85th Shock and Vibration Symposium

Reston, VA (D.C. Metro) | October 26-29, 2014

CONFERENCE PROGRAM

SAVE
SHOCK & VIBRATION
EXCHANGE

HI-TEST
Laboratories, Inc.

Introduction

Welcome to Reston and the 85th Shock and Vibration Symposium!

Since the first meeting in 1947, the Shock and Vibration Symposium has become the oldest continual forum dealing with the 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 now provides a valuable opportunity for the technical community in government, private industry, and academia to meet and discuss research, practices, developments, and other issues of mutual interest.

The symposium is presented by HI-TEST Laboratories and The Shock and Vibration Exchange. Our special event sponsors are:

Hosts of the Tuesday Night Social

NTS PCB PIEZOTRONICS HI-TEST Laboratories, Inc.

Host of the Internet Café

WEIDLINGER

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Sponsors of the 85th S&V Commemorative T-shirt

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85th Shock and Vibration Symposium Committee*

Mr. Ed Alexander (BAE Systems)
Dr. Joseph Ambrico (NUWC Newport)
Mr. James Breault (Lansmont Corp.)
Mr. Rick Coffman (Northrop Grumman Corp.)
Ms. Alicia D'Aurora (HII-NNS)
Mrs. Jenny Duty (HI-TEST Labs)
Mr. Bill Gregory (HI-TEST Labs)
Ms. Krista Harris (NAVSEA Carderock)
Mr. Kurt Hartsough (NAVSEA Philadelphia)
Mr. Thomas Julian (LFT&E/DOT&E)
Mr. Chris Key (HI-TEST Labs)
Mr. Bart McPheeters (NEi Software)
Dr. Tom Moyer (NAVSEA Carderock)
Mr. Drew Perkins (HI-TEST Labs)
Mr. Mike Poslusny (National Technical Systems)
Mr. John Przybysz (IDA)
Mr. Henry Pusey (HI-TEST Labs)
Mrs. Ashley Shumaker (HI-TEST Labs)
Mr. Ernie Staubs (Air Force Research Laboratory)
Ms. Margaret Tang (Weidlinger Assoc)
Mr. Bill Yancey (HI-TEST Labs)

**Only TAG Members in Attendance for Symposium Review Meeting (held August 7th at NAVSEA Carderock) are Listed.*

PROGRAM OVERVIEW / DAILY OUTLINE / TOC

INTERNET CAFE	
Room: Robert E. Simon Room	
HOSTED BY: WEIDLINGER	
Sunday, Oct 26	12PM—8PM
Monday, Oct 27	7AM—8PM
Tuesday, Oct 28	7AM—8PM
Wednesday, Oct 29	7AM—Noon

EXHIBIT HALL SCHEDULE (Exhibitors Listed on Page 24-31)		
Sunday, Oct 26	*Setup*	*Noon—7:00PM*
	Reception	7:00PM—8:00PM
Monday, Oct 27	Exhibit Hall Open	9:30AM—5:00PM
	Exhibitors' Luncheon	11:30AM—1:00PM
	Session Break—PM	3:00PM—3:40PM
Tuesday, Oct 28	Exhibit Hall Open	9:30AM—4:00PM
	Session Break—AM	9:40AM—10:00AM
	Luncheon	12:00PM—1:30PM
	Session Break—PM	3:10PM—4:00PM
	Dismantle	*4:00PM—7:00PM*
Wednesday, Oct 29	*Dismantle (cont.)*	*8:00AM—Noon*

REGISTRATION	
Room: Reston Suites A	
Sunday, Oct 26	9AM—6PM
Monday, Oct 27	7AM—6PM
Tuesday, Oct 28	7AM—6PM
Wednesday, Oct 29	7AM—NOON

FOOD & BEVERAGE EVENTS

All Symposium Attendees Welcome at All F&B Events
Guests Welcome at Sunday Welcome Reception & Tuesday Evening Social

Sunday, October 26

• Welcome Reception	7:00pm—8:00pm	Grand Ballroom (Exhibit Hall)

Monday, October 27

• Continental Breakfast	7:00am—8:00am	Grand Ballroom (Exhibit Hall)
• Exhibitors' Luncheon	11:30am—1:00pm	Grand Ballroom (Exhibit Hall)

Tuesday, October 28

• Continental Breakfast	7:00am—8:00am	Grand Ballroom (Exhibit Hall)
• Symposium Awards Luncheon	12:00pm—1:30pm	Grand Ballroom (Exhibit Hall)
• Symposium Social/Dinner	7:00pm—10:00pm	The Wolf Trap

Wednesday, October 29

• Continental Breakfast	7:00am—8:00am	Regency Ballroom Foyer

Welcome Reception

Sunday, Oct. 26 • 7:00pm—8:00pm • Grand Ballroom (Exhibit Hall)

Sponsored by: HI-TEST Laboratories, Inc.

Exhibitors' Luncheon w/ Keynote Speaker

Monday, Oct. 27 • 11:30am—1:00pm • Grand Ballroom (Exhibit Hall)

Sponsored by: 85th Shock & Vibration Symposium Exhibitors

Symposium Awards Luncheon w/ Keynote Speaker

Tuesday, Nov. 28 • 12:00—1:30pm • Grand Ballroom (Exhibit Hall)

WOLF TRAP
Foundation for the Performing Arts

Symposium Social/Dinner

Tuesday, Oct. 28 • 7:00pm—10:00pm

Sponsored by: NTS PCB PIEZOTRONICS HI-TEST Laboratories, Inc.

SUNDAY PM (OCTOBER 26)

TUTORIAL SESSION 1 / 12:00pm—3:00pm

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Shock Qualification Testing **Meeting Room: Lake Audubon**

Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia)
Mr. Michael Campbell (NAVSEA 05P1)

The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD-SSES) Code 669 is NAVSEA 05P1's Delegated Approval Authority (DAA) for MIL-S-901D Surface Ship Shock. As the DAA, Code 669 engineers are responsible for review and approval of all Government Furnished Equipment (GFE) and heavy-weight shock tested equipment. NSWCCD Code 669 will be presenting the requirements for shock qualification testing as detailed in MIL-S-901D and interpreted by NAVSEA 05P1. Shock testing theory, MIL-S-901D shock test devices and facilities, detailed specification requirements, cost avoidance and clarification and MIL-S-901D IC#2 will be covered. 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 & maintenance of shock hardened Navy ships and shock qualification test facilities.

Understanding Aliasing, FFT, Filtering, SRS & More for FEA Users and Test Engineers **Meeting Room: Lake Thoreau**

Dr. Ted Diehl (Bodie Technology)

Obtaining acceptable correlation between physical test data and transient simulations from explicit dynamics codes (LS-Dyna, Abaqus/Explicit, Radioss, DOE and DOD codes) is extremely challenging due to many factors. One aspect that is often underappreciated is the importance of properly using Digital Signal Processing (DSP) in the collection and processing of BOTH the test and simulation data. Users of explicit dynamics codes compute transient solutions with constantly varying time increments that typically contain significant "solution noise" in addition to the expected "frequency-rich" content created by severe impacts, shocks, failure, etc. The nature of the "solution noise" is completely different than measurement noise from physical testing. Additionally, simulation models are typically computed, for Courant stability reasons, with a mean solution sampling rate that is several orders of magnitude greater than sampling rates of typical shock test data. These facts and others such as aliasing (the #1 mistake made by the simulation community), numerical stability of DSP algorithms, and filter-induced distortions can make it very difficult to obtain correlation between simulations and tests. The best approach to achieve success is for both the simulation analyst and the test engineer to understand key concepts of DSP and how to apply them to mechanical engineering problems.

The 3-hour seminar covers highlights of DSP theory in the language of Mechanical Engineering pertinent to test engineers and FEA users along the presentation of numerous practical applications computed with a variety of software. This seminar introduces key aspects of working with transient data in both test and FEA settings – specifically, clearly explaining time-domain and frequency domain analysis (DFS, FFT, PSD); data collection (sampling, aliasing, up-sampling, decimation); filtering (lowpass, highpass, IIR, FIR, cascaded vs non-cascaded, numerical stability, and filter-induced distortions), calculating Shock Response Spectrum (SRS and PVSS) from transient data, and numerous unique aspects related to explicit dynamics FEA data (non-constant time increments, massively over-sampled data, short transient signals with non-zero end conditions, …).

UNDEX Physics and Target Response **Meeting Room: Lake Anne A**

Ms. Krista Harris, Dr. Bradley Klenow, & Dr. Thomas Moyer (NAVSEA Carderock)

This class will explore the physical processes invoked due to the detonation of an UNDerwater EXplosion (UNDEX), the dissemination of energy into the surrounding media, and the response of proximate floating targets. After thorough review of the physics and fundamental theory, methodologies for practical predictions of these phenomena will be discussed. Empirical, analytical and computational models will be introduced with emphasis on the strengths and limitations of their use and applicability to specific scenarios. Topics will include detonation physics, shock physics, cavitation phenomena, structural dynamics and fluid/structure interaction. Physical examples from UNDEX testing will be presented along with predictions of the phenomena demonstrated by the test data. The strengths and limitations of software available for prediction UNDEX phenomena will be discussed.

SUNDAY PM (OCTOBER 26)

TUTORIAL SESSION 2 / 4:00pm—7:00pm

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Shock Qualification Testing Extensions **Meeting Room: Lake Audubon**

Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia)
Mr. Michael Campbell (NAVSEA 05P1)

The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD SSES) Code 669 is NAVSEA 05P1's Delegated Approval Authority (DAA) for MIL-S-901D Surface Ship Shock. As the DAA, Code 669 engineers are responsible for review and approval of all Government Furnished Equipment (GFE) and heavyweight shock tested equipment. NSWCCD Codes 669 will be presenting the requirements for shock qualification extensions as detailed in MIL-S-901D and interpreted by NAVSEA 05P1. Shock extension specification requirements, MIL-S-901D design guidelines and shock design lessons learned will be covered. 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 & maintenance of shock hardened Navy ships and shock qualification test facilities.

Rainflow Cycle Counting for Random Vibration Fatigue Analysis **Meeting Room: Lake Thoreau**

Mr. Tom Irvine (Vibrationdata)

Students will learn the basics of the rainflow cycle counting method. The rainflow results can be fed into Miner's cumulative damage index (CDI). Examples will be given for a metallic structure and an electronics circuit board, where each system is subjected to a random vibration base input. Students will also receive software written in C/C++ & Matlab for making the rainflow calculation.

Beyond the Shock Response Spectrum **Meeting Room: Lake Anne A**

Mr. David Smallwood (Consultant)

In practice shocks are often quite complicated oscillatory time histories with a large random component. By far the most common method for the characterization of shocks is the shock response spectrum (SRS). The SRS was developed to reduce the complexity to a simple measure, that is, the peak response of a single-degree-of-freedom system to the shock. One of the serious limitations of the SRS is that all temporal information is lost. Several attempts have been make to reduce this limitation by specifying the duration of the shock. However the definition of the "duration" for a complicated shock has not been consistent. Temporal moments provide a consistent framework to define the duration and other moments. Fourier spectra can also be used to characterize shock, but again all temporal information is lost. The most general way to characterize a shock with a large random component is with a time varying spectral density. However, we frequently have insufficient information to estimate this spectrum. Bandlimited temporal moments can help bridge this gap.

