SAVIAC
Shock and Vibration Information Analysis Center

Current Awareness

July 2003

The 73rd Shock & Vibration Symposium

Preliminary Program

NAVSEA CRANE
Surface Warfare Center Division

SPAWAR

ENDEVCO

October 26-31, 2003
San Diego, CA

US Army Corps of Engineers®
Engineer Research and Development Center

Introduction

Since the first meeting in 1947, the Shock and Vibration Symposium has become the oldest, continual meeting dealing with the transient response of structures and materials to vibration and shock. The symposium was created as a mechanism for the exchange of information among government agencies concerned with design, analysis and testing. It provides a valuable opportunity for the technical community in government, private industry and academia to meet and discuss problems of mutual interest. This year's symposium features the Naval Surface Warfare Center, SPAWAR Systems Center San Diego, and Endevco Corporation. Representing these organizations are our Co-Chairs.

Program Committee Members

Co-Chair: Mr. Allen Parkes - Naval Surface Warfare Center, Crane Division
Co-Chair: Mr. Don Peckinpaugh, - Naval Surface Warfare Center, Crane Division
Co-Chair: Mr. John Maltby - SPAWAR Systems Center San Diego
Co-Chair: Ms Wendy Smidt - SPAWAR Systems Center San Diego
Co-Chair: - Mr. Jeff Dean, Endevco Corporation
Honorary Co-Chair: Mr. John Walker - SPAWAR
Honorary Co-Chair: Mr. Bob Fogg - SPAWAR
Mr. Najib Abboud - Weidlinger Associates, Inc.
Mr. J. Edward Alexander - United Defense LP
Mr. Austin Alvarez - General Dynamics Electric Boat
Mr. Jeff Blankenship - NAVSEA-NSWC/Coastal Systems Station
Mr. Kevin Castanien - SAIC
Dr. Jeff Cipolla - HKS, Inc./ ABAQUS
Dr. Raymond Daddazio - Weidlinger Associates, Inc.
Mr. Kirk Doughty - NUWC Keyport
Mr. Ami Frydman - ARL/Weapons & Materials Research Directorate
Mr David Guitas - SPAWAR Systems Center San Diego
Mr. Jamie Howell - NSWC/DD
Captain Stuart Kendrick - SPAWAR Headquarters
Ms Mary Q. Kerns - Enidine, Incorporated
Mr. Travis Kerr - Northrup Grumman Newport News
Dr. Ted Krauthammer - Penn State Protective Technology Center
Mr. Joel Leifer - SAVIAC/HI-TEST Laboratories, Inc.
Mr. Andrew Littlefield - US Army TACOM-ARDEC Benet Laboratories
Mr. Eric Luft - NSWCCD/UERD
Mr. Jeffery A. Morris - HI-TEST Laboratories, Inc.
Mr. John Pooley - AMTEC Corp
Mr. Henry Pusey - SAVIAC/MFPT
Dr. Rudy Scavuzzo - University of Akron
Dr. Young Shin - Naval Postgraduate School
Dr. Charles Robert Welch - SAVIAC/USACE
Ms. Lauren Yancey - SAVIAC/HI-TEST Laboratories, Inc.
Mr. William Yancey - HI-TEST Laboratories, Inc.
Mr. Gary Zook - NUWC Keyport

Classified Sessions

A SECRET-level clearance is required to attend the Limited/Classified Sessions held at SPAWAR. A visit request form (included in this program) must be sent to SPAWAR by October 1, 2003. Please bring a photo ID for admittance.

Note to Speakers

Please be aware this is a preliminary program. We have tried to arrange the presentations to minimize conflicts. If you have a conflict resulting from the arrangements as presented here, please contact us for possible changes. For up-to-date program status, check the SAVIAC website at http://www.saviac.org.

Exhibitors

There will be an area for table-top and/or booth exhibits at the hotel. We will be having an Exhibitor's Luncheon on Tuesday for all attendees and exhibitors. In addition, all session breaks will be held in the exhibit area. Please call Lauren Yancey (703) 892-0060 for further information.

Information Numbers

Joel Leifer	(301) 596-0100	The Red Lion Hanalei Hotel Reservations:	(800) 882-0858
Lauren Yancey	(703) 892-0060	Hotel Fax:	(619) 297-6049
FAX	(301) 596-6400	Hotel Website	www.hanaleihotel.com
website	www.saviac.org		

Schedule of Events

This program is preliminary and is subject to modification. Check the SAVIAC website at http://www.saviac.org for up-to-date program status.

Tutorials

Sunday and Monday 7:30 a.m. - 7:00 p.m.

Sessions

Tuesday Morning

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Track One *(Unclassified)*	*Track Two* *(Unclassified)*	*Track Three* *(Unclassified)*	*Track Four* *(Unclassified)*	*Track Five* *(Unclassified)*	*Track Six* *(Classified)*	*Track Seven* *(Classified)*
Tuesday Afternoon						
Gene Sevin	Hi-G Shock ASME Panel	Products & Facilities Manufacturers Panel	Training	Data Arch DG Tech Trnfr DG Fluid Structure Interaction	COTS Panel Common Sense Shock DG	
Wednesday Morning						
Acoustic - Numerical Methods Acoustic Apps	Shock Isolation Shock Mitigation	UK Weapons Clearance Philosophy - Shock and Vibration	Training	Data Acq DG Pyroshock DG SRS DG	Anti-Terrorist I Anti-Terrorist II	
Wednesday Afternoon						
Underwater Acoustics 901 Extension Panel	Human Shock Mitigation Concrete Design	Weapons Acquisition Processes UAVs	Training	Struct Resp to S&V Concrete Resp Mil App	Payloads & Sensors UNDEX Bubble	UNDEX

Wednesday Night: SAVIAC Community Feedback Social Event

Thursday Morning						
901 Subsid Comp Panel Shock Test Methods	Vibration - Test & Appl	Ship Shock Simulation I Ship Shock Simulation II	Vibration - Num Methods Test Methods/Requirements	Damping & Isolation	Military Blast	Homeland Security Intunnel Blast
Thursday Afternoon:						
		Ship Shock Simulation Panel				

Friday: Tour of Endevco
Shock Machine Tutorial (SPAWAR)

74th Shock and Vibration Symposium
Preliminary Program

Sunday, October 26

Tutorials	*Instructor*	*Time*
Basic Concepts of Digital Data Acquisition for Shock and Vibration Testing	Strether Smith	8-11 AM
Performing DDAM Analysis Using MSC Software products	Bart McPheeters	8-11 AM
The Navy Shock Qualification Process	Kurt Hartsough	9-12 AM
Designing Measurement System Transfer Functions for Dynamic Testing	Chuck Wright	12-3 PM
Dynamic Design Analysis Method (DDAM)	Dave Weinberg	12-3 PM
MIL-S-901D Shock Qualification Testing and Extensions	Kurt Hartsough & Domenic Urzillo	1-4 PM
Introduction to Vibration Testing	Jon Wilson	4-7 PM
An Introduction to ABAQUS	Jeff Cipolla	4-7 PM

Monday, October 27

Tutorials	*Instructor*	*Time*
Bad Data Look Just As Believable As Good Data: Plan Your Measurement System To Tell The Difference	Pete Stein	7:30-11 AM
UNDEX and Acoustic Analysis Using ABAQUS	Jeff Cipolla	8-11 AM
Overview of Underwater Shock and DDAM	Young Shin	8-11 AM
Structural Detailing for Blast Resistance	Ted Krauthammer	8-11 AM
The Measurement of Meaningful Shock & Vibration Data	Patrick Walter	12-3 PM
Using contact surface elements in FEA	Dave Weinberg	12-3 PM
Application of the USA Code to Underwater Shock Problems	John DeRuntz	12-3 PM
Substructure Coupling and Structural Modification for Shock & Vibration	Joshua Gordis	12-3 PM
Validation and Editing of Shock & Vibration Data	Allan Piersol	4-7 PM
Vibration And Shock Test Fixture Design, Fabrication And Evaluation	Wayne Tustin	4-7 PM
Naval Shock Analysis & Design	Rudy Scavuzzo	4-7 PM
Beyond the Shock Spectrum - Temporal & Frequency Moments, the Product Model, & Uncertainty	Dave Smallwood	4-7 PM
Navy Shock Database User Certification	Paul Medeiros & Kurt Hartsough	4-7 PM

Tuesday Morning, October 28

Chair/Presenter Meeting (All Tuesday Chairs & Presenters Must Attend)
7:00 - 7:30 a.m. Location TBA

Opening Session

Call to Order: *Mr. Joel Leifer*, *SAVIAC Program Manager*	8:30 am
Welcome: *Mr. Dave Schulte, Director Ordinance Engineering Directorate, Naval Surface Warfare Center, Crane Division*	8:35 am
Welcome: *TBD, Space and Naval Warfare Systems Command*	8:40 am
Welcome: *Mr. Rob Meyer, President, Endevco*	8:45 am
Symposium Highlights: *Mr. Joel Leifer*, SAVIAC Program Manager	8:50 am
Henry Pusey Award Presentation: *Mr. Allen Parkes & Mr. Don Peckinpaugh, Naval Surface Warfare Center, Crane Division, Mr. John Maltby & Ms. Wendy Smidt, Space and Naval Warfare Systems Command, Mr. Jeff Dean, Endevco*	9:10 am
Mel Baron Award Presentation: *TBD*	9:20 am
Life Achievement Award Presentation: *TBD*	9:30 am
SAVIAC Supporters Recognition - *Mr. Joel Leifer, SAVIAC Program Manager*	9:40 am
Director's Remarks: *Dr. Charles Robert Welch*, *USAE Research and Development Center*	9:50 am
Break	10:00 am
Keynote Address: TBD	10:15 am
Elias Klein Memorial Lecture: *TBD*	11:00 am
Break	11:30 am

Exhibitors Luncheon

Tour the exhibits as you enjoy lunch in the exhibit area from 11:30 - 1:00

Tuesday Afternoon, October 28

Track One

Gene Sevin Session — **Chair: Prof. Walter Pilkey, UVA**
Co-Chair: Dr. Kent Goering, ARA, Inc.

