86th
Shock and Vibration Symposium

Orlando | October 5-8, 2015

FINAL CONFERENCE PROGRAM

Introduction

Welcome to Orlando and the 86th 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. The following section features our corporate supporters:

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Ashley Shumaker (SAVE/HI-TEST)
Ernie Staubs (Air Force Research Laboratory)
Michael Woodworth (Weidlinger Associates)
Lauren Yancey (HI-TEST Laboratories)

**TAG members in attendance at summer meeting for 86th S&V program review*

DAILY OUTLINE / TOC / ABSTRACT BOOK

MONDAY, OCTOBER 5	TUTORIALS	8:00AM—7:00PM	P. 5-6
	WELCOME RECEPTION	7:00PM—8:15PM	P. 7
TUESDAY, OCTOBER 6	TUTORIALS	8:00AM—11:00AM	P. 8
	GENERAL SESSION 1 & AWARDS LUNCHEON	11:30AM—1:00PM	P. 9
	TECHNICAL PAPER SESSIONS & TRAININGS (AFTERNOON)	1:00PM—6:00PM	P. 10-13
WEDNESDAY, OCTOBER 7	TECHNICAL PAPER SESSIONS & TRAININGS (MORNING)	8:00AM—NOON	P. 14-17
	GENERAL SESSION 2 & EXHIBITORS' LUNCHEON	NOON—1:30PM	P. 17
	TECHNICAL PAPER SESSIONS & TRAININGS (AFTERNOON)	1:30PM—3:30PM	P. 18-19
	TUTORIALS	3:30PM—6:30PM	P. 20
	SYMPOSIUM SOCIAL/DINNER 100% HOSTED BY SPONSORS	7:00PM—10:00PM	P. 21
THURSDAY, OCTOBER 8	TECHNICAL PAPER SESSIONS & TRAININGS (MORNING)	8:00AM—NOON	P. 22-25
	S&V TAG COMMITTEE MEETING in SALON 8	1:00PM—2:30PM	P. -

ABSTRACT BOOK	ABSTRACTS FOR ALL PAPER/PRESENTATION SESSIONS	-	*AFTER* P. 34

INTERNET CAFE	
Room: Salon 1	
Monday, Oct 5	9AM—8PM
Tuesday, Oct 6	7AM—8PM
Wednesday, Oct 7	7AM—8PM
Thursday, Oct 8	7AM—Noon

EXHIBIT HALL SCHEDULE (Ballroom A/B) **(Exhibitors Listed on Page 26-33)**		
Monday, Oct 5	*Setup*	*Noon—7:00PM*
	Reception	7:00PM—8:15PM
Tuesday, Oct 6	Exhibit Hall Open	9:30AM—5:00PM
	Awards Luncheon	11:30AM—1:00PM
	Session Break—PM	3:00PM—3:40PM
Wednesday, Oct 7	Exhibit Hall Open	9:30AM—4:00PM
	Session Break—AM	9:45AM—10:15AM
	Exhibitors' Luncheon	12:00PM—1:30PM
	Session Break—PM	3:10PM—4:00PM
	Dismantle	*4:00PM—7:00PM*
Thursday, Oct 8	*Dismantle (cont.)*	*8:00AM—Noon*

REGISTRATION	
Room: Salon 3	
Monday, Oct 5	9AM—6PM
Tuesday, Oct 6	7AM—6PM
Wednesday, Oct 7	7AM—6PM
Thursday, Oct 8	7AM—NOON

FOOD & BEVERAGE EVENTS

All Symposium Attendees Welcome at All F&B Events
Guests Welcome at Monday Welcome Reception & Wednesday Evening Social

Monday, October 5

Welcome Reception	7:00pm—8:15pm	Ballroom A/B (Exhibit Hall)

Tuesday, October 6

Continental Breakfast	7:30am—9:00am	Ballroom A/B (Exhibit Hall)
Symposium Awards Luncheon	11:30am—1:00pm	Ballroom A/B (Exhibit Hall)

Wednesday, October 7

Continental Breakfast	7:00am—8:00am	Ballroom A/B (Exhibit Hall)
Symposium Exhibitors' Luncheon	12:00pm—1:30pm	Ballroom A/B (Exhibit Hall)
Ice Cream Social	3:10pm—4:00pm	Ballroom A/B (Exhibit Hall)
Symposium Social/Dinner	7:00pm—10:00pm	Lafayette's (Pointe Orlando)

Thursday, October 8

Continental Breakfast	7:00am—8:00am	Regency Foyer (Salons 1—8)

Welcome Reception

Monday, Oct. 5 • 7:00pm—8:15pm • Ballroom A/B (Exhibit Hall)

Sponsored by: HI-TEST

General Session 1: Symposium Awards Luncheon w/ Keynote Speaker

Tuesday, Oct. 6 • 11:30am—1:00pm • Ballroom A/B (Exhibit Hall)

General Session 2: Exhibitors' Luncheon w/ Henry Pusey Remembrance

Wednesday, Oct. 7 • 12:00pm—1:30pm • Ballroom A/B (Exhibit Hall)

Sponsored by: 86th Shock & Vibration Symposium Exhibitors

Symposium Social/Dinner at Lafayette's Music Room

Wednesday, Oct. 7 • 7:00pm—10:00pm • Lafayette's (Pointe Orlando)

Hosted by: National Technical Systems, PCB Piezotronics, & HI-TEST Laboratories

TUTORIAL SESSION 1 / 8:00am-11:00am

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Cost Avoidance and Clarification Letters-Explained **Meeting Room: Salon 9**
Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia) ~ Mr. Hartsough Presenting

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.

MIL-S-901D Engineering Topics **Meeting Room: Salon 10**
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.

Analysis for Medium Weight Shock **Meeting Room: Salon 11**
Mr. Josh Gorfain (Applied Physical Sciences) & 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 high-light 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.

Quantitative Methods for High-G Electronics Design **Meeting Room: Salon 12**
Dr. Ryan Lowe (Applied Research Associates)
with contributions by: Dr. Jennifer Cordes (ARDEC) / Dr. Jacob Dodson, Dr. Jason Foley, & Dr. Janet Wolfson (AFRL)

The design of high-g electronics remains more of an art than a science. Ensuring the correct operation of an electronics assembly undergoing dynamic loading can be challenging in practice. This tutorial will introduce quantitative methods useful for the design and evaluation of high-g electronics. This tutorial will focus on the design of electronics with loadings that result from a sudden change in velocity (velocity shock). In general the presented methods were developed for applications with accelerations greater than 10,000 g. Emphasis will be placed on the mechanical and thermal aspects of the design process.

The tutorial presentation will be **Distribution D**. Specifics about electrical components and their survivability in laboratory scale testing will be discussed. Weapon systems, their electrical components, and their high-g performance will not be discussed at the tutorial. A list of attendees will be collected during the presentation. Co-authors can choose to share none, some, or all of their presentation materials with attendees.

