective action facility and equipment availability, and other practical reasons, the fix to a failure mode observed on at least one of the units under test is physically implemented on the test units at different times.

On the "No-Internal-Zeros Conjecture" for system signatures in reliability

Frank Samaniego
University of California

Abstract: Consider a coherent system in n components having independent, identically distributed (i.i.d.) lifetimes. The signature of the system is an n -dimensional vector $s^* = (s_1, \dots, s_n)$ representing the probability distribution of the index of the ordered component failure which causes the system to fail. A brief review of the theory and applications of system signatures is given. Since its introduction in Samaniego (1985), signature theory has played an important role in studying the comparative performance of engineered systems and communication networks. It has long been conjectured that a signature vector of a coherent system can have no internal zeros. But the main argument for the conjecture has been that no-one had ever seen such a signature. Recently, we found a paper in an Operations Research journal that proves a rather general theorem that implies that the conjecture is true. The proof is elegant but quite complex. We present a proof of the NIZ property of signatures from basic principles, that is, using only known properties of the cut sets of a coherent system. The new proof is quite revealing and the result has immediate applications. The work is joint with Professor Jorge Navarro.

Contributed Session VI (parallel session)

Wednesday PM, October 24, 2012

Operational Risk Analysis: New analysis methods for numerical and non-numerical survey responses

Michele Wolfe
U. S. Army TRADOC Analysis Center (TRAC)

Abstract: Determining operational risk in support of acquisition decisions is a complex problem that cannot be adequately addressed with the Army's basic risk assessment doctrine. Current operations research delves into non-numerical areas where concrete data do not exist. Categories such as "consequence" or "severity" are not limited to a single answer; instead, these factors are characterized by ranges of responses. To better investigate these complex issues, the U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC) developed a new approach to operational risk analysis. Using the triangular distribution as a means to evaluate the ranges of responses, this new methodology provides a solid mathematical foundation to conduct sensitivity analysis and to inform leadership. Because of its mathematical foundation, gaps and the mitigation of gaps may be assessed with greater analytical rigor, providing numerical information as to how well capability gaps are mitigated. This presentation highlights the new risk analysis method, and how to collect and process the data. The presentation also discusses the implementation of a gap assessment tool and an example within a current analysis of alternatives study conducted by TRAC.

Speed vs. Accuracy, the Shooter's Dilemma

MAJ Benjamin Thirey and MAJ Christopher E. Marks
United States Military Academy

Abstract: Effectively engaging a target with a direct-fire weapon requires both speed and accuracy. However, there is a tradeoff: shooting too quickly results in inaccuracy, while attempting to achieve near-perfect accuracy results in prolonged engagement times. In this paper, we present a method of quantifying the trade-off between speed and accuracy in the context of competition shooting. Using shot placement standard deviation as a measure of a shooter's accuracy, we present a time-dependent model quantifying the increase in accuracy for longer shot times. We fit our model to data collected from two college-level competition shooters using maximum likelihood parameter estimation, and apply our results in order to predict a shooter's optimal engagement time, set marksmanship training objectives, and make assessments and comparisons of shooters' abilities.

Measurement System Analysis and Applications to Improvements in Body Armor Testing

Sandra Meiselwitz and Barbara J. Gillich

US Army Aberdeen Test Center

Abstract: Measurement System Analysis (MSA) is a method that examines the variability of a measurement process to determine the ability of the process to precisely measure an item. At the U.S. Army Aberdeen Test Center (ATC), many different types of items are tested, including body armor items. This presentation will show how ATC has used MSA to examine the precision of different measurement processes related to body armor, including helmet thickness measurements and qualifying operators for the hard body armor plate dimension measurement process. Using MSA has allowed ATC to document reductions in process variability as continuous improvements are made to a measurement system, show customers that measurement procedures are capable of measuring to the desired level, and demonstrate that operators are properly trained prior to participating in customer projects.

Comparative Testing

Jacob J. Warren

Marine Corps Operational Test and Evaluation Activity

Abstract: This presentation will describe a test and evaluation strategy applicable to systems whose requirements are stated via a comparison to another system. An example of a requirement stated as such is: "System X must be able to acquire targets on the move greater than or equal to the legacy." The presentation will compare and contrast standard hypothesis tests (which utilize critical and test values) with: p-values, and confidence intervals for testing a set of hypothesis. Equivalence, superiority, and non-inferiority comparative testing procedures common to clinical trials will be presented, and a non-inferiority testing example will be presented providing a link to how these methodologies can be used in an Operational Test and Evaluation. An R script will be presented to amplify the non-inferiority testing example.

General Session II

Thursday AM, October 25, 2012

How to complete the incomplete; a statistical antidote for incomplete data sets

Ofer Harel

University of Connecticut, Storrs, CT, USA

Abstract: Missing data is a common complication in medical, sociological and public health research. Most of the time researchers tend to ignore this obvious difficulty. In this presentation, I will introduce the missing data problem, introduce several different solutions and argue that considerable thought is needed before analyzing incomplete data.

Special Session II, Simulation Experiments and Efficient Design

Thursday AM, October 25, 2012

Demystifying Kriging Models with Massive Data

Peter Z. G. Qian

Department of Statistics, University of Wisconsin-Madison

Abstract: The Kriging model is the prevailing choice in metamodeling. Fitting a Kriging model with massive data is not only a challenge but also a mystery. On one hand, the nominal accuracy of a Kriging model is supposed to increase with the number of data points. On the other hand, fitting such a model to a large number of points is known to have numerical singularity. To reconcile this contradiction, I will present a sequential method to simultaneously achieve numerical stability and theoretical accuracy in large-scale Kriging models. This method forms nested space-filling subsets of the data, builds kernel models for different subsets and then combines all submodels together to obtain an accurate surrogate model. We introduce a mathematical decomposition of the overall error of a Kriging model into nominal and numeric portions. Theoretical bounds on the numeric and nominal error are developed to show that substantial gains in overall accuracy can be attained with this sequential method. Examples are given to illustrate the effectiveness of the developed method. If time permits, I will discuss extensions of this method to incorporate derivative information and multiple responses.

Recent Breakthroughs in Large-Scale Simulation Studies

Susan M. Sanchez, Thomas W. Lucas, Paul J. Sanchez, Alejandro Hernandez

Naval Postgraduate School

Designed experiments are powerful methodologies for gaining insights into the behavior of complex systems. In recent years, several new designs have been created to address the large number of factors and complex response surfaces that often arise in simulation studies. These include procedures capable of handling discrete-valued or qualitative factors. We describe some of these advances, and summarize the results of using large-scale designed experiments in several recent defense simulation studies. Application areas include the development of more effective training scenarios for peace support operations; logistics life cycle management; and model-based ship design. The new designs provide structured methods for performing trade-off analyses in situations where other techniques have fallen short. Our approaches are scalable and compare well to existing methods that construct custom designs for smaller experiments. These breakthroughs were originally developed for exploring large stochastic simulation models, but may also be of interest for exploring computer models with limited numbers of factors.

Sequential Importance Sampling for Rare Event Estimation with Computer Experiments

Brian Williams

Los Alamos National Laboratory

Abstract: Importance sampling often drastically improves the variance of percentile and quantile estimators of rare events. We propose a sequential strategy for iterative refinement of importance distributions for sampling uncertain inputs to a computer model to estimate quantiles of model output or the probability that the model output exceeds a fixed or random threshold. A framework is introduced for updating a model surrogate to maximize its predictive capability for rare event estimation with sequential importance sampling. Examples of the proposed methodology involving materials strength and nuclear reactor applications will be presented.

Brian Williams, LANL

General Session III

Thursday AM, October 25, 2012

Designing Observational Studies to Avoid Being Misled

Thomas E. Love

Case Western Reserve University School of Medicine

Abstract: This session provides practical advice for researchers and scientists reviewing and designing observational studies, focusing on strategies for dealing with selection bias. The key issue is how we may be appropriately circumspect in evaluating the evidence from observational studies, especially when randomized experiments or clinical trials are unavailable. The presentation focuses on the use of propensity scores, and discusses this approach in light of several case studies, taken from recent reports on clinical medicine and public health.

Special Session III, Design and Analysis of Observational Studies (parallel session)

Thursday PM, October 25, 2012

Propensity Score Analysis: Concepts, Issues, and Examples

Wei Pan, Duke University

Abstract: Researchers often use observational data to estimate treatment effects because randomized controlled trials or experimental designs are not always feasible. The use of observational data threatens the validity of causal inference by introducing selection bias into the treatment assignment. To deal with this challenge, Rosenbaum and Rubin (1983) proposed propensity score analysis (PSA), which balances the distributions of observed covariates between treatment conditions (i.e., treatment vs. control), as a means to reduce selection bias. Over the past three decades, PSA has become increasingly popular for making causal inferences based on observational studies. To further promote the use of PSA, this presentation will introduce basic concepts of PSA and discuss current issues in PSA. Empirical examples will also be used to illustrate how to select and implement appropriate PSA methods for observational studies.