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. Using the product model, a connection between the uncertainty parameter and the variance in the energy estimates will be established. For a shock with a given rms duration, defined by the temporal moments, the uncertainty theorem limits the frequency resolution, as defined by the rms bandwidth. 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 SRS, or used to supplement the SRS of a shock.

Generation and Use of Parametric Models in the Characterization of Dynamic Loads **Meeting Room: Lake Anne B**

Mr. Zeev Sherf (RAFAEL)

1. Parametric modeling of random time series –Principles
2. Parametric modeling based spectrum analysis
3. Parametric modeling of stationary vibrations in airborne stores –straight captive flight
4. Parametric modeling of non stationary vibration in airborne stores (buffet vibration)
5. Parametric modeling of vibration in tracked vehicles
6. Parametric modeling of system's transfer functions
   6.1 Mechanical
   6.2 Thermal
7. Parametric modeling in modal analysis

Welcome Reception

Sunday, Oct. 26 • 7:00pm—8:00pm • Grand Ballroom (Exhibit Hall)

Sponsored by:

HI-TEST Laboratories, Inc.

MONDAY AM (OCTOBER 27)

TUTORIAL SESSION 3 / 8:00am—11:00am

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Subsidiary Component Shock Testing & Alternate Test Vehicles **Meeting Room: Lake Audubon**

Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia)
Mr. Michael Campbell (NAVSEA 05P1)

The MIL-S-901D Subsidiary Component Shock Testing and Alternate Test Vehicles course will cover the following areas: NAVSEA 05P1's current policy for testing subsidiary components, description of test environment requirements, examples of recent successful test programs, alternate test vehicle descriptions, alternate test vehicle limitations, discussions on shock spectra, Multi-Variable Data Reduction (MDR) and various shock isolation systems. This course is intended to give the necessary information to equipment designers and program managers who intend to shock qualify COTS equipment that will require frequent upgrades due to obsolescence, equipment upgrades, change in mission, etc. Although not required, it is recommended that those attending this course also attend courses on Shock Policy, MIL-S-901D Testing and particularly MIL-S-901D Extensions offered by the same instructors (Urzillo and Kurt Hartsough).

Nonstationary Random Vibration **Meeting Room: Lake Thoreau**

Dr. Thomas Paez (Thomas Paez Consulting)

All real random sources are nonstationary, yet, because the stationary representation is well-understood, it is used (and over-used) for applications where a nonstationary model would yield superior accuracy. There are multiple mathematical frameworks for modeling nonstationary random sources. Among them are Priestley's spectral model and its approximate version, the product model, and (2) the Karhunen-Loeve expansion.

This tutorial, first, reviews some fundamentals of probability and random process theories, including several examples. In the process, a formula for generating realizations from a stationary random process is developed. This signal generation formula is generalized to develop the spectral representation of stationary random processes. The stationary representation is further generalized to obtain Priestley's spectral representation for nonstationary random processes. Several examples are presented.

A completely different nonstationary random process representation is embodied in the Karhunen-Loeve expansion (KLE). This representation is developed using eigenvalue expansion of the covariance matrix of a random process. The random process representation is developed and examples of its use are presented. Expressions for linear structural responses to nonstationary random process excitations are developed in both the Priestley and KLE frameworks. Examples of their use are provided. MATLAB files to perform the computations leading to the examples in the tutorial will be provided to attendees.

Shock Response Spectra & Time History Synthesis **Meeting Room: Regency BR A**

Mr. Tom Irvine (Vibrationdata)

Students will receive basic instruction in calculating shock response spectra for time histories and for synthesizing time histories to meet shock response spectra specifications. The synthesis is performed using wavelets and damped sine functions. Students will receive software programs in both C/C++ & Matlab for making these calculations, as well as accompanying pdf files with formulas.

Analysis for a Floating Shock Platform **Meeting Room: Regency BR B**

Mr. Calvin Milam (National Technical Systems) & Mr. Bart McPheeters (Autodesk)

While FSP tests are essentially the bottom line for a shock qualification, a lot of analysis often goes into the mix before the test. The reasons for this are many: The equipment manufacturer wants his/her equipment to pass and will often commission some kind of pre-test prediction to assure success or highlight design problems. Tested equipment usually requires some kind of interface foundation or test fixture to attach it to the FSP, and this structure is designed to simulate the shipboard installation. Finally, items on the deck simulator fixture (DSF) must be examined to assure that the tested environment is correct. This tutorial will describe the types of analysis that can be preformed pre-test to assure a successful test, including discussions of when each is appropriate, necessary or unneeded. Examples will be presented that illustrate different types of analyses that have been done and how the test compared to the pre-test analysis.

9:00-10:00	**IEST Committee Meeting DTE-022; MIMO Recommended Practice Committee** **Meeting Room: Reston Suites B** Chair: Dr. Marcos Underwood (Tu'Tuli Enterprises) Using more than one shaker to test large or unusually shaped objects is becoming an accepted part of the vibration testing industry. 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. Come get up to speed and contribute to our growing database on multi shaker concepts, fixturing, control, and reporting.

General Session 1 & Exhibitors' Luncheon

Monday, Oct. 27 • 11:30am—1:00pm • Grand Ballroom (Exhibit Hall)

Sponsored by: 85th Shock & Vibration Symposium Exhibitors

12:15pm—12:45pm • KEYNOTE LECTURE • MR. TED HONTZ (former CO of the USS Princeton)

MONDAY PM (OCTOBER 27)

	SESSION 1 UNDEX Analysis (1:00pm-3:00pm / Unlimited Dist. A) Chair(s): Ms. Krista Harris (NAVSEA Carderock) Dr. Jonathan Arata (Dassault Systemes Simulia)	SESSION 2 Blast: Numerical Methods (1:20pm-3:00pm / Unlimited Dist. A) Chair(s): Dr. Len Schwer (Schwer Engineering)	SESSION 3 Shock Response Spectra (SRS), Pseudo-Velocity Shock Spectrum (PVSS), & Power Spectral Density (PSD) (1:00pm-3:00pm / Unlimited Dist. A) Chair(s): Dr. Ted Diehl (Bodie Technology, Inc.) Mr. Robert Sharp (Barry Controls)
	All Presenters and Chairs (for Oct 27) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	*Meeting Room: Regency Ballroom B*	*Meeting Room: Lake Audubon*
1:00	**UNDEX Benchmark of Abaqus/Explicit-CEL** *(1)* Dr. Jonathan Arata (Dassault Systemes Simulia Corp.)		**Why Pseudo-Velocity Works (and It's Not What You've Been Told)** *(5)* Dr. David Manko (Sandia National Laboratories)
1:20	**Study of Wall Compliance on Pressure Loading due to bubble Collapse and Jetting** *(1)* Dr. Chao-Tsung Hsiao, Dr. Georges Chahine, & Dr. Anil Kapahi (Dynaflow, Inc.)	**Assessment of the "Blind Blast Simulation Contest" as a Validation Exercise** *(3)* Dr. Len Schwer (Schwer Engineering & Consulting Services)	**Using Shock Response Spectra Methods (SRS & PVSS) to Enhance Explicit Dynamics FEA Simulations** *(5)* Dr. Ted Diehl (Bodie Technology, Inc.)
1:40	**Shock Wave Propagation in Heterogeneous Material** *(1)* Dr. Anil Kapahi , Dr. Chao-Tsung Hsiao, & Dr. Georges Chahine, & (Dynaflow, Inc.)	**ABNC2 - A Fast-running Code for Predicting Blast Loads from Near-contact Explosions** *(4)* Dr. C.K.B. Lee, D. Rubin, & N. Nguyen (Weidlinger Associates)	
2:00	**Damping Characteristics and Their Effects on the Whipping Response of a Surface Ship Subjected to an Underwater Explosion** *(2)* Mr. Haikun Wang & Dr. Jianhu Liu (China Ship Scientific research Center)		**Using the PVSS to Evaluate Connector Shock Damage Potential During Testing** *(6)* Mr. Alex Hardt (Orbital Sciences)
2:20	**Investigations on the Reloading Effect of the Local Cavitation of Double-Plates Structure Filled with Liquid under UNDEX** *(2)* Dr. Jian-hu Liu & Mr. Guo-zhen Liu (China Ship Scientific research Center)	**Verification of Shock Analysis using RADIOSS** *(4)* Mr. Carlos de Lima (Altair)	**Synthesis of an SRS Compatible Transient Acceleration Pulse using Design of Experiments for Identification of Significant Factors Based on Simple 3 DOF Models' Response** *(6)* Mr. Ed Alexander (BAE Systems, Minneapolis)
2:40	**Investigation on Shock Characteristics of Marine Propulsion Shaft** *(3)* Mr. Bo Yan & Dr. Jian-hu Liu (China Ship Scientific research Center)	**Study for Shock Response Evaluation Of Blast Hardened Bulkhead In The Design Of Naval Combatants** *(4)* Dr. Jeong-Il Kwon &Dr. Jung-Hoon, Chung (Korea Institute of Machinery & Materials), Mr. In-Ho, Jang (Daewoo Shipbuilding & Marine Engineering Co., Ltd)	**Fatigue Life Estimation: A Comparison of Rainflow Cycle Counting, the Dirlik Solution, and a Narrow Band Solution** *(7)* Mr. Michael Levy (BAE Systems, Minneapolis)

(##) = Corresponding Page Number in Abstract Book

MONDAY PM (OCTOBER 27)

	TRAINING	TRAINING	USERS GROUP
	Introduction to MIL-S-901D Heavyweight Shock Testing (1:00pm-3:00pm / Unlimited Dist. A)	Understanding Filter Performance (1:00pm-2:00pm / Unlimited Dist. A) Guidance for Filter Selection for Dynamic Structural Measurements (2:00pm-3:00pm / Unlimited Dist. A)	Xcitex Users Group (1:00pm-2:00pm / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 27) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Reston Suites B	***Meeting Room: Lake Thoreau***	***Meeting Room: Living Room***
1:00	**Introduction to MIL-S-901D Heavyweight Shock Testing** Mr. Travis Kerr & Mr. Braden O'Meara (HI-TEST Laboratories) This training will cover the necessary background information relative to heavyweight shock testing. This session is intended for engineers and product developers who are unfamiliar with the heavyweight shock testing process. Subjects covered include pre-test planning, procedure preparation, fixture design, test set-up, test operations, instrumentation interpretation, and reporting. Construction and use of the floating shock platforms (FSP, IFSP, and LFSP) will be covered. MIL-S-901D test requirements applicable to heavyweight shock testing will be discussed.	**Understanding Filter Performance** Dr. Patrick Walter (PCB Piezotronics / TCU) This course portion provides a common vocabulary for describing filters, illustrates the common filter types and their design, and focuses on the individual effects on data of amplitude deviation from flatness and phase deviation from linearity, which occurs in all analog filters.	**Xcitex's ProAnalyst User Group** Mr. Peter Carellas (Xcitex) The Xcitex's ProAnalyst User Group Meeting is where we gather our current and future users of ProAnalyst motion analysis software to discuss features, applications and usage techniques. Xcitex engineers will be on-hand, in an informal interactive setting, to review and present new developments in ProAnalyst. Feel free to bring your videos for review.
2:00		**Guidance for Filter Selection for Dynamic Structural Measurements** Dr. Patrick Walter (PCB Piezotronics / TCU) This course portion provides a handbook for selection of the more common analog filter types where instrumentation designers can quickly and easily match filter types/orders and data sampling rates. Examples are provided.	