The following papers will be organized into three subsessions: Blast, Terrorist, and Limiting Performance, to reflect the major areas Gene has contributed in to date. Additional papers will be added when submitted.

Opening and Hi-Lites of Gene Sevin's Career Up to the Present - *Prof. Walter Pilkey, University of Virginia*
Composite Retrofits of Reinforced Concrete Slabs to Resist Blast Loading - *Darell Lawver, Raymond Daddazio, Gwang Jin Oh, Allen Pifko, Weidlinger Associates; Michael Stanley, New Mexico Institute of Mining and Technology*
Combination Vibration Control Systems For Sensitive Equipment - *Dr. Vyacheslav Ryaboy, Newport Corporation*
Concrete Modeled As An Inhomogeneous Material: Quasi-Static Mechanical Behavior Of Concrete, Mortar, And Aggregate - *Dr. Stephen Akers, Paul Reed, US Army Engineer Research And Development Center*
Blast Mitigation Of Existing Structures Using Fiber Reinforced Polymer Composite Systems - *Peter Milligan, Edward R. Fyfe, Edward Donnelly, Fyfe Co.; John Crawford, Karagozian & Case*
Comparison Of Dynamic Finite Element Analysis Model To Single Degree Of Freedom Method For Blast Analysis Of Multi-Story Steel Frame - *Matthew Edel, Michael Polcyn, Dr. Charles Oswald, Baker Engineering & Risk Consultants*
Development of Design Tools for Blast Loading on Structures - *Raymond Daddazio, Darell Lawver, Mohammed Ettouney, Felix Wong, Kenneth Stultz and David Rubin, Weidlinger Associates*
Protection From Terrorism Through Precision Impact Tests For Computer Code Validation - *Prof. Ted Krauthammer, Protective Technology Center, The Pennsylvania State University*
Computational Approximations of the Hendron-Aiyer Problem: Varying the Third Invariant - *Don Simons, Tom Pucik, Northrup Grumman Information Technology*

Gene Sevin Reception and Dinner — **Master of Ceremonies: Dr. Nicholas Perrone**

Upon completion of the technical sessions, there will be a reception and dinner to honor Gene. The cost to attend the reception and dinner is $35 per person and will include hors d'oeuvres and a cash bar before the meal. After dinner, there will be a talk on "The Forensic Analysis of the World Trade Center" by Najib Abboud of Weidlinger Associates and an opportunity to review Gene's career. You must register in advance for this event by checking the box on the registration form.

Track Two

Hi-G Shock — ***Chair: Prof. Patrick Walter, Endevco & TCU***
Co-Chair: Jeff Dean, Endevco

Lessons Learned In Applying Accelerometers To Nuclear Effects Simulation Testing - *Dr. Patrick Walter, Endevco & Texas Christian University*
Intense Shock In Armored Combat Vehicles - *W. Scott Walton, US Army Aberdeen Test Center*
Shear Mode Shock Accelerometer - *John Kubler, Kistler Instrument Corp.*
Advanced MEMS Shock Accelerometer - *Tom Seng, Endevco Corp.*
Shock Instrumentation Saturation Effects And Compensation - *Strether Smith, DSPCon*
Shock Sensor Performance Evaluation - *Bruce Martha, PCB Piezotronics, Inc.*
An Historical Review Of Theoretical And Practical Investigations Of Bars As A Source Of Mechanical Shock - *David Evans, National Institute of Standards*
High-G Testing For Fuze Research - *Dr. Howard White, Timothy Tobrik, Richard Mabry, AFRL/MNMF*

Progress Report from the ASME PTC 60 Committee on Verification and Validation of Computational Solid Mechanics — ***Chair: Dr. Tim Hasselman, ACTA***

This panel will provide a progress report on the ASME V&V committee's activities. Each panel member will give a ten minute summary on the following topics, consistent with the organization of their Summary Guide : Introduction (Hans Mair, IDA, Committee Co-chairman); V&V definitions (John Cafeo, GM); Role of nondeterminism in V&V (Ben Thacker, Southwest Research Institute); Model development (Scott Doebling, Los Alamos National Laboratory); Verification (Francois Hemez, Los Alamos National Laboratory); Validation (Paul Senseny, Factory Mutual).

Track Three

Products And Facilities — Chair: TBD

Multi Channel, Cost Effective, User Friendly Data Acquisition System In The Environmental Testing Laboratory - *D. Lehman, D. Ben Yehuda, RAFAEL*

NSWC Crane Division T&E Capabilities - *Jim Parsch, Naval Surface Warface Center Crane Division*

Lithium Battery Environmental Testing - *Denis Kristler, Naval Surface Warface Center Crane Division*

Electrodynamic Shaker Performance Breakthroughs: Extreme Random And SRS Shock Testing - *Phillip Rogers, Unholtz-Dickie Corporation*

Primary Calibration Of Accelerometers By Laser Interferometer - *Dr. Jeffrey Dosch, Bruce Martha, PCB Piezotronics, Inc.*

Exceeding Mother Nature's Limits - *Brian O'Keefe, ESI North America*

Statistical Energy Analysis With Autosea2 Software For High Frequency Structural Acoustic Simulation Enhanced By Virtual Mode Synthesis For Shock Modeling - *Marshall Loewenstein, ESI North America*

Manufacturer's Panel — Chair: Jon Wilson, The Dynamic Consultant

Instrumentation manufacturers will present different aspects of shock and/or vibration measurement, control or analysis. Audience participation will be encouraged, allowing customers an opportunity to air their problems and possibly receive answers from knowledgeable technical representatives. Panel members will include representatives from the Symposium exhibitors. Please contact the chair if your firm would like to participate.

Track Four

Training — Chair: TBD

Isolation & Dissipation - Doug Taylor, Taylor Devices

Transient Acoustic Fluid-Structure Interaction - *Prof. Thomas Geers, University of Colorado*

Large Caliber Gun Blast, Recoil, and Dynamics: A Case Study in Shock and Vibration - *Dr. Eric Kathe, Dr. Andrew Littlefield, Dan Cler, Jim Newill, US Army TCOM-ARDEC Benet Laboratories*

Random Vibrations - 1905 Through The Present - *Dr.Thomas Paez, Sandia National Laboratories*

Track Five

Development of a Data Storage Standard Discussion Group — Leader: Dan Worth, NASA/GSFC

Formation of a Tech Transfer/Education Committee Discussion Group — Leader: TBD

Fluid Structure Interactions — Chair:

Modification Of The Geers-Hunter Underwater-Explosion Bubble Model For Close Correlation With Snay Data - *Dr. Thomas Geers, Chung-Kyu Park, University Of Colorado*

Analysis Of The Loading And Response Of Flat Plate Targets Subjected To Close-Proximity Underwater Explosions *Dr. Richard Link; Laura Martin, Merv Norwood, R. Ripley, T. Josey, Martec Ltd; Dr.John E Slater, Defence R&D Canada*

Underwater Explosion Damage Of Thin Rectangular Plates - *Dr. K Ramajey Athilagam; Dr. K. Daniel Prasad, M Suryanarayana, NSTL Shock & Vibration Centre*

Prediction Of Maximum Acceleration Of Equipments On Ships By Underwater Explosion Loading - *Kazuo Shimamura, Ishikawajima-Harima Heavy Industries Co.,Ltd.; Miki Arami; Yuichiro Noma, IHI Marine United Inc.*

A Method For Analyzing Interactions Between Underwater Shock Wave And Acoustic Structure - *Dr. Jian-Hu Liu; Prof You-Sheng Wu, China Ship Scientific Research Center*

Floating Structures Subject To Close-In Explosion - ***S. W. Gong,*** *K. C. Hung, Institute Of High Performance Computing*

Track Six (Classified)

COTS Panel — **Co-Chair: Frederick Costanzo, NSWC/Carderock**
Co-Chair: **Mary Q. Kerns, Enidine**

Over the past four years we have utilized the COTS panel to identify and bound some of the issues and address the concerns of the naval shock community, ship designers, ship builders, ship integrators, COTS and shock & vibration mount manufacturers. As a result of these interactions, we felt that the community was looking for direction, guidance, and clarification. In the 2003 COTS Panel the NAVSEA Directors that represent the Navy Technical Authority for Shock and Vibration will present the Directorates vision for the future to the community. Panel members are Michael R. Riley, Director, Ship Survivability & Structural Integrity, NAVSEA 05P and Gary M. Jebsen, Director, Ship Signatures NAVSEA 05T.

Common Sense Shock Discussion Group — ***Chair:*** **Austin Alvarez, Electric Boat Corp.**
Co-Chair: Robert Bowser, NAVSEA 05P3

The description is pending approval for public release.