Designing observational studies to be more like randomized experiments

Mike Baiocchi

Stanford University

Abstract: Randomized controlled trials (RCTs) are the gold standard for estimating the impact of an intervention (e.g., improvements in outcomes due to a new training regime). There are several reasons RCTs are highly regarded, chief among these are the ability to randomize units of observations into the types of treatment. Through randomization we are able to control both the observed covariates as well as the unobserved covariates (even the infamous "unknown unknowns"). This produces accurate, reliable estimates of the treatment effect. But how can we harness randomization in an observational setting? This talk will cover a very clever technique known as "instrumental variables," which allows for RCT-like studies in some observational settings. The technique will be motivated using a case study which estimated the relative efficacy of intensity of care on quality outcomes.

Contributed Session VII (parallel session)

Thursday PM, October 25, 2012

Discrete Approximations of Controlled Stochastic Systems with Memory

Mou-Hsiung (Harry) Chang

U.S. Army Research Office

Abstract: We consider some computational issues for an optimal control problem in which the controlled state equation is described by a general class of stochastic functional differential equations with bounded memory. In particular, a finite difference method for numerically computing the viscosity and a solution of the infinite dimensional Hamilton-Jacobi-Bellman equation for the optimal control problem will be discussed.

Continuous Updating Procedure for Flow Field Forecasting

Kyle Caudle (South Dakota School of Mines & Technology) and Michael Frey (Bucknell University)

Abstract: Flow field forecasting is a statistical procedure for time series forecasting that is based on the premise that if the time series is currently following a dynamic similar to one observed in its past record, then the process is likely to advance forward in a manner that is similar to how it behaved in the past. Flow field forecasting has three steps: a penalized spline regression (PSR), a Gaussian process regression (GPR) built upon the PSR, and a forecasting mechanism that uses the GPR to interpolate future process changes step-by-step. Often data presents as a flow requiring the need to continuously, efficiently and autonomously update forecasts. Updating the PSR in a strict sense involves a complete reevaluation of its global smoothing parameter by analyzing all data, not just recent data. Through experimentation we show that updating the complete PSR is often not necessary. By using a local smoothing parameter, we show the PSR estimate is better than had a single global smoothing parameter been used. Once the PSR is updated, if we assume that hyperparameters of the GPR have not been drastically altered by the new data point, updating the GPR can also be done in a straightforward fashion that is computationally efficient.

Contributed Session VIII (parallel session)

Thursday PM, October 25, 2012

Computing POD for Structural Health Monitoring Systems

Christine M Schubert Kabban, Mark M. Derriso, and Brandon Greenwell

Air Force Institute of Technology

Abstract: Embracing the objectives of condition based maintenance, structural health monitoring (SHM) systems are sought to improve maintenance performance with respect to materiel availability and reliability as well as reduce mean down time through instantaneous or continual monitoring of structural integrity. SHM can be defined as automated methods for determining adverse changes in the integrity of mechanical systems. The ultimate goal of SHM is to provide an automated and real-time assessment of a structure's ability to serve its intended purpose. SHM assessments consist of a diagnosis of the current state of a structure and a prognosis about the capability of the structure to perform its function in the future. The diagnosis should include the detection, location, and assessment of damage. The prognosis might be that the structure is as good as new; safe to operate for only a certain number of flight hours; or, that immediate repair is required. The detection, location, assessment, and prognosis of damage are considered the four levels of SHM. A level four SHM system potentially provide the greatest benefit in that not only may the system be designed for damage detection, but may also provide estimates of the extent of structural damage as well as continuous monitoring of such damage, leading to better estimation (e.g., crack growth) and time to structural failure. Even with this added capability, however, damage detection (i.e., level one SHM systems) remains a focus for SHM systems. In particular, validation of SHM systems is much debated as the concept of probability of detection (POD) of structural damage remains an open question. Although understood as the key validity measure for detection, the computation of POD is less understood for SHM systems. Specifically for aircraft, thresholds based on the crack size that is detected 90% of the time with 95% statistical confidence is used to establish inspection intervals occurring at $\frac{1}{2}$ the time between this and the crack size associated with structural failure. Statistical methods have been mandated that appropriately address the computation of POD and determination of this crack size for current inspection methods. This methodology may also translate over to SHM systems where data is collected in a manner analogous to that of current inspection routines, that is, at pre-established inspection intervals. For many SHM systems, however, data is

collected continuously and therefore constitutes a different structure, a structure that is not compatible with current statistical methods of POD and critical crack length computations. The purpose of this paper is to review statistical methods for POD and critical crack length computations, demonstrating the usefulness of current methodology and to suggest advanced statistical models for comparable computations using the continuous data collection of SHM systems. Examples using recently collected data will be used to demonstrate these concepts.

Recognition of Microcalcifications in Mammograms: Feature Extraction

Ben Riggan and Wesley Snyder (NCU), Robert Basilio, Rita Freimanis, and Joseph Mammarrappallil (Wake Forest School of Medicine)

Abstract: A careful analysis has been performed of the process of identifying Microcalcifications in mammograms. Of particular interest is the difference between two approaches: (1) developing a data base of small (e.g. 9x9) images and classifying with a Support Vector Machine and (2) using a much lower dimensionality data set based on extracted features. The feature extraction philosophy requires techniques used for preprocessing, segmentation, feature selection, and these are addressed. In particular, features used for classification are discussed in terms of their ability to adequately represent microcalcifications. By virtue of the features' physical and statistical interpretations, they can be well adapted for classifying microcalcifications.

Geographical Trends in Cancer Mortality: Using Spatial Smoothers and Methods for Adjustment

**Karen Kafadar
Indiana University**

Abstract: Mapping health-related data can lead to important insights and generate hypotheses about causes and potential effects. Usually such data are adjusted for age and gender so that inferences are not influenced by these obvious factors. Similarly, data should be (but usually are not) adjusted for known risk factors that have been identified. One method of adjustment is suggested here, and insights from adjusted data are enhanced by smoothing the data in two dimensions (longitude and latitude). The process of adjustment and smoothing is illustrated on cancer mortality data from three different sites: lung, prostate (among nonwhite males), and melanoma (among white males and females). Issues of linear versus nonlinear smoothers and display of trends and their uncertainties are discussed.

[Contributed Session IX \(parallel session\)](#)

Thursday PM, October 25, 2012

Lookahead or Lookback: A Hybrid Architecture in Approximate Dynamic Programming

**Haitao Li and Keith Womer
University of Missouri - St. Louis**

Abstract: The complementary strengths of lookup table and rollout policy in approximate dynamic programming have motivated the idea of combining the two. On one hand, the lookup table directly associates the cost-to-go function with a state-action pair, which offers an accurate and reliable function approximation. On the other hand, for a high-dimensional MDP, it is often not possible to visit *every* state. For those state-action pairs that have not been visited/evaluated by the lookup table, the rollout approach can be employed to evaluate them. This hybrid approximation architecture has been implemented for stochastic project scheduling problems and shows promising results.

Made-to-Order Production Scheduling using Bayesian Updating

**Keith Womer, J. Camm, C. Osterman, R. Radhakrishnan, and Haitao Li
University of Missouri - St. Louis**

Abstract: Production planning for made-to-order (MTO) manufacturing optimizes the production rate in each period before a promised delivery date. As products in MTO are often unique and customized, the associated learning curve slope and other production parameters cannot be accurately estimated before production starts. In this paper, a dynamic and adaptive solution approach is developed to estimate the effects of learning and production rate in conjunction with optimization. This approach offers a closed-loop solution through dynamic programming. Monthly production data are used to update the joint probability distributions of production parameters via Bayesian methods. Our approach is illustrated using historical data from the U.S. Army's Black Hawk Helicopter Program. Managerial insights are obtained and discussed.

Uncertainty Quantification using Soft Information and Exponential Epi-Splines

Johannes O. Royset, PhD, Naval Postgraduate School

Roger J-B Wets, PhD, University of California

Abstract: We address uncertainty quantification in complex systems by a flexible, nonparametric framework for estimation of density and performance functions. The framework systematically incorporates hard information derived from physics-based sensors, field test data, and computer simulations as well as soft information from human sources and experiences. The framework is based on epi-splines for consistent approximation of infinite-dimensional optimization problems arising in the estimation process. Preliminary numerical results indicate that the framework is highly promising.

Contributed Session X (parallel session)

Thursday PM, October 25, 2012

Developing Joint Model of Repeated Measure and Survival Outcome

Jason Zhou and Harry Ji, Digital system, Inc.