MONDAY PM (OCTOBER 27)

ICE CREAM SOCIAL

3:00-3:40 in Exhibit Hall

	SESSION 4	SESSION 5	SESSION 6
	UNDEX Testing (3:40pm-5:20pm / Unlimited Dist. A) Chair(s): Mr. Rick Coffman (Northrop Grumman Corp.)	Blast: Numerical Methods & Testing (3:40pm-5:40pm / Unlimited Dist. A) Chair(s): Mr. Jim Breault (Lansmont Corp.)	DS: Computational Modeling & Experimental Testing of Electronic Components under Mechanical Shock (3:40-5:40 / Limited Dist. C) Chair(s): Dr. Janet Wolfson (Air Force Research Laboratory) Dr. Jennifer Cordes (ARDEC)
	All Presenters and Chairs (for Oct 27) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	*Meeting Room: Regency Ballroom B*	*Meeting Room: Lake Audubon*
3:40	**Effects of Polyurea Coatings on the UNDEX Response of Composite Plates: Experiments and Computational Simulations** *(7)* Dr. James LeBlanc (NUWC Newport), Dr. Arun Shukla (University of Rhode Island)	**Blast Distribution from Large Buried Charges** *(8)* Mr. James Eridon, Mr. Tom Zeleznik, & Mr. Alex Boglaev (General Dynamics Land Systems)	**Computational Round Robin on Components under Shock** *(11)* Dr. Janet Wolfson (AFRL/RWMF)
4:00	**Experimental and Numerical Investigation of Underwater Explosion Load Characteristics in Spherical Pressure Vessel** *(7)* Mr. Zhou Zhangtao, Mr. Hao Yi, & Mr. Wang Jun (China Ship Scientific Research Center)	**Numerical Modeling of Conventional Construction Response to Secondary Debris from Accidental Explosions** *(9)* Dr. Michael Oesterle & Mr. Robert Conway (Naval Facilities Engineering Service Center)	**Modeling and Simulation of Potted Electronics with Different Solder Materials** *(12)* Dr. Jennifer Cordes, Dr. Aisha Haynes, and Dr. Lyonel Reinhardt (ARDEC)
4:20		**Prediction of Load During Accidental Explosions Based on Damage Indicators using Multi Degree of Freedom Approach** *(9)* Mr. David Holgado, Mr. Ben Harrison, & Mr. Johnny Waclawczyk (ABS Consulting)	**Combined Electrical and Mechanical Response of Conductive Polymers** *(12)* Dr. Jason Foley & Mr. Christopher Stilson (AFRL/RWMF), Dr. Genggang Chen, Dr. Sabyasachi Ganguli, & Dr. Ajit Roy (AFRL/RXAN)
4:40	**3D Dynamic Deformation Measurements on a Floating Structure Loaded by an Underwater Explosion** *(8)* Dr. Julian Lee & Mr. Daniel Roseveare (Defence R&D Canada Suffield), Mr. Malcolm Smith (Defence R&D Canada Atlantic)	**Shadowgraph Visualization of Shock and Vortex Interaction with Flame** *(10)* Mr. Paul Giannuzzi (Energetic Materials Research and Testing Center)	**Characterization of G-Switches for Target Detection** *(12)* Dr. Jeff Hill & Dr. Scott McEntire (Sandia National Laboratories)
5:00	**Investigation into the Sensing Characteristics of Sensitive Elements for Underwater Explosion Pressure Measurement** *(8)* Mr. Xianpi Zhang, Mr. Jianqiang Pan, & Dr. Jianhu Liu (China Ship Scientific Research Center)	**Development of a Scaled Shallow-Buried Near-Field Blast Load Test Rig** *(10)* Mr. John Reinecke & Dr. Izak Snyman (Council for Scientific and Industrial Research), Prof. Ian Horsfal (Cranfield University)	**The Development of Embedded Sensing Methods in Polymeric Composite Media** *(13)* Dr. Jacob Dodson & Dr. Janet Wolfson (AFRL/RWMF), Mr. Jonathan Hong & Dr. Alain Beliveau (Applied Research Associates)
5:20		**Determination of Conventional Hollow Metal Doors Resistance to Shock Loading with Dynamic Testing and FEA Modeling** *(11)* Mr. Christopher Hurd, Mr. Jerry Collinsworth, & Mr. Matthew Kreamer (ABS Consulting Inc.)	**Pyroshock Reverse Ballistics for the Measurement of the Embedded Mechanical Response of Explosive Fill** *(13)* Dr. Jacob Dodson & Dr. Janet Wolfson (AFRL/RWMF), Mr. Jonathan Hong & Dr. Alain Beliveau (Applied Research Associates)

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MONDAY PM (OCTOBER 27)

	TRAINING	TRAINING
	MIL-S-901D Cost Avoidance and Clarification Letters - Explained (3:40pm-6:30pm / Unlimited Dist. A)	DDAM Analysis using HyperWorks as a Solver Independent Interface (3:40pm-4:40pm / Unlimited Dist. A) Optimization of Ship Structure to Minimize Vibration Effects (4:40pm-5:40pm / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 27) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading	
	Meeting Room: Reston Suites B	***Meeting Room: Lake Thoreau***
3:40	**MIL-S-901D Cost Avoidance and Clarification Letters—Explained** Mr. Kurt Hartsough, Mr. Domenic Urzillo, & Mr. Jack Pezza (NAVSEA Philadelphia), Mr. Michael Campbell (NAVSEA 05P1) In November of 2012, NAVSEA 05P1, the Shock Technical Warrant, issued three MIL-S-901D Cost Avoidance and Clarification letters. The intent of these letters was to clarify areas of MIL-S-901D, reduce the occurrence of repeat testing and normalize the amount of testing required for Lightweight, Medium Weight and Floating Shock Platform testing. This tutorial will provide an opportunity to discuss specific situations related to shock qualification testing with NAVSEA 05P1's Delegated Approval Authorities for Surface Ships and Submarines. Areas covered include: updated and new definitions, reduce shock test schedules, shock isolation, use of standard and non-standard fixtures, reduced hammer blows, reduced multiple operating mode requirements, reduced retesting, Shock Response Frequency (SRF) and more.	**DDAM Analysis using HyperWorks as a Solver Independent Interface** Mr. Daniel Pusey (Altair) DDAM has long been an integral part of the shock verification process for shipyards and the NAVY. Several COTS finite analysis solvers provide DDAM solution capabilities. Unfortunately, there hasn't been a uniform interface that supports all of these solvers. This has required analysts to learn multiple tools in order to perform this type of analysis or, dedicate time and resources to develop an additional tool that allows the data generated from various solvers to be brought into a single, home-grown interface. Most of the DDAM interfaces were created several years ago with limited development since their original implementation. The lack of ongoing development has left analysts to develop alternative methods to report and illustrate the detailed inputs and results from their DDAM analysis work. Integrating the open architecture inherent in HyperMesh and the interfaces with multiple COTS solvers, provides a single source ideal for DDAM analysis set-up regardless of what software was used to create your model or what solver you want to use to provide your DDAM results. This integrated interface was developed with extensive input from several shipyards with the sole purpose of expediting the process of running a DDAM analysis in an easy to use interface regardless of the solver. The authors will present details of the new, solver independent, DDAM interface in HyperMesh, including a demonstration of the interface. There will also be a discussion of the plans for future enhancements. Attendees will be encouraged to provide feedback and ask questions regarding the interface.
4:40		**Optimization of Ship Structure to Minimize Vibration Effects** Mr. Daniel Pusey (Altair) Creation of ship structure is based heavily on existing rules and requirements. Often additional structure needs to be added or removed to meet fabrication or space requirements as components are added to the vessel. These components, and the changes made to the structure to account for them, will change the structural characteristics of the area in which they are located. While material can always be added or removed from an area to increase strength, reduce weight, or provide space, such changes can have a profound effect or the ability to meet design criteria to avoid certain natural frequencies or other vibration/spectrum effects. Employing a multi-disciplinary optimization tool, users can specify multiple design criteria and determine the ideal placement of structure to meet their design constraints including vibration and frequency response. This session will illustrate, in detail, the process used to determine the optimal placement of structure in a ship hull to meet specified design criteria. A COTS solution, Altair's OptiStruct, will be used to illustrate the effects of optimizing vessel design based on defined criteria, such as vibration, frequency response, or structural loading. It will also illustrate how implementing optimization studies can take the guesswork out of the design process and giving engineers a way to quickly and efficiently place structural reinforcements.

TUESDAY AM (OCTOBER 28)

	SESSION 7 Vibration: Case Studies (8:00am-9:40am / Unlimited Dist. A) Chair(s): Mr. Tony Keller (Spectral Dynamics)	SESSION 8 Instrumentation: Methodology (8:20am-9:40am / Unlimited Dist. A) Chair(s): Mr. Robert Sill (PCB Piezotronics)	SESSION 9 Implosion (8:00am-8:40am / Limited Dist. C) Implosion (9:00am-9:20am / Unlimited Dist. A) Chair(s): Dr. Emily Guzas (NUWC Newport)
	All Presenters and Chairs (for Oct 28) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	***Meeting Room: Regency Ballroom B***	***Meeting Room: Lake Audubon***
8:00	**Highly Damped, Sinusoidal Long Fiber Composite Material Evaluation** ***(13)*** Mr. Troy J. Skousen, Mr. Randall L. Mayes, & Mr. Peter G. Stromberg (Sandia National Laboratories)		**Implosion of Composite Cylinders** ***(17)*** Ms. Erin Gauch (NUWC Newport), Mr. Michael Pinto (University of Rhode Island)
8:20	**Aspects in the Analysis and Simulation of Vibrations Measured During a Road Test** ***(14)*** Mr. Zeev Sherf (Consultant), Mr. A. Katz & Mr. Y. Trachtman (RAFAEL)	**Innovative Portable Tool to Measure Shock and Vibration** ***(15)*** Mr. Stephen Hanly (Midé Technology)	**Computational Modeling of Shock Initiated Implosion of a Tube within a Closed Tube** ***(17)*** Dr. Emily Guzas & Dr. James LeBlanc (NUWC Newport), Mr. Sachin Gupta & Dr. Arun Shukla (University of Rhode Island)
8:40	**A Revised Algorithm for Minimum Input Trace to a Multiple-input/Multiple-output System (MIMO) to Match the Output Auto-spectral Densities** ***(14)*** Mr. David Smallwood (Consultant)	**Down Selection of an Accelerometer for Near-field Pyroshock Measurement** ***(15)*** Mr. Brian Solomon, Mr. Roque Salas, Mr. Brad Allred, & Mr. Richard Ott (ATK)	
9:00	**State of the Art Large Vibration Test System for Testing the James Webb Space Telescope** ***(14)*** Mr. Joel Hoksbergen & Mr. Doug Lund (Team Corporation), Mr. Brian Ross & Mr. Eric Johnson (NASA Goddard Space Flight Center)	**Testing of the Endevco® 7270A and 7280A High g Shock Accelerometers to the New MIL-STD-810G, Change 1 Calibration Requirements** ***(16)*** Mr. Randy Martin (Meggitt Sensing Systems), Dr. Vesta Bateman (Mechanical Shock Consulting)	**Implosion of a Tube within A Closed Tube: Experiments and Computational Simulations** ***(18)*** Dr. James LeBlanc (NUWC Newport), Mr. Sachin Gupta & Dr. Arun Shukla (University of Rhode Island)
9:20	**Applications of Coherent Output Power (COP) to Multi-Shaker MIMO Testing** ***(15)*** Dr. Marcos Underwood (Tu'Tuli Enterprises), Mr. Tony Keller (Spectral Dynamics Corporation)	**MIL-STD-810G, Change 1 Calibration of PCB® Series 350 Mechanically Isolated and Electrically Filtered High-g ICP® Shock Accelerometers** ***(16)*** Mr. Robert Sill & Mr. Bob Metz (PCB Aerospace & Defense)	