MONDAY PM (OCTOBER 5)

TUTORIAL SESSION 2 / 12:00pm—3:00pm

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Shock Qualification Testing **Meeting Room: Salon 9**

Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia)

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 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/PVSS for FEA/ Test Engineers **Meeting Room: Salon 10**

Dr. Ted Diehl (Bodie Technology)

This three hour seminar covers, in the language of Mechanical Engineering, Digital Signal Processing (DSP) theory and its application to analyzing challenging transient problems (shock, impact, and other nonlinear, noisy problems). A key focus of the course is obtaining credible correlation and improved interpretation between physical test data and transient simulation data derived from FEA software or similar programs (LS-Dyna, Abaqus/Explicit, Radioss, DOE & DOD codes,…). The presentation explains best practices for working with noisy data and offers many tips to avoid mistakes in data collection and analysis that result in distorted data and incorrect conclusions. One aspect that is often underappreciated is the importance of properly using (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. This complexity along with other undesirable effects such as aliasing (an often unseen mistake made by the simulation community), numerical stability of DSP algorithms, and filter-induced distortions, can make it very difficult to obtain accurate 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 seminar covers 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, …). Along with a review of the underlying theory, the seminar presents practical applications that demonstrate concepts and also shows how different DSP software products process this class of challenging data.

Introduction to Vibration Testing **Meeting Room: Salon 11**

Mr. Jon Wilson (Wilson Consulting)

This tutorial introduces the novice to vibration testing and provides a comprehensive review for the experienced practitioner. It concentrates on conceptual understanding and minimizes mathematics. It is recommended for technicians, engineers, program managers, and others who need a basic understanding of the fundamentals of vibration testing.

Topics covered include the definition and nature of vibration; fundamental structural dynamics; sine, complex and random vibration; spectra; vibration measurement and different measurement systems; shakers and shaker system characteristics; and fundamental fixture design and analysis. Student participation and questions are encouraged. Numerous references are cited.

Introduction to Pyroshock Testing **Meeting Room: Salon 12**

Dr. Vesta Bateman (Mechanical Shock Consulting)

This course discusses the concepts of Near Field, Mid Field Pyroshock and Far Field Pyroshock and their criteria. Instrumentation used for measurement of pyroshock and structural response to pyroshock is described. The development of pyroshock specifications using primarily the Shock Response Spectra is discussed in detail, and various other analysis techniques are presented as well. Simulation techniques for near field, mid field and far field pyroshock are presented and include both pyrotechnic simulations and mechanical simulations. Examples of actual test specifications and the resulting laboratory test configuration and measured results are discussed. In addition, recent problems and issues in the pyroshock community are described and analyzed.

1:30-3:30 **DTE 022 Meeting: MIMO Recommended Practice Committee** **Meeting Room: Salon 13**

Chair: Dr. Marcos Underwood (Tutuli 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.

TUTORIAL SESSION 3 / 4:00pm—7:00pm

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Shock Qualification Testing Extensions **Meeting Room: Salon 9**

Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia)

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.

Effective Solutions for Shock and Vibration Control **Meeting Room: Salon 10**

Mr. Alan Klembczyk (Taylor Devices) & Mr. Herb LeKuch (Consultant)

This presentation provides an outline of various applications and methods for implementing isolation control of dynamic loads and damping within a wide array of dynamic systems and structures. Photos, videos, and graphical results are presented of solutions that have been proven effective and reliable in the past. Design examples are given and typical applications are reviewed Additionally, key definitions and useful formulae are presented that will provide the analyst or systems engineer with the methods for solving isolation problems within the commercial, military, and aerospace sectors.

A wide range of isolation mounts and systems are covered including liquid dampers, elastomer and wire rope isolators, tuned mass dampers, and engineered enclosures. Engineering guidelines are presented for the selection and evaluation of isolation control products. Protection of COTS electronic equipment and probable damage levels are reviewed for the preparation of design and test specifications. Applications involve shipboard, off-road vehicles and airborne projects. Included also are industrial equipment and seismic control of structures and secondary equipment. Field and test data such as Mil-S-901D barge test measurements are presented. The use of Shock Response Spectra (SRS) for equipment assessment as well as isolator analysis is discussed. Details and examples of shock and vibration analyses are presented including case studies with step by step description of engineering calculations.

Beyond the Shock Response Spectrum **Meeting Room: Salon 11**

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.

Use of the SEA (Statistical Energy Analysis) Method in the Analysis of Structures' Dynamic Behavior under Random Loads **Meeting Room: Salon 12**

Mr. Zeev Sherf (Consultant)

The SEA is a method that analyses the behavior of structures exposed to random loads (acoustic noise, random vibration) in statistical terms using energy flow consideration. The dynamic behavior of a structure is described by a set of equations that relates between an exciting power vector to a response energies vector. The relation is established through a coupling matrix, the elements of each are generated from the modal densities, internal dissipation factors of the structure's subsystems and the coupling loss dissipation factors between the structure's subsystems. First the principles of a system's dynamic behavior description in terms of energy flow are elucidated on two subsystems system. Following methods for identification of modal densities, internal dissipation and coupling loss factor for and between different subsystems by models and by measurements are described. The use of the method in the dynamic behavior description of a structure exposed to an acoustic noise is presented as an example.

Welcome Reception

Monday, Oct. 5 • 7:00pm—8:15pm • Ballroom A/B (Exhibit Hall)

Sponsored by:

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TUESDAY AM (OCTOBER 6)

TUTORIAL SESSION 4 / 8:00am—11:00am

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

MIL-S-901D Subsidiary Component Shock Testing & Alternate Test Vehicles **Meeting Room: Salon 9**
Mr. Kurt Hartsough & Mr. Domenic Urzillo (NAVSEA Philadelphia)

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).

Peak Response and First Passage in Random Vibration **Meeting Room: Salon 10**
Dr. Thomas Paez (Paez Consulting)

Random vibration tests are performed on structures for several reasons. Among those are (1) exploration of structural characteristics, (2) efforts to understand how structures and their components perform in certain environments, (3) attempts to prove that structures and their components will survive specific environments, etc. The third reason motivates this tutorial. There are two basic causes of structural failure: mechanical fatigue and passage of a measure of response at a location on a structure beyond a critical level. This tutorial develops the formulas for peak response and first passage in stationary random vibration. We start with reviews of probability theory, deterministic structural dynamics, random processes, and stationary random vibration. We then proceed to show how the two problems of first passage and peak response in random vibration are related. We develop general formulas for the probability distribution of peak structural response during a pre-established time period of stationary random vibration. We then use the probability distribution of peak response to obtain the mean and standard deviation of peak response at a sequence of times. The fundamental formulas for the probability distribution of peak response are obtained for narrow-band random vibration. These formulas are generalized to wide-band random vibration during the tutorial. All the topical presentations of this tutorial refer to a numerical example continuously developed throughout the course. MATLAB programs to solve the problems presented in class and for general use are available to class participants. (Note that it is often specified that the peak response of a structure in stationary random vibration is "about three-sigma." This tutorial shows why that idea is a complete, and usually under-conservative, over-generalization.)

Shock Response Spectra & Time History Synthesis **Meeting Room: Salon 11**
Mr. Tom Irvine (Vibrationdata)

This session covers classical, seismic and pyrotechnic shock. 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 & Python for making these calculations, as well as accompanying pdf files with formulas.

