

The 76th Shock & Vibration Symposium

Conference Program



US Army Corps of Engineers®
Engineer Research and Development Center



WEIDLINGER ASSOCIATES® INC
CONSULTING ENGINEERS



October 30 - November 3, 2005
Destin, FL

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 US Army Engineer Research & Development Center (ERDC), the Defense Threat Reduction Agency (DTRA), Weidlinger Associates, Inc., and MSC.Software. Representing these organizations are our Co-Chairs.

Program Committee Members

Co-Chair: Dr. Bob Welch - SAVIAC Director/USACE ERDC

Co-Chair: Mr. Michael Giltrud - Defense Threat Reduction Agency

Co-Chair: Dr. Raymond P. Daddazio - Weidlinger Associates, Inc.

Co-Chair: Mr. Bart Mcpheeters - MSC.Software

Mr. Ed Alexander - United Defense LP
Mr. Austin Alvarez - General Dynamics Electric Boat
Mr. George Camp - Bath Iron Works
Mr. Frederick Costanzo - Naval Surface Warfare Center Carderock Division
Mr. Sal Detruit - National Technical Systems
Mr. Karl D'Souza - ABAQUS, Inc.
Mr. Tim Edwards - Sandia National Laboratories
Dr. Mike Hale - Redstone Technical Test Center
Mr. James Howell III - Naval Surface Warfare Center, Dahlgren Division
Mr. Travis Kerr - Northrop Grumman Newport News
Mr. Bob Krezel - HI-TEST Laboratories, Inc.
Mr. Joel Leifer - SAVIAC
Dr. Paul Mlakar - US Army Engineer Research & Development Center
Mr. Jeffery Morris - HI-TEST Laboratories, Inc.
Dr. Reed Mosher - US Army Engineer Research & Development Center
Mr. Jon Pasckvale - Naval Undersea Warfare Center Keyport Division
Mr. Allen Parkes - Naval Surface Warfare Center Crane Division
Mr. Drew Perkins - HI-TEST Laboratories, Inc.
Mr. Henry Pusey - MFPT/SAVIAC
Dr. Rudy Scavuzzo - University of Akron
Mr. Jim Sullivan - PCB Piezotronics Inc.
Ms. Margaret Tang - Weidlinger Associates, Inc.
Prof Patrick Walter - PCB Piezotronics Inc./TCU
Mr. David Watts, Air Force Research Laboratory
Mr. Bill Yancey - HI-TEST Laboratories, Inc.
Mr. Gary Zook - Naval Undersea Warfare Center Keyport Division

Classified Sessions

A SECRET-level clearance is required to attend the Classified Sessions held at Naval Surface Warfare Center Dahlgren Division Coastal Systems Station in Panama City, FL on Thursday afternoon. The Limited (Distribution Statement C) Sessions will be held at the Hilton Sandestin on Tuesday afternoon through Thursday morning. A visit request form (included in this program) must be sent to ERDC by October 9, 2005. 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 Darnise Johnson (301) 596-0100 for further information.

Information Numbers

Joel Leifer (Technical Info)	(301) 596-0100	Hilton Sandestin Hotel Reservations:	(800)-367-1271
Darnise Johnson (General Info)	(301) 596-0100	Hotel Website	www.sandestinbeachhilton.com
FAX	(301) 596-6400		
website	www.saviac.org		

76th Shock and Vibration Symposium

Conference Program

Sunday, October 30

Tutorials	Room	Instructor	Time
Theoretical Background and Best Practice Using DDAM	Coral A	Mr. Tony Abbey	8-11 AM
Beyond the Shock Spectrum Temporal & Frequency Moments, the Product Model, & Uncertainty	Coral B	Mr. Dave Smallwood	8-11 AM
UNDEX Analysis of Floating Structures	Coral C	Mr. Fred Costanzo & Dr. Ray Daddazio	8-11 AM
Dynamic Pressure Measurements for Munitions, Ordnance, and Other Testing: Part Science and Part Art	Coral D	Prof Pat Walter	8-11 AM
DDAM Using MSC Software Tools	Coral A	Mr. Bart McPheeters	12-3 PM
Shock Response Spectrum – Uses & Abuses	Coral B	Mr. Tim Edwards	12-3 PM
Data Validation and Editing	Coral D	Mr. Allan Piersol	12-3 PM
Productive DDAM Analysis Using ABAQUS	Coral A	Dr. David Winkler	4-7 PM
Basis of Elementary Shock Isolation System Design	Coral B	Dr. D. Christopher Merrill	4-8 PM
ESS, HALT & Hass	Coral C	Mr. Wayne Tustin	4-7 PM
Introduction to Vibration Testing	Coral D	Mr. Jon Wilson	4-7 PM

Tutorials	Room	Instructor	Time
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Monday, October 31

An Introduction to ABAQUS	Coral A	Mr. Karl D'Souza	8-11 AM
Review of Structural Dynamics	Coral B	Mr. Joel Leifer & Prof Walter Pilkey	8-11 AM
Naval Shock Analysis & Design	Coral C	Dr. Rudy Scavuzzo	8-11 AM
The Measurement and Utilization of Valid Shock and Vibration Data	Coral D	Dr. Patrick Walter	8-11 AM
Non-Linear FE Analysis for Shock and Vibration	Coral A	Mr. Tony Abbey	12-3 PM
Shock and Vibration Analysis Using MATLAB	Coral B	Prof Kjell Ahlin	12-3 PM
A Primer On Explosion Effects In the Air, Water, and Soil	Coral D	Dr. Bob Welch	12-3 PM
UNDEX and Acoustic Analysis With ABAQUS	Coral A	Dr. Jeff Cipolla	4-7 PM
Damping Analysis & Technology	Coral B	Dr. Jack Henderson, Dr. Peter Torvik & Mr. Ahid Nashif	4-7 PM
Application of the USA Code to Underwater Shock Problems	Coral C	Dr. John DeRuntz	4-7 PM

DTE-019 Vibration Controller Selection **Chair: Mr. Tony Keller, Spectral Dynamics**

1:00 - 2:30 PM
Heron

Selecting a new digital vibration control system for your lab is an important but need not be a daunting experience. DTE-019 is tasked with creating a recommended practice to assist those tasked with choosing a control system for their organization. Please join us to input your ideas or listen to other inputs as this Committee reaches the final phases of creating this important document.

DTE-022 Multi-Shaker Test and Control **Chair: Mr. Tony Keller, Spectral Dynamics**

2:30 - 4:00 PM
Heron

Using more than one shaker to test large or unusually shaped objects is becoming a well accepted part of the vibration testing industry. Also, as interest in simultaneously testing articles in multiple axis increases, the need for guidelines to understand MIMO (multiple input multiple output) testing grows more important. Here is your chance to get up to speed on and contribute to our growing database on multi shaker concepts, fixturing, control and reporting.

Tuesday Morning, November 1

Chair/Presenter Meeting (All Tuesday Chairs & Presenters Must Attend)

7:00 - 7:30 AM

Chair: Jeff Morris, HI-TEST Labs

Theater

Opening Session

Call to Order: <i>Mr. Joel Leifer, SAVIAC Program Manager</i>	8:30 am
Welcome: <i>TBD Defense Threat Reduction Agency</i>	8:35 am
Welcome: <i>Dr. Bob Welch, US Army Engineer Research & Development Center</i>	8:40 am
Welcome: <i>Dr. Ray Daddazio, Weidlinger Associates, Inc.</i>	8:45 am
Welcome: <i>Dr. Reza Sadeghi, MSC.Software</i>	8:50 am
Symposium Highlights: <i>Mr. Joel Leifer, SAVIAC Program Manager</i>	8:55 am
Henry Pusey Award Presentation: <i>Mr. Mike Giltrud, Defense Threat Reduction Agency, Dr. Paul Mlakar, US Army Engineer Research & Development Center, Dr. Howard Levine, Weidlinger Associates, Inc., Mr. Bart Mcpheeters, MSC.Software</i>	9:10 am
SAVIAC Supporters Recognition - <i>Mr. Joel Leifer, SAVIAC Program Manager</i>	9:20 am
Lifetime Achievement Award Presentation - <i>Mr. Robert Bowser, NAVSEA 05P3</i>	9:30 am
Director's Awards Presentation - <i>Dr. Bob Welch, USAE Research and Development Center</i>	9:45 am
Director's Remarks: <i>Dr. Bob Welch, USAE Research and Development Center</i>	9:50 am
Break	10:00 am
Keynote Address: <i>Dr. James Houston, Director, USAE Research and Development Center</i>	10:15 am
Elias Klein Memorial Lecture: "Space Shuttle Orbiter Debris Impact Studies - the Behavior of "Soft" Foam at Ballistic Velocities": <i>Dr. Ed Fasanella, US Army Research Laboratory, NASA Langley Research Center</i>	11:00 am
Break	11:30 am

Exhibitors Luncheon

Tour the exhibits as you enjoy lunch in the exhibit area from 11:45 - 1:00

Tuesday Afternoon, November 1

Track One

Hiring, Training, & Mentoring of the Next Generation of Technical Professionals

1:00 - 3:00

Chair: Dr. Bob Welch, SAVIAC Director, ERDC

Coral Ballroom A

The technical professionals represented by this community play a vital role in fielding equipment for use by the warfighter so it is essential that this expertise is passed on. Come join Mr. Gary Jebson (US Navy), Ms Mary M. Donohue Perry (USAF), Dr. James Houston (US Army), Dr. Ray Daddazio (Weidlinger Associates, Inc.), Prof Sam Kiger (University of Missouri), Mr. Ray Williams (Electric Boat Corp.), and Dr. Reza Sadeghi (MSC.Software) for their thoughts and be prepared to offer your ideas on how this can be accomplished.

Pyroshock Discussion Group

3:20 - 4:20 PM

Leader: Dr. Vesta Bateman, Sandia National Laboratory

Coral Ballroom A

The group will discuss current pyroshock testing issues as volunteered by group members. Current success stories are welcome as well as problems with pyroshock testing, instrumentation, and data analyses.