Wednesday Morning, October 29

Chair/Presenter Meeting (All Wednesday Chairs & Presenters Must Attend)
7:00 - 7:30 a.m. Location TBA

Track One

Acoustics - Numerical Methods — ***Chair: Dr. Jeff Cipolla, Hibbitt Karlsson & Sorensen***

State-Of-The-Art Infinite Element Methods For The Efficient Simulation Of Exterior Acoustics - *Daniel Dreyer, Prof. Otto Von Estorff; Technical University Hamburg-Harburg*

An Approach To Aero-Acoustics Modeling: Linking CFD And Computational Acoustics To Implement The Acoustic Analogy - *Scott Bergeon, LMS North America; Dr. Michel Tournour, Zoubida El-Hachemi, Colin Mcculloch: LMS International*

Energy Finite Element And Boundary Element Formulations For Computing High Frequency Vibration And Noise Of Submersible Structures - *Nickolas Vlahopoulos, Aimin Wang, Univeristy Of Michigan; Kuangcheng Wu, Richard Shaw, Northrop Grumman Newport News*

Modeling Viscoelastic Laminate Sections In Statistical Energy Analysis - *Phil Shorter, Bryce Gardner, Vibro-Acoustic Sciences/ESI North America*

Elastoacoustic Response Of Layered Composite Plates Under Acoustic Loadings - *Dr. Ramesh Kolar, Naval Postgraduate School*

Prediction Of Vibration Energy Flow Variability In Random Built-Up Structures - *Sonjoy Das, Johns Hopkins Univeristy; Prof. C.S. Manohar, Indian Institute Of Science*

Acoustics Applications — ***Chair: TBD***

Analysis Of Probability Density Functions Of CMC Plate Strain Responses To Acoustic Excitation In Progressive Wave Tube - *Dr. Alexander Steinwolf, University Of Aukland; Michael Spottswood; Air Force Research Laboratory, WPAFB*

Using Acoustic Intensity Measurements In Acceptance Tests In The Manufacturing Line - *D. Lehman, Z. Sherf, RAFAEL*

Damage Monitoring By Means Of Acoustic Spectroscopy - *Dr. Gerard Vanderborck, Thales Underwater Systems; Dr. Amine Hassim, Inria*

Recents Advancements In Particle Impact Noise Detection (PIND) - *Stewart Slykhous, Spectral Dynamics, Inc.*

Random Vibration Environment Predictions For Secondary Spacecraft Payloads - *Dr. Juan Betts, Aerospace Corporation; Scott Bergeon, LMS North America; Colin Mccolloch, LMS International*

COTS Structureborne Noise Isolation Survey For Future Submarine Installations - *John Nagurny, Lockheed Martin; Stephen Zajkowski*

Track Two

Shock Isolation — *Chair: Brian Detwiler, Bath Iron Works*

Evaluation Of Shock Isolating Heavy Machinery For Deck And Hull Mounted Applications Aboard A Typical Carrier Platform - *Kevin Arden, Sarah Staggers, Northrup Grumman Newport News*

Shock Isolation System Selection For Successful MIL-S-901 Qualification - *Rick Griffen, Northrup Grumman Newport News*

Successful Shock Isolation Of Naval Enclosures - *Dr. Robert Monson, Dr. Jianhua Yan, Lockheed Martin Tactical Systems*

Comparison Of The Shock Response Of A Machinery Component Employed With Different Acoustic Isolators - *Katie Goodman, Northrup Grumman Newport News*

Shock Response Analysis Of Marine Floating Raft Shock-Resistant System By Finite Element Method - *YL Zhao, Naval University Of Engineering*

Shock Mitigation — *Chair: Dr. Tim Coats, NSWC Dahlgren*

Shock Mitigation - A Familiar Topic In High-Speed Planing Boat Design - *Dr. Timothy Coats, Jennifer Speir, Richard Wilson, Naval Surface Warfare Center, Carderock Division*

High Speed Craft Motions: A Case Study - *Kelly Haupt, Naval Surface Warfare Center, Carderock Division*

Design Methods For High Speed Combatant Craft - *Jenny Speirs, Jason Marshall, Andrew Speirs, Naval Surface Warfare Center Carderock Division*

Considerations For Data Acquisition, Analysis, And Interpretation For High Speed Craft Motions - Kelly Haupt, Naval Surface Warfare Center Carderock Division

Mitigating Severe Shock To The Crews Of Naval Craft - *Capt. Theodore Grabowsky, USN Ret, Vibration & Sound Solutions Limited*

Shock Mitigation Through Motion Control - *Chris Swanton, Maritime Dynamics*

Track Three

UK Weapons Clearance Philosophy - Shock and Vibration — *Chair: Dr. Ian Carr, Defense Procurement Agency* / *Co-Chair: Dr. Philip Bell, Cranfield Aerospace Ltd*

UK Philosophy For Weapons Clearances Programmes - *Dr. Ian Carr, Defense Procurement Agency*

UK Approach to Munitions Trials Programmes - *Dr. Ian Carr, Defense Procurement Agency*

Trials Programmes - A Case History: Transportation of Equipment by C130J - *Dr. Darrel Charles, Cranfield Aerospace Ltd.*

Gunfire Shock - The Development of Test Specifications & Implementation Part I: The Objectives for Sequential Service Testing - *Dr. Ian Carr, Defense Procurement Agency*

Gunfire Shock - The Development of Test Specifications & Implementation Part II: The Development of Test Specifications for Gunfire Shock (UK Apache) - *Dr. Philip Bell, Cranfield Aerospace Ltd*

Gunfire Shock - The Development of Test Specifications & Implementation Part III: Test Considerations and Implementation - *Barry Gasper, Kent Engineering Services, Ltd*

Vibration and Shock Environments in Tracked Vehicle - *Dr. Giles Clarke, Defense Procurement Agency*

Tracked Vehicle Case History - Light Forces, Anti-Tank Weapons on the Warrior Tracked Vehicle - *Darrel Charles, Cranfield Aerospace Ltd.*

Vibration and Shock Data Logging Requirements for Munitions - *Dr. Giles Clarke, Defense Procurement Agency*

Wide Dynamic Range MEMS Sensors for Shock and Vibration - *Dr. Philip Bell, Cranfield Aerospace Ltd*

Track Four

Training — *TBD*

Normal Mode Theory - *Dr. Rudy Scavuzzo, University of Akron*

Introduction to Data Acqusition - Part I - *Prof. Joshua Gordis, Naval Postgraduate School*

Introduction to Data Acqusition - Part II - *Prof. Joshua Gordis, Naval Postgraduate School*

TBD - *Prof. Ted Krauthammer, The Penn State University*

Track Five

Data Analysis Discussion Group — *Leader: Strether Smith, DSPCon*

The data acquisition and signal conditioning vendors will be invited to describe what is new and wonderful in their product lines. Then, the vendors and attendees will participate in a discussion of these developments and what the users would like to see in future offerings.

Pyroshock Discussion Group — *Leader: Dr. Vesta Bateman, Sandia National Labs*

The Pyroshock Working Group will meet to discuss topics such as concepts of near-field, mid-field and far-field pyrochock, pyroshock specifications and instrumentation, and simulation of near-field, mid-field and far-field pyroshocks. Group members are encouraged to participate in a general discussion of recent experiences and problems in pyroshock testing.

Formation of a Shock Response Spectrum Committee Discussion Group — *Chair: Ed Alexander, UDLP*

Track Six (Classified)

Anti-Terrorist I - (Classified) — *Chair: Dr. Paul Mlakar, USAERDC*

SDOF Analysis Of CMU Wall Response To Blast Load - *Dr. Thomas Slawson, Carol Johnson, US Army Engineer Research & Development Center; Dr. Mary Beth Hueste, Texas A&M University*

Finite Element Predictions Of Air-Backed Reinforced Concrete Wall Response To Cased Munitions - *David Bogosian, Karagozian & Case; Frank Dallriva, US Army Engineer Research And Development Center*

An Enhanced Methodology For Predicting Loads Behind Blast Barriers - *David Bogosian; Dr.Yongjiang Shi, Karagosian & Case*

Retrofit Techniques For Strengthening Stud Walls Subjected To Nearby Blast Loads - *Ken Morrill; J.E. Crawford, Karagosian & Case*

A Comparison Of Predicted And Measured Response Of Steel Double-Leaf Blast Doors Subjected To Combined Airblast And Fragment Loadings - *Darren Tennant, Dr. Weihong Yang, Dr. Howard Levine, Weidlinger Associates, Inc.*

Anti-Terrorist II - (Classified) — *Chair: Ron Hunt, AFRL*

Effects Of A Neighboring Structure On Loads On A Structure - *Dr. James Baylot, Byron Armstrong, Denis Rickman, US Army Engineer Research & Development Center*

Effects Of Inclusion Of Compressed Gas Bottles In A TNT Explosive Charge:Results From The CANNED HEAT Experiments - *Denis Rickman, US Army Engineer Research & Development Center*

Assessment Of Meshfree Methods For Fragment Impact And Penetration - *Dr. Leonard Schwer, Schwer Eng & Consulting Services*

Risk Assessment Of Damage Effects On Structures Due To Unconventional Explosives - *Dr. Young Sohn, DTRA; Chuck Allen, Andrew Prinaris, Thomas Rosener, Mark Swanson; Northrup Grumman, Dave Herman, URS*

Wednesday Afternoon, October 29

Track One

Under Water Acoustics — *Chair: Richard Taddeo, NAVSEA 05T*

Overview Of The Target Strength Predictive Model - *Thomas Yates, Jan Niemiec, Carderock Division NSWCCD*

Radiation Efficiencies For Plates In Water - *Melvyn Rumerman, Carderock Division NSWCCD*

Acoustic Returns From Impedance-Coated Submerged Objects, With Applications - *R. Hughes, H. Uberall, Carderock Division NSWCCD*

An Approximate Solution For The Response Of Two Joined, Semi-Infinite, Fluid Loaded Plates Due To A Line Drive - *Daniel Diperna, Carderock Division NSWCCD*

Efficient Use Of A Parallel Domain Decomposition Approach For Large-Scale Structural AcousticPredictions Using SARA3D Finite Element Code - *Robert Dees, Thomas McCormick, BBN Technologies*

Experimental And Analytical Investigation Of Surface Ship Hull Structural Acoustics Using 1/8th - Scale Physical Models - *Mathew Craun, Gerald Carrill, William Martin, NSWCCD; Charles Corrado, Applied Physical Sciences, Inc.*

Development Of An On-Surface Pressure-Velocity Relationship For Planar And Cylindrical Structural Acoustic Radiators - *David Feit, Ronald Hughes, Carderock Division NSWCCD*

MIL-S-901 Shock Extension Case Studies & Panel

Co-Chair : Allen Parkes, NSWC/Crane
Co-Chair: Kurt Hartsough, NSWCCD

The panel shall present MIL-S-901 Shock Extension case studies that compare items that are identical or similar to previously shock tested and approved items, and to items identical to those previously approved on the basis of shock extension. In addition, the MIL-S-901 extension justification shall be discussed in depth to further enhance the knowledge base of this unque cost savings method for MIL-S-901 shock qualification.