Yuanzhang Li, U.S. Army Medical Research and Materiel Command

Abstract: In order to assess the causal effect of treatment s in longitudinal, observational data, it is need to address repeated measure and survival outcome with incomplete data. Statistical Model Development in Epidemiological Research can be used to develop joint model of repeated measure and survival outcome for epidemiology statistical analysis that enables users to conduct those longitudinal data. SMDER is built on top of BASE SAS with another user friendly interface. In this presentation, we will express that SMDER allow the researchers to develop joint model of repeated measure and survival outcome to conduct a survival analysis using all SAS advanced procedures to analyze time to event-- survival outcome.

DOE and Tolerance Design for Antenna Design

William C. Thomas

Raytheon

Abstract: A sequence of 5 DOE's was performed on an antenna design. The single experiment I will discuss was a 3^{8-2} fractional factorial design. This means running 729 different combinations from a total of 6561. This number of experiments is possible because they are simulations. A statistical tolerance analysis was performed to insure performance and affordability. I will discuss the methodology and the interesting results that provided the Engineers an affordable solution.

A Robotic Trenching Capability Experiment

Barry Bodt

U. S. Army Research Laboratory

Abstract: The Robotics Collaborative Technology Alliance administered by the U.S. Army Research Laboratory has focus areas in Cognitive Architectures, Human/Robot Interaction, Perception/Sensing, and Dexterous Manipulation and Unique Mobility. Periodically the research program conducts Integrated

Research Assessments (IRA) to evaluate component technologies integrated on a robotic platform. In IRA2, a robotic arm with claw was mounted on a small Dragon Runner robotic platform. The goal was to assess performance of the autonomous trenching function over varied terrain composition, topography, obstacle clutter, robot control, and arm motion. A straightforward experimental design is discussed in the context of an interesting technology, with encouraging findings reported for an autonomous trenching capability.

Contributed Session XI (parallel session)

Thursday PM, October 25, 2012

Applications of Clustered Designs

Selden Crary

NewallStreet, Inc.

Abstract: Careful searches for exact, optimal designs for computer experiments, under the minimum-Gaussian-process-IMSE objective and assuming fixed Gaussian-covariance parameters, led to the discovery, c. Y2000, of frequent proximal points (clusters) in these designs. These "clustered designs" specify that both a function evaluation and one or more specific directional derivative should be taken at the location of the twin points. The existence of these optimal designs runs counter to the prevailing view that designs for computer experiments should be space filling in the usual sense (maximin distance between nearest neighbors, minimax Voronoi-cell volume, uniform, etc.). We show examples of these designs, their symmetry properties, and the possibility of a universality class for the resulting phase diagram. We provide an example of the application of clustered designs to sequential generation of metamodels, as well as the application of clustered-design theory to the numerical inversion of highly ill-conditioned covariance matrices.

Verifying System Performance Using Designed Simulation Experiments

Terril N. Hurst, Allan T. Mense, and Colin Pouchet

Raytheon Missile Systems

Abstract: Recent guidance has been issued from the Department of Defense Operational Test and Evaluation Directorate (DOD OT&E) on the creation of Test and Evaluation Master Plans (TEMPs). The Guide includes instructions and several examples clarifying the use of Design of Experiments (DOE) during Developmental Test, Live-Fire Evaluation, and Operational Evaluation. The Guide also repeatedly mentions the use of Modeling and Simulation (M&S), which has become an increasingly important tool for verifying that system performance requirements are met. However, the Guide is silent on how conventional DOE should be used or adapted when simulation experiments are employed to satisfy OT&E objectives. M&S-based DOE is an area undergoing rapid change, particularly as more practitioners seek to employ it to develop and verify software-intensive systems.

During the past few years, Raytheon Missile Systems has been learning how to apply DOE to M&S. Four categories of objectives have been identified for the design and analysis of simulation experiments (DASE). A 7-step protocol has been developed, taught, and practiced for planning, executing and briefing results. Performance Verification, labeled as a "Category 1" DASE objective, differs substantially from the other DASE categories, including Design Exploration (Category 2). The latter commonly uses conventional experimental designs and response surface methods. Category 1 DASE is used in "scoring" performance, and involves sampling over the full extent and dimensionality (factor space) of the system's operational envelope. Scoring thus requires descriptive, rather than predictive response models. The difference between the two model types dictates different types of experimental design, with space-filling designs being commonly used for building descriptive models expressed as moments or quantiles of a scoring bin's population. The use of hypothesis tests (confidence and power) and confidence intervals also differs between Category 1 and Category 2 DASE. This paper uses several examples to illustrate lessons learned in applying DOE and M&S for

performance verification and is intended to engage the DOD Acquisition community in active dialog on how to more fully integrate DOE and M&S within the system performance verification process.

General Session IV

Friday AM, October 26, 2012

Extracting communities from networks

Ji Zhu

University of Michigan

Abstract: Analysis of networks and in particular discovering communities within networks has been a focus of recent work in several fields, with applications ranging from citation and friendship networks to food webs and gene regulatory networks. Most of the existing community detection methods focus on partitioning the network into cohesive communities, with the expectation of many links between the members of the same community and few links between different communities. However, many real-world networks contain, in addition to communities, a number of sparsely connected nodes that are best classified as "background". To address this problem, we propose a new criterion for community extraction, which aims to separate tightly linked communities from a sparsely connected background, extracting one community at a time. The new criterion is shown to perform well in simulation studies and on several real networks. We also establish asymptotic consistency of the proposed method under the block model assumption. This is joint work with Yunpeng Zhao and Elizaveta Levina.

Contributed Session XII

Friday AM, October 26, 2012

Threshold Boolean Reformulation of Probabilistic Constraints with Multi-Row Random Technology Matrix

Miguel Lejeune, George Washington University

Alexander Kogan, Rutgers University

Abstract: We construct a partially defined Boolean function (pdBf) representing the satisfiability of a joint probabilistic constraint with random technology matrix. We extend the pdBf as a threshold Boolean tight minorant to derive a series of integer reformulations equivalent to the stochastic problem. Computational experiments will be presented. We develop a modeling and exact solution method for stochastic programming problems including a joint probabilistic constraints with multi-row random technology matrix. We binarize the probability distribution of the random variables and extract a threshold partially defined Boolean function (pdBf) representing the probabilistic constraint. We then construct a tight threshold Boolean minorant for the pdBf. The separating structure of the tight threshold Boolean minorant defines sufficient conditions for the satisfaction of the probabilistic constraint and takes the form of a system of linear constraints. We use the separating structure to derive three new deterministic formulations equivalent to the stochastic problem. A crucial feature of the derived integer formulations is that the number of integer variables does not depend on the number of realizations that the vector of random variables can take. Computational results will be presented.

An integrated model for locating and dispatching ambulances.

Laura A. McLay and Sardar Ansari

Virginia Commonwealth University

Abstract: There is a rich literature that develops covering location problem models that seek to locate servers (ambulances) at a set of stations to maximize the coverage level, the fraction of demand that the servers can reach in a prespecified amount of time. These models focus solely on how to locate ambulances

and they make assumptions about how the ambulances would be dispatched to customers. In this paper, we lift the dispatching assumptions to develop a novel model that simultaneously locates ambulances at stations and creates dispatching rules using a mixed integer programming (MIP). Together, these decisions can be used to identify ambulance response districts. Contiguity constraints are added to the model to maintain contiguous response districts. The modeling approach applies a Hypercube approximation to a queuing system to identify the MIP model input parameters. An iterative procedure updates the parameters and balances the workload among the servers.

Characterizing Probability Distributions Using Econometric Concentrations

Nozer D. Singpurwalla

George Washington University

Abstract: Characterizing probability distributions is an old and honourable pass time of applied probabilists if not probability theorists. Concentration measures like the Kolmogorov-Smirnov, the Anderson-Darling, and the Gini Index, are a part of the toolkit of statisticians, econometricians, and those involved with the diagnostic testing of diseases and threats. In this talk I make the argument that the statistician's toolkit can supplement the probabilist's pass time. To do so, I introduce a new measure of concentration based on income inequalities and demonstrate its use for the stochastic characterization of ageing. My work is motivated by an idea of Moshe Shaked and his coworkers, who introduced the notion of "excess wealth" as a property of distribution functions, and my interest in developing meaningful measures of concentration for diagnostic testing. Aspects of this work are to appear in the Annals of Operations Research.