Shock and Vibration Applications using Femap and NX Nastran **Meeting Room: Salon 12**
Mr. Jonathan Buck (ATA Engineering)

Femap is an advanced engineering analysis environment used to pre- and post-process finite element models. Paired with the respected structural solver NX Nastran, Femap can be used to predict the behavioral responses of complex structures in static, dynamic, thermal and vibration environments. CAD and solver-neutral technology and cost-effective functionality have enabled Femap to be widely used by the world's leading engineering organizations. We will begin by introducing Femap and its many uses in shock and vibration environments. We will also demonstrate numerous analyses including transient and frequency responses, normal modes, and the U.S. Navy-developed Dynamic Design Analysis Method (DDAM) using Femap and NX Nastran.

Application of Engineering Fundamentals in Solving Shock and Vibration Problems **Meeting Room: Salon 8**
Mr. Fred Costanzo (Engineering Consultant, LLC & NAVSEA Carderock/UERD, ret.)

This tutorial first presents a brief primer in underwater explosion (UNDEX) fundamentals and shock physics. Included in this discussion are the features of explosive charge detonation, the formation and characterization of the associated shock wave, bulk cavitation effects, gas bubble formation and dynamics, surface effects and shock wave refraction characteristics. In addition, analyses of associated measured loading and dynamic response data, as well as descriptions of supporting numerical simulations of these events are presented. Next, simple tools are introduced to assist engineers in benchmarking solutions obtained for more complex UNDEX problems. Presented will be the generation of "bounding" estimates for the global dynamic response of surface ship and submarine structures subjected to underwater shock. Three well documented methodologies are presented, including the Taylor flat plate analogy for both air- and water-backed plates, the peak translational velocity (PTV) method, and the application of the conservation of momentum principle to estimating the vertical kickoff velocity of floating structures (spar buoy approach). Derivations of the governing equations associated with each of these solution strategies are presented, along with a description of the appropriate ranges of applicability.

Finally, special case studies involving numerical methods applications in shock and vibration problems will be presented. Specific areas that are discussed include finite difference approximations, root finding techniques and other numerical solution strategies. For each area covered, the basic theory is briefly described, a shock and vibration application is set up and a solution algorithm in the form of a Python script is developed and presented. Next, a solution is generated and the results are illustrated and discussed.

General Session 1 & Awards Luncheon

11:30am—1:00pm
Ballroom A/B (Exhibit Hall)

11:30am—11:50am	Buffet Lunch
11:50am—12:00pm	Lifetime Achievement Award (presented to Mr. Jim Lally by Dr. Patrick Walter)
12:00pm—12:10pm	Lifetime Achievement Award (presented to Mr. Bob Krezel by Mr. Fred Costanzo)
12:10pm—12:20pm	Henry Pusey Best Paper Award (presented to Dr. Erik Timpson & Dr. Thomas Engel)
12:20pm—12:25pm	Keynote Speaker Introduction by Mr. Thomas Irvine
12:25pm—12:55pm	Keynote Lecture: Dr. Curtis Larsen (NASA Technical Fellow)

Lifetime Achievement Award Winners

This award recognizes **James (Jim) Lally's** 60 years of dedication to providing dynamic sensor technology in blast, ballistics, shock, vibration, acoustics, strain, and dynamic force to the SAVE community. It also recognizes both his generous contributions to educational institutions and his professionalism in corporate interactions.

Throughout his 50 year career in ship survivability, **Bob Krezel** has demonstrated superb leadership and technical direction in the creation, execution, and enhancement of numerous major Navy survivability programs. His dedication was the driving force behind development and execution of new shock test methods which saved millions in current and future programs.

Henry Pusey Best Paper Award Winner (*presented for best paper at previous symposium*)

Reversible Electromagnetic Launchers for Mechanical Shock Testing

Dr. Erik Timpson (Honeywell) & Dr. T.G. Engel (University of Missouri)

A 750 mm barrel length x 40 mm bore diameter hollow projectile, reversible helical electromagnetic launcher (RHEML) is evaluated for its ability to produce a negative acceleration (i.e., a "jerk"). The RHEML projectile and payload weighs approximately 750 grams and will travel with velocity up to 100 m/s. A 450 kJ multiple-module capacitive pulse forming network (PFN) with the ability to provide both positive and negative voltage and current is used to power the RHEML launcher. Special precautions must be taken when designing this type of PFN and RHEML. Theoretical and practical design guidelines for this type of PFN are presented and discussed. The results of the systematic experimental approach taken to generate and evaluate the transient current waveforms is presented and analyzed. Results show the reversible HEML is able to produce a negative jerk and travel in the opposite direction.

Keynote Lecture: Dr Curtis Larsen (bio)

Dr. Curtis E. Larsen is currently the NASA Technical Fellow for Loads and Dynamics and is resident at the Johnson Space Center. Prior to joining the NESC, Dr. Larsen was the Technical Discipline Manager for Cargo Integration Structures in the Space Shuttle Program's Flight Operations and Integration Office. Prior to that assignment, he was a technical integration lead in the Space Shuttle System Integration Office responsible for structures, loads and dynamics for both cargo elements and the Shuttle vehicle. Dr. Larsen has also served as the Shuttle/Station technical liaison for structures and as a member of the Shuttle Loads and Structural Dynamics Panel.

Dr. Larsen has over 35 years of engineering experience and first worked at the NASA Johnson Space Center from 1985 to 1990 as a structural engineer in the Loads and Dynamics Branch of the Structures and Mechanics Division. His particular areas of expertise and interest are in stochastic structural dynamics, structural safety, and probabilistic engineering applications. Before rejoining NASA in 2001, Dr. Larsen held various engineering research, development, and design positions with companies in the offshore oil construction, building construction, and aerospace industries, including McDermott Engineering, Boeing, and United Space Alliance.

Dr. Larsen received a B.S. in Civil Engineering from the University of North Dakota in 1980, and a Master of Engineering in Civil Engineering (Structures/Soils) from the University of North Dakota in 1982. He received a Ph.D. from Rice University in 1988. In addition, Dr. Larsen is a registered Professional Engineer in the State of Texas.

TUESDAY PM (OCTOBER 6)