Track Two

Human Shock Mitigation For High Speed Surface Craft

Chair: Dr. Ron Peterson, NSWC Dahlgren CSS

Human Shock Mitigation For High Speed Surface Craft - *Dr. Ron Peterson, Eric Pierce, NSWC/CSS*
Human Biodynamic Response To High Speed Craft Shock Loading - *Dr. Cameron Bass, Dr. Robert Salzar, Scott Lucas, Dr. L van Rooij, Dr. Walter Pilkey, University Of Virginia*
Analysis, Optimization, And Development Of A Specialized Passive Shock Isolation System For High Speed Planing Boat Seats - *Alan Klembczyk, Taylor Devices, Inc.; Michael Mosher, Tayco Developments, Inc.*
Shock And Vibration Data Collection And Analysis For Specdial Operations Craft - *Brian Price, Eric Tuovila, Jeff Blankenship, Coastal Systems Station, NSWC; Suzanne Hoffman, University of Michigan*
Shock Mitigation Tests On The MK V Special Operations Craft - *Jeff Blankenship, Pedro Braco, Brian Price, Dr. Ron Peterson, Coastal Systems Station, NSWC*
Biochemical Markers Of Musculoskeletal Status Associated With Shock Loading On Special Operations Craft - *Dr. James Hodgdon, Dr. Brandon Walsh, Naval Health Research Center; Dr. Anthony Hackney, University of North Carolina*
Shock Mitigation Of Small Craft Seat Occupants Utilizing Semi-Actively Controlled Dampers - *Bill Larkins, John LaPlante, Active Shock, Inc.*

Concrete Design

Chair: TBD

Mechanical Properties Of White Masonry Concrete - *Erin Williams; Dr.Stephen Akers, Paul Reed, US Army Engineer Research And Development Center*
Reinforced Concrete Slabs Subjected To Localized Impact - *Prof. Ted Krauthammer, M. Zineddin, Protective Technology Center, The Penn State University*
Reinforced Concrete Shear Behavior Under Blast And Impact - *Prof. Ted Krauthammer, R. M. Schoedel, M. Seltzer, Protective Technology Center, The Penn State University*
Effect Of Material Properties On Projectile Deceleration - *Dr. James O'Daniel; Dr. Donald Cargile, US Army Engineer Research And Development Center*
Shock Loading Experiments On Concrete - *Dr.-Ing. Nico Herrmann; Prof. Josef Eibl; Prof. Lothar Stempniewski, University of Karlsruhe*

Track Three

Weapons Acquisition Processes

Chair: Jamie Howell, NSWC/DD

This session is under development

UAV's: New Requirements and Challenges for the S&V Community Panel

Chair: Dr. Robert Sierakowski, AFRL

This technical panel will discuss the potential role of unmanned aerial vehicles (UAV's) as a response to the modern asymmetric threat. An overview of UAV technology will be provided along with the requirements from the different services. The discussion will highlight technical challenges for UAV development and testing with an emphasis on shock and vibration issues. The panel discussions will include topics such as the use of UAV's in urban environments, micro aerial vehicles, scaling effects, mobility, fabrication, communications, power sources, swarms, etc.

Track Four

Training

Chair: TBD

TBD - *Dan Worth, NASA/GSFC*
The Origins and Current Status of Rotor Dynamics - *Prof. Frederick Nelson, Tufts University*
Tutorial on Ballistic Shock in Armored Vehicles - *W. Scott Walton, US Army Aberdeen Test Center*
Shock Response Spectrum - *Dr. Howard Gaberson, Consultant*

Track Five

Structure Response to S&V Loads — *Chair: Dr. Andrew Whittaker, State University of NY*

SDOF Code Development For Analyzing Structural Systems Under Blast And Impact Loads - *Prof. Ted Krauthammer, M. Frye, T. R. Schoedel, M. Selzer, Protective Technology Center, The Penn State University*

Macro And Micro Nonlinear Analysis Methods To Assess Progressive Collapse Potential In High-Rise Steel Frame Buildings As A Function Of Beam-To-Column Connection Behavior - *David Houghton, Jesse Karns, Myers, Houghton & Partners, Inc.*

Cladding-Structure Interaction Under Impact Loads - *Craig Starr, Prof. Ted Krauthammer, Stacy Worley, Protective Technology Center, The Penn State University*

Performanced-Based Engineering of Building Structures - *Prof. Andrew Whittaker, State University of New York; Ronald Hamburger, Simpson, Gumpertz and Hager; Craig Comartin; Comartin-Reis; Robert Bachman;Consultant; Christopher Rojahn, Applied Technology Council*

Composite Response — *Chair: TBD*

Application Of The DYCOSS Failure Prediction Tool To Bonded Steel-GRP Joints Of An Integrated Mast - *Wim Trouwborst, TNO Building and Construction Research, Center For Mechanical and Maritime Structures*

Dynamic Analysis Of Glass-Fiber Composite Panel Under Blast Wave Loading, Including Progressive Material Damage Effects - *Dr. Ki Kim, Joe Fries, US Army Research Laboratory*

Firing Test Of A Composite Gun Tube Support For The Multi-Role Armament And Ammunition System - *Dr. Andrew Littlefield, US Army TACOM-ARDEC Benet Laboratories*

Military Applications — *Chair: TBD*

Design Of Soldier's Protective Equipment: Recent Trends In Biomechanical Models And Comfort - *Alain Trameçon; Etienne Gai, ESI North America*

Development Of Mineblast Attenuating Seat For Military Ground Vehicle Applications - *Dr. Ken-An Lou; William Perciballi, Dick Zimmermann, Armorworks, Inc.*

Structural Response To Land Mines - *Laura Martin; Dr. Rick Link, Martec, Ltd.; Sheri Hlady, DRDC Suffield; Capt. Robert Durocher, DCDC Valcartier*

Air Explosion Analysis Of Naval Ship Considering Survivability - *Jae Hyun Kim, Dr. Hyung Chul Shin, Hyundai Heavy Industries Co., Ltd.; Dr. Myeong Gyu Park, Korea Maritime University*

Utilizing Computational Fluid Dynamics To Determine Blast Pressure Loading On Large Caliber Gun Systems - *Daniel Cler, US Army TACOM-ARDEC Benet Labs*

AGS Barrel Motion During Firing: Experimental And Modeling Results - *Eric Petersen, United Defense LP*

Track Six (Classified)

Payload & Sensors: Flexible Payload Module (Classified) — *Chair: Dawn Barasso, Electric Boat*

Flexible Payload Module (FPM) Overview - *Dawn Barrasso, Electric Boat Corp.*

Flexible Payload Module (FPM) - Concept Development - *George Schmeelk, General Dynamics - Electric Boat*

Payload & Sensors - Flexible Payload Module (FPM) Material Characterization - *David Russell, Electric Boat Corp.*

Payloads And Sensors - Flexible Payload Module (FPM) Medium Weight Shock Testing - *Roland Trailor, Jr., Electric Boat Corp.*

Flexible Payload Module (FPM) Shock Isolation - *George Schmeelk, General Dynamics - Electric Boat*

Summary Discussion Of Payloads & Sensors - Flexible Payload Module - *Dawn Barrasso, Electric Boat Corp.*

Payload Interface Module/Payload Module Shock Environment Analysis Studies - *Dawn Barrasso, Electric Boat Corp.*

UNDEX Bubble Analysis (Classified) — *Chair: Dr. E Thomas Moyer, NG-NNS*

Use Of Bubble Jetting For Antitorpedo Ship Defense - *Dr. Kit-Keung Kan, Dr. Philemon C. Chan, Jaycor/Titan*

Evaluation Of UNDEX Bubble Models For Submarine Applications - *Christopher Abate, Electric Boat Corp.*

Another Look At UNDEX Bubble Loads - *Dr. E. Thomas Moyer Jr., Sean Murphy, Northrup Grumman Ship Systems*

Simulations 0f The Response Of Thin-Walled Structures To UNDEX Shock And Bubble Jet Loading - *Dr. J. Alan Luton, Dr. Andrew Wardlaw, NSWC/Indian Head*

Computational And Experimental Results For A Divided Hopkinson Bar - *Dr. Vesta Bateman; Fred Brown, Michael Nusser, Kenneth Gwinn, Sandia National Laboratories*

Track Seven (Classified)

UNDEX (Classified) — ***Chair: George Camp, BIW***
Co-Chair: Bob Marshall, NG-NNS

MIL-S-901D Extension Of Shock Qualification For A Ship Mounted Non-Isolated Structure - *Brett Werner, NSWC/Crane; Mark Steudel, Jens Ortendahl, Raytheon; Stanley Williams, NSWC/Crane*

Calculation Of Buckling Limits For Alignment Critical Foundations Using Finite Element Analysis And DDS 100-4 - *Robin Lawson, Northrup Grumman Newport News*

Data Processing For The Parsing Demonstration Test - *Kathleen Lincoln; Dr. David Russell, Electric Boat Corp.*

Technology Needs Assessment For Integrating External Implodable/Explodable Volumes In Submarine Design - *Alan White; Christopher Abate, Electric Boat Corp.*

Development Of A Shock Characterization For A Full Scale Isolator Using Parsing - *Dr. David Russell, Electric Boat Corp.*

Analytical Comparison of Steel Plate Responses to Proximity UNDEX Using High Strain Rate Dependent Material Models- *Morgan Eash, NSWC Carderock DIvision*

Utilize Energy Finite Element and Boundary Element Formulations to Predict Flow of Noise of Large Scale Vehicle Under Turbulent Boundary Layer Excitation - *Kuangcheng Wu, Richard Shaw, Northrup Grumman Newport News; Nickolas Vlahopoulos, University of Michigan*

Wednesday Evening, October 29

SAVIAC Community Feedback
Town Hall Meeting

This is your opportunity to provide feedback to the SAVIAC leadership on items of importance to you. Whether you have an idea of a new product or service SAVIAC should provide, or just want to comment on the Symposium programming, you will find a platform here. Join us prior to the Social event for an hour of spirited discussion.