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TUESDAY AM (OCTOBER 28)

	TRAINING MIL-S-901D Engineering Topics (8:00am-11:00am / Unlimited Dist. A)	TRAINING Introduction to Finite Element Analysis (8:00am-9:30am / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 28) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading	
	Meeting Room: Reston Suites B	***Meeting Room: Lake Thoreau***
8:00	**MIL-S-901D Engineering Topics** Mr. Domenic Urzillo (NAVSEA Philadelphia) MIL-S-901D Engineering topics is a follow-on course to the MIL-S-901D Test and Extension training courses and is aimed at providing the NAVSEA acquisition and engineering communities with a more in-depth review of engineering mathematics routinely used in equipment shock qualification. Topics covered include shock spectrum as it relates to MIL-S -901D testing, digital data filtering, shock response frequency, shock test fixture design fundamentals and FSP deck simulation fixtures.	**Introduction to Finite Element Analysis** Mr. Bart McPheeters (NEi Software) This class will focus on the practical aspects of finite element theory and modeling techniques. We will work through a few examples to demonstrate the application of theory and examine some of the implications of using it. We will conclude with a section on practical modeling tips for a diverse array of problems, including choosing elements, modeling approaches. We will discuss some of the issues with stiffened shells, bolts, resilient mounts, and rigid representations and the pros and cons of different approaches. Finally, the tutorial will examine result post processing and some of the common issues that come up in that area.
9:00		

TUESDAY AM (OCTOBER 28)

	SESSION 10 Vibration: Numerical Methods (10:00am-11:40am / Unlimited Dist. A) Chair(s): Mr. David Wood (Northrop Grumman) Dr. Thomas Paez (Thomas Paez Consulting)	SESSION 11 Numerical Methods for Navy Structures (10:00am-11:00am / Limited Dist. C) (11:00am-Noon / Unlimited Dist. A) Chair(s): Mr. Daniel Pusey (Altair)	SESSION 12 DS: Navy Enhanced Sierra Mechanics (10:00am-Noon / Limited Dist. C) Chair(s): Dr. Thomas Moyer (NAVSEA Carderock)
	All Presenters and Chairs (for Oct 28) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	*Meeting Room: Regency Ballroom B*	*Meeting Room: Lake Audubon*
10:00	**Signal Analysis and Modeling** ***(18)*** Dr. Thomas Paez (Thomas Paez Consulting)	**Cohesive Zone for Prediction of Ductile Fracture of Aluminum Welds** ***(20)*** Dr. Pawel Woelke & Dr. Badri Hiriyur (Weidlinger Associates), Dr. J.W. Hutchinson (Harvard University), Dr. Ken Nahshon (NAVSEA Carderock)	**A Numerical Approach to Understanding Close-In UNDEX Events** ***(22)*** Mr. Jeff L. Adelman & Mr. C. J. Joseph (Huntington Ingalls Industries)
10:20	**Damage Index Sensitivity to Cycle Counting Methods in Random Excitation** ***(19)*** Dr. Vit Babuška & Dr. Troy Savoie (Sandia National Laboratories)	**Human Injury and Treatment Predictions In the Presence of Shock and Blast Loadings** ***(21)*** Dr. Ryan Lowe (Applied Research Associates), Dr. Timothy Walilko & Ms. Lee Ann Young (Air Force Research Laboratory), Dr. William Krebs (Office of Naval Research)	**NESM Scalability Studies Using Fully Coupled Fluid-Structure Interaction Analysis On A Submerged Cylinder** ***(23)*** Mr. Matthew Davis, Dr. Kuangcheng Wu, & Mr. Rick Griffen (Newport News Shipbuilding)
10:40	**Steady State Response of Pipes with Various End Supports and Geometric Imperfections** ***(19)*** Dr. Rudolph J Scavuzzo (Consultant), Mr. Domenic Urzillo (NAVSEA Philadelphia)	**Modification of DDAM For Thin Sheet Structures** ***(21)*** Mr. Rick Griffen (HII-NNS)	**Underwater Explosion Effects Study of the Hunley Confederate Submarine** ***(23)*** Dr. Ken Nahshon, Ms. Jamie Cruce, & Ms. Krista Harris (NAVSEA Carderock)
11:00	**Study of Tools for Health Assessment and Prognosis in Mechanical Systems and Structures during Service and Laboratory Vibration Testing, using Vibro– Acoustic Parameters** ***(19)*** Mr. Zeev Sherf (Consultant), Mr. Arie Elka & Mr. Philip Hopstone (RAFAEL)	**Optimal Design of Shipborne Equipment Foundations Subject to UNDEX Shock Loads** ***(21)*** Mr. Roope Kotiranta & Ms. Kirsi Partiala (Surma Ltd.)	**Uncertainty Quantification Studies in NESM and Full-Scale Test Planning and Evaluation** ***(23)*** Mr. Adam Hapij, Mr. Ryan Anderson, Ms. Margaret Tang, & Dr. Raymond Daddazio (Weidlinger Associates)
11:20	**Generation and use of Airborne Stores Vibration Signatures Library Based on Parametric Models** ***(20)*** Mr. Zeev Sherf (Consultant), Mr. Arie Elka & Mr. Philip Hopstone (RAFAEL)	**Influence of Fluid-Filled Tanks on Tank Top Stress Distribution when Subject to an UNDEX Event** ***(22)*** Mr. Dustin Pearson (Martec)	**Recent Advances in Code Verification of Sierra Solid Mechanics and Structural Dynamics** ***(24)*** Dr. James V. Cox, Dr. Garth M. Reese, & Dr. Kendall H. Pierson (Sandia National Labs)
11:40		**COTS Interface to Exodus II** ***(22)*** Mr. Daniel Pusey (Altair)	**NESM Validation Study Using the Floating Shock Platform Model** ***(24)*** Mr. Chris Van Valkenburgh & Mr. Jonathan Stergiou (NAVSEA Carderock)

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TUESDAY AM (OCTOBER 28)

	TRAINING MIL-S-901D Engineering Topics (8:00am-11:00am / Unlimited Dist. A) DISCUSSION GROUP Abaqus User Group Meeting (11:00am-Noon / Unlimited Dist. A)	TRAINING Introduction to Nonlinear Analysis (10:00am-11:30am / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 28) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading	
	Meeting Room: Reston Suites B	***Meeting Room: Lake Thoreau***
10:00	**MIL-S-901D Engineering Topics (cont.)** Mr. Domenic Urzillo (NAVSEA Philadelphia) MIL-S-901D Engineering topics is a follow-on course to the MIL-S-901D Test and Extension training courses and is aimed at providing the NAVSEA acquisition and engineering communities with a more in-depth review of engineering mathematics routinely used in equipment shock qualification. Topics covered include shock spectrum as it relates to MIL-S-901D testing, digital data filtering, shock response frequency, shock test fixture design fundamentals and FSP deck simulation fixtures.	**Introduction to Nonlinear Analysis** Mr. Bart McPheeters (NEi Software) This class will provide an introduction to nonlinear engineering problems. We will identify characteristics of a nonlinear problem and discuss exactly what makes a problem nonlinear. The class will describe the different types of nonlinearities and what distinguishes a nonlinear problem from a linear one. We will discuss strategies for solution of nonlinear problems, and the limits of different solutions methods. Additionally, we will discuss implicit and explicit finite element codes and how each can be best used (either alone or together) to solve a nonlinear problem.
11:00	**Abaqus User Group Meeting** Mr. Peter Nannucci (SIMULIA Aerospace & Defense Industry) SIMULIA is the Dassault Systèmes brand that delivers a portfolio of Realistic Simulation solutions including the Abaqus product suite for Unified Finite Element Analysis, multiphysics solutions for insight into challenging engineering problems, and product lifecycle management solutions for managing simulation data, processes, and intellectual property. The Abaqus Unified FEA product suite is widely used in the Defense, Shipbuilding and Energy industries across the globe and offers powerful and complete solutions for both routine and sophisticated engineering problems covering a vast spectrum of industrial applications. Peter Nannucci and Dr. Jon Arata will moderate this discussion and give an update presentation covering some of the newer features in Abaqus and other SIMULIA products that are of interest to the Shock and Vibration community. An open discussion focused on the use of the Abaqus product suite in these key industries will follow.	

General Session 2 & Awards Luncheon

Tuesday, Oct. 28 • Noon—1:30pm • Grand Ballroom (Exhibit Hall)

12:50pm—1:25pm • KEYNOTE LECTURE • MR. CHARLES SOUTHALL (Chief Engineer, HII-NNS)

TUESDAY PM (OCTOBER 28)