New Engineer's Forum

5:00 - 7:00 PM

Chair: Ms. Margaret Tang, Weidlinger Associates, Inc.

Coral Ballroom A

The forum will provide an opportunity for engineers new to the community to network with their peers and develop the skills needed to move into leadership positions in the community. Mr. Ray Williams, Director of Naval Architecture, Electric Boat, will address the forum. Others on the program include a TBD person talking about a TBD topic and Mr. Ray Williams will show a video on how a submarine is constructed. There will also be a presentation on the SAVIAC sponsored Mentor Program by Joel Leifer and a discussion with the participants on the future direction of the Forum.

Track Two**Test Criteria****Chair: Dr. Robert Hall, US Army ERDC****Coral Ballroom B**

- 1:00 **Derivation of MALD Ground Test Vibration Requirements from Captive Carriage Flight Tests** ~ *Pat Willems Raytheon Missile Systems, Scott Fling, JE Sverdrup*
- 1:20 **Development of Rail Impact Test Criteria for Cushioned Draft Gear Rail Cars** ~ *Stanley Poynor, Wayne Clay, Jeff Kirk, Lockheed Martin Missiles & Fire Control*
- 1:40 **On the Use of Linear Accelerometers in Six-DOF Laboratory Motion Replication: A Unified Time-Domain Analysis** ~ *Dr. Norman Fitz-Coy University of Florida, Dr. Michael Hale, Redstone Technical Test Center*
- 2:00 **Utilization of Vehicle Test Course Speed Distributions to Refine Methods of Vehicle Scenario Derivation for Laboratory Vibration Test Schedule (LVTS) Development** ~ *Jesse Porter, US Army Redstone Technical Test Center, Michael Barry, US Army Aberdeen Test Center*
- 2:20 **Methodology for Determining Ballistic Shock Damage to Internal Components Mounted within Combat Vehicles** ~ *Jennifer Akers, Michael Gillich, Ed Fioravante, U.S. Army Research Laboratory*
- 2:30 **Earthquake Hazard Analysis and Dynamic Site Response Evaluation for Design of Tower Buildings in Dubai, UAE** ~ *Prof Azm Al-Homoud, American University of Sharjah*

Hardening of Electronics & Structures to High-g Effects Induced by Gun Launch & Ballistic Shock**Chair: Mr. Ami Frydman, ARL****Coral Ballroom B**

- 3:10 **Finite Element Modeling of Electronic Components in Projectile** ~ *Dr. Mohamed Trabia, Dr. Brendan O'Toole, Dr. Samaan Ladkany, Dr. Mostafiz Chowdhury, University of Nevada, Las Vegas*
- 3:30 **Optimization of Joint Design for Side Panel of a Military Vehicle for Shock Reduction** ~ *Dr. Mohamed Trabia, Dr. Brendan O'Toole, Dr. Samaan Ladkany, Dr. Jinhua Huang, University of Nevada, Las Vegas*
- 3:50 **Protection of Military Vehicle Occupants from Mine Blast Using an Air Bladder Seat Shock Isolation System** ~ *Dr. Douglas Reynolds, Dr. Brian Landsberger, Chris Ransel, Tarek Deeb, University of Nevada Las Vegas*
- 4:10 **Simulation and Measurement of Shock Transmission Across Joints** ~ *Dr. Brendan O'Toole, Dr. Samaan Ladkany, Masoud Fegghi, Karthik Doppola, University of Nevada Las Vegas*

ABAQUS User's Group Meeting**Chair: Dr. Jeff Cipolla, ABAQUS, Inc.****6:30 - 7:30 PM****Coral Ballroom B**

ABAQUS has become an important analysis tool for many shock and vibration engineering applications. This meeting is an opportunity for engineers and scientists in the field to meet with ABAQUS personnel and to discuss application of ABAQUS to their problems, share best practices, and make requests for new features. The meeting will include a brief discussion of new features in the V6.6 release, available in early 2006, but will otherwise be informal. Refreshments will be served, but attendance will be limited to 25 participants. Please contact Jeff Cipolla to sign up for this meeting.

Track Three**Test Facilities I****Chair: Mr. Ed Dyer, BAE Systems****Coral Ballroom C**

- 1:00 **US Army Centrifuge: Critical Capability for the Future** ~ *Dr. Joseph P. Koester, US Army Engineering Research and Development Center*
- 1:20 **Magneto-Inductive Remote Activation Munitions System** ~ *Dr. Jon Windham, Dr. James Cargile, US Army Engineer Research & Development Center, Richard Andrejkovics, Picatinny Arsenal, Paul Wrathal, Magneto-Inductive Systems Ltd*
- 1:40 **Simultaneous Multi-Axis Mechanical Shock Simulations** ~ *Dr. Vesta Bateman, Lawrence Carlson, Sandia National Laboratories*
- 2:00 **Design and Evaluation of Multi-Axis High-Frequency Vibration Shaker Systems** ~ *Dr. Georg Mauer, Brinda Venkatesh, University of Nevada, Las Vegas*
- 2:20 **Structural Damage Detection and Localization by Non-linear Acoustic Spectroscopy** ~ *Dr. Gerard Vanderborck, Thales Underwater Systems, Dr. Bernard Rousselet, Nice University*

Test Facilities II

Chair: Mr. Jeff Blankenship, NSWCCD/CSS

Coral Ballroom C

- 3:00 **Design of a Shock Test Machine for Encanistered Missiles** ~ *Dr. Jon Yagla, Naval Surface Warfare Center Dahlgren Division*
- 3:20 **Calibration and Qualification of the WOX-MSTM Encanistered Missile Shock Test Machine** ~ *Dr. Jon Yagla, Naval Surface Warfare Center Dahlgren Division*
- 3:40 **Development of a Test System to Replicate the Shock Profiles Through Small Arms Accessories** ~ *Nigel Linden, Re Test Equipment, Inc.*
- 4:00 **Littoral Warfare Environment** ~ *Robert McHugh, U.S. Army Aberdeen Test Center*
- 4:10 **Using a Six Ton Pile Driver to Mimic Firing Pressures of Large Caliber Cannon -Softly** ~ *Dr. Eric Kathe, John Keating, Lawrence Kelley, Dr. Andrew Littlefield, US Army RDECOM/Benet Labs*

NE/Nastran User's Group Meeting

Chair: Mr. Tony Abbey, Inc.

6:30 - 7:30 PM

Coral Ballroom C

Noran Engineering, Inc. will host their inaugural User Meeting for NE/Nastran users. All attendees who use NE/Nastran are invited and encouraged to bring their wish lists with them. The meeting will be chaired/moderated by Tony Abbey, NEi's Manager of Technical Support, who will deliver a schedule of upcoming enhancements, and will also lead a discussion with the users regarding their experience, lessons learned and recommendations for use of NE/Nastran. Our main objective is to launch a formal Independent NE/Nastran User Group.

Track Four

Training I

Chair: Ms Linda Towler, MSC.Software

Coral Ballroom D

- 1:00 **Basics of Acoustics: Generation, Description, Instrumentation, & Measurement** ~ *Richard Peppin, Scantek, Inc.*
- 2:00 **Using The Pseudo Velocity Shock Spectrum For Shock Damage Potential, Part 1** ~ *Dr. Howard Gaberson Consultant*
- 3:00 **Using The Pseudo Velocity Shock Spectrum For Shock Damage Potential Part 2** ~ *Dr. Howard Gaberson, Consultant*

Short Course Development Discussion Group

Leader: Mr. Richard Peppin, Scantek, Inc.

4:00 - 5:00 PM

Coral Ballroom D

SAVIAC is interested in developing a series of courses to offer to the community. We're looking for ideas for short courses, distance learning, home-study, and web based offerings of various lengths in subjects that would be of interest to the community. If you would like to be an instructor or are interested in taking a course, come to present your ideas.

Track Five (LIMITED, Distribution Statement C)

DockShock – An Alternative Ship Shock Test Concept

Chair: Mr. Steve Schreppler, ONR

Sandpiper CD

- 1:00 **DockShock: An Introduction to the DockShock Concept** ~ *Dr. Russel Miller, Roger Bagbey, Erv Pettersen, Dr. Christopher Mairs, Anteon Corporation*
- 1:20 **An Electromagnetic Transducer for Generating High Pressure, Underwater Pulses** ~ *Dr. Michael Raleigh, Dr. James Galambos, BAE Systems Advanced Technologies, Inc.*
- 1:40 **DockShock: Predicting Target Response** ~ *Dr. Russel Miller, Dr. Christopher Mairs, Anteon Corporation*
- 2:00 **Cavity Dynamics and the Development of a Non-Explosive Ship Shock Testing System** ~ *Dr. Georges Chahine, Dynaflow, Inc.*
- 2:20 **DockShock: System Design Considerations** ~ *John Tullai, Christian Whitney, Anteon Corporation*

Alternate Ship Shock Testing Systems - Air Guns

Chair: Mr. Erik Rasmussen, NSWCCD

Sandpiper CD

- 3:00 **Non- Explosive Shock Testing Requirements and Aspirations: The US Navy and OSD LFT&E Perspective** ~ *Frederick A. Costanzo, Carderock Division, Naval Surface Warfare Center*
- 3:20 **Non- Explosive Shock Testing Requirements and Aspirations: The United Kingdom Ministry of Defence Perspective** ~ *Barry Knott, Ministry of Defence (UK)*

- 3:40 **Overview of the Development of Seismic Airgun Techniques for Non-Explosive Shock Testing** ~ Phillip Thompson, Weidlinger Associates Ltd
- 4:00 **High Frequency Airgun Signature Characterisation and Shock Barge Testing Using Airgun Arrays** ~ Mr Gavin Colliar, Weidlinger Associates Ltd
- 4:20 **SBIR Phase I Review: Non Explosive Shock Testing Using Airguns** ~ Dr Raymond Daddazio PE, Weidlinger Associates Inc.
- 4:40 **Large Structure Modal Testing Using Seismic Airgun Excitation Techniques** ~ Phillip Thompson, Weidlinger Associates Ltd