Social Event - All are invited

Thursday Morning, October 30

Chair/Presenter Meeting (All Thursday Chairs & Presenters Must Attend)
7:00 - 7:30 a.m. Location TBA

Track One

MIL-S-901D Subsidiary Component & Alternate Test Vehicle — **Co-Chair: Jamie Howell, NSWCDD**
Co-Chair: Kurt Hartsough, NSWCCD

The panel will discuss machines and methods to test subsidiary components. Subsidiary components are items which are the major parts of a principal unit. The shock response of the subsidiary component is significantly affected by that of the associated principal unit and all associated subsidiary components. The shock response of the associated principal unit and all associated subsidiary components are significantly affected by that of the subsidiary component. Examples are the diesel engine of a diesel-generator set, the electric motor of an air conditioning unit, or the power supply section of a radio transmitter. The panel will discuss subsidiary component shock test vehicles and methods. The pros and cons of test vehicles will be discussed as well as limitations of the test vehicles. Subsidiary component test environments will also be discussed. Subsidiary components are items which are the major parts of a principal unit. The shock response of the subsidiary component is significantly affected by that of the associated principal unit and all associated subsidiary components.

Shock Test Methods — **Chair: Rick Griffen, NG-NNS**

Barge Shock Simulator - *John Maltby, SPAWAR Systems Center*

Application Of A High Force Electrodynamic Vibration Test Machine To Component And Subassembly Shock Testing For Naval Combat Environments - *Gary R. Johnson, Lockheed Martin Tactical Systems*

Fixture Design Examples and Evaluation - *Dennis Harshman, NSWC Crane Division*

A Comparison of Shock Analyses of a COTS Cabinet on an FSP Deck Simulator - *James Patterson, Dr. Rudolph Scavuzzo, University of Akron*

Barge Rolling Motion Effects On Floating Shock Platform Using Multi-DOF Analysis - *Mark Ott, Enidine, Inc.*

Track Two

Vibration - Test And Application I — Chair: Dr. Andrew Littlefield, Benet Labs

An Investigation Of The Feasibility Of Scavenging And Storing Ambient Shipboard Vibration Energy For Powering Ship Systems - *Troy Tanner, Northrup Grumman Newport News*

Pendulum Testing In Support Of Guidelines For Airfield Frangibility Zones - *Sharon Garner; Vincent Chiarito; James Ray, US Army ERDC*

Applying Coordinate Transformations To Multi Degree Of Freedom Shaker Control - *Dr. Marcos Underwood; Tony Keller, Spectral Dynamics, Inc.*

Force Measurement Systems Development - *Dennis Booth, Allied Aerospace Industries, GASL Division*

Multi-Shaker Control To Create A Six Degrees-Of-Freedom Vibration Environment - *Dr. Bart Peeters, Ir. Jan Debille, Ir. Filip De Coninck, LMS International*

Vibration - Test And Application II — Chair: TBD

Improvements in Accelerometer Calibration Using Fringe Counting and Minimum Point Methods - *Bev Payne, National Institute of Standards and Technology*

Microwave Component Repair Environmental Stress Screening - *Randall Wood, Allen Parkes, NSWC Crane DIvision*

Detrimental Chemical Interaction between Materials during High Frequency Vibration - *Dr. Nancey Maegerlein, John Fassino, NSWC/Crane Division*

Review of Flight and Ground Vibration Test Data in Support of the MK-84 Air and GBU-10 Fin Failures When Carried On the PIDS/3 Pylon - *Roque Salas, Avionics Test and Analysis Corporation*

Track Three

Ship Shock Modeling And Simulation I — Chair: Prof. Young Shin, Naval Postgraduate School

Ship Shock Trial Simulation Of USS Winston S. Churchill (DDG81): Modeling And Simulation Strategy - *Prof. Young Shin, Lt. Nathan Schneider, Naval Postgraduate School*

Ship Shock Trial Simulation Of USS Winston S. Churchill (DDG81): Parametric Studies Of Surrounding Fluid Volume - *Lt. Nathan Schneider, Prof. Young Shin, Naval Postgraduate School*

Damping Modeling Strategy For Naval Ship System - *Prof. Young Shin, Naval Postgraduate School*

Modeling And Simulation Of Explosion Bubble Dynamics And Its Effect On Submerged Structure - *Kin Chew Hung, C. Wang, E. Klaseboer, Institute Of High Performance Computing, B. C. Khoo, National University of Singapore*

Digital Filtering Scheme For Transient Response Data - *Prof. Young Shin, I. B. Ham, Naval Postgraduate School*

Uncertainty Analysis In Ship Shock Modelling And Simulation - *Prof. Roger Ghanem, Sonjoy Das, Johns Hopkins Univ*

Ship Shock Modeling And Simulation II — Chair: Prof. Young Shin, Naval Postgraduate School

This session is under development.

Track Four

Vibration - Numerical Methods — Chair: Ami Frydman, ARL; Co-Chair: Dr. Paul Franklin, BIW

Frequency Domain Nonlinear System Identification For A Two Degree Of Freedom System - *Dr. Ronald Merritt, NAVAIR Warcenter*

A Procedure For The Analysis Of Flight Vibration Data - *Jerome Cap, John C. De Baca, Sandia National Labs*

On The Use Of Digital Filters For Mechanical System Simulation - *Prof. Kjell Ahlin, Blekinge Institute Of Technology*

An Approximation For The Generation Of A Nonstationary Random Transient From A Two Dimensional Time-Frequency Spectrum - *David Smallwood, Consultant; Dr. Thomas Paez, Sandia National Laboratories*

Shock And Vibration Testing Using A High Frequency 6-Dof Hydraulic Shaker Table - *Filip De Coninck, Prof. Wim Desmet, Prof. Paul Sas, Davis Vaes, Kuleuven*

Output-Only Damage Detection Using Forward Prediction Error - *Tim Edwards, NSWC/Dahlgren*

Test Methods/Requirements — Chair: TBD

Seismic Equipment Qualification: Translating Lateral Force Procedures Into Dynamic Testing Protocols - *Jeff Gatscher; Phillip Caldwell, Square D/Schnieder Electric; Robert Bachman, Past Chair, BSSC TC8*

Excitatory Potential Density, A Time Domain Metric For Assessing Shock Tests - *Rick Griffen, Northrup Grumman Newport News*

Simulating The Dynamic Environment Of A Medical System Component - *Zeev Sherf, A. Katz, P. Hopstone, A. Manor: RAFAEL; S. Bros, Y. Kanfi: ELGEMS*

Flyout Shock Mitigation Systems For Affordable Submarine Capsule Launching Systems - *Benjamin Bourne, Dr. James Colton, SRI International*

Dynamics Of Structures And Development Of Measurement Technique Of Quickly Proceeding Processes In A Changing Centrifugal Field, Part I: About Measurements Impulsive Deformations In Elastic Waves - *Dr. George Abramchuk, Consultant; Kristina Abramchuk, University of Toronto*

Model Analysis Of Square Plate Reducing The Max. Deflection In Several Boundary Condition - *Faisal Al-Harbi, Kuwait University*

Navy Surface Combatants Temporary Test Installation Design Requirements - *Jefferey Giesecke, James Gentry, Lockheed Martin*

Track Five

Damping And Isolation — Chair: Troy Tanner, NG-NNS

Energy Absorption Properties Of Niti Reinforced Cementitious Composites With Damage Monitoring Capability - *Prof. Yunfeng Zhang; David Brown, Lehigh University*

Modal Evaluation Of A Typical Lower Heavy Machinery Deck Supporting A Shock Isolated System - *Sarah Staggers, Northrop Grumman Newport News*

The Multi-Degree-Of-Freedom Performance Of The Mram Shock And Vibration Isolation Mount - *Troy Tanner, Northrup Grumman Newport News*

Damping Estimation Of A Cast Aluminum Structure - *Fadil Mert Sasoglu, Tennessee Technological University; Dr. Caner Demirdogen, Fleetguard; Dr. Sally Pardue, Tennessee Technological University*

Dynamic Properties Of Squeeze Type Mount Using MR Fluid - *Prof. Young-Kong Ahn, Pukyong, Jong-Yong Ha, Prof. Bo- Suk Yang, Prof. Bo-Suk Yang, Prof. Dong-Jo Kim, Pukyong National University*