	SESSION 13 **Shock Isolation Technology** **(1:30pm-2:10pm / Unlimited Dist. A)** **Instrumentation Technology** **(2:10pm-3:10pm / Unlimited Dist. A)** Chair(s): Mr. Neil Donovan (ShockTech)	SESSION 14 **Structural Response I** **(1:30pm-2:50pm / Unlimited Dist. A)** Chair(s): Dr. Peter Vo (Raytheon)	SESSION 15 **DS: Measurement & Testing of Complex Systems under Mechanical Shock** **(1:30-3:10 / Unlimited Dist. A)** Chair(s): Dr. Jacob Dodson (Air Force Research Laboratory) Mr. Jonathan Hong (Applied Research Associates)
	All Presenters and Chairs (for Oct 28) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	***Meeting Room: Regency Ballroom B***	***Meeting Room: Lake Thoreau***
1:30	**Description of Shocktech's Newer Series of Seamounts for the Reduction of Severe Shock in Barge Test** ***(24)*** Mr. Kevork Kayayan (ShockTech), Mr. Herb LeKuch (Engineering Consultant)	**The Derivation of System Shock Responses for a Worst Case Road** ***(26)*** Mr. Troy J. Skousen, Mr. Jerome S. Cap, & Ms. Melissa K. C' de Baca (Sandia National Laboratories)	**A Review of Shock Mitigation Techniques** ***(27)*** Mr. Kyle Smith (NRC, AFRL/RWMF) & Dr. Jason Foley (AFRL/RWMF)
1:50	**Comparing the Barge Shock Response of Mid-sized Populated Isolated Racks to Taller Isolated Racks** ***(25)*** Mr. Herb LeKuch (Engineering Consultant), Mr. Neil Donovan (ShockTech)	**Challenges in Random Vibration Qualification Testing of Structures Behaving Nonlinearly** ***(26)*** Mr. Gary Wang & Dr. Ali Kolaini (Jet Propulsion Laboratory)	**Kulite GMD-280-100KG-P Piezoresistive Shock Accelerometer Performance Evaluation** ***(27)*** Mr. Jonathan Hong & Dr. Alain Beliveau (Applied Research Associates), Dr. Jacob Dodson, Mr. Tom Lagoski, & Ms. Jontia Brown (AFRL/RWMF)
2:10	**Transverse Sensitivity Testing of the Endevco® Model 75 High-g Shock SMT Triaxial Accelerometer** ***(25)*** Mr. James Letterneau (Meggitt Sensing Systems)	**Response of Load-Bearing Precast Concrete Panels to Blast Loads** ***(27)*** Mr. Barry Bingham (Baker Engineering and Risk Consultants)	**High-Bandwidth Signal Conditioning for High Rate Experiments** ***(28)*** Mr. Alan Szary (Precision Filters)
2:30	**Developments in Digital Sensors and Instrumentation for Shock and Vibration Measurement Systems** ***(25)*** Mr. Kurt Veggeberg (National Instruments)	**Optimizing of Anti-shock Chiral Layer under Impulse Loading** ***(27)*** Mr. Pengduo Zhao (Naval Academy of Armament,China)	**Multi-Axial Pyroshock Plate Characterization** ***(28)*** Lt. Joshua Campbell, Dr. Janet Wolfson, Dr. Jason Foley, & Dr. Jacob Dodson (AFRL/RWMF), Mr. Greg Falbo (LMS), Dr. Alain Beliveau (Applied Research Associates)
2:50	**Triaxial Surface Mount Accelerometer** ***(26)*** Mr. Robert D Sill (PCB Piezotronics)		**Towards A Standardized Test Board for High-G and Large Delta-V Electronic Component Survivability** ***(28)*** Dr. Ryan Lowe (Applied Research Associates), Mr. Joel Metz (ARDEC), Mr. Serge Kaplan (Air Force Institute of Technology), Dr. Jason Foley (AFRL/RWMF)

(##) = Corresponding Page Number in Abstract Book

Popcorn & Pretzel Break in Exhibit Hall
3:10PM - 4:00PM*

**Tuesday PM tutorial registrants begin at 3:30PM*

TUESDAY PM (OCTOBER 28)

	TRAINING	DISCUSSION GROUP
	Shock Policy 9072 **(2:30pm-3:20pm / Limited Dist. C)**	**LS-DYNA Discussion Group** **(1:30pm-3:30pm / Unlimited Dist. A)**
	All Presenters and Chairs (for Oct 28) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading	
	Meeting Room: Lake Audubon	***Meeting Room: Reston Suites B (Tall Oaks & Hunter Woods)***
1:30		**LS-DYNA Discussion Group** Dr. Len Schwer (Schwer Engineering & Consulting) LS-DYNA and its predecessor, LLNL DYNA3D, were originally developed for military and defense applications, and are widely used in both the DoD and DoE. LS-DYNA has advanced features for defense applications, including simulating projectile penetration, blast response, explosives modeling, and underwater shock simulation. This discussion group is an opportunity for engineers and analysts to meet with Livermore Software Technology Corporation (LSTC) personnel, learn about recent developments in LS-DYNA, LS-PrePost, LS-Opt, discuss applications of LS-DYNA, share best practices, and make requests for new features. The meeting is supported by Livermore Software and Technology Corporation (LSTC) and moderated by Dr. Len Schwer of Schwer Engineering & Consulting Services. You may contact Len (Len@Schwer.net) for more information, comments, or suggestions. The invited speaker this year is Dr. Jingxiao Xu, lead developer at LSTC for the LS-DYNA Smooth Particle Hydrodynamics (SPH) capability. Dr. Xu has been rewriting much of the SPH solver since taking over as lead SPH developer. He has also been adding new SPH capabilities including 2D plane strain and axisymmetric SPH, SPH to SPH contact, explicit SPH thermal solver, coupling between SPH and solid elements and adaptive solid to SPH.
2:30	**Shock Policy 9072** Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia), Mr. Michael Campbell (NAVSEA 05P1) The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD-SSES) Code 669 is NAVSEA 05P1's Delegated Approval Authority (DAA) for MIL-S-901D Surface Ship Shock. As the DAA, Code 669 engineers are responsible for review and approval of all Government Furnished Equipment (GFE) and heavyweight shock tested equipment. This course will cover in detail the responsibilities of all Navy organizations. 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. 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 & maintenance of shock hardened Navy ships and shock qualification test facilities.	

1:30-3:30	**Shock and Vibration IAC Meeting**	**Meeting Room: North Point**
	Chair: Dr. Bob Welch (SAVIAC Emeritus Director) **(By Invitation Only)** This meeting will assess/discuss the government and DoD's need for a S&V IAC. The meeting is being hosted by SAVIAC Emeritus Director Dr. Bob Welch, and will have an attendance of current S&V TAG members and other invited guests.	

TUESDAY PM (OCTOBER 28)

TUTORIAL SESSION 4 / 3:30pm—6:30pm

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

Shock Test Failure Modes **Meeting Room: Lake Audubon**

Mr. Kurt Hartsough, Mr. Domenic Urzillo, & Mr. Jack Pezza (NAVSEA Philadelphia)

This tutorial will cover examples of shock test failures typically experienced by equipment exposed to MIL-S-901D shock levels. MIL-S-901D provides guidance for designers responsible for meeting the requirements of MIL-S-901D. This tutorial will show how and why equipment failures occur and show how minor design changes can prevent shock failures. Hands on demonstrations, real time high speed video and analysis will be used to demonstrate both failures and corrective actions.

Analysis for Medium Weight Shock Testing **Meeting Room: Lake Thoreau**

Mr. Josh Gorfain & Mr. Jeff Morris (HI-TEST Laboratories)

While a shock test is essentially the bottom line for a shock qualification, a lot of analysis often goes into the mix before the test. The reasons for this are many: The equipment manufacturer wants his equipment to pass and will often commission some kind of pre-test prediction to maximize the likelihood of success or to highlight design problems. Since the weight and frequency of the tested equipment can affect the response of the test significantly, the system may need to be examined to assure that the tested environment is correct. This tutorial will first review the Medium Weight Shock Machine (MWSM) and its use in shock qualification testing, followed by presentation of the test environment. Next, the types of analysis that can be performed to estimate the test environment experienced by a given piece of equipment will be described. The intention of these analyses is to provide an assessment of equipment response subject to a MWSM test in an effort to assure a successful test. Additionally, the merits and limits of these methods are discussed so the most appropriate method may be rationally selected for a given application. Examples will be presented that illustrate the different types of analyses and how they may be applied.

Fundamentals of Multiple-Input/Multiple-Output Vibration Testing **Meeting Room: Reston Suites B (HW/TO)**

Mr. David Smallwood (Consultant)

The fundamentals of multiple-input/multiple-output (MIMO) vibration random testing will be described. Various forms of the testing will be illustrated including multiple inputs in a single axis into a large test item and multiple inputs in several axes. The basic matrix algebra needed to define the test and the results will be developed. A short discussion of waveform replication and sine testing will be presented. The basic formulation of the control of a MIMO test will be discussed. Random test specifications must now be presented in terms of a spectral density matrix at the control points. The diagonal terms are the auto (power) spectra at the control points. The off diagonal terms are the cross spectra between pairs of control points. The cross spectra are often presented in terms of phase and coherence. The problems in developing specification for these tests will be discussed. Then methods and suggestions for the development of specifications for a MIMO test will be discussed and illustrated.

Composite Laminate Engineering **Meeting Room: Regency BR A**
(Theoretical and Computational Analysis of Composite Materials and Structures)

Mr. Bart McPheeters (Autodesk) & Dr. Tom Moyer (NAVSEA Carderock)

This tutorial is designed for engineers who are using composite materials, or are considering using them. The tutorial will cover theories used to predict the behavior of composite materials and its limitations. We will cover the current state of composite analysis technology and illustrate some successful implementations. the tutorial will then have a section devoted to the implementation of composite analysis in finite elements, its strengths and its limitations. Various modeling strategies will be considered to handle common issues in composites, such as sandwich materials, delamination and progressive and partial failure. Finally, we well close with a discussion of the limitations of current technology and a summary of best practices for considering the analysis of composite materials.

The Measurement & Utilization of Valid Shock and Vibration Data **Meeting Room: Regency BR B**

Dr. Patrick Walter (TCU / PCB Piezotronics)

Significant focus is often provided to applying sophisticated analysis techniques to 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.

HI-TEST Laboratories, Inc.

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PCB PIEZOTRONICS

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An Evening at the

WOLF TRAP

Foundation for the Performing Arts

Food, Drinks, & Live Music

Tuesday, October 28th

7:00pm - 10:00pm

Transportation Provided

WEDNESDAY AM (OCTOBER 29)

	SESSION 16 Pyroshock (8:00am-9:00am / Unlimited Dist. A) Mechanical Shock (9:20am-10:00am / Limited Dist. C) Chair(s): Mr. Sean Murphy (HII—Ingalls Shipbuilding)	SESSION 17 UNDEX Testing (8:00am-9:00am / Limited Dist. C) (9:40am-10:00am / Limited Dist. C+) Chair(s): Mr. Brian Lang (NAVSEA Carderock)	SESSION 18 Blast (8:00am-8:20am / Limited Dist. D) (8:20am-10:00am / Limited Dist. C) Chair(s): Dr. Wije Wathugala (ACTA Inc.)
	All Presenters and Chairs (for Oct 29) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	***Meeting Room: Regency Ballroom B***	***Meeting Room: Lake Audubon***
8:00	**Performance Characteristics of Tuned Vibration Mounts for the Attenuation of Pyrotechnic Shock** ***(29)*** Mr. JJ Osmecki & Mr. Kevork Kayayan (ShockTech), Mr. Herb LeKuch (Engineering Consultant)	**Flexible Infrastructure Two-Piece Deck Track Pre-Test Extension and Heavyweight Qualification: Part 1** ***(30)*** Mr. Matthew Davis & Mr. Matthew Tilley (Newport News Shipbuilding)	****An Assessment of End Design Affects on Airblast for Simple Cased Right Circular Charges** ***(32)*** Mr. Roosevelt Davis (Air Force Research Laboratory) *** Presentation is Limited Distribution D*
8:20	**Mechanical Excitation of a Resonant Structure for Pyroshock Simulation** ***(29)*** Mr. Bret Burkett & Mr. Jeff Kirk (Lockheed Martin)	**Flexible Infrastructure Two-Piece Deck Track Pre-Test Extension and Heavyweight Qualification: Part 2** ***(31)*** Mr. Matthew Tilley & Mr. Matthew Davis (Newport News Shipbuilding)	**Secondary Debris Field Generated from Buried Cased Explosive** ***(32)*** Dr. Wije Wathugala (ACTA Inc.)
8:40	**Reversible Electromagnetic Launchers for Mechanical Shock Testing** ***(29)*** Dr. Erik Timpson (Honeywell), Dr. T. G. Engel (University of Missouri)	**Medium Weight Shock Machine (MWSM) Equipment Kill Criteria: Test Design, Setup, and Execution** ***(31)*** Mr. Brian Lang (NAVSEA Carderock)	**Measurements of Blast Pressure Past a Hinged Panel in a Pipe** ***(32)*** Dr. James Gran (SRI International)
9:00			**Buried Blast Performance of Various Explosive Formulations** ***(32)*** Mr. Jeffrey Koch (Army Research Laboratory)
9:20	**Shock Testing of Welded Stud Mounted Equipment** ***(30)*** Mr. Jarrod Gilmore & Mr. Sean Murphy (HII - Ingalls Shipbuilding)		**Experimental Validation and Comparative Evaluation of Steel Plate Response Models** ***(33)*** Ms. Allison Yu & Mr. David Bogosian (Baker Engineering and Risk Consultants)
9:40	**Shock Testing of Structural Closures** ***(30)*** Ms. Jennifer Schilling (HII-Ingalls Shipbuilding) & Mr. Jeff Morris (HI-TEST Laboratories, Inc.)	**On the Shock Response of Naval Steel*** ***(31)*** Mr. Jan Czaban (Canadian Department of National Defence), Mr. Mervin Norwood (MARTEC Limited) * Limited to: US, UK, CA, AUS and/or NZ.	**Determining the Relative Effectiveness of the Impulsive Loading from Buried Explosives using UNDEX derived Bubble Energy** ***(33)*** Mr. Collin Pecora (Army Research Laboratory)