Track Six (LIMITED, Distribution Statement C)

Vibration

Chair: Dr. James O'Daniel, ERDC

Sandpiper AB

- 1:00 **Comparing the Measured Response of an AN/ALQ-99 Tactical Jamming System Pod to the Input Motions During a Vibration Study** ~ James Wilcoski, Jonathon Trovillion, US Army Engineer Research and Development Center, Construction Engineering
- 1:20 **Vibration Measurements Performed on Carrier Sea Trials to Support CVN Design** ~ James Gardner, Northrop Grumman Newport News
- 1:40 **Use of Vibration Measurements and FEM Predictions to Evaluate Location of Island Structure for New CVN Design** ~ Davis Hill, Jason Hartmann, Northrop Grumman Newport News
- 2:00 **Validation of FEM Predictions of Vibration Levels to support CVN Design** ~ Kevin Arden, Northrop Grumman Newport News

Finite Element Modeling

Chair: Mr. Ed Alexander, BAE Systems

Co-Chair: Mr. Robert Handleton, NSWCCD

- 2:30 **Finite Element Modeling of Close Encounters With Underwater Explosions** ~ Dr. Gale Mulligan, Electric Boat
- 2:50 **A Comparison of LS-DYNA Composite Failure Models In a Dynamic Environment** ~ Bill Gregory, Christopher Key, Dr. Iam Lua and Dr. Richard Cobb, Anteon Corp
- 3:10 **Dynamic Response And Failure Prediction Of Composite Hat Stiffeners** ~ Bill Gregory, Dr. Richard Cobb, Dr. Jim Lua, Joshua Gorfain, Anteon Corp
- 3:30 **Finite Element Analysis in Support of MIL-S-901D Shock Testing of the AN/SPQ-9B Antenna Group** ~ Andrew Lotz, Northrop Grumman Electronic Systems
- 3:50 **Structural Optimization of Non-Line-of-Sight Cannon (NLOS-C) Turret** ~ Dr. Nam Ngo, Vincent Whelan, Dr. Brian Bauman, Ed Alexander, BAE Systems

Wednesday Morning, November 2

Chair/Presenter Meeting (All Wednesday Chairs & Presenters Must Attend)

7:00 - 7:30 AM

Chair: Mr. Jeff Morris, HI-TEST Labs

Theater

Track One

Shock Response (Sponsored by the SRS Committee)

Chair: Mr. Steve Lofton, ERDC, Co-Chair: Mr. Eric Luft, NSWCCD

Coral Ballroom A

- 8:00 **Derivation of the Ramp Invariant Filter for Shock Response Spectrum Calculations** ~ David Smallwood, Consultant
- 8:20 **Applying Fuzzy Structure Theory to Shock Response Predictions** ~ Carina Ting, Thomas Littlewood, Dr. Russel Miller and Jeffrey O'Brien, Anteon Corporation
- 8:40 **A Technique for the Identification of the Optimum Inputs for a Vibration or Acoustic Test** ~ Jerome Cap, Melissa C de Baca, Sandia National Laboratories, David Smallwood, Compa Industries
- 9:00 **On the Comparison of Test Specification and Measured Field Data** ~ Prof Kjell Ahlin, Blekinge Institute of Technology
- 9:20 **Modal Expressions for Relative Displacements Underlying Pseudovelocity Shock-Response Spectra, for Idealized Remote Shock Loadings: Derivation and Verification** ~ Dr. R. David Hampton, US Military Academy
- 9:40 **Analytical Kinematic Expressions for Pseudovelocity Shock Response Spectra of Generally Damped Linear Systems** ~ Dr. R. David Hampton, Colonel Kip P. Nygren, Captain Jared Erickson, U.S. Military Academy; Ting H. Li, U.S. Army Research Laboratory
- 10:00 **Using Work and Energy to Characterize Mechanical Shock** ~ Timothy Edwards, Sandia National Laboratories

Track One (Continued)**Shock Response Spectrum Committee****Chair: Mr. Timothy Edwards, Sandia****10:40 - 11:40 AM****Coral Ballroom A**

The Technical Committee on the Shock Response Spectrum was recently organized to serve the SAVIAC community as a central point of contact for shock representation issues. The committee's duties include: organizing symposium discussion groups and dedicated paper sessions, acting as a forum for introducing new and related procedures for shock representation, producing best practices guidelines for validation & implementation of SRS algorithms, interfacing with standards organizations (ISO, IEC & others) on standards for calculation of a SRS, assembling landmark papers on SRS and related procedures and producing a compilation or compendium, and acting as a repository for representative digitized data sets (naval shock, El Centro earthquake, pyro-shock, classical, etc.). Join us as we discuss SRS committee business such as shaping the committee's interfacing role with standards organizations and beginning the assembly of important works for a compendium on shock representation.

Track Two**Perforation/Penetration****Chair: Dr. Eric Rinehart, DTRA****Coral Ballroom B**

- 8:00 **An Experimental Approach to Determine Load-functions for the Impact of Fluid Filled Projectiles** ~ Dr. Nico Hermann, Klaus Kreuker, Prof. Lothar Stempniewski, University of Karlsruhe
- 8:20 **Perforation of Metal Plates: Laboratory Experiments and Numerical Simulations** ~ Dr. Leonard Schwer, Schwer Engineering and Consulting Services, Dr. Kurt Hacker, Dr. Kenneth Poe, Naval Explosive Ordnance Disposal Technology Division
- 8:40 **Numerical Simulations Of Inverse Planar Impact Tests On Sand** ~ Dr. Leo Laine ANKER-ZWMER Engineering AS
- 9:00 **Numerical Investigation on the Impact Strength of back Plates of Weldox Steel, Pure Copper, 2024-T3 Aluminum Alloy, Ti-6Al-4V Titanium Alloy and Some Composites** ~ Rengas Venkataraman, Dr. Abdalla Elbella, Potluri Krishna, Bradley University
- 9:20 **The Characteristics of Blade Formation/Cutting Process of Linear Shaped Charges (LSCs)** ~ Seokbin Lim, Braden Lusk, Dr. Paul Worsley, Rock Mechanics & Explosives Research Center
- 9:40 **Projectile Deceleration for Perforation through Layers of Un-reinforced Concrete Targets** ~ Jeff Averett, Dr. Donald Cargile, US Army Engineer Research and Development Center, John Foster, Dr. Vincent Luk, Sandia National Laboratories

Numerical Methods**Chair: Dr. Albert Bush, ERDC, Co-Chair: Dr. Paul Franklin, BIW****Coral Ballroom B**

- 10:20 **Extension of Infinite Elements and Absorbing Boundary Conditions to Eigenanalysis of Submerged Structures** ~ Dr. Jeff Cipolla, ABAQUS, Inc.
- 10:40 **Cross Orthogonality Check-out of Superelements** ~ Frederick Russell, Electric Boat Corporation
- 11:00 **Understanding and Using the Spectral Density Matrix** ~ Dr. Marcos Underwood, Tony Keller, Spectral Dynamics, Inc.
- 11:20 **A Comprehensive Approach for Treating Closely Spaced Modes in the Dynamic Design Analysis Method** ~ Dr. David Winkler, David Woyak, ABAQUS Inc.
- 11:40 **Cumulative Error Due to Integration Procedure in Progressive Collapse Analysis** ~ Dr. Hyung-Jin Choi, Karagozian & Case

Track Three**SEI/ASCE Blast Protection of Buildings Standard Committee Meeting****Chair: Mr. Don Dusenberry, Simpson, Gumpertz & Heger, Inc.****8:00 - 12:00 PM****Coral Ballroom C**

The Structural Engineering Institute of the American Society of Civil Engineers is preparing a new Standard for the design of buildings for blast effects. At the Committee's semi-annual meeting at the SAVIAC Symposium, Task Committees will present the first drafts of the mandatory and commentary chapters for the Standard, for discussion and comment.

Track Four**Training II**
Chair: TBD**Coral Ballroom D**

- 8:00 **Tutorial on Ballistic Shock in Armored Vehicles** ~ Scott Walton US Army Aberdeen Test Center
 9:00 **Metal Fatigue I** ~ Dr. Rudy Scavuzzo, University of Akron
 10:00 **Metal Fatigue II** ~ Dr. Rudy Scavuzzo, University of Akron
 11:00 **Centrifuge Technology** ~ Dr. Mike Sharp, Dr. Joe Koester, US Army Engineer Research & Development Center

Track Five (LIMITED, Distribution Statement C)**DD(X) UNDEX****Chair: Mr. Sean Murphy, NGSS, Co-Chair: Mr. Joel Myers, NGSS****Sandpiper CD**