Contributed Session XIII

Friday AM, October 26, 2012

Divisive normalization in neural circuits drives context-dependent choice

Kenway Louie and Paul W. Glimcher

New York University

Abstract: A fundamental assumption of rational theories of choice is that decisions are free of context; how a chooser decides between any two options should not depend on the presence of other options, a property known as independence of irrelevant alternatives. In contrast to theory, context profoundly affects empirical choice behavior in species ranging from insects to birds to humans. Various psychological explanations have been proposed for specific context effects, but these proposed mechanisms do not incorporate information about neural processing, and no general model exists for context-dependence. Here, we describe a stochastic choice model based on normalized value coding, characterize novel context-dependent behavior in simulation, and test the model predictions in animal and human choosers. Observations in sensory pathways suggest that signal normalization is a canonical feature of neural computation. Recent electrophysiological studies have extended these insights beyond the sensory domain, demonstrating an analogous algorithm for the value signals that directly guide behavior. This normalized value coding, in which firing rates depend on intra- and extra-response field targets, introduces an inherent contextual dependency in the decision process, but its implications for behavior are unknown. In a simple computational model incorporating normalized value coding, we find that choice efficiency between high-valued options decrements as a function of the value of irrelevant alternatives. This effect occurs across a broad range of tested conditions, and is dependent on both the magnitude of divisive scaling and level of stochastic variability. Notably, the normalization model predicts context-dependent effects from varying both distracter value and number, and generalizes to well-known set size phenomena. In behavioral experiments, both monkey and human choosers reproduce the context-dependence predicted by normalized value coding. In both paradigms, we found shallower conditional choice curves and increasingly inefficient choice behavior with larger distracter values. In the human data, we also observed a reversal of context-dependence at very high distracter values, a biphasic effect also predicted in model simulations. These findings suggest that the neural mechanism of value coding

critically influences stochastic choice behavior and provides a generalizable quantitative framework for examining context effects in decision-making

The role of incentive schemes in probability assessment under uncertainty.

Adam S. Goodie, Prashant Doshi, and Daniel G. Hall

University of Georgia

Abstract: A series of empirical studies investigated probability assessment under conditions of high uncertainty that characterize much combat operation space. This study utilized a simulated UAV theater with realistic scenery of the Bagram AFB in Afghanistan. The subject is tasked with guiding her UAV I from the initial sector to the target sector without being spotted by an opponent UAV J. J follows a trajectory that loops around continuously and independently of I. Studies utilized human participants from the University of Georgia's Psychology Research Pool, as well as UGA Army and Air Force ROTC cadets. Participants experienced a training phase of 5 trials, followed by a test phase of 15 trials, updating subjective probability of reaching the target sector at each of up to 10 decision points within each trial. In Study 1, no systematic inflationary or deflationary bias in the uncertainty expressions could be inferred. In Study 2 probability assessments were tested under proper scoring rules, non-proper rules or no scoring rules. Results showed significant improvement under a "zero-one" scoring rule that was simple but non-proper. In Study 3, an attempt to replicate this finding in a within-subjects design was not successful. In Study 4, a motivational intervention following the 5 training trials was accompanied by learning in all groups during the course of the study, but no significant differences were observed between scoring rule groups.

Neurally-informed graph-based transductive models for rapid decision making

Paul Sajda

Columbia University

Abstract: Our visual systems are amazingly complex rapid decision making machines. Using our brain's visual system we can recognize objects at a glance, under varying pose, illumination, and scale, and are able to rapidly learn and recognize new configurations of objects and exploit relevant context even in highly cluttered scenes. However our brains are subject to fatigue and have difficulty finding patterns in high-dimensional feature spaces that are often useful representations for multimedia data. In this talk I will describe our work in developing a synergistic integration of human visual processing and computer vision via a novel brain computer interface (BCI). Our approach, which we term cortically-coupled computer vision (C3Vision), uses non-invasively measured neural signatures from the electroencephalogram (EEG) that are indicative of user intent, interest and high-level, subjective and rapid reactions to visual and multimedia data. These neural signatures are ingested into a graph-based representation of an image search space, and transductive inference is used to propagate these labels and identify subsets of images in the graph which are likely to be of interest to the individual. I will describe several system designs for C3Vision and current applications that are being developed for government and commercial applications.

Modeling Real and Artificial Neurons for Robot Control

Holly Yanco and Abraham Shultz

University of Massachusetts Lowell

Abstract: Multi-Electrode Arrays (MEAs) are a useful tool for inspecting the activity of living, interacting brain cells in a manner that is not intrusive to the cells. However, the limited lifespan of the cells in vitro and the impossibility of exactly duplicating any particular network of living cells are problems for research with MEAs. This talk describes a simulation method for modeling the layout and networking of the cells in a culture, and for simulating the activity of that network. We are investigating the predictive value of such simulated networks for some aspects of MEA research to allow easier "rough drafts" of experiments, which may allow researchers to determine if the effort of culturing a living neural network is warranted or can help determine possible parameters for the in vitro cultures. We will describe our use of this simulation and in vitro cultures to control a robot arm to point at an object.

REPORT DOCUMENTATION PAGE (SF 298 Continuation Sheet)

Demographics:

Total Participants: **112** (Total on-site attendees: **68**; Total contributing authors: **100**)

Participants by Category	
<i>Category</i>	<i>Count</i>
com	14
edu	43
gov	5
mil (AF)	9
mil (Army)	22
mil (Navy)	12
mil (USMC)	1
other	5
student	1

Total: 112

Breakout of Demographics by Categories						
com	edu	gov	mil (AF)	mil (Army)	mil (Navy)	mil (USMC)
Digital System	Bucknell	DLI	AFIT	AMSAA	NPS	MCOTEA
IDA	Case	LANL	Edwards AFB	ARL		USMC
NewallStreet	Columbia			Army		
Raytheon	Duke			ARO		
RSA Group	GATECH			ATC		
SAS	GWU			ATEC		
	Indiana			Dugway		
	MIIS			TRAC		
	Missouri			TRAC-Monterey		
	NCSU			USAMRMC		
	NYU			USMA		
	Rutgers			WRAIR		
	SDSMT					
	Stanford					
	UC Davis					
	UCONN					
	UGA					
	UMASS					
	UMICH					
	UMSL					
	USC					
	VCU					
	VMI					
	VT					
	WFU					
	WISC					

ACAS 2012

Breakout of Demographics by Categories

com	edu	gov	mil (AF)	mil (Army)	mil (Navy)
ARS	American	BLS	AFIT	AMC	CNA
Boeing	Brigham Young	DLI	AFLCMC	AMC-AFRIMS	Navy
Census	Bucknell	DOT&E	Edwards AFB	AMSAA	NASC
CEW	Case	EPA		APG	NPS
Digital System	CMU	JPL		ARL	NRL
Elder Research	Columbia	LLNL		Army	NSWC
Engility Gp	Cornell	LANL		ARL-WSMR	
Google	Duke	NIST		ARO	
IDA	GATECH	OASD		ATC	
JRAD	GMU	Sandia		ATEC	
Mathematica	GWU	VAMHCS		Dugway	
NewallStreet	IASTATE			ISMED	
Qualcomm	Indiana			TRAC	
Raytheon	Miami			TRAC-Monterey	
RSA Group	MIIS			USAMRMC	
SAS	Missouri			USMA	
TQI	NCSU			WRAIR	
	NYU				
	PSU				
	Rice				
	RIT				
	Rutgers				
	SDSMT				
	Stanford				
	SUNY Buffalo				
	Texas Tech				
	UC Davis				
	UChicago				
	UCONN				
	UGA				
	UMASS				
	UMICH				
	UMSL				
	UMB				
	USC				
	UT Austin				
	VCU				
	VMI				
	VT				
	WFU				
	WISC				
	W&M				

Note: Breakout shown comprises in-category members attending and/or contributing 2012, ICAS 2013, and CASD 2014/2015 conferences. Shaded cells (with strikethrough indicate those members in this amalgamated listing that were NOT in attendance and, contributing to the ACAS 2012 conference per se.