	SESSION 1	SESSION 2	SESSION 3
	UNDEX I (1:00pm-2:40pm / Unlimited Dist. A) Chair(s): Dr. E. Thomas Moyer (NSWC Carderock) -	Structural Response (1:00pm-3:00pm / Unlimited Dist. A) Chair(s): Mr. Rob Sharp (Hutchinson USA) -	DS: Material Characterization and Evaluation under Mechanical Shock (1:00pm-2:20pm / Limited Dist. D+) (2:20pm-2:40pm / Unlimited Dist. A) Chair(s): Dr. Jacob Dodson (Air Force Research Laboratory) Mr. Curtis McKinion (Air Force Research Laboratory)
	All Presenters and Chairs (for Oct 6) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading		
	Meeting Room: Salon 9	***Meeting Room: Salon 10***	***Meeting Room: Salon 7***
1:00	**Response of Composite Plates to Near Field Underwater Explosions Including Polyurea Coating Effects** (AB 1) Dr. James LeBlanc (NUWC Newport)/ *Presented by: Mr. Kevin Behan (NUWC Newport)*	**Progress on Verification and Acceptance of the Residual Mass Dynamic Design Analysis Method**§ (AB 2) Mr. Rick Griffen (HII-NNS) ***§ Short Presentation (10 min)***	**Development of a Dynamic Mechanically Matched Explosive Simulant for Shock Testing Embedded Electronic Components** (AB 5) Dr. Tammy Metroke (University of Dayton Research Institute), Dr. Jacob Dodson & Dr. Janet Wolfson (Air Force Research Laboratory)
1:20	**An Experimental Study of Loading from UNDEX Bubble Collapse** (AB 1) Mr. John M. Brett, Mr. George Yiannakopoulos, & Mr. Andrew Krelle (Defence Science & Technology Group) / *Presented by: Mr. Warren Reid (Defence Science & Technology Group—Australia)*	**AT Planner for Bridges: Computationally Efficient Software For Assessing The Response Of Bridge Components Subjected To Blast Loads** (AB 2) Dr. Eric Williamson (University of Texas at Austin), Mr. Eric L. Sammarco, Mr. Joeny Q. Bui, & Dr. David J. Stevens (Protection Engineering Consultants), Dr. C. Kennan Crane (US Army Corps of Engineers, ERDC)	**Shock Testing of Conductive and Electronic Materials** (AB 5) Mr. Curtis McKinion (Doolittle Institute/AFRL), Dr. Jason Foley (Air Force Research Laboratory)
1:40	**Application of the Coupled Eulerian-Lagrangian (CEL) Technology in Abaqus/Explicit for Near Field UNDEX** (AB 1) Mr. Mike Sasdelli & Mr. Dave Woyak (Dassault Systemes SIMULIA Corp)	**Detailing of Steel Structures Subjected to Blast Loading** (AB 3) Mr. David A. Holgado, Dr. Rachel Stansel, & Mr. Darrell Barker (ABS Consulting)	**Polymeric Composite Characterization Using Embedded Instrumentation in High-G Loading** (AB 5) Dr. Jacob Dodson, Lt. Hayley Chow, & Dr. Janet Wolfson (Air Force Research Laboratory)
2:00	**Physics Based Modeling & Simulation For Shock & Vulnerability Assessments; Navy Enhanced Sierra Mechanics (NESM)** (AB 2) Dr. E. Thomas Moyer (NSWC Carderock)	**Shock Optimized Foundation Designs** (AB 4) Mr. Carlos de Lima & Mr. Daniel Pusey (Altair Engineering)	**Evaluation of Damage Induced by Embedded Masses in Polymeric Composites** (AB 6) Lt. Hayley Chow & Dr. Janet Wolfson (Air Force Research Laboratory), Mr. Shane Curtis (Sandia National Laboratories)
2:20	**Equipment and Deck Fixture Response Prediction using a 2-DOF Oscillator** (AB 2) Mr. Rick Griffen & Mr. Matt Davis (HII-NNS)	**Precision Guidance Kit (PGK) Power Electronics Module Gun Launch** (AB 4) Mr. Miroslav Tesla, Mr. Eric Marshall, & Mr. Michael Hollis (US Army ARDEC)	**Wave Propagation Methods for Modeling Pyrotechnic Shock Attenuation across Material and Joints** (AB 6) Mr. Tom Irvine (Vibrationdata)
2:40		**The Damage Procedure of a H-type Beam to a Inclined Dynamic Force** (AB 4) Mr. Haikun Wang & Mr. Jian Hu Liu (China Ship Scientific Research Center)	

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TUESDAY PM (OCTOBER 6)

	VENDOR SESSION A **Exhibitor Presentations including: Product and/or Service Overviews, Product Demos, & New Developments and Technologies** Chair(s): Dr. Patrick Walter (PCB Piezotronics / Texas Christian Univ.) Mr. Alan Klembczyk (Taylor Devices)	TRAINING **Optimized DDAM Analysis** (1:00pm-2:00pm / Unlimited Dist. A) **Developing Exodus II and Sierra Format Models using HyperMesh Commercial Solution** (2:00pm-3:00pm / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading	
	Meeting Room: Salon 11	***Meeting Room: Salon 12***
1:00	**Bodie Technology** ***Smart-Tools for Noisy and Messy Data.*** Dr. Ted Diehl	**Optimized DDAM Analysis** Mr. Daniel Pusey & Mr. Carlos de Lima (Altair Engineering) 1:00pm—2:00pm In this workshop, the focus will be in optimizing DDAM simulations. The new solver-neutral DDAM utility in HyperMesh will be used to illustrate how you can prepare your finite element models more effectively regardless of your choice of solver. In addition, an analysis will be run using OptiStruct to provide both the initial DDAM analysis and then size and shape optimization will be applied to the foundation model to improve the performance of the model under DDAM shock simulation conditions. Complete post-processing of the analysis and optimization will be completed using HyperView and HyperGraph.
1:15	**Vibro/Dynamics LLC** ***Specializing in Vibration Isolation and Shock Control since 1964.*** Mr. Claude Prost	
1:30	**HBM Test & Measurement** ***Improving Products One Measurement at a Time*** Mr. Mike Hoyer	
1:45	**PCB Piezotronics** ***A Designer and Manufacturer of Sensors to Measure Vibration, Acoustics, Force, Pressure, Load, Strain, Shock & Torque.*** Dr. Patrick Walter	
2:00	**Taylor Devices** ***The World Leader in Innovative Shock and Vibration Control Since 1955.*** Mr. Alan Klembczyk	**Developing Exodus II and Sierra Format Models using HyperMesh Commercial Solution** Mr. Matthew King (Altair Engineering) 2:00pm—3:00pm This training session will be a presentation of the process involved to develop a model using a commercial software solution, HyperMesh. The session will be based on the Technical Presentation introducing a commercially available interface, built specifically to facilitate the process of building models for analysis in the Exodus II and Sierra formats. The interface will be demonstrated including CAD interfacing, geometry modification/creation, model meshing, and potential for model optimization. Editing of existing Exodus II/Sierra formatted models to incorporate design changes will also be illustrated.
2:15	**Kistler Instruments** ***Measuring Systems and Sensors to Meet Extreme Challenges.*** Mr. Rich Cadille	
2:30	**Vision Research** ***When It's Too Fast to See and Too Important Not To.*** Mr. Russ Lessmeier	
2:45	**Precision Filters** ***Founded in 1975, Precision Filters, Inc. is a Manufacturer and Global Distributor of High Performance Instrumentation for Test Measurements.*** Mr. Douglas Firth	

TUESDAY PM (OCTOBER 6)