- 8:00 **DD(X) Whole Ship Transient Analysis** ~ Tom Littlewood, Morgan Eash, Chris Key, Christian Whitney, Anteon Corporation
 8:20 **Modeling, Simulation and Validation of GOLDWHIP for DD(X)** ~ Sean Murphy, Northrop Grumman Ship Systems
 8:40 **DD(X) UNDEX Hull Whipping Test: A Modeling and Simulation Comparison of Large Charge and Small Charge Shock Trial Scenarios** ~ Derek Skahen, T&E Solutions; Joel Myers, Northrop Grumman Ship Systems; Steve Rutgerson, NSWC/CD
 9:00 **DD(X) UNDEX Hull Whipping Test: An Evaluation of M&S Tools for Above Design Level Analyses** ~ Sean Murphy, Dr. Erwin Moyer, Northrop Grumman Ship Systems
 9:20 **Tutorial- PPD 802-7651312 Shock (High-Impact and Low-Impact) Testing, DD(X) Shipboard Machinery, Equipment and Systems, Requirements for** ~ D. Shawn McPartland, Anteon Corp.
 9:40 **Break**
 10:00 **DD(X) Machinery and Electronics Shock Mitigated Rafting: Design Concepts** ~ Dr. Russ Miller, Vince Godino, Skip Dixon, Jeff O'Brien, Anteon Corp.
 10:20 **DD(X) Machinery and Electronics Shock Mitigation Rafting: Equipment Testing and Modeling** ~ Jeff O'Brien, Brendan Woolrich, Vince Godino, Dr. Russ Miller, Anteon Corporation
 10:40 **DD(X) Machinery and Electronics Shock Mitigation Rafting: Device Algorithm Development** ~ Jeff O'Brien, Brendan Woolrich, Vince Godino, Dr. Russ Miller, Anteon Corporation
 11:00 **DD(X) Machinery and Electronics Shock Mitigated Rafting: Modeling, Simulation and Validation** ~ Dr. Russ Miller, Jeff O'Brien, Brenden Woolrich, Jeff Gorfain, Anteon Corp
 11:20 **DD(X) Machinery and Electronics Shock Mitigated Rafting: Test Articles** ~ William Dickson, Vince Godino, Russ Miller, Jeff O'Brien, Anteon Corporation

Track Six (LIMITED, Distribution Statement C)**Special Sessions on DTRA Nuclear Weapons Effects Technologies: Non-ideal Airblast Loading****Chair: Mr. Mike Giltrud, DTRA****Sandpiper AB**

- 8:00 **DTRA Software Tools for Target Damage Assessment** ~ Michael Giltrud, Defense Threat Reduction Agency
 8:25 **NIAB Overview** ~ Ken Kreyenhagen, NGIT
 8:50 **An Automated Reachback Capability for Non-Ideal Airblast Calculations** ~ Paul Yarrington, Sandia National Laboratory
 9:15 **Loading On Closely Spaced Structures** ~ Dr. Michael Kerry, Dr. Keith Seal, A.W.E.
 9:40 **Response of Closely Spaced Multiple Objects When Subject to Blast Loading** ~ Dr Keith Seal, Dr. Mike Kerry, A.W.E.
 10:05 **Break**
 10:20 **Non Ideal Airblast Effects from Urban and Natural Terrain** ~ Joe Crepeau, Charles Needham, ARA
 10:45 **Urban Airlast Calculations** ~ Jack Klump, SAIC
 11:10 **Airblast from Underground Explosions** ~ Philip Hookham, Titan Research
 11:35 **Targeting Considerations (VNTK Overview)** ~ Charles Deel SAIC

Wednesday Afternoon, November 2

Track One

High Performance Data Acquisition Systems

Chair: Mr. Scott Walton, ARL

Coral Ballroom A

- 1:00 **High Speed Ballistic Digitizer System** ~ Dr. Lee Francis, Gary Uhland, Dustin Houseman, Corey Himes, US Army
Aberdeen Test Center
- 1:20 **Electro-Magnetic Interference (EMI) in Instrumentation Cables During Explosive Testing** ~ Scott Walton US
Army Aberdeen Test Center
- 1:40 **The Accelerometer Cable - It Can't Get No Respect** ~ Prof Patrick Walter, Texas Christian University
- 2:00 **New Approaches to High Performance Data Acquisition** ~ Gary Schneider, Hi-Techniques
- 2:20 **LD Tests: A method for Long Distance Communication to Smart Transducers with TEDS** ~ Douglas Firth,
Stephen Finney, Precision Filters, Inc.

Blast Effects

Chair: Mr. Denis Rickman, ERDC

Coral Ballroom A

- 3:00 **Dynamic Analysis of Concrete Structure Under Blast Load Using Plastic Damage Model** ~ Jim Won Nam, Ho Jin
Kim, Yonsei University, Dr. Hyung Jin Choi, Karagozian & Case Inc., Ha-Won Song, Yonsei University
- 3:20 **Numerical Modeling Approaches for Simulation of Landmine Blast Loading** ~ Laura Donahue, Martec, Ltd., Dr.
Amal Bouamoul, Defense R&D Canada - Valcartier, Tim Dunbar, Martec, Ltd.
- 3:40 **Consideration on Bridge Blast Analysis and its Damage Evaluation** ~ Dr. Hyung-Jin Choi, Karagozian & Case Inc.
- 4:00 **Protecting Humans From Blast Induced Shock Waves** ~ Dr. Ken-An Lou, ArmorWorks, Inc., Richard Zimmerman,
Zerad, Inc.
- 4:20 **Numerical Method for Evaluating Debris Size and Velocity of Slab** ~ Dr. Hyung-Jin Choi, John Crawford,
Karagozian & Case Inc.
- 4:40 **Improvised Explosive Devices** ~ Gary Kehoe, Chief Security and Law Enforcement, North Atlantic Division, US Army
Corps of Engineers

Track Two

Vibration Damping

Chair: Dr. John Henderson, UTC

Coral Ballroom B

- 1:00 **Rim Dampers for System Modes of a Turbine Engine Integrally Bladed Rotor** ~ Dr. John Henderson, John Justice,
Philip Johnson, Universal Technology Corp., Brian Runyon, AF Research Laboratory, Ahid Nashif, Consultant
- 1:20 **Durability Studies of the Resistance of Viscoelastic Materials to High Temperatures** ~ Ahid Nashif, Consultant,
Universal Technology Corporation
- 1:40 **Broadband Damping in High Temperature Environments Using Multiple Tuned Mass Absorbers** ~ Dr. Jeffery
Zapfe, Acentech Incorporated
- 2:00 **Sources of Error in Obtaining Damping Properties of Hard Coatings from Vibration Tests** ~ Dr. Peter Torvik,
Consultant

Web Based Viscoelastic Material Properties Database

2:30 - 3:30 PM

Chair: Mr. Ahid Nashif, Consultant, UTC

Coral Ballroom B

This discussion will center of the status of the effort to build a viscoelastic materials properties database that can be accessed on the internet.

Blast Response

Chair: Dr. Alan Ohrt, AFRL

Coral Ballroom B

- 3:50 **Constitutive Model Evaluation for EOD Ballistic Impact Simulations** ~ Dr. Mark Vulitsky, Naval Explosive
Ordnance Disposal Technology Division, Dr. Leonard Schwer, Schwer Engineering & Consulting Services, Kenneth Poe, Dr. Kurt Hacker, Naval Explosive Ordnance Disposal Technology Division
- 4:10 **Blast Resistance of Steel and Composite Bridge Piers and Decks** ~ Prof Abolhassan Astanteh-Asl, Jin Son Dr.
Marcus Rutner, University of California, Berkeley
- 4:30 **Performance of R/C and Composite Walls of Buildings under Blast Loads** ~ Prof Abolhassan Astanteh-Asl,
Qihong Zhao, University of California, Berkeley, Casey Heydari, MSC.Software Corp.
- 4:50 **A Comparison Of Accelerometer Mounting Techniques On Internal Blast Cubicle Experiments Undergoing Elasto-Plastic Deformation** ~ George Yiannakopoulos, DSTO

Track Three**SEI/ASCE Blast Protection of Buildings Standard Committee Meeting****1:00 - 5:00 PM****Chair: Mr. Don Dusenberry, Simpson, Gumpertz & Heger, Inc.****Coral Ballroom C**

The Structural Engineering Institute of the American Society of Civil Engineers is preparing a new Standard for the design of buildings for blast effects. At the Committee's semi-annual meeting at the SAVIAC Symposium, Task Committees will present the first drafts of the mandatory and commentary chapters for the Standard, for discussion and comment.

Track Four**Training III****Chair: TBD****Coral Ballroom D**

- 1:00 **Practical Random Vibration Analysis of Nonlinear Structures via Finite Element Models** ~ Dr. Thomas Paez, Sandia National Laboratories
- 2:00 **Pyroshock Testing** ~ Dr. Vesta Bateman, Sandia National Laboratories
- 3:00 **FEA, Sparse Data, and Aliasing** ~ Edward Dyer, BAE Systems
- 4:00 **Simulation Process and Data Management. Industry Examples** ~ Mathew Macias, MSC Software Corp.

Track Five (LIMITED, Distribution Statement C)**The Peripheral Vertical Launcher System (PVLS) Engineering Development Model (EDM) for the DD(X) Design Methodology****Co-Chair: Dr. Tom Moyer, NGSS, Co-Chair: Mr. Bob Wunderlick, NSWCCD****Sandpiper CD**

- 1:00 **The PVLS EDM & DD(X) Design Methodology** ~ Dr. E. Thomas Moyer, Northrop Grumman Ship Systems, Robert Wunderlick, Naval Surface Warfare Center Carderock Division, Robert DeGraeve, Northrop Grumman Ship Systems
- 1:20 **Contribution to Blast of Solid Propellant Under Shock Loading - Experiments and Models** ~ Dr. Michael Kaneshige, Dr. David Crawford, Daniel Sandoval, Dr. Robert Pahl, Sandia National Laboratory
- 1:40 **PVLS Design Load Methodology** ~ Dr. Christopher Freitas, Southwest Research Institute, Dr. David Crawford, Sandia National Laboratory, Ryan Keedy, Trueman Sharron, Southwest Research Institute
- 2:00 **PVLS Structural Analysis** ~ Christopher Joseph, Dr. E. Thomas Moyer, Robert DeGraeve, H.W. Ruth, Northrop Grumman Ship Systems
- 2:20 **Planning, Management, and Conduct of DD(X) PVLS EDM Full-Scale Developmental Tests Events** ~ G.D. (Jerry) Hill, Glen Snyder, Alion Science and Technology/JJMA Maritime Sector
- 2:40 **Break**
- 3:00 **PVLS Design Evolution & Lessons Learned** ~ Dr. E. Thomas Moyer, Christopher Joseph, Robert DeGraeve, Northrop Grumman Ship Systems
- 3:20 **Fragmentation Protection and Warhead Resistance Experiments** ~ Dr. Charles Anderson, Southwest Research Institute, Dr. E. Thomas Moyer Northrop Grumman Ship Systems, G.D. (Jerry) Hill, Alion Science and Technology/JJMA Maritime Sector, Dr. Christopher Freitas, Ryan Keedy, Erick Sagebiel, Carl Weiss, Southwest Research Institute
- 3:40 **Maximum Credible Detonation Event; MCDE(2) Final Design & Performance** ~ Dr. E. Thomas Moyer, H W Ruth, Christopher Joseph, Northrop Grumman Ship Systems
- 4:00 **PVLS Risk Retirement** ~ Robert Wunderlik, Naval Surface Warfare Center Carderock Division, Dr. E. Thomas Moyer, Northrop Grumman Ship Systems