Mega Brace Seismic Dampers For The Torre Mayor Project At Mexico City - *Douglas Taylor, Taylor Devices, Inc.*

An Application Of Active Control Theory To A Passive Isolation System: Launch Boom Retraction Mechanism - *Michael Mosher, Taylor Devices, Inc.*

Crusader Platform Stability Analysis For The 40 Ton Self-Propelled Howitzer (SPH) - *Jerry Chang, United Defense, LP*

Track Six (Classified)

Military Blast(C) — Chair: Dr. Eric Rinehart, DTRA

Effect Of Vehicle Bottom Floor Shapes On Mine-Blast Loading - *Dr. Aaron Gupta, Army Research Laboratory*

Airblast Field From An Explosive Charge Surrounded By Casing Of High Mass But Low Mechanical Strength - *Dr. Alan Ohrt, Wayne Richards, Air Force Research Lab*

Measured Airblast Fields From Sub-Scale Cased Munitions Of Different L/D Ratio - *Robert Britt, SAIC; Dr. Alan Ohrt, Air Force Research Lab*

Results From ¼-Scale Structure-Medium-Interaction Experiments On Damaged And Undamaged Structures - *Dr. Jon Windham; Bruce Phillips; Denis Rickman; Dr. Donald Cargile, US Army Engineer Research & Development Center*

Application Of Structural Failure Methodologies To STMG Targets Using The Airburst Module - *Atris Ray, Robert Britt, Van Le, SAIC; Dr. Alan Ohrt, Air Force Research Lab*

Fragment Velocities For A Scaled Charge: A Comparison Of Test Data And Conwep Predictions - *Paul Graham, US Army Engineer Research & Development Center; Leo Stockham, Northrop Grumman Information Technology; Dirk Plante, Defense Threat Reduction Agency*

Penetration Of Urban Construction Materials By Indirect Fire Weapons - *Rayment Moxley; Dr. Donald Cargile, US Army Engineer Research And Development Center*

Computer Network Response To Blast From Internal Detonations - *Ernest Staubs, Air Force Research Laboratory*

Track Seven (Classified)

Homeland Security For Civil Infrastructure(C) — Chair: Dr. Will McMahon, USAERDC

Results Of Water Shock Tests On Model-Scale Tainter And Miter Gates - *Charles Joachim, C. T. Sullivan, G. W. McMahon, US Army Engineer Research & Development Center; R. E. Walker, Alpha to Omega*

Blast Effects On Dams, Historical Perspective - *L.K. Davis, US Army Engineer Research & Development Center*

Mitigation Of Embankment Cratering From Truck Bombs - *Denis Rickman, US Army Engineer Research & Development Center*

Modeling Explosion Near The Water Surface With Experiments And REFMS And SAGE Codes - *James Britt, SAIC, CE Joachim, CT Sullivan, US Army Engineer Research & Development Center*

Thursday Morning Continued

Computational Analysis Of Explosive Damage To Steel Gates - *Dr. James O'Daniel, US Army Engineer Research & Development Center*

AT Planner For Dams - *William H. Hossley, US Army Engineer Research & Development Center*

Intunnel Blast(C) — Chair: Dr. Al Ohrt, AFRL

In-Tunnel Pressure Measurements For A Sub-Scale Tunnel Test Facility - *Dr. Susan Babcock, Applied Research Associates; Dr. Edward Tremba*

Blast Door Response In Tunnels From Portal Detonations - *Dr. Will McMahon, US Army Engineer Research & Development Center; Bruce Patterson, Air Force Research Lab*

In-Tunnel Airblast From Near Portal Detonations - *Charles Joachim; Charles Ertle, Byron Armstrong, US Army Engineer Research & Development Center; Robert Britt, SAIC*

Thursday Afternoon, October 30

Track Three

Ship Shock Modeling And Simulation Panel — Chair: Prof. Young Shin, Naval Postgraduate School

This panel is under development

Friday Morning, October 31

Tutorial	*Instructor*	*Time*
Calibration, Maintenance, and Operation of the Lightweight and Medium Weight Shock Machines	*B. Christopher Grunau & Jeffery A. Morris*	*8-12 PM*

Tour of Endevco

This tour will last approximately 8 a.m. - 2 p.m, including travel time. Buses will be provided for transportation to and from the hotel, or you can drive yourself. A mexican-style lunch will be available at the end of the tour, complements of Endevco Corp. Tour attendees will be able to take a look at Endevco's calibration laboratory, sensors, MSA - MAG, PE - cables, medical, electronics, VC, and pressure facilities. Pre-registration is required to assure space, so please sign up for this tour on your Registration Form.

Guest Program

CITY TOUR - SAN DIEGO OLD & NEW - Tuesday, 10:00 AM - 3:00 PM, Cost $45.00 - Drive through of Gaslamp Quarter, etc. (Mini City Tour), visit Seaport Village (Free time to shop), Balboa Park, Lunch at The Prado in Balboa Park, arrive at B Street Pier for a (1) Hour public harbor cruise, return to Hotel, Cost includes cruise, bus transportation and lunch.

LA JOLLA - JEWELS BY THE SEA - Wednesday, 10:00 AM - 3:00 PM, Cost $50.00 - Visit Birch Aquarium at Scripps, Narration of La Jolla during drive, stop at Children's Pool area to see the sea lions, Lunch at Azul, free time to shop and explore La Jolla, Return to Hotel. Cost includes aquarium, bus transportation and lunch.

Hotel Accommodations

The Symposium, including the unclassified sessions, will be held at the Red Lion Hanalei Hotel. A block of rooms have been reserved at the rate of $99.00 per night. Reservations must be made by October 1st. Rooms not reserved by October 1st will be released to the public by the hotel. After that date you will no longer be eligible to receive the negotiated rate and you may not be able to reserve a room. When making your reservation identify yourself as an attendee of the Shock and Vibration Symposium. The room rate is the same for US Government and private sector employees. For reservations, please contact:

The Red Lion Hanalei Hotel
2270 Hotel Circle North
San Diego, CA 92180
(888) 882-0858
(619) 297-1101 (voice) (619) 297-6049 fax
www.hanaleihotel.com

Tutorial Descriptions

Sunday, October 26

Basic Concepts of Digital Data Acquisition for Shock and Vibration Testing **Strether Smith**

Digital data acquisition has become the standard method of recording the shock and vibration measurements. The advantages of this approach in cost, accuracy, and convenience are enormous but there are traps set to catch the unwary investigator. One of the worst "features" of digital data acquisition is, if the system is not properly designed, it may produce data that looks good but is completely wrong. The primary aim of the course is to avoid this fatal result. The three-hour course discusses the hardware and software strategies required to assure good data is acquired. Sampling (aliasing) and digitalizing theory are emphasized and modern hardware solutions are discussed. The reasons for using, or not using, the new generation of sigma-delta data acquisition systems is featured and a fast and easy method of evaluating candidate hardware systems is described. This course is a must for those who want to assess the quality of the data they are acquiring or those who are fortunate enough to be buying/building a new system.

Performing DDAM Analysis Using MSC.Software products **Bart McPheeters**

A short primer showing both the basics and advanced procedures for using MSC.Nastran to perform DDAM analyses. This will include basic run procedures and setting up an input deck, Nastran options, and more advanced capabilities such as mode-by-mode output, specific modal selection, and single run capability. We will talk about using the intermediate Fortran program, and some of the options available there, including metric units and user-defined spectra. There will be a discussion of post-processsing Nastran results, including some of the common pitfalls, and ways to effectively visualize the output data. It will also include a section on setting up the model to run using the new MSC.FEA+DDAM capability.

The Navy Shock Qualification Process **Kurt Hartsough**

The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD SSES) Code 623 is NAVSEA 05P3's Delegated Approval Authority (DAA) for MIL-S-901D Surface Ship Shock. As the DAA, Code 623 is responsible for review and approval of all Government Furnished Equipment and all Heavyweight tested equipment. In addition, NSWCCD SSES Code 6202 is the NAVSEA 05P3 DAA for all analysis and DDAM approvals. NSWCCD SSES Codes 623 and 6202 will be presenting the Navy's Shock Qualification Process as detailed in NAVSEAINST 9072.1A. This course will cover in detail the responsibilities of all Navy organization. It will cover in detail the documentation requirements for a successful shock qualification program. This includes technical policy requirements, the requirements for waivers, deviations and deficiencies and a detailed explanation of the shock qualification approval process. This is an expanded version of what was covered in the Navy Shock Qualification Approval Process course last year without covering MIL-S-901D. Who should attend? Attendees should include anyone involved in the acquisition, specification, review and approval of Navy shipboard equipment including PARMs and LCMs and contracting officers, contractors having to deal with the Navy and wishing to supply shock qualified equipment to the Navy, Ship Program Managers and Ship Logistic Managers responsible for the acquisition and maintenance of shock hardened Navy ships and shock qualification test facilities.

Designing Measurement System Transfer Functions for Dynamic Testing **Chuck Wright**

This tutorial is for working engineers and managers whose job is to deliver or assess structural dynamics test data to assure validity. Topics covered include: simple and more complex system components; the amplitude portion of the transfer function; the often neglected phase portion; step responses; using resonant components; real world examples; building system level transfer functions from components with examples; system linearity; design rules for both waveshape and spectrral reproduction; proper acceptance and interval testing of data acquisition systems.

Dynamic Design Analysis Method (DDAM) **Dave Weinberg**

A technical discussion reviewing normal modes analysis, modal effective mass, traditional shock spectrum methods, and background to Dynamic Design Analysis Method. Simple and complex examples will be covered.