	SESSION 4 Mechanical Shock: Advanced Modeling and Testing Methods (3:40pm-4:40pm / Limited Dist. C) (4:40pm-5:40pm / Unlimited Dist. A) Chair(s): Mr. Brian Lang (NSWC Carderock) Mr. Matt Davis (HII-NNS)	SESSION 5 Isolation (3:40pm-5:40pm / Unlimited Dist. A) Chair(s): Mr. Herb LeKuch (Consultant—901d & Shock Tech) -	SESSION 6 UNDEX Analysis Applications (3:40pm-5:20pm / Limited Dist. C) Chair(s): Dr. Joseph Ambrico (NUWC Newport) Mr. Stephen Turner (NUWC Newport)
	All Presenters and Chairs (for Oct 6) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading		
	Meeting Room: Salon 8	***Meeting Room: Salon 9***	***Meeting Room: Salon 7***
3:40	**Medium Weight Shock Machine (MWSM) Equipment Kill Criteria: Test Results** (AB 7) Mr. Brian Lang (NSWC Carderock), Mr. Chris Szczur (American Society for Engineering Education)	**A New Short Mount for Barge Shock Isolation** (AB 8) Mr. Kevork Kayayan & Mr. JJ Osmecki (Shock Tech)	**Analysis of an Implosion Mitigation Device** (AB 11) Dr. Joseph Ambrico, Mr. Ryan Chamberlin, & Mr. Stephen Turner (NUWC Newport)
4:00	**Medium Weight Shock Machine (MWSM) Equipment Kill Criteria: Model Development** (AB 7) Mr. Brian Lang (NSWC Carderock), Mr. Chris Szczur (American Society for Engineering Education)	**Selection of Shock Tech Isolation Systems for Populated 901d Racks** (AB 9) Mr. Herb LeKuch (Consultant– 901d and Shock Tech), Mr. Neil Donovan (Shock Tech)	**Proof-of-Concept Testing for Implosion Mitigation Device** (AB 12) Mr. Stephen Turner (NUWC Newport)
4:20	**An Updated Medium Weight Shock Machine and Ballasted Spring Deck Fixture FEA Model** (AB 7) Mr. Matt Davis & Mr. Rick Griffen (HII-NNS)	**Design and Evaluation of a Support Platform for a Bulkhead Mounted Electronic Unit** (AB 9) Mr. Fred Sainclivier & Mr. Aldric Seguin (901d)	**Computational Modeling of Shock Initiated Implosion of a Metal Tube within a Closed Tube** (AB 12) Dr. Emily Guzas, Dr. Joseph Ambrico, & Dr. James LeBlanc (NUWC Newport)
4:40	**Effects of Geometric Nonlinearity on Shock Response of the Antenna Structure** (AB 7) Mr. Yunus E. Özçelik (ASELSAN Inc.), E.CİĞEROĞLU & M.CALISKAN (Middle East Technical University, Department of Mechanical Engineering)	**Using Wire Rope Isolators for Seismic Protection** (AB 10) Mr. Claude Prost & Mr. Joshua Partyka (Vibro / Dynamics LLC)	**Testing and Analysis of a Water-Borne IED (WBIED) to Characterize the Above and Below Waterline Explosive Loading Environment** (AB 12) Mr. Ken Nahshon, Mr. Michael Miraglia (*presenter*), Mr. N. Reynolds, & Mr. D.T. Wilson (NSWC Carderock)
5:00	**Response Limited Shaker Shock Testing** (AB 8) Mr. Troy J. Skousen & Mr. Ronald G. Coleman (Sandia National Laboratories), Mr. David O. Smallwood (Consultant)	**Modelling The Response to Underwater Explosions of Internal Platforms Resiliently Mounted with Rubber Shock Isolators** (AB 10) Mr. Steven De Candia (Australian Maritime College), Dr. Craig Flockhart (Defence Science & Technology, Australian DoD) *Presented by: Mr. Warren Reid (Defence Science & Technology Group—Australia)*	**Determination of a Design Pressure for External Volumes to Resist Implosion Failure when Subjected to Combined Shock and Submergence Loading** (AB 12) Mr. Christopher J. Abate and Mr. Dashiell B. Parsons (Electric Boat Corporation)
5:20	**Development of a Single Input Multiple Output (SIMO) Input Derivation Algorithm for Oscillatory Decaying Shocks** (AB 8) Mr. Chad A Heitman, Mr. Jack B. Reid, & Mr. Vit Babuska (Sandia National Laboratories)	**Wire Rope vs. Elastomer Isolators for Naval Applications** (AB 11) Mr. Claude Prost & Mr. Joshua Partyka (Vibro / Dynamics LLC)	

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TUESDAY PM (OCTOBER 6)

	VENDOR SESSION B Exhibitor Presentations including: Product and/or Service Overviews, Product Demos, & New Developments and Technologies Chair(s): Mr. Gary Marraccini (Spectral Dynamics) Mr. Jake Rosenthal (Dewesoft, LLC)	TRAINING Introduction to Finite Element Analysis (3:45pm-5:15pm / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 6) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading	
	Meeting Room: Salon 11	***Meeting Room: Salon 10***
3:45	**Xcitex** ***Video Capture and Motion Analysis Solutions.*** Mr. Peter Carellas	**Introduction to Finite Element Analysis** Mr. Bart McPheeters (Autodesk) 3:45pm—5:15pm 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.
4:00	**Dewesoft, LLC** ***Development, Production, and Sales of Measurement Instruments.*** Mr. Jake Rosenthal	
4:15	**Spectral Dynamics** ***A Leading Worldwide Supplier of Systems and Software for Vibration Testing, Structural Dynamics, and Acoustic Analysis.*** Mr. Gary Marraccini	
4:30	**Vibration Research** ***Experienced, Industry Leaders Offering State-of-the-Art Vibration Controllers for Electrodynamic and Servo-Hydraulic Shakers.*** Mr. Kevin Van Popering	
4:45	**Dytran Instruments** ***Piezoelectric and DC MEMS Sensors for Measurement and Monitoring.*** Mr. Kevin Westhora	
5:00	**IMV Corporation** ***IMV CORPORATION specializes in environmental testing, measurement and analysis equipment for vibration-related applications.*** Mr. Ichiro Hayashi	

WEDNESDAY AM (OCTOBER 7)