Track Six (LIMITED, Distribution Statement C)**Special Sessions on DTRA Nuclear Weapons Effects Technologies: Vulnerability of Underground Facilities****Chair: MAJ Jim Chrisley, DTRA****Sandpiper AB**

- 1:00 **DTRA IGVN Program Overview** ~ Maj Jim Chrisley, Defense Threat Reduction Agency
- 1:25 **Target Planning: Ground Vulnerability Number** ~ Charles Deel, SAIC
- 1:50 **Ground Shock Model, WinGS** ~ Russ England, TRT
- 2:15 **Structural Response: Local Damage Mode** ~ Scott Blouin, ARA
- 2:40 **Break**
- 2:50 **Structural Response Global Damage Mode: Finite Element Modeling** ~ Dr. Howard Levine Weidlinger Associates, Inc.
- 3:15 **Structural Response Global Damage Mode: Experimental Calibration** ~ Dan Burgess, NGIT
- 3:40 **Structural Response Global Damage Mode: Engineering Model** ~ Regan Burmeister, Applied Research Associates
- 4:05 **Field Experiment Comparisons** ~ Maj Scott Grammer, Defense Threat Reduction Agency

Wednesday Evening, November 2

SAVIAC Community Feedback Town Hall Meeting

Chair: Mr. Joel Leifer

6:00 - 7:00 PM

Coral Ballroom A

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

7:00 - 9:00 PM

Destin Beach

Thursday Morning, November 3

Chair/Presenter Meeting (All Thursday Chairs & Presenters Must Attend)

Chair: Mr. Jeff Morris, HI-TEST Labs

7:00 - 7:30 AM

Theater

Track One

Shock Isolation

Chair: Brian Detwiler, BIW, Co-Chair: Mr. John Przybysz, NSWCCD

Coral Ballroom D

- 8:00 **A Comparison of Elastomeric Isolators for Cabinet Isolation on Naval Vessels** ~ *Dr Robert Monson, Dr. Jack Yan, Julia Neuman, Lockheed Martin*
- 8:20 **Dynamic Properties and Modeling of Wire Rope Isolator** ~ *Dr. Jarkko Keinanen, Dr. Kalle Vehvilainen, VIT, Technical Research Center of Finland*

UNDEX Analysis I

Chair: Mr. Adam Hapij, Weidlinger, Co-Chair: Mr. Brian Lang, NSWCCD

Coral Ballroom D

- 9:20 **Modeling of Unsteady Cavitation Induced by UNDEX** ~ *Dr. Kin Chew Hung, Institute of High Performance Computing, Dr. Boo Cheong Khoo, Wenfeng Xie, Dr. Tiegang Liu, National University of Singapore*
- 9:40 **Dynamic Simulation of a Mine Barge Subjected to Underwater Explosions (UNDEX)** ~ *Dr. Juha Virtanen, Dr. Markku Jutunen, VTT Technical Research Center of Finland*
- 10:00 **Littoral UNDEX Development Program of the Finnish Navy** ~ *LT. Turkka Jappinen, Finnish Navy, Dr. Markku Juntunen, VTT Technical Research Center of Finland*
- 10:20 **Application of Non-linear Contact Surfaces in Modeling Whole Ship Shock Analysis** ~ *Tony Abbey, Noran Engineering*
- 10:40 **Fluid-Structure Interaction Effects Resulting From Hull Appendage Coupling** ~ *LT. Mehmet Avcu, Turkish Navy, Jarema Didoszak, Dr. Young Shin, Naval Postgraduate School*
- 11:00 **Further Investigation into the Technique and Applicability of DDAM Analysis in Large Models** ~ *Tony Abbey, Noran Engineering*

Track Two

Vibration Testing

Chair: Mr. Gary Zook, NUWC, Co-Chair: Mr. Vince Chiarito, ERDC

Emerald Ballroom A

- 8:00 **Flutter and Vibration of Bearingless Elastic Helicopter Rotor Blades Featuring Flapping and Feathering Coupling** ~ *Prof Metin, Orhan Kaya, Ozge Ozdemir, Istanbul Technical University*
- 8:20 **Analysis of the Effect of Hydrodynamic Preloading on the Acoustic Radiation of a Sonar Array** ~ *Karl D'Souza Subham Sett, Dr. Jeffrey Cipolla, ABAQUS, Inc.*
- 8:40 **New Developments in Shipboard Vibration** ~ *Chuck Vallance, Raytheon*
- 9:00 **Development of a Seismo-Tectonic Model for the United Arab Emirates** ~ *Dr. Azm Al-Homoud, American University of Sharjah*

MIL-STD-810G Working Group**Chair: Mr. Randy Patrick, Yuma Proving Ground****10:00 - 12:00 PM
Emerald Ballroom A**

A new edition of the DoD's "Test Method Standard for Environmental Engineering Considerations and Laboratory Tests" is now under development by a Tri-Service Working Group. Here's YOUR chance to make a difference! The purpose of this meeting is to discuss numerous Shock & Vibration test methods, with emphasis on Methods 514 (Vibration), and 516 (Shock). DoD experts will introduce new draft methods and lead open discussions on what can be done to improve the methods and to make them more user-friendly. Please plan on participating in these stimulating discussions, and introducing what you feel will make -810G a more improved document.

Track Three**UNDEX Testing****Chair: Mr. Eric Duncan, NSWCCD****Emerald Ballroom B**

- 8:00 **Nearby UNDEX Tests On a Thick Plate** ~ Johannes E. Van Aanhold, TNO Built Environment and Geosciences, Theo N. Bosman, Royal Netherlands Navy
- 8:20 **Nearby UNDEX Tests on Thin Panels** ~ Johannes E. Van Aanhold, TNO Built Environment and Geosciences, Theo N. Bosman, Royal Netherlands Navy
- 8:40 **Mechanical Shock Failure of Electronic Equipment** ~ Dr. Leland Smith, Thomas Savell, GCAS, Inc.
- 9:00 **Experimental Verification of Relationship Between Bubble Motion and Shock Vibration of Ship Equipment** ~ Prof. Li Guo-Hua, China Ship Scientific Research Centre
- 9:20 **Advanced Modeling & Simulation to reduce reliance on Navy Ship Life Fire Test & Evaluation** ~ Glen Sturtevant, US Navy PEO Ships

UNDEX Analysis II**Chair: George Camp, BIW, Co-Chair: Mr. Steve Rutgerson, NSWCCD****Emerald Ballroom B**

- 10:00 **VR Based Visualization System for UNDEX Ship Shock Simulation by Using Digital Mock-up Technology** ~ Changmin Lee, Dr. Jung-Hoon Chung, Jaemun Yun, Dr. Hanjin Lee, Korea Research Institute of Ships & Ocean Engineering
- 10:20 **Application of Design of Experiment Methodology to the UNDEX Whole Ship Shock Modeling & Simulation** ~ Dr Jung-Hoon Chung, Korea Institute of Machinery and Materials, Jeong-II Kwon, Dr. Sang-Gab Lee, Korea Maritime University
- 10:40 **Bidynamic Response Analysis of a Human on Floating Shock Platform to UNDEX** ~ Prof Sang-Gab Lee, Jeong-II Kwon, Korea Maritime University, Dr. Jung-Hoon Chung, Korea Institute of Machinery and Materials
- 11:00 **Estimation Method for Longitudinal Bending Strength of a Damaged Ship due to a Close-in UNDEX Bubble** ~ Dr. Akihiro Yasuda, Akihiko Imakita, Mitsui Engineering & Shipbuilding Co, Ltd.
- 11:20 **Littoral Environment Modelling of UNDEX and Air Blast Events** ~ Graeme Birkhead, John McVee, QinetiQ

Track Four**Training IV****Chair: TBD****Theater**

- 8:00 **Addressing Variability and Uncertainty to Improve Product Design** ~ Gene Allen, MSC.Software Corporation
- 9:00 **Finite Element Analysis** ~ Bart Mcpheeters, MSC.Software Corporation

Education Committee**Chair: Mr. Andy Anderson, BAE Systems****10:00 - 11:00 AM
Theater**

The Tutorial Development Working Group will meet to discuss the tutorial program leading to a comprehensive Certificate for those who complete the entire program. This program will share the tutorial program of the Institute of Environmental Sciences and Technology (IEST) to quickly allow participants to acquire their Certificate. Inputs for education topics of interest, potential tutorial presenters, and other ideas to improve and foster this program are urgently requested. Come join us and provide your input!

Bolted Joints Under UNDEX Shock Discussion Group
Leader: Mr. James Jennings, NSWCCD

11:00 - 12:00 PM
Theater

For most Navy equipments and systems, designing bolted joints for UNDEX shock is easy - just use the standard formulas and values. However, experience has shown that the standard formulas and values don't always work, and when they don't work the consequences can be very expensive. This Discussion Group is a forum for the Navy community to share problems with designing bolted joints, discuss on-going or proposed efforts to solve these problems, and to brainstorm a way (or ways) forward.