MIL-S-901D Shock Qualification Testing and Extensions **Kurt Hartsough & Domenic Urzillo**

The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD SSES) Code 623 is NAVSEA 05P3's Delegated Approval Authority (DAA) for MIL-S-901D Surface Ship Shock. As the DAA, Code 623 is responsible for review and approval of all Government Furnished Equipment and all Heavyweight tested equipment. In addition, NSWCCD SSES Code 6202 is the NAVSEA 05P3 DAA for all analysis and DDAM approvals. NSWCCD Codes 623 and 6202 will be presenting the requirements for Shock Qualification Testing and Analysis as detailed in NAVSEAINST 9072.1A, MIL-S-901D and NAVSEA 0908-LP-

000-3010 Rev 1. This course will concentrate on MIL-S-901D test requirements and how the DDAM requirements in NAVSEA 0908-LP-000-3010 fit into the shock qualification process of equipment. This course will include a detailed explanation of the test requirements as stated in MIL-S-901D and as interpreted by NAVSEA 05P3. Shock qualification testing of principal units, shock qualification by extension of principal units and shock testing of subsidiary components will be covered. This is an expanded version of what was covered in the Navy Shock Qualification Approval Process course last year without covering NAVSEAINST 9072.1A. Who should attend? Attendees should include anyone involved in the acquisition, specification, review and approval of Navy shipboard equipment including PARMs and LCMs and contracting officers, contractors having to deal with the Navy and wishing to supply shock qualified equipment to the Navy, Ship Program Managers and Ship Logistic Managers responsible for the acquisition and maintenance of shock hardened Navy ships and shock qualification test facilities.

Introduction to Vibration Testing **Jon Wilson**

This tutorial introduces the novice to vibration testing and provides a comprehensive review for the experienced practitioner. It concentrates on conceptual understanding and minimizes mathematics. It is recommended for technicians, engineers, program managers and others who need a basic understanding of the fundamentals of vibration testing. Topics covered include the definition and nature of vibration, fundamental structural dynamics, sine, complex and random vibration, spectra, vibration measurement and different measurement systems, shakers and shaker system characteristics and fundamental fixture design and analysis. Student participation and questions are encouraged. Numerous references are sited.

An Introduction to ABAQUS **Jeff Cipolla**

ABAQUS is a family of general purpose finite element analysis tools for the analysis of complex engineering problems. ABAQUS/CAE is an interactive application for constructing, analyzing, and visualizing finite element models and results. ABAQUS/Standard is a general purpose finite element code, which handles a wide variety of linear and nonlinear analyses. ABAQUS/Explicit uses explicit time integration for linear and nonlinear problems, and is especially suited for modeling transient effects. This tutorial provides an overview of ABAQUS, its capabilities, and examples of applications. The tutorial is suitable for beginners in finite element analysis, experienced users of other software, and those interested in a survey of recently added features.

Monday, October 27

Bad Data Look Just As Believable As Good Data: Plan Your Measurement System To Tell The Difference **Pete Stein**

During the measurement of static or dynamic quantities, well calibrated measurement systems may produce believable outputs that are, in fact, total, certified, unadulterated garbage as will be illustrated by demonstrations and numerous case studies drawn from real life. It is possible to design and plan measurement systems and procedures to validate acquired data during the data acquisition process. The Unified Approach to the Engineering of Measurement Systems, developed by the lecturer, is such a procedure.

UNDEX and Acoustics Analysis Using ABAQUS **Jeff Cipolla**

This tutorial describes the analysis of problems of particular interest to the Shock and Acoustics community using the general purpose finite element code, ABAQUS. In shock and acoustic analysis, it is useful to distinguish between 'heavy fluid' problems, in which the mass and stiffness of the fluid is an important factor in the structural motion, and 'light fluid' problems, in which parts of the fluid-solid interaction effect may be neglected. 'Heavy fluid' applications include underwater shock and acoustics, and some geotechnical problems. 'Light fluid' problems include metal structures in air. In either case, modal analysis, steady-state dynamic (time-harmonic) analysis, and transient problems are of interest. The use of ABAQUS/Standard for general steady state and modal acoustic analysis is described, including problems with heavy fluid, light fluid, solid structures, and infinite exteriors. ABAQUS/Explicit is particularly well-suited to UNDEX problems, which are characterized by rapid transient loads due to incident waves, as well as fluids of infinite extent. Modeling issues for each class of problem will be discussed.

Overview of Underwater Shock and DDAM **Young Shin**

This three hour short course on naval ship shock analysis and design will be presented by Dr. Young Shin, Professor of Mechanical Engineering at the Naval Postgraduate School. It will provide engineers, scientists, and naval architects a general overview of underwater explosion phenomena, structural response analysis, fluid-structure interaction, shock spectrum and the Dynamic Design Analysis Method. It will cover the free-field problem, the drystructure problem, the fluid-structure interaction and shock spectra problem, shock qualification of internal equipment using DDAM and Hopkinson's scaling problem.

Structural Detailing for Blast Resistance **Ted Krauthammer**

This tutorial will build on the material presented in the “Explosion Effects and Blast Resistant Structural Design” tutorial. The issue of structural design and the critical importance of paying attention to structural details will be discussed. How this has been studied, what the observations are, and recommended implementation in practice will be presented.

The Measurement of Meaningful Shock & Vibration Data **Patrick Walter**

Significant focus is often provided to applying sophisticated analysis techniques to the data resulting from shock and vibration tests. Conversely, inadequate focus is often provided to assuring that meaningful shock and vibration data are acquired in the first place. This tutorial attempts to correct this deficiency. For the instrumentation novice it will provide an introduction to shock and vibration measurements and the physics of piezoelectric and silicon based accelerometers. For the experienced test technician or engineer it will provide additional insight into topics such as modification of structural response by the presence of the accelerometer, accelerometer and measurement system calibration, optimization of measurement system design, analog filtering, data validation during test, data utilization, and more. For the analyst or designer it will provide a series of simple observations and back of the envelope calculations that they can make on received data to validate its credibility before using it in product development. The tutorial is routinely updated to remain current with evolving technology. Endevco will provide a complimentary copy of the Handbook of Dynamic Force, Pressure and Acceleration Measurement, written by Dr. Walter, to tutorial registrants.

Using Contact Surface Elements in FEA **Dave Weinberg**

A technical discussion on advantages of general 3D contact, general background to surface contact in NE/Nastran, setup of simple contact analysis in NE/Nastran and FEMAP, impact analysis using contact, forming analysis using contact, and usage of contact surfaces in static analysis.

Application of the USA Code to Underwater Shock Problems **John DeRuntz**

The purpose of this course is to provide engineers, scientists and naval architects a working knowledge of the theoretical foundations and practical details of the Underwater Shock Analysis code for usage in design and analysis problems of submerged and semisubmerged structures in an explosive environment. The tutorial will include an introduction and brief history of USA, the physics of underwater shock, fluid-structure interaction, fluid mass matrix development, overview of the USA Code, cavitating fluid analysis, recent enhancements and work in progress, problem areas where scientists and naval architects working on the design and analysis of submerged and semisubmerged structures in an explosive environment.

Substructure Coupling and Structural Modification for Shock & Vibration **Joshua Gordis**

Substructure coupling and structural modification refer to techniques for the efficient analysis of large and/or complex structural dynamics, vibration and shock. By treating structural systems as assemblages of components or substructures, structural design "what if" calculations can be performed quickly. This tutorial will review the background necessary in order to introduce several general approaches to substructuring and modification, in modal and physical coordinates and in the frequency and time domains. Included will be Component Mode Synthesis (e.g. NASTRAN superelements), model modifications, frequency domain coupling/modifications and time domain coupling/modification. The background review will include finite element structural matrices, decoupling, mode superposition (mode displacement and mode acceleration data recovery), frequency and impulse response functions and model reduction. Examples will be used throughout to illustrate the concepts covered.

Validation and Editing of Shock & Vibration Data **Allan Piersol**

This short course surveys the most common errors that occur during the acquisition of shock and vibration data, including signal clipping, transducer and/or amplifier saturation, excessive background noise, intermittent noise spikes and wild points, power line pickup, spurious trends and signal dropouts. Practical procedures to detect such errors and wild points, power line pickup, spurious trends and signal dropouts. Practical procedures to detect such errors by visual inspections of the data signals and/or simple analysis of the signals are detailed. For those cases where the resulting anomalies can be removed from the data, appropriate data editing techniques are discussed. Emphasis is given to pyroshock dat, which is particularly vulnerable to data acquisition errors. The presentation concentrates on graphical illustrations of the detection and editing procedures rather than an analytical treatment of the problem. This short course is intended for all engineers and scientists that are engaged in the acquisition and analysis of all types of analog data. The material is presented at a level appropriate for entry level engineers and technicians, but should also be beneficial to more experienced laboratory engineers and managers of data acquisition and analysis facilities.

Vibration And Shock Test Fixture Design, Fabrication And Evaluation **Wayne Tustin**

Usually fabricated from magnesium or aluminum for lightness with rigidity, a fixture adapts the mounting provisions of a device under test (DUT) to the armature of a shaker (for vibration testing) or to the table or anvil of a shock test machine (for shock testing). In a sense, the DUT side of the fixture attempts to "represent" the hardware to which the DUT will attach in service. This tutorial will examine that goal and various design and fabrication approaches to achieving that goal. Prior to first use, a new fixture should be evaluated experimentally. During use, DUT-fixture and fixture-shaker or fixture-shock test machine bolting is critical. Between tests, the fixture should be stored properly.