ACAS 2012

Definitions

Tag	Affiliation
Com	ARS
Com	Boeing
Com	Census
Com	CEW
Com	Digital System
Com	Elder Research
Com	Engility Gp
Com	Google
Com	IDA
Com	JRAD
Com	Mathematica
Com	NewallStreet
Com	Qualcomm
Com	Raytheon
Com	RSA Group
Com	SAS
Com	TQI
Edu	American
Edu	Brigham Young
Edu	Bucknell
Edu	Case
Edu	CMU
Edu	Columbia
Edu	Cornell
Edu	Duke
Edu	GATECH
Edu	GMU
Edu	GWU
Edu	IASTATE
Edu	Indiana
Edu	Miami
Edu	MIIS
Edu	Missouri
Edu	NCSU
Edu	NYU
Edu	PSU
Edu	Rice
Edu	RIT
Edu	Rutgers
Edu	SDSMT
Edu	Stanford
Edu	SUNY Buffalo
Edu	Texas Tech
Edu	UC Davis
Edu	UChicago

Demographic
AFIT
AFLCMC
AMC
AMC-AFRIMS
American
AMSAA
APG
ARDEC
ARL
ARL-WSMR
Army
ARO
ARS
ATC
ATEC
BLS
Boeing
Brigham Young
Bucknell
Case
C N A
Census
CEW
CMU
Columbia
Cornell
Digital System
DLI
DOT&E
Dugway
Duke
Edwards AFB
Elder Research
Engility Gp
EPA
GATECH
GMU
Google
GWU
IASTATE
IDA
Indiana
ISMED
JPL
JRAD

Edu	UCONN
Edu	UGA
Edu	UMASS
Edu	UM St Louis
Edu	UMB
Edu	UMICH
Edu	USC
Edu	UT Austin
Edu	VCU
Edu	VMI
Edu	VT
Edu	WISC
Edu	Wake Forrest
Edu	W&M
Gov	BLS
Gov	DLI
Gov	DOT&E
Gov	EPA
Gov	JPL
Gov	Lawrence Livermore
Gov	Los Alamos
Gov	NIST
Gov	OASD
Gov	Sandia
Gov	VAMHCS
Mil (AF)	AFIT
Mil (AF)	AFLCMC
Mil (AF)	Edwards AFB
Mil (Army)	AMC
Mil (Army)	AMC-AFRIMS
Mil (Army)	AMSAA
Mil (Army)	APG
Mil (Army)	ARDEC
Mil (Army)	ATC
Mil (Army)	ARL
Mil (Army)	ARL-WSMR
Mil (Army)	ARO
Mil (Army)	Army
Mil (Army)	ATEC
Mil (Army)	Dugway
Mil (Army)	ISMED
Mil (Army)	TRAC
Mil (Army)	TRAC-Monterey
Mil (Army)	USAMRMC
Mil (Army)	USMA
Mil (Army)	USMA
Mil (Army)	WRAIR
Mil (Navy)	C N A
Mil (Navy)	Navy

LLNL
LANL
Mathematica
MCOTEA
Miami
MIIS
Missouri
NASC
Navy
NCSU
NewallStreet
NIST
NPS
NRL
NSWC
NYU
OASD
PSU
Qualcomm
Raytheon
Rice
RIT
RSA Group
Rutgers
Sandia
SAS
SDSMT
Stanford
SUNY Buffalo
Texas Tech
TQI
TRAC
TRAC-Monterey
UC Davis
UChicago
UCONN
UGA
UMASS
UMSL
UMB
UMICH
USAMRMC
USC
USMA
USMC
UT Austin
VAMHCS
VCU

Mil (Navy)	NASC
Mil (Navy)	NPS
Mil (Navy)	NRL
Mil (Navy)	NSWC
Mil (USMC)	MCOTEA
Mil (USMC)	USMC
Other	other
Student	student

VMI
VT
WISC
WFU
W&M
WRAIR
other
student

Category
com
edu
gov
mil (AF)
mil (Army)
mil (Navy)
mil (USMC)
other
student

Attendees and/or Contributors

by CAT/by Demographic

LAST	FIRST	AFFILIATION	CAT	Demographic	Abstract
Ji	Harry	Digital System	com	Digital System	*
Zhou	Jason	Digital System	com	Digital System	*
Freeman	Laura	IDA	com	IDA	*
Holcomb	Robert	IDA	com	IDA	*
Parry	Sam	IDA	com	IDA	*
Wilson	Alyson	IDA	com	IDA	*
Fries	Arthur	IDA	com	IDA	*
Crary	Selden	NewallStreet	com	NewallStreet	*
Hurst	Terril	Raytheon	com	Raytheon	*
Mense	Alan	Raytheon	com	Raytheon	*
Pouchet	Colin	Raytheon	com	Raytheon	*
Thomas	William C	Raytheon	com	Raytheon	*
Martin	Owen S.	RSA Group	com	RSA Group	*
Donnelly	Tom	SAS	com	SAS	*
Frey	Michael	Bucknell	edu	Bucknell	*
Love	Thomas E.	Case	edu	Case	*
Sajda	Paul	Columbia	edu	Columbia	*
Pan	Wei	Duke	edu	Duke	*
Wu	Jeff	GA Institute of Tech	edu	GATECH	*
Lejeune	Miguel	GWU	edu	GWU	*
Singpurwalla	Nozer	GWU	edu	GWU	*
Kafadar	Karen	Indiana	edu	Indiana	*
Gard	Robert	MIIS	edu	MIIS	*
Wikle	Christopher	U Missouri	edu	Missouri	*
Riggan	Ben	NCSU	edu	NCSU	*
Snyder	Wesley	NCSU	edu	NCSU	*
Louie	Kenway	NYU	edu	NYU	*
Glimcher	Paul	NYU	edu	NYU	*
Kogan	Alexander	Rutgers	edu	Rutgers	*
Caudle	Kyle	SD Schl Mines & Tech	edu	SDSMT	*
Baiocchi	Michael	Stanford	edu	Stanford	*
Samaniego	Francisco	UC Davis	edu	UC Davis	*
Harel	Ofer	U Connecticut	edu	UCONN	*
Doshi	Prashant	U Georgia	edu	UGA	*
Goodie	Adam	U Georgia	edu	UGA	*
Hall	Daniel	U Georgia	edu	UGA	*
Schultz	Abraham M.	U Mass Lowell	edu	UMASS	*
Yanco	Holly	U Mass Lowell	edu	UMASS	*
Sen	Ananda	U Michigan	edu	UMICH	*
Zhu	Ji	U Michigan	edu	UMICH	*
Camm	J	U Missouri St Louis	edu	UMSL	*
Li	Haitao	U Missouri St Louis	edu	UMSL	*
Osterman	C	U Missouri St Louis	edu	UMSL	*
Radhakrishnan	R	U Missouri St Louis	edu	UMSL	*
Womer	Keith	U Missouri St Louis	edu	UMSL	*
Galstyan	Aram	USC	edu	USC	*
Raghavan	Vasanthan	USC	edu	USC	*

Tartakovsky	Aleander	USC	edu	USC	*
Ansari	Sardar	VCU	edu	VCU	*
McLay	Laura	VCU	edu	VCU	*
Dewald	Lee	VMI	edu	VMI	*
Dickinson	Rebecca	VA Tech	edu	VT	*
Basilico	Robert	Wake Forrest	edu	WFU	*
Freimanis	Rita	Wake Forest	edu	WFU	*
Mammarappallil	Joseph	Wake Forest	edu	WFU	*
Loh	Wei-Yin	U Wisconsin	edu	WISC	*
Qian	Peter (Zhigueng)	U Wisconsin	edu	WISC	*
Mirikitani	Ray	DLI	gov	DLI	
Collins	David	Los Alamos	gov	LANL	*
Huzurbazar	Aparna	Los Alamos	gov	LANL	*
Weaver	Brian	Los Alamos	gov	LANL	*
Williams	Brian	Los Alamos	gov	LANL	*
Derriso	Mark	AFIT	mil (AF)	AFIT	*
Freels	Jason	AFIT	mil (AF)	AFIT	*
Greenwell	Brandon	AFIT	mil (AF)	AFIT	*
Kabban	Christine Schubert	AFIT	mil (AF)	AFIT	*
Warr	Richard	AFIT	mil (AF)	AFIT	*
Brownlow	James	Edwards AFB	mil (AF)	Edwards AFB	*
Hurwitz	Arnon	Edwards AFB	mil (AF)	Edwards AFB	*
Remund	Todd	Edwards AFB	mil (AF)	Edwards AFB	*
Weisz	Jeff	Edwards AFB	mil (AF)	Edwards AFB	*
Ellner	Paul	USA Mat Sys Anal Act	mil (Army)	AMSAA	*
Herbert	Nathan	USA Mat Sys Anal Act	mil (Army)	AMSAA	*
Wayne	Martin	USA Mat Sys Anal Act	mil (Army)	AMSAA	*
Bodt	Barry	ARL	mil (Army)	ARL	*
Grynovicki	Jock	ARL	mil (Army)	ARL	*
Henry	James	US Army	mil (Army)	Army	*
Chang	Mou-Hsiung	ARO	mil (Army)	ARO	*
West	Bruce	US Army Rsch Ofc	mil (Army)	ARO	*
Gillich	Barabara	ATC	mil (Army)	ATC	*
Meiselwitz	Sandra	ATC	mil (Army)	ATC	*
Christino	Angelo	ATEC	mil (Army)	ATEC	
Cushing	Michael	US Army Eval Ctr	mil (Army)	ATEC	*
Tamburello	Robert	US Army Eval Ctr	mil (Army)	ATEC	*
Hunter	Scott	Dugway	mil (Army)	Dugway	*
Noble	Cindy	TRAC	mil (Army)	TRAC	
Wolfe	Michele	TRADOC Anal Ctr	mil (Army)	TRAC	*
Deveans	MAJ Thomas	TRAC Monterey	mil (Army)	TRAC-Monterey	*
Li	Yuanzhang	USAMRMC	mil (Army)	USAMRMC	*
Glen	Andy	USMA	mil (Army)	USMA	*
Marks	Christopher	USMA	mil (Army)	USMA	*
Thirey	Benjamin	USMA	mil (Army)	USMA	*
White	Charles E	WRAIR	mil (Army)	WRAIR	*
Buss	Andrew	Naval Post Grad Schl	mil (Navy)	NPS	*
Buttrey	Sam	Naval Post Grad Schl	mil (Navy)	NPS	*
Gaver	Don	Naval Post Grad Schl	mil (Navy)	NPS	
Gordon	Anna	Naval Post Grad Schl	mil (Navy)	NPS	