Track Five (LIMITED, Distribution Statement C)

Structural Response I

Chair: Dr. Paul Mlakar, ERDC, Co-Chair: Mr. Jeff Averett, ERDC

Sandpiper CD

- 8:00 **Arena Fragment Experiments Using Mortars** ~ *Lebron Simmons, US Army Engineer Research & Development Center*
- 8:20 **Experiments to Investigate Behind-Wall Effects Due to Explosive Breaching of Reinforced Concrete Walls** ~ *Denis Rickman, Jay Ehr Gott, US Army Engineer Research & Development Center*
- 8:40 **Development of an Improved Model for Predicting First-Crack of Laminated Glass Subjected to Airblast** ~ *Steven Lofton, US Army Engineer Research & Development Center, Clayton Hooker, Sentel, Inc.*
- 9:00 **Pressure-Impulse Curves for Airblast Loaded Flat Slabs** ~ *Dr. Kent Goering, Michael Miraglia, Applied Research Associates, Inc.*
- 9:20 **Portable Pressure - Field Test Devices** ~ *Michael Dean, US Army Aberdeen Test Center, Christina Milazzo, Aberdeen Test Support Services*

Structural Response II

Chair: Dr. Reed Mosher, ERDC

Sandpiper CD

- 10:00 **Using Coupled Numerical Simulations to Study Blast Focusing** ~ *Dr. James O'Daniel, James Ray, US Army Engineer Research & Development Center*
- 10:20 **Ground Shock Loading on Concrete Slabs with Varying Edge Fixity** ~ *Jay Ehr Gott, Dr. Donald Cargile, Jon Windham, US Army Engineer Research & Development Center*
- 10:40 **Oblique Perforation Experiments of Urban Wall Materials in Urban Operations by Indirect Fire Munitions** ~ *Rayment Moxley, Dr. Donald Cargile, US Army Engineer Research & Development Center, Richard Summers, Robert Phillabaum II, US Army Research Laboratory*
- 11:00 **Numerical Simulation of Projectile Penetration Into Thick and Thin Slabs of SAM-35 Concrete** ~ *Erin Williams, Dr. Stephen Akers, Rayment Moxley, Paul Reed, US Army Engineer Research & Development Center*
- 11:20 **Measurement of Airblast from Carbon Composite Cased Munitions Containing Dense Inert Metal Explosive** ~ *Roosevelt Davis, Donald Cunard, Air Force Research Laboratories*

Track Six (LIMITED, Distribution Statement C)

Shock Loading

Chair: Ms. Dawn Barasso, Electric Boat

Sandpiper AB

- 8:00 **Determination of Deck Frequencies to Support Shock Isolator Design** ~ *Jerry Dwyer, Northrop Grumman Newport News*
- 8:20 **LPD-17 Pretrial Ship Shock Response Predictions: Preliminary Ship System Response** ~ *Jarema Didoszak, Jose Lepe, LCDR Laura Bollock, Dr. Young Shin, Naval Postgraduate School*
- 8:30 **LPD-17 Pretrial Ship Shock Response Predictions: Coupled Ship-Fluid Model Generation** ~ *Jarema Didoszak, LCDR Laura Bollock, Jose Lepe, Dr. Young Shin, Naval Postgraduate School*

Blast

Chair: Dr. James Baylot, ERDC, Co-Chair: Mr. Lebron Simmons, ERDC

Sandpiper AB

- 9:00 **Theoretical and Empirical Analysis of the Behavior of Electromagnetic Emissions from Cased Explosives** ~ *Mark Schmidt, Dr. William Brown, Tim Samaras, and William Broad, Applied Research Associates*
- 9:20 **Partial-City Air-blast Experiments and Comparison with Numerical Predictions** ~ *Dr. James Baylot, Byron Armstrong, Dennis Rickman, US Army Engineer Research & Development Center*
- 9:40 **Blast Load Predictions for Building Groups and Comparison with Test Data** ~ *Dr. Jihui Geng, Dr. Kelly Thomas, Baker Engineering and Risk Consultants, Inc., Dale Nebuda, US Army Corps of Engineers Protective Design Center*

- 10:40 **A Study of the Effects of Casing Material Properties on the Airblast From Cased Explosive Charges ~ Dr. Alan Ohrt, Air Force Research Laboratory, Dr. Seung Lee, Defense Threat Reduction Agency**
- 11:00 **Benefits to the Warfighter from DTRA Hard Target Defeat Air-Delivered Weapon Testing ~ Dr. Eric Rinehart, Dr. Robert Henny, DTRA Test Division, Robert Cilke, Jeffery Duray, Applied Research Associates**

Thursday Afternoon, November 3

Track One

Vibration Modeling

Chair: Dr. Mike Hale, RTTC

Coral Ballroom D

- 1:00 **Structural Response Limit Specifications for Product Models ~ Dr. Ronald Merritt, Naval Air Warfare Center**
- 1:20 **Free Vibration Analysis of a Rotating Double Tapered Timoshenko Beam by Dtm ~ Ozge Demiriozg, Prof Metin Orhan Kaya, Istanbul Technical University**
- 1:40 **Densification Using Deep Vibro Compaction of Highly Compressible Reclaimed Beach Sand Characterized by High Percentage of Shell and Carbonates ~ Prof Azm Al-Homoud, American University of Sharjah**
- 2:00 **Random Excitation of the Van der Pol Oscillator ~ Dr. Hans Gruenberger, Consultant**

Track Two

Analysis Results

Chair: Mr. Jay Ehrgott, ERDC

Emerald Ballroom A

- 1:00 **A Diagnostic Method for Predicting Maintenance Requirements in Rotating Equipment ~ Kevin Hunt, William Lindsay, Dofasco, Inc.**
- 1:20 **Soil Properties From Low-Velocity Probe Penetration ~ Dr. Jerome Johnson, US Army Engineer Research and Development Center, CRREL, Dr. Donald Cargile, Dr. Donald Smith, US Army Engineer Research & Development Center**
- 1:40 **Sensitivity Analysis of Shot Peening Parametes Using Numerical Model ~ Rengas Venkataraman, Dr. Abdalla Elbella, Sridevi Earmani, Bradley University**
- 2:00 **Use of Seismic Surface Measurements for Assessment of Ground Improvement at Reclaimed Land ~ Prof Azm Al-Homoud, American University of Sharjah**
- 2:20 **Testing and Modeling Of Small Substructures Of Equipment. An Exercise With A Screw Joint ~ Markku Juntunen, VTT, Dr. Kari Ojala, NOKIA**
- 2:40 **Evaluation of Injury Criteria for High Speed Planing Craft ~ Dr. Cameron Bass, University of Virginia, Dr. Ron Peterson, Naval Surface Warfare Center - Panama City, Adam Ziemba, Dr. Robert Salzar, University of Virginia**
- 3:00 **Injury Specification Strategy for Occupants in High-Speed Planning Craft ~ Dr. Cameron Bass, University of Virginia, Dr. Ron Peterson, Naval Surface Warfare Center - Panama City, Adam Ziemba, Dr. Robert Salzar, University of Virginia**

Track Three

Working Group 13 ~ ANSI Accredited Standards Committee S2

1:00 - 3:00 PM

Chair: Mr. Pete Loeffler, NSWCCD/UERD

Emerald Ballroom B

Join Working Group 13 of ANSI Accredited Standards Committee S2, Mechanical Vibration and Shock to review the current draft standard "Shock Test Requirements for Equipment in a Rugged Shock Environment." The goal of the working group is to write a standard that will be widely adopted by manufacturers of equipment used in rugged environments. All interested parties are invited to attend this open session to discuss the implementation and application of the standard.

Track Five (CLASSIFIED)

Vulnerability of Civil Infrastructure to Terrorist Threats

Chair: Dr. G. Will McMahon, ERDC, Co-Chair: Ms Yazmin Seda Sanabria, ERDC

Panama City

- 1:00 **Numerical Simulations of Navigation Lock (Lift) Gates Subject to Blast Loading ~ Dr. James O'Daniel, Enrique E. Matheu, US Army Engineer Research & Development Center**
- 1:20 **Risk Vulnerability Assessment of Navigation Lock Projects ~ Dr. Will McMahon, Yazmin Seda-Sanabria, US Army Engineer Research & Development Center**

- 1:40 **Numerical Study of a Suspension Bridge Tower Leg Subjected to a Large Close-in Detonation** ~ *Dr. James O'Daniel, James C. Ray, US Army Engineer Research & Development Center*
- 2:00 **Physical Vulnerability Assessment of Water Supply Systems** ~ *Dr. Will McMahon, US Army Engineer Research & Development Center*
- 2:20 **Embankment Dams Blast Research and Vulnerability Assessment Methodology** ~ *Todd Hill, U.S. Bureau of Reclamation*
- 2:40 **Simulations of Fixed Wheel and Radial Gate Response to Underwater Explosion using Fully-Coupled Hydrocode** ~ *Roger Ilamni, Jr., Michael Scherr, NSWCI/IHD, Larry Nuss, David Achterberg, Bureau of Reclamation*

Whipping

Chair: Dr. David Russell, Electric Boat

Panama City

- 3:20 **Shock Issues Associated with the Integration of the Multi-Mission Module (MMM) Into the VIRGINIA Class Submarines** ~ *Dawn Barrasso, Electric Boat Corporation*
- 3:40 **Evaluating Ship Structure Subjected to Whipping, Due to UNDEX, During the Design Process** ~ *Nicole Dudley, Northrop Grumman Newport News, Natale Nappi, N.S. Nappi Associates, Inc.*

Track Six (CLASSIFIED)

- 1:00 **Shipboard Shock Qualification of the MK54 Torpedo** ~ *Frank McNeilly Naval Undersea Warfare Center Division Newport*
- 1:20 **VIRGINIA Class Main Propulsion Unit and Ship Service Turbine Generator Qualification Shock Analyses:**