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WEDNESDAY AM (OCTOBER 29)

	TRAINING	DISCUSSION GROUP
	Testing on the Deck Simulating Shock Machine (DSSM) (8:00am-9:00am / Limited Dist. C) Testing on the Large Displacement Shock Simulator (LDSS) (9:00am-10:00am / Unlimited Dist. A)	Navy Enhanced Sierra Mechanics - Current Status & Plans Forward (8:00am-10:00am / Limited Dist. C)
	All Presenters and Chairs (for Oct 29) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading	
	Meeting Room: Lake Thoreau	***Meeting Room: Reston Suites B***
8:00	**Testing on the Deck Simulating Shock Machine (DSSM)** Mr. Michael Poslusny (National Technical Systems) *No Abstract Available*	**Navy Enhanced Sierra Mechanics - Current Status & Plans Forward** Dr. Tom Moyer (NAVSEA Carderock) This will be a Distribution C: briefing on the current status of the Navy Enhanced Sierra Mechanics (NESM) software suite and a blueprint for the development plans through FY19. There will be ample time allotted for questions and discussion. NESM is designed to meet the requirements of the entire community interested in Naval Shock & Vulnerability M&S. These discussions validate and support the NESM development process while affording the community visibility into the program status and plans.
9:00	**Testing on the Large Displacement Shock Simulator (LDSS)** Mr. Steve McCampbell & Mr. Matt Dolan (HI-TEST Laboratories) *No Abstract Available*	

WEDNESDAY AM (OCTOBER 29)

	SESSION 19 Vibration: Test Methods (10:00am-11:20am / Unlimited Dist. A) Chair(s): Mr. Tony Keller (Spectral Dynamics)	SESSION 20 DS: DYSMAS (10:00am-Noon / Limited Dist. C) Chair(s): Mr. Greg Harris (NAVSEA Indian Head) Mr. Jeffrey St. Clair (NAVSEA Indian Head)	SESSION 21 Structural Response II (10:00am-11:40am / Limited Dist. C) Chair(s): Dr. Ken Nahshon (NAVSEA Carderock)
	All Presenters and Chairs (for Oct 29) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading		
	Meeting Room: Regency Ballroom A	*Meeting Room: Regency Ballroom B*	*Meeting Room: Lake Audubon*
10:00	**Several Factors to be Considered in the Accelerated Simulation Planning of a Vibration Regime** *(34)* Mr. Zeev Sherf (Private Consultant), Mr. Arie Elka & Mr. O. Tabentchik (RAFAEL)	**DYSMAS Program Status and Plans** *(35)* Mr. Gregory Harris (NAVSEA Indian Head)	**A Fast-running Model for Soil-Structure Interaction (SSI) Effects for Buried Structures** *(37)* Dr. Bryan Bewick & Mr. Matt Barsotti (Protection Engineering Consultants), Dr. Ian Flood (University of Florida)
10:20	**Stress Based Comparisons between Single & Multiple Degree-Of-Freedom Vibration** *(34)* Mr. William Barber & Dr. Michael Hale (US Army Redstone Test Center)	**DYSMAS Analysis of the LCS-5 Side Launch** *(35)* Dr. Bradley Klenow, Mr. J. Matthew Grassman, & Ms. Amanda Blumenthal (NAVSEA Carderock)	**Stress Testing of Mortar Baseplates – Method and Validation** *(37)* Dr. Andrew Littlefield (US Army RDECOM-ARDEC Benét Labs)
10:40	**Methodology for Defining Multi-Axis Vibration Specifications** *(34)* Dr. Laura Jacobs-O'Malley (Sandia National Laboratory)	**Implementation of Strength into DYSMAS/FD** *(36)* Dr. Thomas McGrath & Mr. Jeffrey St. Clair (NAVSEA Indian Head)	**Effect of Known Variations in Material and Structure on Blast Performance of Ship Structure** *(38)* Dr. Ken Nahshon, & Mr. Nicholas Reynolds (NAVSEA Carderock)
11:00	**Comparison of Multi-Axis and Single Axis Testing on Plate Structures** *(35)* Mr. Garrett Nelson & Dr. Laura Jacobs-O'Malley (Sandia National Laboratories)	**DYSMAS Simulation of the Response of Dam Structures to Blast Loading** *(36)* Mr. Roger Ilamni & Mr. James Warner (NAVSEA Indian Head), Mr. Robert Browning (ERDC)	**Analysis of Bulb-Flat Stiffened Structures Subjected to Blast** *(38)* Dr. Ken Nahshon & Mr. Nicholas Reynolds (NAVSEA Carderock)
11:20		**DYSMAS Simulation of UNDEX Shock Loading from a Bottom Explosion at the Briar Point Test Pond** *(36)* Mr. Martin Marcus & Mr. Gregory Harris (NAVSEA Indian Head)	
11:40		**A DYSMAS/DFBEM Incompressible-Compressible Approach to Model Cavitation Erosion** *(36)* Dr. Georges Chahine, Dr. Chai-Tsung Hsiao, A. Kapahi, & J-K Choi (Dynaflow, Inc.)	

(##) = Corresponding Page Number in Abstract Book

WEDNESDAY AM (OCTOBER 29)

	TRAINING	DISCUSSION GROUP
	Introduction to Medium Weight Shock Testing (10:00am-Noon / Unlimited Dist. A)	**Shock Testing: Past, Present, & Future (10:00am-Noon / Unlimited Dist. A)**
	All Presenters and Chairs (for Oct 29) are Required to Meet at 7:00AM in Lake Audubon for Presentation Loading	
	Meeting Room: Lake Thoreau	***Meeting Room: Reston Suites B***
10:00	**Introduction to Medium Weight Shock Testing** Mr. Braden O'Meara (HI-TEST Laboratories) This training will cover the necessary background information relative to medium weight shock testing. This session is intended for engineers and product developers who are unfamiliar with the medium weight shock testing process. Subjects covered include pre-test planning, fixture selection, test set-up, test operations, and reporting. Some aspects of medium weight shock machine operation will be covered.MIL-S-901D test requirements applicable to medium weight shock testing will be discussed.	**Shock Testing: Past, Present, & Future** Mr. Henry Pusey (HI-TEST Laboratories/SAVE) Mr. Jerry Sullivan (Consultant) Mr. Kurt Hartsough (NAVSEA Philadelphia) *No Abstract Available*
11:00		

CURRENT SYMPOSIUM EXHIBITORS

Event Sponsor

HI-TEST Laboratories[1]

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Data Physics

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ATK Aerospace

National Technical Systems[1]

PCB Piezotronics[1]

SIMULIA (Dassault Systèmes)

Spectral Dynamics[3,4]

TEAM Corporation[3]

Additional Exhibiting Organizations

Altair Engineering
Autodesk
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Boeing
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Clark Testing
Crystal Instruments
Damping Technologies Inc.
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Kistler Instruments
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NAVSEA Carderock
OROS
Precision Filters
PVI Systems
Society for Experimental Mechanics / IMAC
Taylor Devices
Tritek / TEAC
Vibration Research Corporation
Xcitex

[1] **Hosting the Social Event on Tuesday, October 28th, at the Wolf Trap**
[2] **Sponsoring the Internet Café throughout Symposium**
[3] **Sponsoring the Ice Cream Social in Exhibit Hall on Monday Afternoon**
[4] **Sponsoring the 85th Commemorative T-shirt for All Attendees**

EXHIBITOR DESCRIPTIONS

Jennifer Cecchitti
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Altair, using our simulation-driven design process, an extensive suite of technology products and services, coupled with our expansive list of "best-in-class" technology partners, continues to help the Navy and Navy Shipbuilders aggressively address Total Ownership Cost, Design Cycle Times, Energy Efficiency, and Survivability. Altair provides our customers with the proper level of technology, expertise, and support from concept to launch via our flexible engagement model. Altair proudly serves the US Navy as a an Engineering Prime Contractor. We stand ready to assist you in the achievement of your mission critical goals.

Mark Stephens
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ATK Aerospace is the world's top producer of solid rocket propulsion systems and a leading supplier of military and commercial aircraft structures. It also specializes in small and micro-satellites; satellite components and subsystems; lightweight space deployables and solar arrays; low-cost, quick-to-market launch solutions; flares and decoys; and energetic materials and related technologies. The group also has extensive experience supporting human and space payload missions.

Dave Beer
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Autodesk, Inc., is a leader in 3D design, engineering and entertainment software. Customers across the manufacturing, architecture, building, construction, and media and entertainment industries—including the last 19 Academy Award winners for Best Visual Effects—use Autodesk software to design, visualize, and simulate their ideas before they're ever built or created. From blockbuster visual effects and buildings that create their own energy to electric cars and the batteries that power them, the work of our 3D software customers is everywhere you look.

Tom Diehl
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Bodie Technology - Specialists in properly handling noisy data via Digital Signal Processing (DSP). Our unique expertise benefits users of Transient Dynamics Simulations (Abaqus/Explicit, LS-Dyna, Virtual.Lab Motion …) and Engineers/Technicians working with Experimental Measurements. Those trying to correlate/interpret transient simulations and experiments find our Kornucopia® software, Customizable Training, and Consulting highly valuable.

Steve Tanaka
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Boeing is the world's leading aerospace company and largest and most versatile manufacturer of commercial and military aircraft. Boeing designs, manufactures, and supports aircraft, unmanned vehicles, electronic and defense systems, missiles, satellites and advanced communication systems. Boeing also is a major service provider to NASA for the space shuttle and International Space Station.

Jenn Mowry
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Brüel & Kjær will be highlighting the latest PULSE hardware and software for data acquisition including PULSE Reflex Shock response spectrum (SRS) synthesis and control that provides a valuable tool to evaluate the shock-worthiness of equipment. In addition, we will also be showcasing VC-LAN which is the latest generation of vibration controllers, offering LAN-based connectivity alongside advanced testing capabilities such as kurtosis control and environmental chamber integration. Brüel & Kjær offers a full range of accelerometers, force transducers, impact hammers, impedance heads, non-contact transducers, conditioning amplifiers, cables and accessories.