Naval Shock Analysis and Design **Rudy Scavuzzo**

First an overview of content of SVM-17, Naval Shock Analysis and Design, by Rudy Scavuzzo and Henry Pusey will be presented. The monograph briefly covers naval shock testing machines and vehicles, a detailed treatment of normal mode theory and its relationship to the Dynamic Design Analysis Method (DDAM); special considerations of DDAM including allowable stresses are covered in Chapter 3. Whole ship shock analyses including fluid-structure interaction and shock analyses in the plastic regime are presented in Chapters 4 and 5, respectively. Emphasis in the tutorial will be made on Chapter 5, shock analyses in the plastic regime. Energy in the modes of vibration can be directly related to the shock spectrum. This concept is very important because it means the energy in a system is bounded. Thus, plastic deformation or plastic work from shock in an equipment structure is also bounded. After considering the energy in shock, plastic analyses in piping and foundations from shock inputs will be presented. Analytical results will be compared to test data.

Beyond the Shock Response Spectrum - Temporal & Frequency Moments, the Product Model, & Uncertainty **Dave Smallwood**

The tutorial will show how the first few bandlimited temporal moments can be used to characterize shock. This information can be used independently of the Shock Response Spectrum (SRS), or used to supplement the SRS of a shock. The tutorial will introduce the temporal moments and discuss the theoretical implications. The uncertainty theorem will be discussed, and it will be shown how this theorem limits the available information about a shock. For a shock with a given rms duration, defined by the temporal moments, the uncertainly theorem limits the frequency resolution, as defined by the rms bandwidth. A demonstration will be given on how the product model can be used to synthesize realizations of a shock, which match the temporal moments. Examples will be provided which suggest, if the bandlimited temporal moments are matched, the SRS will also be matched. The realizations can be used for some tests, for example, shaker shock, or can be used as inputs to analytical models to estimate response. It will also be shown if the product model is assumed, that for estimates of the temporal moments, estimates of the mean is unbiased and estimates of the variance of the mean estimate can be found. This is useful in establishing the uncertainty in moment estimates from measured data. Several examples using real data will be used to illustrate the moments and the application.

Navy Shock Database User Certification **Paul Medeiros & Kurt Hartsough**

The Navy Shock Data Base (NSDB) is mandated by NAVSEAINST 9072.1A. In accordance with NAVSEAINST 9072.1A, it is managed by NAVSEA 05P3 and maintained by Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD SSES) Code 623. The NSDB is a compilation of shock hardness requirement by ship or ship class and a compilation of equipment shock qualification status for both Contractor Furnished Equipment and Government Furnished Equipment. Recent security issues and data integrity issues were the caused of a major overhaul of the NSDB. In order to maintain security and data integrity of the NSDB, this course will be required by any persons requesting read/write access to the NSDB. Those persons requiring read/write access include PARM/LCMs, NAVSEA PEOs, ship builders and contractor support for those activities. Although this course is not required for persons requesting read only access, it is recommended so that they fully understand the working of the data base and can take full advantage of the data in the data base. This will be the first time this course has been offered and it is expected that additional course offerings will be made as the need arises.

Friday, October 31

Calibration, Maintenance, and Operation of the Lightweight and Medium Weight Shock Machines ***B. Christopher Grunau & Jeffery A. Morris***

This course provides a detailed, hands-on overview of the calibration, maintenance, and operation of the Lightweight Shock Machine and the Medium Weight Shock Machine. This class is tailored for those who are technical operators of the lightweight and medium weight shock machines. The course covers the rules and guidelines of machine operation, according to MIL-S-901D(NAVY) standards, routine maintenance procedures, and required machine calibration procedures.

Registration Form

74th Shock and Vibration Symposium

October 27-31, 2003
San Diego, CA

return to:
SAVIAC/ HI-TEST Labs
5136 Celestial Way,
Columbia, MD 21044
301 596-0100

fax: (509) 351-9733

Name: _____

Organization: _____

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_____

Phone: _____ Fax: _____ Email: _____

REGISTRATION FEE: $745 (Discounted price of $695 granted to registrations, INCLUDING PAYMENT INFORMATION, if received by SAVIAC by October 1, 2003.)

I WILL BE ATTENDING (Check all that apply, send appropriate clearance form to ERDC)
❑ Unclassified ❑ Classified

TUTORIALS: $250 each (You must pay the Symposium registration fee in order to take tutorials)

		Sunday, Oct 26
❑	Basic Concepts of Digital Data Acquisition for Shock and Vibration Testing - Strether Smith	8-11 AM
❑	Performing DDAM Analysis Using MSC.Software products - Bart McPheeters	8-11 AM
❑	The Navy Shock Qualification Process - Kurt Hartsough	9-12 AM
❑	Designing Measurement System Transfer Functions for Dynamic Testing - Chuck Wright	12-3 PM
❑	Dynamic Design Analysis Method (DDAM) - Dave Weinberg	12-3 PM
❑	MIL-S-901D Shock Qualification Testing and Extensions - Kurt Hartsough & Domenic Urzillo	1-4 PM
❑	Introduction to Vibration Testing - Jon Wilson	4-7 PM
❑	An Introduction to ABAQUS - Jeff Cipolla	4-7 PM
		Monday, Oct 27
❑	Bad Data Look Just As Believable As Good Data: Plan Your Measurement System To Tell The Difference - Pete Stein	7:30-11 AM
❑	UNDEX and Acoustic Analysis Using ABAQUS - Jeff Cipolla	8-11 AM
❑	Overview of Underwater Shock and DDAM - Young Shin	8-11 AM
❑	Structural Detailing for Blast Resistance - Ted Krauthammer	8-11 AM
❑	The Measurement of Meaningful Shock & Vibration Data - Patrick Walter	12-3 PM
❑	Using contact surface elements in FEA - Dave Weinberg	12-3 PM
❑	Application of the USA Code to Underwater Shock Problems - John DeRuntz	12-3 PM
❑	Substructure Coupling and Structural Modification for Shock & Vibration - Joshua Gordis	12-3 PM
❑	Validation and Editing of Shock & Vibration Data - Allan Piersol	4-7 PM
❑	Vibration And Shock Test Fixture Design, Fabrication And Evaluation - Wayne Tustin	4-7 PM
❑	Naval Shock Analysis & Design - Rudy Scavuzzo	4-7 PM
❑	Beyond the Shock Spectrum - Temporal & Frequency Moments, the Product Model, & Uncertainty - Dave Smallwood	4-7 PM
❑	Navy Shock Database User Certification - Paul Medeiros & Kurt Hartsough	4-7 PM
		Friday, Oct 31
❑	Calibration, Maintenance, and Operation of the Lightweight and Medium Weight Shock Machines - B. Christopher Grunau & Jeffery A. Morris	8-12 PM

SOCIAL EVENT: Wednesday evening, Registered attendee: no charge/Guest charge: $10
❑ yes, I will attend ❑ yes, I will attend with 1 guest ❑ no, I will not attend

Gene Sevin Social & Dinner: Tuesday evening, charge: $35/person
❑ yes, I will attend ❑ yes, I will attend with 1 guest ❑ no, I will not attend

GUESTS' PROGRAM: Tues CITY TOUR - SAN DIEGO OLD & NEW ❑ guest attending Tues (10/28): $45
Wed LA JOLLA - JEWELS BY THE SEA ❑ guest attending Wed (10/29): $50

LIMITED SPACE AVAILABLE FOR GUEST PROGRAM, REGISTER EARLY

TOUR: Friday 11/22 Endevco ❑ yes (indicate # of persons)___ ❑ not attending
Names:

PAYMENT INFORMATION: Please provide complete payment information. Checks should be made payable to SAVIAC/HI-TEST. Payment may also be made by AMEX, Visa, or Master Card. **Government credit cards will be processed during the Symposium**. Purchase orders are not accepted. **A $50 administrative fee will be charged to ALL cancellations received after October 1, 2003. Substitutions are accepted.**

❑ Check ❑ AMEX ❑ Visa ❑ Master Card Card # _ _ _ _ - _ _ _ _ - _ _ _ _ - _ _ _ _

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Multiple Attendance
Registration Form

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5136 Celestial Way,
Columbia, MD 21044
301 596-0100

fax: (509) 351-9733

SAVIAC is offering discounts for multiple registrations from the same company. To take advantage of this offer, choose the option below and fill out a registration form for each attendee. Send the entire package together with payment to SAVIAC. You may also register at our web site.

❑ Option A – One Exhibit Booth, 2 Registrations (total of 3), unlimited tutorials, 3 Tickets to Gene Sevin Dinner, Single Use License of 56 Year's of Proceedings, SAVIAC Supporter Recognition, Silver Level ($5,000)

(Savings of $3490 over the individual price of $8490)

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Attendee: _____ Attendee: _____

❑ Option B – One Exhibit Booth, 4 Registrations (total of 5), unlimited tutorials, 5 Tickets to Gene Sevin Dinner, Single Use License of 56 Year's of Proceedings Calendar Ad, SAVIAC Supporter Recognition, Gold Level ($10,000)

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Attendee: _____ Attendee: _____

Attendee: _____ Attendee: _____

❑ Option C – One Exhibit Booth, 6 Registrations (total of 7), unlimited tutorials, 7 Tickets to Gene Sevin Dinner, Five Seat Use License of 56 Year's of Proceedings Calendar Ad, SAVIAC Supporter Recognition, Platinum Level ($15,000)

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Attendee: _____ Attendee: _____

Attendee: _____ Attendee: _____

Attendee: _____ Attendee: _____

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In the July 2003 Current Awareness Newsletter

74th Shock & Vibration Symposium Preliminary Program

New This Year

Tutorials on Sunday, Monday & Friday

New Registration Options

The Current Awareness newsletter is published by the Shock and Vibration Information Analysis Center, which is operated by HI-TEST Laboratories, Inc., under contract to the U.S. Army Engineer Research and Development Center.

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