Shock Qualification

Chair: Mr. Joseph Venne, NSWCCD

Panama City

Procedure Overview ~ Lee Miller, Electric Boat Corporation

- 1:50 **Main Propulsion Unit and Ship Service Turbine Generator Qualification Shock Analyses** ~ *Jonathan Webster, Lee Miller, Electric Boat Corporation*
- 2:00 **Underwater Explosion Finite Element Analyses using ABAQUS Explicit in Support of the Low Cost Conformal Array Shock Qualification Effort** ~ *Brett Lussier, Naval Undersea Warfare Center Division Newport*
- 2:20 **UERG Tools Implementation of Principle Component Analysis and Application to UNDEX Barge Test Data from an Isolated Raft** ~ *Eric Luft, Paul Mantz, Naval Surface Warfare Center Carderock Division*

Shock Testing I

Chair: MS Rhonda Ingler, NSWCCD

Panama City

- 2:40 **Application of VIRGINIA COTS Lessons Learned to Future Ship Designs** ~ *Stephen Foltz, Electric Boat*
- 3:00 **UNDEX Testing of Representative Hull Structure for the General Dynamics Littoral Combat Ship** ~ *Dr. Paul Franklin, Eugene Miller, George Camp, Bath Iron Works*
- 3:20 **Overview of the Submersible UNDEX Test Vehicle (SUTV) Characterization Shock Test Series** ~ *Brian Lang, Rhonda Ingler, Jennifer Marr, NSWCCD/UERG*

Shock Testing II

Chair: Mr. James Howell III, NSWCCD

Panama City

- 3:40 **Encanistered Missile Perspective of WOX Calibration Test Results** ~ *Kenneth Lussky, BAE Systems Land & Armaments*
- 4:00 **Qualification of the WOX- Missile Shock Test Machine (WOX-MSTM) For Testing Standard Missile 3 in a MK21 Canister** ~ *Dr. Jon Yagla, Naval Surface Warfare Center*

SAVIAC Block Funding Organizations (FY-05)

Defense Threat Reduction Agency - FC
 Engineer Research & Development Center - GSL
 Engineer Research & Development Center - ITL
 Idaho National Labs
 Naval Surface Warfare Center/Carderock
 Naval Surface Warfare Center/Dahlgren

Naval Undersea Warfare Center - Division Keyport
 Sandia National Laboratories
 US Army Research Lab (Aberdeen)
 US Army Redstone Technical Test Center
 US Air Force Research Laboratory (Eglin AFB)

Tutorial Descriptions

Sunday, October 30

Theoretical Background and Best Practice Using DDAM

Mr. Tony Abbey

The course is aimed at engineers who are just starting to use the DDAM method, or existing users who need some guidance as to practical usage. The examples use NEiNastran, but the technique and ideas presented are generic. No background in dynamic analysis is required as the basics of modal analysis will be covered. Any theory will be based on a practical engineering approach. The course will look at the background to the DDAM method, considering the evolution of the technique and the current specification. The theoretical basis of the method will be covered from a practical engineering perspective with the use of simple examples to illustrate the various stages. Several example DDAM analysis will be carried out using NEiNastran DDAM solution to illustrate the process. Full interpretation of the results will be given with attention paid to understanding what are the design drivers in each case and what engineering judgements can be made from the data. Typical problems with DDAM analysis will be shown, traps to avoid and best practice. Finally a strategy for dealing with large models is presented. The need to reach a target Modal Effective mass and the potential for many hundreds of modes being required is critical issue in the Industry and is fully addressed. Attendees will be given a full set of notes including background modal analysis techniques.

Beyond the Shock Response Spectrum

Mr. David Smallwood

The method of Shock Response Spectra (SRS) is reviewed. The SRS is defined and the advantages and disadvantages are discussed. Temporal and spectral moments are then described that can be used independently to describe shock or used to supplement the SRS. Methods for synthesizing shocks that will match the SRS and the temporal moments are discussed. Implications of the uncertainty theorem when describing shocks are discussed. Several methods that can be used in place of the SRS to characterize shocks are then described. These include the method of least favorable response, wavelets, and the Karhunen-Loeve expansion.

UNDEX Analysis of Floating Structures

Mr. Fred Costanzo, Dr. Ray Daddazio

This tutorial starts off with an introduction of why the analysis of floating structures to underwater explosions (UNDEX) loadings is of interest. This is followed by a brief discussion of free-field UNDEX phenomena, followed a more detailed description of physics-based UNDEX simulation. Both coupled and decoupled fluid-structure interaction (FSI) problems will be discussed. Next, a discussion of strategies employed in simulating structural responses to UNDEX will be presented, starting with simple analytical tools, and progressing to more detailed finite element analysis strategies. Issues associated with energy dissipation, frequency ranges of interest, and validation through comparison with existing test data will be addressed. Finally, the highlights of this tutorial will be summarized, and where appropriate throughout each of the sections, example problems and lessons learned will be presented.

Dynamic Pressure Measurements for Munitions, Ordnance, and Other Testing: Part Science and Part Art

Dr. Patrick Walter

This tutorial first encompasses the physics of dynamic pressure transducers (i.e., how they work). Once the operating principals of these transducers are understood, they must be properly interfaced to the pressure environment they are intended to measure. Next, their output signal must be passed with fidelity through appropriate signal conditioning and cabling for recording. In harsh environments, other measurands (e.g., acceleration, strain, temperature, ionization products of a detonation, etc.) can also superpose as additive or multiplicative noise levels on the desired pressure signal. It must then be validated that the recorded signal contains only pressure information. If not, corrective action must be taken. Finally, checks must be performed on the resultant data to assure that it was not unknowingly constrained by the bandwidth of the recording system. At this point in time, the data can be certified as valid and representative of the desired physical phenomenon to be measured. This tutorial encompasses all of these topics.

DDAM using MSC.Software Tools

Mr. Barton 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 non-standard capabilities such as mode-by-mode output. This class will focus on using the new SOL 187 DDAM capability available since V2004, but will include all you need to know to use V2001 and earlier versions. It will also focus on using MSC.Patran as the pre-processor for DDAM SOL 187, but will include all the information one needs to run Nastran without Patran or any pre-processor. The class will cover the details of how the procedures work and what all the files mean as well as the basic run procedures. The goal of the class is to teach a user all they need to run DDAM with MSC.Nastran, and to understand the inputs and outputs we use in order to provide insight into the process instead of treating it like a black box.

Shock Response Spectrum - Uses & Abuses

Mr. Tim Edwards

The shock response spectrum (SRS) is by far the most widely used tool for analyzing shock data. Although quite useful, the SRS does have limitations. This tutorial will illustrate both the proper use and exploitation of the SRS. Both analysts and testers will find this tutorial useful. Topics will include: Definition of the shock response spectrum; Common SRS ordinates; SRS computation including the use of digital filters for SRS computation (the Smallwood algorithm); Specifying shock tests including the SRS envelopes and notches and Specifying levels of conservatism; Examples of un-conservative SRS test specifications including failure mechanisms in mechanical systems and misapplication of SRS to MDOF systems; SRS cheating including different waveform types used to achieve a specified SRS; the abuse of haversines; and using the SRS to inflate testing capability; and Alternative descriptions of shock.

Data Validation and Editing

Mr. 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 data, 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.

Productive DDAM Analysis Using ABAQUS

Dr. David Winkler

An effective approach to performing DDAM analysis is available using Version 6.5 of the ABAQUS linear and nonlinear FEA program. Developed as a free product called DDAM for ABAQUS, it allows DDAM-specific input through graphical and non-graphical user interfaces. Emphasis has been made on providing the Navy with ease-of-use, standardization of output results, and a high degree of automation. Many features have been incorporated to help enhance the productivity of any DDAM practitioner. For example, a closely spaced modes method has been included as an optional analysis procedure. As an add-on module that is separate from the core ABAQUS program, the application can be rapidly enhanced to meet special needs of the shock community. This tutorial will teach the proper usage of DDAM for ABAQUS and will highlight particular features and advantages of the capability as illustrated by examples. The material is suitable for both managers and analysts.

Basis of Elementary Shock Isolation System Design

Dr. D. Christopher Merrill, P.E.

Shock isolation system design is sometimes performed by persons that have not had the opportunity to design shock isolation systems for the various types of shock tests and inputs encountered in today's DOD environment. This short course is intended to provide a framework that the designer can use to direct a shock isolation design with minimum false starts. Explanations are provided for the basic engineering issues and terminology encountered in shock isolation system design problems. Possible selection criteria that the designer may encounter during design of a shock isolation system are identified. Two design examples are provided that demonstrate incompatibilities sometimes encountered. Finally, the basic steps of the design process algorithm are reviewed. This course is directed at the design or analytical professional that has limited experience with shock isolation system design or the design professional with major expertise in a specialized area of shock isolation that wants to investigate more global excitations (i.e. vehicular shock expert that is interested in parallels with marine or seismic shock).

ESS, HALT and HASS

Mr. Wayne Tustin

We will briefly examine the history of ESS, commencing in 1979 and updating to present HALT and HASS practices aimed at increasing reliability, mainly of electronics. We will mention temperature ramping but focus on random vibration. We will glance at multiple electrodynamic shakers as a very expensive way to get multiaxis vibration. Then focus on cheaper multiaxis pneumatic bangers - RS or repetitive shock set ups.

Introduction to Vibration Testing

Mr. 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 cited.

Monday, October 31

An Introduction to ABAQUS

Mr. Karl D'Souza

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.

Review of Structural Dynamics

Mr. Joel Leifer & Prof. Walter Pilkey

Description not available at time of printing.

Naval Shock Analysis and Design

Dr. 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.

The Measurement and Utilization of Valid Shock and Vibration Data

Dr. Patrick Walter

Significant focus is often provided to applying sophisticated analysis techniques to the data resulting from shock and vibration tests. However, inadequate focus is often provided to assuring that valid 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, the physics of piezoelectric and silicon based accelerometers, and motion characterization. For the experienced test technician or engineer it will provide additional insight into topics such as optimized measurement system design, accelerometer and measurement system calibration, accelerometer mounting effects, analog filtering, data validation, data utilization, and more. For the analyst or designer it will provide a series of simple observations and back of the envelope calculations that he/she can make on data to validate its credibility before using it in product design.