Chantrel Goldstohm
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Clark Testing has been providing product qualification testing and design verification for manufacturers for 20 years. We provide our clients with independent, objective, and competitively priced solutions to their testing needs. You will find that we are dedicated to delivering premium value to clients through superior technical expertise, advanced technology, and a deeply felt commitment to customer satisfaction. Our experience and dedication to testing helps assure that our customers in industries around the world qualify their products in an efficient manner. Clark's comprehensive catalogue of testing services provides a foundation for our commitment to product quality. We look forward to providing that service to you.

EXHIBITOR DESCRIPTIONS (CONT.)

Gina Kim
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Crystal Instruments (CI) is a leading worldwide supplier of vibration controllers, portable dynamic signal analyzers, and dynamic measurement systems for product testing, machine monitoring, and vibration and acoustic analysis. CI's products are used across a wide range of industries, including aerospace, defense, and medical device manufacturing.

Tom Lewis
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Welcome to **Damping Technologies, Inc.** (DTI), where for over 15 years we have been creating unique vibration damping products. DTI's products efficiently deliver significant levels of damping to structures for control of vibration and noise related issues. DTI has extensive experience in creating effective noise and vibration control solutions in the aerospace, automotive, and consumer products industries.

Bourke MacDonald
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Established in 1984, **Data Physics** is a worldwide leader in high performance solutions for noise and vibration testing. Data Physics manufactures hardware and software with its full line of SignalCalc Dynamic Signal Analyzers, SignalStar Vibration Control Systems, SignalSound High Intensity and Underwater Acoustic Systems and SignalForce Electrodynamic Shakers.

Stefanie Montemurro
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Ask about our new 3 inch displacement UD T5500 shaker! **Dayton T. Brown, Inc.** is an A2LA / NVLAP accredited*, independent engineering and testing lab. Our facility stands apart from the rest by providing a full spectrum of engineering and testing services. For over 60 years, our goal has been to provide our customers with competitive pricing, low project cost and impeccable services. At DTB, we are committed to helping you successfully meet all of your goals. Our lab's low set-up costs and reduced time-to-test will satisfy your most demanding and complex test objectives. No other testing lab can offer the host of testing services that we can provide to you in one location with a 24/7 schedule.
*Please refer to our website for testing covered under Scopes of Accreditation.

Laurie Talbot
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Dytran Instruments, Inc. is a leading designer and manufacturer of innovative piezoelectric and MEMS type sensors. Their expansive product line includes piezoelectric and MEMS type accelerometers, force sensors, pressure sensors, impulse hammers, cable assemblies and support electronics. Dytran sensors serve in shock, ballistic, modal analysis, structural dynamics, NVH, ESS and crash applications to name a few. Their sensors are getting "smarter" with the addition of TEDS (Transducer Electronic Data Sheet) and MEMS capabilities. Dytran is always looking forward to new challenges.

Ken Malley
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At **E-Labs**, we offer the ability for our customers to access state of the art facilities and personnel. E-Labs personnel have over 40 years of hands on laboratory testing experience within all testing disciplines for the aerospace, automotive, military, commercial and the IT industries. We're a Full Service Testing Laboratory for Industrial, Commercial and Utility Testing, offering Climatic Testing for issues such as Salt Fog, Sand and Dust, Immersion Testing and more. We also offer full EMI and EMC Testing, and Dynamics Testing such as Mechanical Shock, Lightweight Hammer Shock, and Vibration Testing.

Mike Hoyer
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HBM Test and Measurement offers Genesis HighSpeed DAQ with exceptional accuracy, data security and scalability, over 4000 channels in one system plus integrated IEPE/charge conditioning matched with extensive shock and vibration analysis software including Shock Response Spectrum (SRS), Extreme Response Spectrum (ERS) and Fatigue Damage Spectrum (FDS) using nCode GlyphWorks.

Tony Crook
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Hi-Techniques has been a leader in High Performance Data Acquisition Systems for nearly 30 years. Initially founded as a spin off of Norland Corporation, Hi-Techniques has specialized in transient recorders, data acquisition systems and high resolution Digital Oscilloscope products for a variety of applications and markets. Our latest product range, the Synergy, is Hi-Techniques' 7th Generation of Data Acquisition Products. Designed from the ground up, Synergy offers unparalleled performance and flexibility in data acquisition.

EXHIBITOR DESCRIPTIONS (CONT.)

Lauren Yancey
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HI-TEST Laboratories, Inc. is a world-class provider of single-source test program solutions for industry and government, including research, design, testing and evaluation. The company's testing facility is based in Arvonia, VA and offers a full spectrum of testing including standard MIL-S-901D lightweight, medium weight, and heavyweight testing, MIL-STD-167 Types I and II vibration testing, MIL-STD-740 noise and MIL-1399 inclination testing. HI-TEST's Applied Technologies Division offers numerical and analytical testing expertise including response to underwater shock, survivability/vulnerability analysis, advanced composite materials design, progressive failure/survivability of composite structures, fracture mechanics and ballistic modeling and simulation. HI-TEST is a certified HUBZone Small Business.

www.huntingtoningalls.com

Huntington Ingalls Industries (HII) designs, builds and maintains nuclear and non-nuclear ships for the U.S. Navy and Coast Guard and provides after-market services for military ships around the globe. For more than a century, HII has built more ships in more ship classes than any other U.S. naval shipbuilder. Employing nearly 38,000 in Virginia, Mississippi, Louisiana and California, its primary business divisions are Newport News Shipbuilding and Ingalls Shipbuilding.

Tomoko Komuro
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IMV Corporation engages in the design, production, and sale of dynamic simulation systems and measuring systems. The company also provides test house, measuring analysis, and other consulting services for vibration tests. It offers vibration test systems that include energy-saving type, single and multi axis basic, compact type, and temperature, humidity, and vibration combined type systems, as well as vibration controllers. IMV Corporation was founded in 1957 and is headquartered in Osaka, Japan.

Ronnie Viscusi
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ITT is a diversified leading manufacturer of highly engineered critical components and customized technology solutions for growing industrial end-markets in energy infrastructure, electronics, aerospace and transportation. Building on its heritage of innovation, ITT partners with its customers to deliver enduring solutions to the key industries that underpin our modern way of life. Founded in 1920, ITT is headquartered in White Plains, NY, with employees in more than 15 countries and sales in more than 125 countries.

Rich Cadille
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Kistler Instrument Corporation will exhibit dynamic pressure and force sensors, along with accelerometers used in many shock and vibration applications. New this year will be PiezoStar, high temp, multiple-ranged, piezoelectric triaxial accelerometers along with a high g, high temp 8715 miniature accelerometer. Applications engineering support available at our booth.

Ira Levine
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Kulite Semiconductor Products, Inc. is a leading name in the transducer industry on a worldwide level. Kulite is the first name in pressure transducers for scientists and engineers working at the cutting edge of research and design in their fields.

Jim Breault
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Lansmont Corporation provides specialized engineering and manufacturing services, delivering field instruments (portable data recorders) and dynamic test equipment (shock, vibration, drop, compression) used to improve quality, reduce costs and fulfill regulatory compliances associated with robust product and efficient transport packaging. Over the last 40 years Lansmont has developed distinct expertise in mechanical and electrical design, as well as software control and data analysis. Engineers around the world have relied on Lansmont equipment and our Field-to-Lab™ Methodology to discover the limits and eliminate the unknowns associated with robust design of their products.

Chris Wilcox
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Product designers and test engineers throughout the world trust **m+p international** for reliable noise and vibration analysis, structural dynamics, vibration and acoustic control. On display will be m+p's Smart Office Analyzer and Vibco with VibPilot 24, VXI, LXI and USB measurement hardware along with the new data acquisition and control system hardware, VibRunner. Additionally, m+p's Coda, Continuous On-line, Data Acquisition system will be demonstrated.

EXHIBITOR DESCRIPTIONS (CONT.)

Stacy Belanger
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Meggitt Sensing Systems is the Meggitt division specializing in sensing and monitoring systems. We measure physical parameters in the extreme environments of aircraft, space vehicles, power generators, nuclear, oil and gas installations and test laboratories. Meggitt Sensing Systems has operated through its antecedents since 1927 under the names of Ferroperm Piezoceramics, Lodge Ignition, Endevco, Sensorex, ECET, Vibro-Meter and Wilcoxon Research. Today, their capabilities and facilities have been integrated under one Meggitt division to provide complete systems from a single supply base.

Sara Lincoln
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MET Laboratories: A leading independent electrical testing & certification lab providing true single-source testing in four world-class laboratories in Maryland, California & Texas, and through wholly-owned China, Taiwan, Korea & Italy operations. MET Laboratories offers a unique array of testing services and accreditations, and partners with leading laboratories to offer comprehensive global compliance solutions. For over 50 years, MET has provided leading-edge customers with unparalleled facilities and technical know-how, and real-time online tracking of each project's progress.

Stephen Hanly
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Midé Technology Corporation is an engineering company that develops, produces, and markets smart technology products and materials - primarily for the marine, aerospace, automotive, research, and manufacturing industries. Our products include; Hydroactive Seals for bulkhead shafts in ships, packaged (QuickPack), & conformable (PowerAct) piezoelectric sensors and actuators; Quickpack High Voltage Piezo amplifiers; Volture™ vibration energy harvesting systems, and Shape Memory Alloy Starter Kits. Mide also provides engineering, and forensic analysis consultation services.

Albert Prosuk
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With over 350 highly qualified staff, **Müller BBM** is one of the leading engineering companies for consultancy services, testing and planning in all fields of acoustics, building physics and environmental protection. We examine the effects of sound, vibration, heat, humidity, odours and harmful substances, in addition to the effect of electromagnetic waves on humans, on machinery and on the environment. We quantify, evaluate, and shape these effects, offering you complete one-stop solutions.

Mike Poslusny
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National Technical Systems (NTS) offers a full range of engineering solutions; from product design, development and testing to systems integration, project management and managed services at laboratories located across the US. Our testing capabilities include MIL-S-901D, MIL-STD-167, MIL-STD-810, MIL-STD-461/461, RS 105, DO-160, MIL-STD 202, and MIL-STD 883.

Geraldine Yarnall
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NAVSEA Carderock is the Navy's center of excellence for ships and ship systems. For over 100 years, Carderock has helped preserve and enhance the nation's presence on and under the seas. Carderock is the full-spectrum research and development, test and evaluation, engineering, and Fleet support organization for the Navy's ships, submarine, military watercraft, and unmanned vehicles with insight into new concepts and technologies for the Navy Fleet of the 21st Century. The Division's expertise spans more than 40 disciplines, from electrical and mechanical engineering to computer engineering and physics.

Melissa Hill
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OROS designs and manufactures noise and vibration signal analyzers, dedicated solutions and offers related services. It masters the latest technology of data acquisition, digital signal processing as well as user interface software. OROS instruments are used in the major sectors of industry and research, for industrial acoustics, structural dynamics and rotating machinery applications. Hardware and software are totally designed in-house. OROS instruments are renowned as being designed for the field but powerful enough for any lab.