Hernandez	Alejandro	Naval Post Grad Schl	mil (Navy)	NPS	*
Jacobs	Patricia	Naval Post Grad Schl	mil (Navy)	NPS	
Lucas	Thomas	Naval Post Grad Schl	mil (Navy)	NPS	*
Royset	Johannes	Naval Post Grad Schl	mil (Navy)	NPS	*
Sanchez	Paul	Naval Post Grad Schl	mil (Navy)	NPS	*
Sanchez	Susan	Naval Post Grad Schl	mil (Navy)	NPS	*
Wets	Roger	Naval Post Grad Schl	mil (Navy)	NPS	*
Whitaker	Lyn	Naval Post Grad Schl	mil (Navy)	NPS	*
Warren	Jacob	MCOTEA	mil (USMC)	MCOTEA	*
Avery	Matthew	other	other	other	
Joseph	Antony	other	other	other	
Talley	Colton	other	other	other	
Turner	Casey	other	other	other	
Whitney	Laura	other	other	other	
Sok	Sam	student	student	student	

112

100

<i>Category</i>	<i>Count</i>
com	14
edu	43
gov	5
mil (AF)	9
mil (Army)	22
mil (Navy)	12
mil (USMC)	1
other	5
student	1

112

Attendee
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**Attachment to Bodt Email of Nov 2nd
ACAS 2012 Close Out**

LAST	FIRST	Demographic	Reg	COURSE	SOCIAL	BANQ	PAID
Bodt	Barry		-1 x				0
Chang	Harry		-1				GUEST
Davies	John		-1	x		x	250
Ellner	Paul		-1	y			0
Herbert	Nathan		-1	y			0
Hurwitz	Arnon		-1				0
Mullis	Chad		-1				0
Ray	Douglas		-1				0
Spoonamore	Janet		-1			x	GUEST
Tamburello	Robert		-1				0
West	Bruce		-1				GUEST
Wilson	Alyson		-1				0
Baiocchi	Michael	Stanford	0				0
McLay	Laura	VCU	0				0
Royset	Johannes	NPS	0				0
Sajda	Paul	Columbia	0				0
Avery	Matthew	other	1	x		x	300
Brownlow	James	Edwards AFB	1	y		x+1	340
Buttrey	Sam	NPS	1 x				250
Caudle	Kyle	SDSMT	1	x		x	250
Christino	Angelo	ATEC	1				300
Crary	Selden	NewallStreet	1 x	x		x	125
Deveans	MAJ Thomas	TRAC-Monterey	1				250
Dewald	Lee	VMI	1	x		x	250
Dickinson	Rebecca	VT	1				50
Donnelly	Tom	SAS	1 x	x		x+1	290
Fries	Arthur	IDA	1			x	250
Gard	Robert	MIIS	1			x	GUEST
Gaver	Don	NPS	1			x+1	165
Glen	Andy	USMA	1			y	300
Goodie	Adam	UGA	1				250
Gordon	Anna	NPS	1				125
Grynovicki	Jock	ARL	1	x		x	250
Harel	Ofer	UCONN	1	x		x	GUEST

**Attachment to Bodt Email of Nov 2nd
ACAS 2012 Close Out**

Hunter	Scott	Dugway	1	x	x	250
Hurst	Terril	Raytheon	1 x	x	x	250
Jacobs	Patricia	NPS	1			250
Joseph	Antony	other	1			300
Kabban	Christine Schubert	AFIT	1		x	250
Kafadar	Karen	Indiana	1		x	250
Lejeune	Miguel	GWU	1			250
Li	Yuanzhang	USAMRMC	1	x	x	250
Li	Haitao	Missouri	1		x	250
Loh	Wei-Yin	WISC	1	x	x	250
Louie	Kenway	NYU	1			250
Love	Thomas E.	Case	1		y	GUEST
Marks	Christopher	USMA	1	x		250
Martin	Owen S.	RSA Group	1		x	50
Meiselwitz	Sandra	ATC	1	x	x	250
Mense	Alan	Raytheon	1 x	x	x+1	290
Mirikitani	Ray	DLI	1 x	x	x	300
Noble	Cindy	TRAC	1 x	x	x	250
Pan	Wei	Duke	1			125
Parry	Sam	IDA	1	x	x	250
Qian	Peter (Zhigueng)	WISC	1		x	250
Raghavan	Vasanthan	USC	1 x	x		250
Remund	Todd	Edwards AFB	1			300
Samaniego	Francisco	UC Davis	1		x+1	290
Sanchez	Susan	NPS	1			250
Schultz	Abraham M.	UMASS	1			50
Sen	Anada	UMICH	1	x	x	250
Singpurwalla	Nozer	GWU	1		x	125
Snyder	Wesley	NCSU	1		x	125
Sok	Sam	student	1			50
Talley	Colton	other	1			250
Thomas	William C	Raytheon	1 x	x	x	250
Turner	Casey	other	1			300
Warr	Richard	AFIT	1	x	x	250
Warren	Jacob	MCOTEA	1	x	x	250

**Attachment to Bodt Email of Nov 2nd
ACAS 2012 Close Out**

Weisz	Jeff	Edwards AFB	1				300
Whitaker	Lyn	NPS	1				250
White	Charles E.	WRAIR	1	x		x	250
Whitney	Laura	other	1				250
Wikle	Christopher	Missouri	1 x				GUEST
Williams	Brian	Los Alamos	1			x	250
Wolfe	Michele	TRAC	1 x	x		x	250
Wu	Jeff	GATECH	1			x	GUEST
Yanco	Holly	UMASS	1				250
Zhou	Jason	Digital System	1				250
Zhu	Ji	UMICH	1				GUEST

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12 28 40 13850

**Attachment to Bodt Email of Nov 2nd
ACAS 2012 Close Out**

NOTES

Cancelled (Army Withdraw)

Cancelled (Army Withdraw)

Cancelled (Army Withdraw) (Charged)

Cancelled (Army Withdraw)

Cancelled (Army Withdraw)

Cancelled (Health)

Cancelled (Army Withdraw)

Cancelled (Army Withdraw)

Cancelled (Health)

Cancelled (Army Withdraw)

Cancelled (Health)