	SESSION 7 **Mechanical Shock Using Energy Methods** (8:00am-9:40am / Unlimited Dist. A) Chair(s): Mr. Ed Alexander (BAE Systems) -	SESSION 8 **Vibration and Acoustic Testing/Analysis** (8:00am-9:40am / Unlimited Dist. A) Chair(s): Dr. Peter Vo (Raytheon) Mr. Tony Keller (Spectral Dynamics)	SESSION 9 **DS: Experimental Testing Methods and Instrumentation in High-g Environments** (8:00am-9:20am / Limited Dist. D+) Chair(s): Dr. Janet Wolfson (Air Force Research Laboratory) Mr. Jonathan Hong (Applied Research Associates)
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading		
	Meeting Room: Salon 9	***Meeting Room: Salon 10***	***Meeting Room: Salon 7***
8:00	**Use of Energy & Temporal Duration to Synthesize SRS Compatible Acceleration** (AB 13) Mr. J. Edward Alexander (BAE Systems)	**6 DOF Shock and Vibration: Testing and Analysis** (AB 15) Dr. Brian C. Owens, Dr. D. Gregory Tipton, & Mr. Matthew McDowell (Sandia National Laboratories)	**Using Multiple G-Switches for Target Detection** (AB 17) Dr. Jeff Hill (Sandia National Laboratories)
8:20	**Shock Sequence at a Forward Location in a Large Boat: Analysis and Generation of a Laboratory Simulation Regime** (AB 13) Mr. Zeev Sherf, Dr. Arie Elka, Mr. Philip Hopstone, & Mr. L. Klebanov (RAFAEL Environmental Engineering Center)	**Phase Influence on the Response of a Slender Beam Structure under Combined Rotational and Transverse Base Excitations** (AB 16) Dr. Ed Habtour (US Army Research Laboratory), Mr. Raman Sridharan & Mr. Abhijit Dasgupta (Center for Advanced Life Cycle Engineering, University of Maryland)	**Mechanical Survivability of an Embedded Fireset in a Quasi-Static and Dynamic High-Pressure Environment** (AB 17) Lt. Josh Campbell, Dr. Jacob Dodson, & Dr. Janet Wolfson (Air Force Research Laboratory)
8:40	**Mechanical Shock Failure Predictions of a Cantilever Structure Using Energy Response Spectra Methods** (AB 14) Mr. Vit Babuska, Mr. Carl Sisemore, & Mr. Jason Booher (Sandia National Laboratories)	**The Derivation of Multiple-Input-Multiple Output (MIMO) Acoustic Test Specifications to Simulate a Missile Flight** (AB 16) Mr. Jerome Cap & Ms. Shantisa Norman (Sandia National Laboratories), Mr. David Smallwood (Consultant)	**Experimental Evaluation of Additively Manufactured Supports under High-G Loads** (AB 18) Dr. Ryan Lowe (Applied Research Associates), Mr. Lyonel Reinhardt & Dr. Jennifer Cordes (US Army Picatinny Arsenal), Dr. Jason Foley (Air Force Research Laboratory)
9:00	**A Method for Extrapolating Haversine Shock Test Input Levels** (AB 14) Mr. Carl Sisemore & Mr. Troy Skousen (Sandia National Laboratories)	**The Effects of Vibration on Measurement Microphones** (AB 16) Mr. Robert K. O'Neil (GRAS Sound and Vibration)	**Measuring Embedded Dynamic Pressure: Design, Characterization, and Implementation** (AB 18) Dr. Alain Beliveau & Mr. Jonathan Hong (Applied Research Associates), Lt. Hayley Chow & Dr. Jacob Dodson (Air Force Research Laboratory)
9:20	**Calculation of the Dissipated Energy Spectrum from a Fourier Amplitude Spectrum** (AB 15) Mr. Carl Sisemore, Ms. Julie Harvie, & Mr. Troy Skousen (Sandia National Laboratories)	**The Use of Quaternions to Compensate for Geometric Distortion in Dynamic Seismic and Satellite Testing** (AB 17) Dr. Marcos Underwood (Tutuli Enterprises)	

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Coffee Break in the Exhibit Hall

9:45am—10:15am (Ballroom A/B)

WEDNESDAY AM (OCTOBER 7)

	VENDOR SESSION C Exhibitor Presentations including: Product and/or Service Overviews, Product Demos, & New Developments and Technologies Chair(s): Mr. Ray Rautenstrauch (Meggitt PLC) Mr. Britton Kreitz (National Technical Systems)	TRAINING Introduction to Testing on the Deck Simulating Shock Machine (DSSM) (8:00am-8:30am / Unlimited Dist. A) Introduction to Nonlinear Analysis (8:30am-10:00am / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading	
	Meeting Room: Salon 11	***Meeting Room: Salon 12***
8:00		**Introduction to Testing on the Deck Simulating Shock Machine (DSSM)** Mr. Calvin Milam (National Technical Systems) 8:00am—8:30am *No abstract available.*
8:15		
8:30	**Meggitt PLC** ***Meggitt is a global engineering group specialising in extreme environment components and sub-systems for aerospace, defence and energy markets.*** Mr. Ray Rautenstrauch	**Introduction to Nonlinear Analysis** Mr. Bart McPheeters (Autodesk) 8:30am—10:00am 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.
8:45	**National Technical Systems** ***NTS is a diversified engineering services company, providing a wide range of product testing, certifications, and supply chain management solutions.*** Mr. Britton Kreitz	
9:00	**Noise and Vibration Technologies (NVT)** ***Measuring, simulating and analyzing the effects of vibration, noise, shock, and other environmental variables.*** Mr. Bryan Williams	
9:15	**ITT** ***A diversified manufacturer of highly engineered critical components and customized technology solutions for the energy, transportation & industrial markets.*** Mr. Mark Gilson / Mr. Bill Wilk	
9:30	**Kulite** ***A global leader in pressure transducer technology serving high tech industries worldwide.*** Mr. Steve Carter	

Coffee Break in the Exhibit Hall

9:45am—10:15am (Ballroom A/B)

WEDNESDAY AM (OCTOBER 7)

	SESSION 10	SESSION 11	SESSION 12
	Advanced Data Analysis in Vibration (10:20am-11:40am / Unlimited Dist. A) Chair(s): Dr. Luke Martin (NSWC Dahlgren) -	**Response to Detonations** (10:20am-10:40am / Limited Dist. C) **Analysis of Detonations** (10:40am-Noon / Unlimited Dist. A) Chair(s): Mr. James Eridon (General Dynamics Land Systems) -	**DS: The Navy Energetic Modeling Oracle -NEMO-** (10:20am-Noon / Limited Dist. C) Chair(s): Dr. E. Thomas Moyer (NSWC Carderock) -
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading		
	Meeting Room: Salon 9	*Meeting Room: Salon 7*	*Meeting Room: Salon 8*
10:20	**The Solution to Random Over-Testing** (AB 18) Mr. Philip Van Baren, Mr. Joel Minderhoud, & Mr. Jacob Maatman (Vibration Research), *presented by* Mr. Kevin Van Popering (Vibration Research)	**Development of a Scalable/Selectable Wall Breaching Munition** (AB 21) Mr. Timothy Shelton & Dr. John Ehrgott (US Army Corps of Engineers - ERDC), Mr. Andrew Woetzerl (ARDEC - Picatinny Arsenal)	**Introducing The Navy Energetic Modeling Oracle (NEMO)** (AB 23) Dr. E. Thomas Moyer (NSWC Carderock)
10:40	**Employing Monte Carlo Techniques to Explore the Spectral Density Matrix Solution Space** (AB 19) Dr. Luke A. Martin & Mr. Shawn Schneider (NSWC Dahlgren)	**Analysis of Blast Overpressure from Ammunition Compartment Events** (AB 21) Mr. James Eridon (General Dynamics Land Systems)	**Sierra Mechanics & Its Critical Contributions to NESM** (AB 23) Dr. Garth Reese & Dr. Kendall Pierson (Sandia National Laboratories)
11:00	**Natural Frequencies of Layered Beams Using a Continuous Variation Model** (AB 19) Mr. Arnaldo J. Mazzei, Jr. (Kettering University), Mr. Richard A. Scott (University of Michigan)	**Analysis of Craters from Large Buried Charges** (AB 21) Mr. James Eridon, Mr. Tom Zeleznik, Mr. Matt Miiller, & Mr. Jonathan West (General Dynamics Land Systems)	**NEMO Parallel Code Communication & The Navy Standard Coupler (NSC)** (AB 23) Dr. Badri Hiriyur (Weidlinger Associates)
11:20	**Tactical Transportation Vibration Characterization and Comparison to MIL-STD810G** (AB 20) Mr. Galit Kipervaser-Levit, Mr. R. Moshe, Mr. I. Sofer, Mr. L. Klebanov, & Mr. Arie Elka (RAFAEL), Mr. Zeev Sherf (Consultant)	**A Lagrangian Particle Formulation for Modeling Fragmentation Processes** (AB 22) Mr. Youcai Wu, Mr. Joseph M. Magallanes, & Mr. Hyung-Jin Choi (Karagozian & Case)	**Approach to Fluid-Structure Interactions within a Fixed Eulerian CFD Grid** (AB 24) Mr. Paul Hassig & Dr. Badri Hiriyur (Weidlinger Associates)
11:40		**Simulation of Experiments which Show that Reflection Pressure Time History from Ground Shock Depends on the Reflected Structure's Stiffness and Mass** (AB 22) Mr. Leo Laine (LL Engineering AB), Mr. Morgan Johansson (Reinertsen Sverige AB), Mr. Ola Pramm Larsen (CAEwiz Consulting)	**Verification & Validation of NEMO** (AB 24) Mr. Jonathan Stergiou & Mr. Michael Miraglia (NSWC Carderock)