Non-Linear FE Analysis for Shock and Vibration

Mr. Tony Abbey

The course is aimed at engineers who are just starting to use nonlinear FE dynamic analysis with impacting surfaces to investigate shock and vibration, or existing users who need some guidance as to practical usage. The examples use NEiNastran, but the technique and ideas presented are generic. No background in dynamic analysis is required as the basics of modal analysis and non-linear transient analysis will be covered. Any theory will be based on a practical engineering approach. The course will look at the background to dynamic analysis using modal methods, linear transient and nonlinear transient analysis. Finally the use of contact surfaces to model accurate impulsive loads is covered. The theoretical basis of the method will be covered from a practical engineering perspective with the use of simple examples to illustrate the various stages. Practical guidelines on carrying out a prior modal survey, estimating time step size and impact duration prior to the transient analysis will be shown. Several example nonlinear analysis will be carried out using NEiNastran to illustrate the process. Full interpretation of the results will be given with attention paid to understanding what are the design drivers in each case and what engineering judgements can be made from the data. Typical problems with nonlinear analysis will be shown, traps to avoid and best practice. Finally a strategy for dealing with large models is presented. Model size and solution times are becoming ever larger, and the importance of reducing analysis and data extraction to practical limits is explored. Attendees will be given a full set of notes including background modal analysis techniques.

Shock and Vibration Analysis Using MATLAB

Prof. Kjell Ahlin

In recent years, systems for multichannel data acquisition of shock and vibration signals have become available at much lower cost than before. In the meantime, Matlab has become a leading software for engineering computations at universities as well as in industry. Matlab can be used as a very cost effective solution for the engineer who needs powerful software for analyzing shock and vibration data. The tutorial will give an overview of how Matlab can be used to analyze data from typical applications.

A Primer on Explosion Effects in the Air, Water, and Soil

Dr. Bob Welch

The effects of detonations from high explosives have unfortunately become a challenge for the civilian as well as the military community. This tutorial provides basic information about explosions for the practicing engineer. Blast effects phenomena

associated with explosions in air, water, and geologic media are described. Hopkinson scaling relations are discussed that dictate how explosion effects scale with charge size and distance. Simple equations are given that predict blast field parameters in water, air, and soil as a function of charge weight and range. Explosion-induced cratering phenomena in soil and rock are described and predictive graphs provided. Airblast reflection phenomena at rigid interfaces are covered and relationships that quantify the reflected waves as a function of incident pressure and incident angle are given. Airblast inside tunnels from high explosive detonations is discussed. The tutorial material is taken from unclassified Corps of Engineers technical manuals, classical literature and papers on the subject, and the author's research experience.

UNDEX and Acoustic Analysis with ABAQUS

Dr. Jeffrey 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 analyses, 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-structure 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 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 problems will be discussed.

Damping Analysis and Technology

Dr. Peter Torvik Mr. Ahid Nashif, Dr. Jack Henderson

Damping is first discussed as a material property, and such measures of material damping as the unit damping, the material loss factor and the complex modulus are introduced and discussed. The different classes of materials with high inherent damping properties are introduced and the characteristics of each are described. Damping is then discussed as a system property with such system level measures as the fraction of critical damping, the logarithmic decrement, the resonant amplification factor (quality factor), bandwidth, Nyquist plot, hysteresis area, and complex stiffness introduced. The limitations of each are discussed, and relationships between various measures are given. The relationship between material damping and system damping, the challenges in extracting material properties from the system response, and the influence of nonlinearities on the measurement of damping are also given. The critical role of damping in the reduction of vibratory amplitudes at resonance is emphasized.

Application Of The USA Code To Underwater Shock Problem

Dr. 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 USA (Underwater Shock Analysis) code for usage in design and analysis problems of submerged and semi-submerged structures in an explosive environment.

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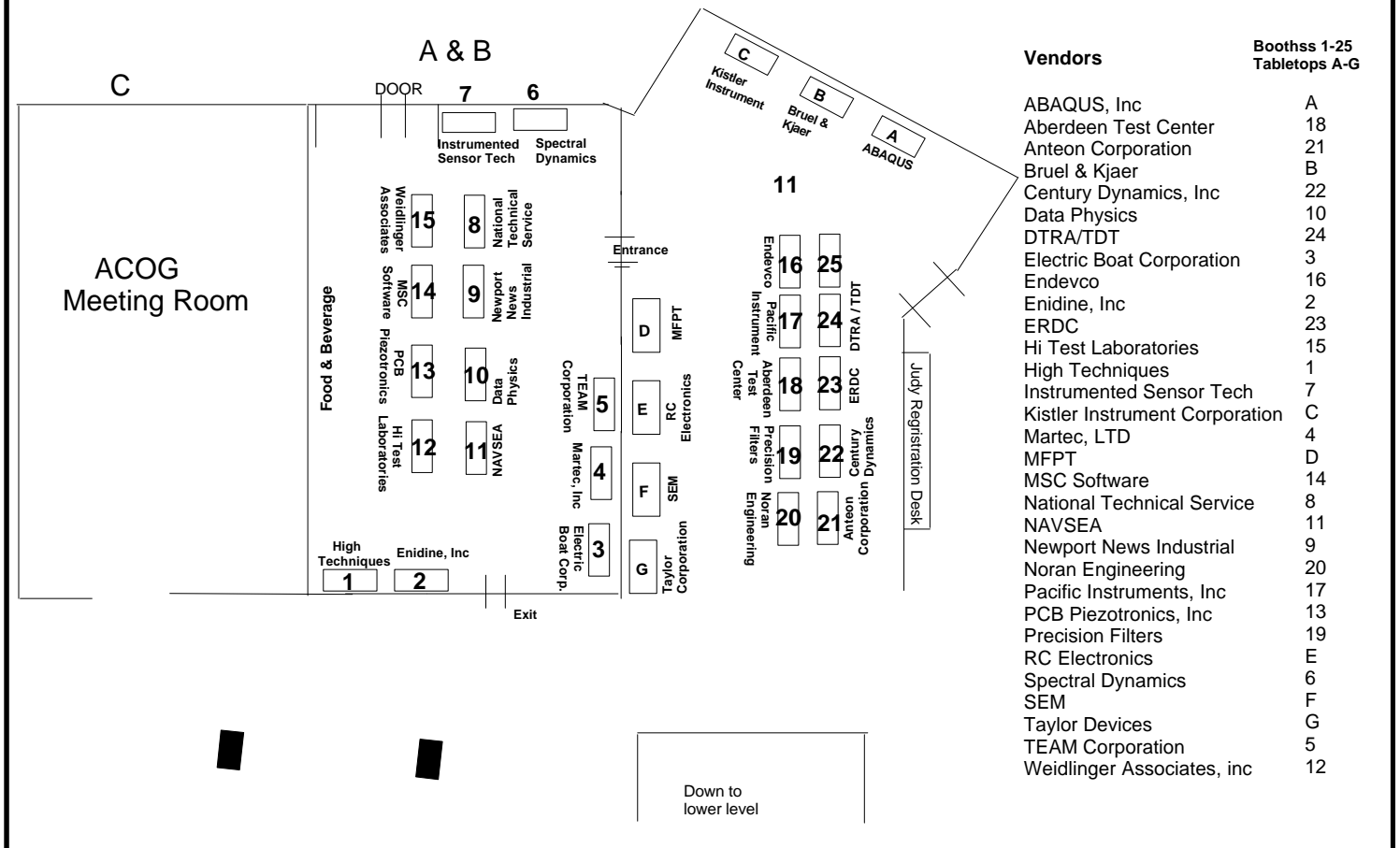
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76th S&V Symposium Exhibitors



Guest Program

Tuesday's program is a visit to Seaside. This award-winning 'new urbanism' town is home to many art galleries including Fired Up (paint your own pottery studio, handbuilding with clay, stained-glass mosaic, and fine silver workshops), Fusion Art Glass (award winning gallery representing over 200 of North America's finest glass artists), The L2 Gallery(original & collectible fine art), and Round Tree Gallery (Raku fired pottery, Horse Hair pottery and fine art paintings). There are also shopping opportunities and fine restaurants as well as the opportunity to stroll through a town built unencumbered by "traditional" zoning regulations. We will use the hotel's bus and you will be on your own for lunch (but we plan on selecting a couple of restaurants so we can dine together as a group) which will keep the cost low. A \$10.00 donation (which will be donated to the Red Cross to help the victims of Hurricane Katrina) will be solicited. Meet in the hotel lobby at 9:00 am and return at 4:00 pm.

Wednesday will be a trip to the Silver Sands Factory Stores. This complex, one mile west of the hotel, has over 100 of your favorite brand name stores. Shuttle buses run from the hotel every two hours starting at 10:00 am. Don't forget to stop by the Center Office at the outlets to get your complementary coupon book. There is no charge for this event and you can do it at your convenience or meet in the lobby at 9:45 am if you'd like to have company.

Thursday's program will be a visit to the "Serenity by the Sea" Spa at the hotel. This full service Spa, Salon & Fitness Center is billed as "the best kept secret of the Emerald Coast", but we've heard that its well known for its service and ambience. We've arranged for the Harmony Package, which includes a 30 minute Refresher facial, 30 minute Signature massage (customized for you), a regular manicure and \$10 gift certificate for the Spa Shoppe. After a hard week at the resort this will be just what the doctor ordered to help you face going home. The cost of this package is \$65. Meet in the hotel lobby at 10:00 am.



invites you to attend the

76th Shock & Vibration Symposium

October 29 - November 2, 2006

Hyatt Monterey Hotel
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featuring

Naval Undersea Warfare Center Division Keyport

(poc Gary Zook)

ABAQUS

(poc Jeff Cipolla)

Spectral Dynamics, Inc.

(poc Tony Keller)

important dates

Abstracts Due: June 1, 2006

Notification of Acceptance: July 14, 2006

Papers Due: October 6, 2006

for more information visit our web site, www.saviac.org