Present, no registration form

Present, no registration form

Present, no registration form

Present, no registration form

Extra Wilks Ticket

Registration with Liz

\$40.00 Check for Banquet

\$40.00 Check for Banquet

Retiree + Wilks

**Attachment to Bodt Email of Nov 2nd
ACAS 2012 Close Out**

Check
\$40.00 Check for Banquet

Registration with Liz

**Attachment to Bodt Email of Nov 2nd
ACAS 2012 Close Out**

ACAS 2012

Participants**Attendees and/or Contributors****by LAST/by FIRST**

LAST	FIRST	AFFILIATION	CAT	Demographic	Abstract	Attendee
Ansari	Sardar	VCU	edu	VCU	*	
Avery	Matthew	other	other	other		*
Baiocchi	Michael	Stanford	edu	Stanford	*	*
Basilico	Robert	Wake Forrest	edu	WFU	*	
Bodt	Barry	ARL	mil (Army)	ARL	*	
Brownlow	James	Edwards AFB	mil (AF)	Edwards AFB	*	*
Buss	Andrew	Naval Post Grad Schl	mil (Navy)	NPS	*	
Buttrey	Sam	Naval Post Grad Schl	mil (Navy)	NPS	*	*
Camm	J	U Missouri St Louis	edu	UMSL	*	
Caudle	Kyle	SD Schl Mines & Tech	edu	SDSMT	*	*
Chang	Mou-Hsiung	ARO	mil (Army)	ARO	*	
Christino	Angelo	ATEC	mil (Army)			*
Collins	David	Los Alamos	gov	LANL	*	
Crary	Selden	NewallStreet	com	NewallStreet	*	*
Cushing	Michael	US Army Eval Ctr	mil (Army)	ATEC	*	
Derriso	Mark	AFIT	mil (AF)	AFIT	*	
Deveans	MAJ Thomas	TRAC Monterey	mil (Army)	TRAC-Monterey	*	*
Dewald	Lee	VMI	edu	VMI	*	*
Dickinson	Rebecca	VA Tech	edu	VT	*	*
Donnelly	Tom	SAS	com	SAS	*	*
Doshi	Prashant	U Georgia	edu	UGA	*	
Ellner	Paul	USA Mat Sys Anal Act	mil (Army)	AMSAA	*	
Freels	Jason	AFIT	mil (AF)	AFIT	*	
Freeman	Laura	IDA	com	IDA	*	
Freimanis	Rita	Wake Forest	edu	WFU	*	
Frey	Michael	Bucknell	edu	Bucknell	*	
Fries	Arthur	IDA	com	IDA	*	*
Galstyan	Aram	USC	edu	USC	*	
Gard	Robert	MIIS	edu	MIIS	*	*
Gaver	Don	Naval Post Grad Schl	mil (Navy)	NPS		*
Gillich	Barabara	ATC	mil (Army)	ATC	*	
Glen	Andy	USMA	mil (Army)	USMA	*	*
Glimcher	Paul	NYU	edu	NYU	*	
Goodie	Adam	U Georgia	edu	UGA	*	*
Gordon	Anna	Naval Post Grad Schl	mil (Navy)	NPS		*
Greenwell	Brandon	AFIT	mil (AF)	AFIT	*	
Grynovicki	Jock	ARL	mil (Army)	ARL	*	*
Hall	Daniel	U Georgia	edu	UGA	*	
Harel	Ofer	U Connecticut	edu	UCONN	*	*
Hernandez	Alejandro	Naval Post Grad Schl	mil (Navy)	NPS	*	
Henry	James	US Army	mil (Army)	Army	*	

Herbert	Nathan	USA Mat Sys Anal Act	mil (Army)	AMSAA	*	
Holcomb	Robert	IDA	com	IDA	*	
Hunter	Scott	Dugway	mil (Army)	Dugway	*	*
Hurst	Terril	Raytheon	com	Raytheon	*	*
Hurwitz	Arnon	Edwards AFB	mil (AF)	Edwards AFB	*	
Huzurbazar	Aparna	Los Alamos	gov	LANL	*	
Jacobs	Patricia	Naval Post Grad Schl	mil (Navy)	NPS		*
Ji	Harry	Digital System	com	Digital System	*	
Joseph	Antony	other	other	other		*
Kabban	Christine Schubert	AFIT	mil (AF)	AFIT	*	*
Kafadar	Karen	Indiana	edu	Indiana	*	*
Kogan	Alexander	Rutgers	edu	Rutgers	*	
Lejeune	Miguel	GWU	edu	GWU	*	*
Li	Haitao	U Missouri St Louis	edu	UMSL	*	*
Li	Yuanzhang	USAMRMC	mil (Army)	USAMRMC	*	*
Loh	Wei-Yin	U Wisconsin	edu	WISC	*	*
Louie	Kenway	NYU	edu	NYU	*	*
Love	Thomas E.	Case	edu	Case	*	*
Lucas	Thomas	Naval Post Grad Schl	mil (Navy)	NPS	*	
Mammarappalil	Joseph	Wake Forest	edu	WFU	*	
Marks	Christopher	USMA	mil (Army)	USMA	*	*
Martin	Owen S.	RSA Group	com	RSA Group	*	*
McLay	Laura	VCU	edu	VCU	*	*
Meiselwitz	Sandra	ATC	mil (Army)	ATC	*	*
Mense	Alan	Raytheon	com	Raytheon	*	*
Mirikitani	Ray	DLI	gov	DLI		*
Noble	Cindy	TRAC	mil (Army)	TRAC		*
Osterman	C	U Missouri St Louis	edu	UMSL	*	
Pan	Wei	Duke	edu	Duke	*	*
Parry	Sam	IDA	com	IDA	*	*
Pouchet	Colin	Raytheon	com	Raytheon	*	
Qian	Peter (Zhigueng)	U Wisconsin	edu	WISC	*	*
Radhakrishnan	R	U Missouri St Louis	edu	UMSL	*	
Raghavan	Vasanthan	USC	edu	USC	*	*
Remund	Todd	Edwards AFB	mil (AF)	Edwards AFB	*	*
Riggan	Ben	NCSU	edu	NCSU	*	
Royset	Johannes	Naval Post Grad Schl	mil (Navy)	NPS	*	*
Sajda	Paul	Columbia	edu	Columbia	*	*
Samaniego	Francisco	UC Davis	edu	UC Davis	*	*
Sanchez	Paul	Naval Post Grad Schl	mil (Navy)	NPS	*	
Sanchez	Susan	Naval Post Grad Schl	mil (Navy)	NPS	*	*
Schultz	Abraham M.	U Massachusetts Lowell	edu	UMASS	*	*

Sen	Ananda	U Michigan	edu	UMICH	*	*
Singpurwalla	Nozer	GWU	edu	GWU	*	*
Snyder	Wesley	NCSU	edu	NCSU	*	*
Sok	Sam	student	student	student		*
Talley	Colton	other	other	other		*
Tamburello	Robert	US Army Eval Ctr	mil (Army)	ATEC	*	
Tartakovsky	Aleander	USC	edu	USC	*	
Thirey	Benjamin	USMA	mil (Army)	USMA	*	
Thomas	William C	Raytheon	com	Raytheon	*	*
Turner	Casey	other	other			*
Warr	Richard	AFIT	mil (AF)	AFIT	*	*
Warren	Jacob	MCOTEA	mil (USMC)	MCOTEA	*	*
Wayne	Martin	USA Mat Sys Anal Act	mil (Army)	AMSAA	*	
Weaver	Brian	Los Alamos	gov	LANL	*	
Weisz	Jeff	Edwards AFB	mil (AF)	Edwards AFB	*	*
West	Bruce	US Army Rsch Ofc	mil (Army)	ARO	*	
Wets	Roger	Naval Post Grad Schl	mil (Navy)	NPS	*	
Whitaker	Lyn	Naval Post Grad Schl	mil (Navy)	NPS	*	*
White	Charles E	WRAIR	mil (Army)	WRAIR	*	*
Whitney	Laura	other	other			*
Wikle	Christopher	U Missouri	edu	Missouri	*	*
Williams	Brian	Los Alamos	gov	LANL	*	*
Wilson	Alyson	IDA	com	IDA	*	
Wolfe	Michele	TRADOC Anal Ctr	mil (Army)	TRAC	*	*
Womer	Keith	U Missouri St Louis	edu	UMSL	*	
Wu	Jeff	GA Institute of Tech	edu	GATECH	*	*
Yanco	Holly	U Massachusetts Lowell	edu	UMASS	*	*
Zhou	Jason	Digital System	com	Digital System	*	*
Zhu	Ji	U Michigan	edu	UMICH	*	*

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Category	Count
com	14
edu	43
gov	5
mil (AF)	9
mil (Army)	22
mil (Navy)	12
mil (USMC)	1
other	5
student	1

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ACAS 2012**Attendees**

LAST	FIRST	AFFILIATION	CAT	Demographic	Abstract
Avery	Matthew	other	other		
Baiocchi	Michael	Stanford	edu		
Brownlow	James	Edwards AFB	mil (AF)		
Buttrey	Sam	NPS	mil (Navy)		
Caudle	Kyle	SDSMT	edu		
Christino	Angelo	ATEC	mil (Army)		
Crary	Selden	NewallStreet	com		
Deveans	MAJ Thomas	TRAC-Monterey	mil (Army)		
Dewald	Lee	VMI	edu		
Dickinson	Rebecca	VT	edu		
Donnelly	Tom	SAS	com		
Fries	Arthur	IDA	com		
Gard	Robert	MIIS	edu		
Gaver	Don	NPS	mil (Navy)		
Glen	Andy	USMA	mil (Army)		
Goodie	Adam	UGA	edu		
Gordon	Anna	NPS	mil (Navy)		
Grynovicki	Jock	ARL	mil (Army)		
Harel	Ofer	UCONN	edu		
Hunter	Scott	Dugway	mil (Army)		
Hurst	Terril	Raytheon	com		
Jacobs	Patricia	NPS	mil (Navy)		
Joseph	Antony	other	other		
Kabban	Christine Schubert	AFIT	mil (AF)		
Kafadar	Karen	Indiana	edu		
Lejeune	Miguel	GWU	edu		
Li	Yuanzhang	USAMRMC	mil (Army)		
Li	Haitao	Missouri	edu		
Loh	Wei-Yin	WISC	edu		
Louie	Kenway	NYU	edu		
Love	Thomas E.	Case	edu		
Marks	Christopher	USMA	mil (Army)		
Martin	Owen S.	RSA Group	com		
McLay	Laura	VCU	edu		
Meiselwitz	Sandra	ATC	mil (Army)		
Mense	Alan	Raytheon	com		
Mirikitani	Ray	DLI	gov		
Noble	Cindy	TRAC	mil (Army)		
Pan	Wei	Duke	edu		
Parry	Sam	IDA	com		
Qian	Peter (Zhigueng)	WISC	edu		
Raghavan	Vasanthan	USC	edu		
Remund	Todd	Edwards AFB	mil (AF)		