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WEDNESDAY AM (OCTOBER 7)

	VENDOR SESSION D Exhibitor Presentations including: Product and/or Service Overviews, Product Demos, & New Developments and Technologies Chair(s): Mr. Travis Kerr (HI-TEST Laboratories) Mr. Ray Deldin (Altair)	USER GROUP Kornucopia® ML - Enhancing Analysis of Test and FEA Data in MATLAB® (10:15am-12:15pm / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading	
	Meeting Room: Salon 11	*Meeting Room: Salon 10*
10:15	**Altair** *Altair is focused on the development and broad application of simulation technology to synthesize and optimize designs, processes and decisions.* Mr. Ray Deldin	**Kornucopia® ML - Enhancing Analysis of Test and FEA Data in MATLAB®** Dr. Ted Diehl (Bodie Technology, Inc.) 10:15am—12:15pm In this group discussion Dr. Ted Diehl will cover the features of the new Kornucopia® ML release, rewritten from scratch, and now configured to run natively in MATLAB®. Kornucopia® is a unique suite of tools to improve speed, flexibility and precision in the analysis and management of high volumes of noisy, real-world data generated in the experimental, test, research, and simulation environments. Dr. Diehl will show how the elements of Kornucopia® can improve the effectiveness of the data analyst/engineer in several key areas that will have immediate benefit. Applied areas will include: Maintenance of consistent data units through mathematical operations and freedom to work with any unit format/system interchangeably while Kornucopia® automatically insures consistency and accuracy, Easy to use SRS & PVSS analysis, Highly automated work flows, Repeatable and traceable output plot options that offer flexibility to restructure and rerun (automatically retrieving meta data from plot variables to populate plot axes, legends, and titles), Automated work flows to directly read data out of Abaqus ODB files, and Easy management of a large array of experimental test ASCII data files. Specific examples will cover importing data from FEA and test data files, correlation of Test and FEA data for Missile Penetration Analysis, and Component shock analysis including rapid estimation of shock mitigation via shock isolation. A question and answer period with Dr. Diehl is included. Discussion of attendee application problems/issues is encouraged.
10:30	**Shock Tech** *Shock Tech designs, manufactures and tests shock attenuation and vibration isolation mounting systems for the most demanding environments.* Mr. Neil Donovan	
10:45	**Huntington Ingalls Industries (NNS/NNI)** *Newport News Shipbuilding is the sole designer, builder and refueler of U.S. Navy aircraft carriers and 1 of 2 providers of U.S. Navy submarines.* Ms. Tiffany Boyle	
11:00	**HI-TEST Laboratories** *A single-source solution for MIL-S-901D shock and Mil-Std-167 vibration testing plus numerical and analytical engineering expertise.* Mr. Travis Kerr	
11:15	**Dayton T. Brown** *Superior quality in engineering, testing, contract manufacturing, test systems and technical communications services.* Mr. Haim Gurewich	
11:30	**AUTODESK** *Autodesk, Inc., is a leader in 3D design, engineering and entertainment software.* Mr. Dave Beer	
11:45	**Dongling USA** *Dongling is a world leading manufacturer of vibration, shock and shake testing machinery.* Mr. Matt Millard	

General Session 2: Exhibitors' Luncheon & Henry Pusey Remembrance

Wednesday, Oct. 7 • Noon—1:30pm • Ballroom A/B (Exhibit Hall)

Noon—1:00pm: Luncheon, 1:00pm-1:25pm: Henry Pusey Remembrance

WEDNESDAY PM (OCTOBER 7)

	SESSION 13 Airblast Testing and M&S of Systems (1:30pm-2:10pm / Limited Dist. D) Modeling for Structural Response (2:10pm-3:10pm / Unlimited Dist. A) Chair(s): Mr. Bradford Steed (US Army ERDC) -	SESSION 14 Acoustic and Vibration Environments: Characterization & Analysis (1:30pm-2:50pm / Unlimited Dist. A) Chair(s): Mr. Zeev Sherf (RAFAEL) Mr. Jerome Cap (Sandia National Laboratories)	SESSION 15 Ballistics Effects: Modeling & Testing (1:50pm-3:10pm / Limited Dist. C) Chair(s): Dr. Jennifer Cordes (US Army, Picatinny Arsenal) -
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading		
	Meeting Room: Salon 7	***Meeting Room: Salon 9***	***Meeting Room: Salon 8***
1:30	**Experimental Series to Evaluate the Performance of the Modular Protective System (MPS) Against Airblast Loading** (AB 24) Mr. Bradford A. Steed, Mr. Matthew S. Holmer, Mr. Donald H. Nelson, Mr. Omar Esquilin-Mangual, & Mr. Billy Bullock (US Army ERDC)	**Performance Evaluation of Flow Induced Noise Models for a Cylinder in Axial Flow** (AB 27) Dr. Krishna Kumar & Dr. Bhujanga Rao (Defence Research & Development Organization)	
1:50	**Development and Experimental Evaluation of the Modular Protective System (MPS) Multi-purpose Guard Tower** (AB 25) Mr. Matthew S. Holmer, Mr. Bradford A. Steed, Mr. Micael C. Edwards, & Mr. Patrick M. Kieffer (US Army ERDC)	**The Derivation of Appropriate Laboratory Vibration Test Durations and Number of Shock Hits from Non Stationary Field Test Data** (AB 27) Mr. Jerome Cap & Ms. Melissa C' de Baca (Sandia National Laboratories)	**Modeling and Simulation with User Material Models using ABAQUS** (AB 29) Dr. Jennifer Cordes, Mr. Pavol Stofko, & Mr. Steve Recchia (US Army, Picatinny Arsenal)
2:10	**The Role of Geometric Imperfections on Quasi-static Axial Crushing of Bisected Honeycomb Structures** (AB 25) Mr. Morris Berman (US Army Research Lab)	**Analysis of the Vibration Measured during Exposure of a Launcher to an In-Laboratory Simulated Dynamic Regime at the Rear of a Fast Boat** (AB 27) Mr. Zeev Sherf, Dr. Arie Elka, Mr. Philip Hopstone (RAFAEL Environmental Engineering Center)	**Variables Impacting the Projectile Dynamics near Muzzle Exit** (AB 29) Dr. Jennifer Cordes, Dr. Donald Carlucci, & Mr. Matt Hawkswell (US Army, Picatinny Arsenal)
2:30	**Steady State Response of Pipes with Various End Supports and Geometric Imperfections** (AB 26) Dr. Rudolph J. Scavuzzo (Consultant), Mr. Domenic A. Urzillo (NSWCCD Philadelphia)	**Vibrations at an Aft Location on a Large Boat–Analysis and Generation of a Laboratory Simulation Regime** (AB 28) Mr. Zeev Sherf, Dr. Arie Elka, Mr. Philip Hopstone, & Mr. L. Klebanov (RAFAEL Environmental Engineering Center)	**Stress Testing of Mortar Baseplates – Method and Validation** (AB 29) Dr. Andrew Littlefield (US Army RDECOM-ARDEC Benét Labs)
2:50	**Simplified Model Generation for Exodus II** (AB 26) Mr. Matthew King (Altair Engineering)		**Weapon Ricochet as a Continuously Decaying Process** (AB 30) Ms. Anju Shah & Dr. Philip Randles (Defense Threat Reduction Agency)