EXHIBITOR DESCRIPTIONS (CONT.)

Lou Zagst
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PCB® manufactures precision sensors and sensor accessory products. Our product lines include sensors for the measurement of acceleration, acoustics, force, load, pressure, shock, strain, torque, and vibration. Our products are the first choice of engineers and scientists at leading businesses, research institutions, and independent laboratories around the world. We offer unmatched customer service, a global distribution network, 24-hour Sensorline℠, and a Lifetime Warranty to deliver Total Customer Satisfaction.

Alan Szary
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Precision Filters manufactures high performance instrumentation for test measurements including Signal Conditioning for static and dynamic strain and shock and vibration. PFI also carries lines of Programmable Switching Systems and portable Filter/Amplifier Systems. Rely on a single source for Signal Conditioning and Switching products designed to provide high performance at reasonable cost.

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PVI Systems is a National Instruments Gold Alliance Partner providing customized engineering solutions to a diverse array of industries including; Life Sciences, Pharmaceutical, Defense, Aerospace, Manufacturing, Energy, and Marine. PVI's experienced team of engineers are skilled at integrating NI devices with custom designed hardware and software to provide unique solutions for R&D and manufacturing, particularly in the fields of Data Acquisition, Machine Vision, Automated Test, and Motion/Process Control. Since 1999, PVI has focused on tackling difficult engineering problems and providing customers with solutions that significantly improve their development and manufacturing processes.

Matthew Card
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SIMULIA is the Dassault Systèmes brand that makes realistic simulation an integral business practice improving product performance, reducing physical prototypes, and driving innovation. SIMULIA solutions include Abaqus Unified Finite Element Analysis solutions, multiphysics solutions for insight into challenging engineering problems, and SIMULIA SLM for managing simulation data, processes, and intellectual property.

Joni Normandin
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Society for Experimental Mechanics (SEM) is composed of international members from academia, government and industry who are committed to interdisciplinary application, research and development, education and active promotion of experimental methods to: (a) increase the knowledge of physical phenomena; (b) further the understanding of the behavior of materials, structures and systems; and (c) provide the necessary physical basis and verification for analytical and computational approaches to the development of engineering solutions.

Tony Keller
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Spectral Dynamics (SD) is a technically innovative company that has served the Shock and Vibration community continuously for 48 years. Whether it's Sine control of challenging tests, innovative MIMO control of multiple shakers, Shock data capture at 5 Msample/s/channel or accurate Phase-locked acquisition of hundreds of channels of data, Spectral Dynamics uses mathematics effectively to reduce the total costs of dynamic testing. Call Spectral Dynamics for a customized solution to your needs in Vibration, Shock or Acoustic Test Control; Multi-Channel Data Acquisition; Modal Analysis or PIND Testing.

Douglas Taylor
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The *Shock and Vibration Literature/Information Table* is sponsored by **Taylor Devices, Inc.**, designers and manufacturers of components and systems for the control of shock and vibration. Founded in 1955, Taylor Devices' products are used world-wide for energy absorption and control, damping, weapons effects, MIL-S901D, vibration control, and seismic protection.

EXHIBITOR DESCRIPTIONS (CONT.)

Curt Nelson
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Team Corporation designs, builds and delivers high proof vibration test systems and related components. The advent of vibration testing technology has resulted in the steady improvement, across many sectors of our economy, in product reliability, passenger comfort, and public safety. From the first hydraulic shakers, to the recent introduction of the first 6-degree-of-control systems, Team Corporation has introduced a long list of innovations. We have developed solutions for vibration testing of armaments and missiles, automobile components and vehicles, communication satellites, instrumentation of all types, military and civilian aircraft components, and shipping containers. And Team is making important advances in the field of seismic testing.

Steve Astulfi
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Tritek is proud to be the Authorized North American Distributor for **TEAC** Data Recorders. TEAC offers a complete range of Instrumentation Data Recorders, utilizing flash-memory card, solid state, and hard-disk recording media, with onboard signal conditioning. The innovative WX-7000 Series Wide Band Data Recorder, featuring 80kHz max bandwidth, 16/24-bit resolution, DC/AC/IEPE input, and expansion to 128 channels, will be exhibited at SAVE. The WX Series can operate in stand-alone mode with front panel control and monitoring, or by PC software-controlled mode via Gigabit Ethernet interface. IRIG-B and GPS input options are available. The portable and rugged LX-110/120 Series will also be exhibited, featuring 16/24-bit resolution, DC/IEPE and Strain inputs, stand-alone recording capacity to 64GB, and front-end recording to PC via Ethernet interface. The AQ-VU Video/Data Recorder, providing portable synchronized video and data recording and playback, will also be on display.

Jared Van Baren
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Vibration Research (VR) designs and manufactures vibration control systems for electrodynamic and servohydraulic shakers. Since 1995 Vibration Research has become a pioneer in the industry and a leader in the field of vibration control. Advanced hardware capabilities combined with powerful user friendly software make Vibration Research controllers the premier choice of testing labs around the globe. It is the mission of Vibration Research to provide engineers & technicians with superior, easy to use test technology, expert customer support and continual innovation to meet the needs of today and drive industries to the possibilities of tomorrow.

Adam Hapij
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Weidlinger Associates has been one of the world's leading structural engineering and applied mechanics consultants since its founding in 1949. With a staff of more than 300, the firm has seven U.S. offices and an office in the United Kingdom. Weidlinger investigates, designs, rehabilitates, and protects buildings and infrastructure and performs advanced computational analyses for many complex and award-winning projects. The firm is committed to the principles of sustainable design and energy efficiency and is a member of the U.S. Green Building Council.

Leah Holber
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Xcitex is an innovator in the industries of motion analysis and video-based motion capture. ProAnalyst® is the world's leading software for extracting ("tracking"), analyzing, and presenting motion from pre-recorded video. MiDAS DA software combines and synchronizes data from a variety of sensors with your high-speed video.

EXHIBITOR LAYOUT

Grand Ballroom

501	502/503	509	504	505	506	507	508
PRECISION FILTERS, INC.	Xcitex	MET LABORATORIES	E-LABS	TEAC	DAMPING TECHNOLOGIES	MIDE	AUTODESK

SEATING IN ROUNDS

401	402	403	404	405	406	407
KISTLER measure. analyze. innovate.	OROS	IMV	MEGGiTT	Huntington Ingalls Industries	HBM	PVI SYSTEMS
301	302	303	304	305	306	307
BOEING	BODIE TECHNOLOGY	taylor	NTS	kulite	DYTRAN	NAVSEA WARFARE CENTERS Carderock Division

201	202	203	204	205	206	207
SPECTRAL DYNAMICS	MÜLLER-BBM	Team VIBRATION TESTING EQUIPMENT	Lansmont Field-to-Lab	Hi-Tech Techniques	SEM	CLARK TESTING
101	102	103	104	105	106	107
PCB	DAYTON T. BROWN	CRYSTAL instruments	SIMULIA	VIBRATION RESEARCH	B K Brüel & Kjær	Altair

ENTRANCES TO HALL

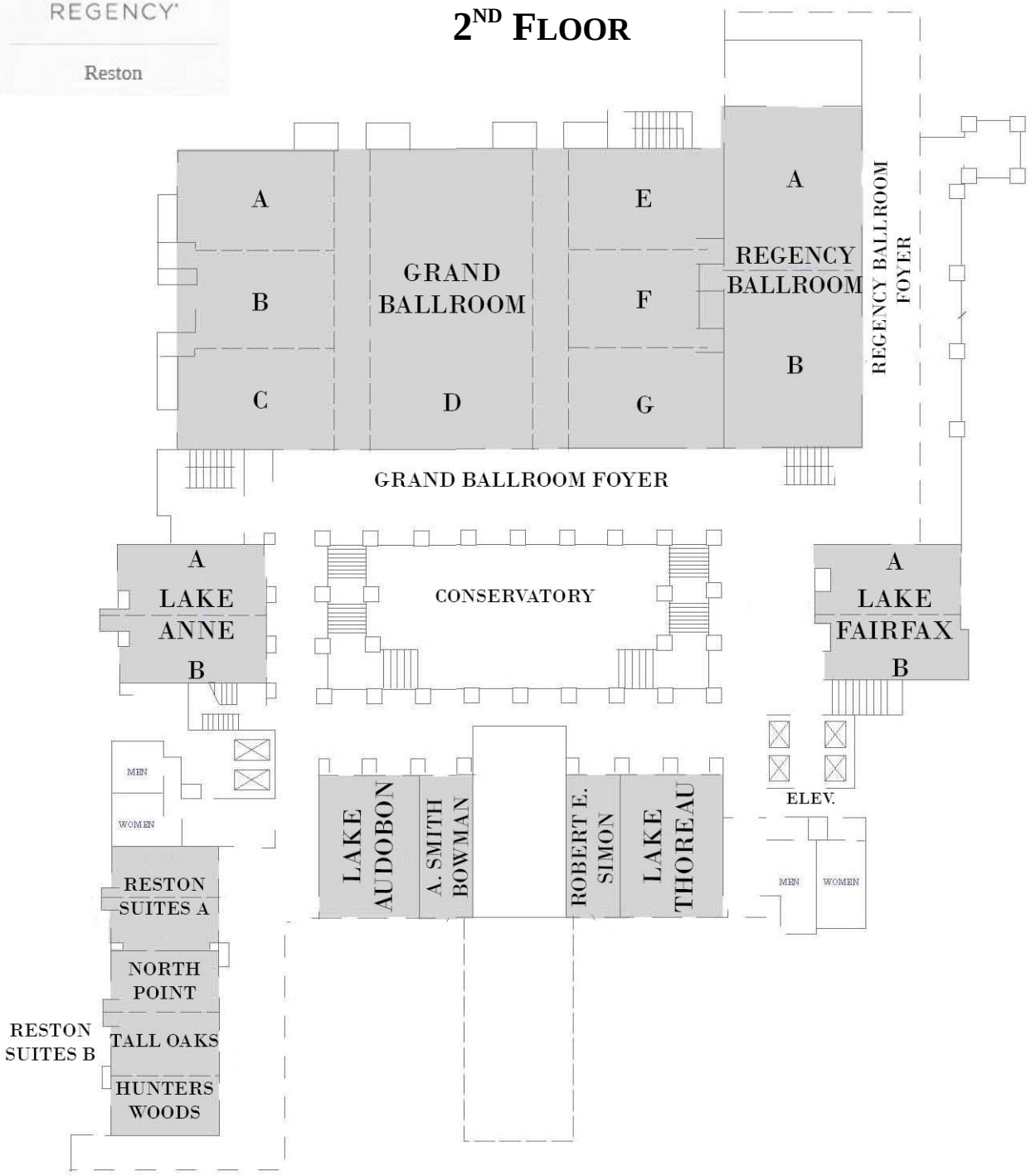
Grand Ballroom Foyer

FYR 5	FYR 6	FYR 1	FYR 2	FYR 7	FYR 3
mp INTERNATIONAL	dp Data Physics	WEIDLINGER	HI-TEST Laboratories, Inc.	ITT	ATK

Layout not to scale

HYATT REGENCY
Reston

2ND FLOOR



1ST FLOOR

THE LIVING ROOM
(Located Adjacent to the Hotel Lobby)