Royset	Johannes	NPS	mil (Navy)		
Sajda	Paul	Columbia	edu		
Samaniego	Francisco	UC Davis	edu		
Sanchez	Susan	NPS	mil (Navy)		
Schultz	Abraham M.	UMASS	edu		
Sen	Anada	UMICH	edu		
Singpurwalla	Nozer	GWU	edu		
Snyder	Wesley	NCSU	edu		
Sok	Sam	student	student		
Talley	Colton	other	other		
Thomas	William C	Raytheon	com		
Turner	Casey	other	other		
Warr	Richard	AFIT	mil (AF)		
Warren	Jacob	MCOTEA	mil (USMC)		
Weisz	Jeff	Edwards AFB	mil (AF)		
Whitaker	Lyn	NPS	mil (Navy)		
White	Charles E.	WRAIR	mil (Army)		
Whitney	Laura	other	other		
Wikle	Christopher	Missouri	edu		
Williams	Brian	Los Alamos	gov		
Wolfe	Michele	TRAC	mil (Army)		
Wu	Jeff	GATECH	edu		
Yanco	Holly	UMASS	edu		
Zhou	Jason	Digital System	com		
Zhu	Ji	UMICH	edu		

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Category	Count
com	9
edu	27
gov	2
mil (AF)	5
mil (Army)	11
mil (Navy)	7
mil (USMC)	1
other	5
student	1

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Contributors

LAST	FIRST	AFFILIATION	CAT	Demographic
Ansari	Sardar	VCU	edu	VCU
Baiocchi	Michael	Stanford	edu	Stanford
Basilico	Robert	Wake Forrest	edu	WFU
Bodt	Barry	ARL	mil (Army)	ARL
Brownlow	James	Edwards AFB	mil (AF)	Edwards AFB
Buss	Andrew	Naval Post Grad Schl	mil (Navy)	NPS
Buttrey	Sam	Naval Post Grad Schl	mil (Navy)	NPS
Camm	J	U of Missouri St Louis	edu	UMSL
Caudle	Kyle	SD Schl Mines & Tech	edu	SDSMT
Chang	Mou-Hsiung	ARO	mil (Army)	ARO
Collins	David	Los Alamos	gov	LANL
Crary	Selden	NewallStreet	com	NewallStreet
Cushing	Michael	US Army Eval Ctr	mil (Army)	ATEC
Deveans	MAJ Thomas	TRAC Monterey	mil (Army)	TRAC-Monterey
Dewald	Lee	VMI	edu	VMI
Derriso	Mark	AFIT	mil (AF)	AFIT
Dickinson	Rebecca	VA Tech	edu	VT
Donnelly	Tom	SAS	com	SAS
Doshi	Prashant	U of Georgia	edu	UGA
Ellner	Paul	USA Mat Sys Anal Act	mil (Army)	AMSAA
Freeman	Laura	IDA	com	IDA
Freels	Jason	AFIT	mil (AF)	AFIT
Frey	Michael	Bucknell	edu	Bucknell
Fries	Arthur	IDA	com	IDA
Freimanis	Rita	Wake Forest	edu	WFU
Galstyan	Aram	USC	edu	USC
Gard	Robert	MIIS	edu	MIIS
Gillich	Barabara	ATC	mil (Army)	ATC
Glen	Andy	USMA	mil (Army)	USMA
Glimcher	Paul	NYU	edu	NYU
Goodie	Adam	U of Georgia	edu	UGA
Greenwell	Brandon	AFIT	mil (AF)	AFIT
Grynovicki	Jock	ARL	mil (Army)	ARL
Hernandez	Alejandro	Naval Post Grad Schl	mil (Navy)	NPS
Hall	Daniel	U of Georgia	edu	UGA
Harel	Ofer	U of Connecticut	edu	UCONN
Henry	James	US Army	mil (Army)	Army
Holcomb	Robert	IDA	com	IDA
Herbert	Nathan	USA Mat Sys Anal Act	mil (Army)	AMSAA
Hunter	Scott	Dugway	mil (Army)	Dugway
Hurst	Terril	Raytheon	com	Raytheon
Hurwitz	Arnon	Edwards AFB	mil (AF)	Edwards AFB
Huzurbazar	Aparna	Los Alamos	gov	LANL

Ji	Harry	Digital System	com	Digital System
Kabban	Christine Schubert	AFIT	mil (AF)	AFIT
Kafadar	Karen	Indiana	edu	Indiana
Kogan	Alexander	Rutgers	edu	Rutgers
Lejeune	Miguel	GWU	edu	GWU
Li	Yuanzhang	USAMRMC	mil (Army)	USAMRMC
Li	Haitao	U of Missouri St Louis	edu	UMSL
Loh	Wei-Yin	U of Wisconsin	edu	WISC
Louie	Kenway	NYU	edu	NYU
Love	Thomas E.	Case	edu	Case
Lucas	Thomas	Naval Post Grad Schl	mil (Navy)	NPS
Mammarappallil	Joseph	Wake Forest	edu	WFU
Marks	Christopher	USMA	mil (Army)	USMA
Martin	Owen S.	RSA Group	com	RSA Group
McLay	Laura	VCU	edu	VCU
Meiselwitz	Sandra	ATC	mil (Army)	ATC
Mense	Alan	Raytheon	com	Raytheon
Osterman	C	U of Missouri St Louis	edu	UMSL
Pan	Wei	Duke	edu	Duke
Parry	Sam	IDA	com	IDA
Pouchet	Colin	Raytheon	com	Raytheon
Qian	Peter (Zhigueng)	U of Wisconsin	edu	WISC
Radhakrishnan	R	U of Missouri St Louis	edu	UMSL
Raghavan	Vasanthan	USC	edu	USC
Remund	Todd	Edwards AFB	mil (AF)	Edwards AFB
Royset	Johannes	Naval Post Grad Schl	mil (Navy)	NPS
Riggan	Ben	NCSU	edu	NCSU
Sajda	Paul	Columbia	edu	Columbia
Samaniego	Francisco	UC Davis	edu	UC Davis
Sanchez	Paul	Naval Post Grad Schl	mil (Navy)	NPS
Sanchez	Susan	Naval Post Grad Schl	mil (Navy)	NPS
Schultz	Abraham M.	U of Massachusetts Lowell	edu	UMASS
Sen	Ananda	U of Michigan	edu	UMICH
Singpurwalla	Nozer	GWU	edu	GWU
Snyder	Wesley	NCSU	edu	NCSU
Tartakovsky	Aleander	USC	edu	USC
Thomas	William C	Raytheon	com	Raytheon
Tamburello	Robert	US Army Eval Ctr	mil (Army)	ATEC
Thirey	Benjamin	USMA	mil (Army)	USMA
Wayne	Martin	USA Mat Sys Anal Act	mil (Army)	AMSAA
Warr	Richard	AFIT	mil (AF)	AFIT
Warren	Jacob	MCOTEA	mil (USMC)	MCOTEA
Weaver	Brian	Los Alamos	gov	LANL
Weisz	Jeff	Edwards AFB	mil (AF)	Edwards AFB
Wets	Roger	Naval Post Grad Schl	mil (Navy)	NPS
West	Bruce	US Army Rsch Ofc	mil (Army)	ARO

Whitaker	Lyn	Naval Post Grad Schl	mil (Navy)	NPS
White	Charles E.	WRAIR	mil (Army)	WRAIR
Wikle	Christopher	U of Missouri	edu	Missouri
Williams	Brian	Los Alamos	gov	Los Alamos
Wilson	Alyson	IDA	com	IDA
Wolfe	Michele	TRADOC Anal Ctr	mil (Army)	TRAC
Womer	Keith	U of Missouri St Louis	edu	UMSL
Wu	Jeff	GA Institute of Tech	edu	GATECH
Yanco	Holly	U of Massachusetts Lowell	edu	UMASS
Zhou	Jason	Digital System	com	Digital System
Zhu	Ji	U of Michigan	edu	UMICH