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Ice Cream Social & Final Call for the Exhibit Hall

3:10PM - 4:00PM*

SPECTRAL
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WEDNESDAY PM (OCTOBER 7)

	SESSION 16 UNDEX Assessment Tools (1:30pm-1:50pm / Limited Dist. C) (1:50pm-2:50pm / Unlimited Dist. A) Navy Shock Requirements & Testing (2:50pm-3:30pm / Unlimited Dist. A) Chair(s): Dr. Jeffrey Cipolla (Weidlinger Associates) -	USER GROUP Abaqus User Group Meeting (1:30pm-3:30pm / Unlimited Dist. A)	WORKING GROUP Handbook of Dynamic Data Acquisition and Analysis Working Group IEST-DTE-RD-012.2 (1:30pm-3:30pm / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 7) are Required to Meet at 7:00AM in Salon 11 for Presentation Loading		
	Meeting Room: Salon 12	***Meeting Room: Salon 10***	***Meeting Room: Salon 11***
1:30	**Decision-Aid Software for UNDEX Qualification and Optimization (ITAR Restricted—Limited Dist. C)** (AB 31) Dr. Jeffrey Cipolla, Dr. Brett Benowitz, & Mr. Adam Hapij (Weidlinger Associates), Mr. Fred Costanzo (NAVSEA Carderock), Dr. Jay Martin & Dr. Michael Yukish (Penn State University)	**Abaqus User Group Meeting** Mr. Mike Sasdelli (Dassault Systemes SIMULIA Corp) 1:30pm—3:30pm 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 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 will follow.	**Handbook of Dynamic Data Acquisition and Analysis Working Group (IEST-DTE-RD-012.2)** Dr. Vesta Bateman (Mechanical Shock Consulting) & Mr. Neil Loychik (ITT) 1:30pm—3:30pm This handbook provides guidelines for acquiring and analyzing dynamic data in order to ensure accuracy while reducing the error and variability associated with the measurement process. The handbook covers a broad range of topics including Measurement Planning, Data Acquisition, Data Validation and Editing, and Data Analysis. For 20 years, the document has been a cornerstone of modern mechanical shock and vibration, and acoustic measurements. Come join us as we modernize the document for its 3rd revision. Commentary and expertise are welcome!
1:50	**ADQUES Validation** (AB 31) Dr. Michael Woodworth, Mr. Adam Dick, & Dr. Jeffrey Cipolla (Weidlinger Associates)		
2:10	**Shock Environment Comparison Methods** (AB 31) Dr. Michael Woodworth, Dr. Jeffrey Cipolla , & Mr. Adam Hapij (Weidlinger Associates)		
2:30	**Investigation of an Extension of DDAM for External Components** (AB 32) Dr. Jeffrey Cipolla, Dr. Michael Woodworth, & Mr. Mahesh Bailakanavar (Weidlinger Associates)		
2:50	**Impact of Recent Revision of US Navy Instruction and Standards on Navy Ship Equipment Shock Qualification and Navy Ship Shock Hardness Certification** (AB 33) Dr. Christopher Merrill (NAVSEA 05P1)		
3:10	**A Practical Band Based Approach for Determination of Shock Response Frequency (SRF) of Class II Equipment for use with MIL-S-901E in Cases where SRF is Useful for Optimal Shock Qualification Testing of Class II Equipment** (AB 33) Dr. Christopher Merrill (NAVSEA 05P1)		

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TUTORIAL SESSION 5 / 3:30pm—6:30pm

~ CHOOSE ONE / ADDITIONAL FEES APPLY TO ATTEND ~

Shock Test Failure Modes **Meeting Room: Salon 9**
Mr. Kurt Hartsough & Mr. Domenic Urzillo (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.

Fundamentals of Multiple-Input/Multiple-Output Vibration Testing **Meeting Room: Salon 10**
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.

Design, Analysis & Assessment of Composite Structures **Meeting Room: Salon 8**
Dr. E. Thomas Moyer (NAVSEA Carderock) & Mr. Barton McPheeters (AUTODESK Inc.)

An increasing number of military, civilian and commercial structures are being constructed using Laminated Composite Materials. Designing structures using Laminated Composite Materials involve considerations not traditionally taught in undergraduate engineering curricula. This tutorial will introduce the engineering principles required to understand the mechanical properties and deformation characteristics of Laminated Composite Materials, required design considerations, and design calculation methods. After the introductory material, the complex considerations for the design of joints will be presented. Joints in structures designed using Laminated Composite Materials often comprise a significant number of the Critical Elements for the structure. Criteria to determine required physical testing for structural integrity demonstration will be presented. This tutorial will then focus on the use of the Finite Element Method (FEM) for the structural analysis of composite structures. Available modeling and analysis tools will be discussed highlighting their proper usage and limitations. This tutorial will include the required theoretical foundations required for the design and analysis of structures constructed using Laminated Composite Materials, however, the focus will be on practical design and analysis methodologies of use by practicing engineers.

The Measurement & Utilization of Valid Shock and Vibration Data **Meeting Room: Salon 12**
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 pro-vide 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.

NTS PCB PIEZOTRONICS HI-TEST Laboratories, Inc.

ALL 86TH S&V SYMPOSIUM ATTENDEES, AND THEIR GUESTS, ARE INVITED TO:

LAFAYETTE'S

FOOD & SPIRITS LIVE MUSIC

Wednesday, October 7th

7:00pm—10:00pm

Food, Drinks, & Entertainment

* * *

★ *Lafayette's is in the Pointe Orlando center directly across the street from the Rosen Plaza.*

★★ *This dinner social is 100% commercially hosted. No funds from registration fees, tutorial fees, or other symposium sponsorships are used for this event.*

THURSDAY AM (OCTOBER 8)

	SESSION 17 Instrumentation & Measurements (8:00am-8:20am / Limited Dist. C) (8:20am-9:40am / Unlimited Dist. A) Chair(s): Dr. Patrick Walter (TCU/PCB Piezotronics) -	SESSION 18 Flight System Testing (8:00am-9:00am / Limited Dist. C) Testing Methods & Correlation (9:20am-9:40am / Unlimited Dist. A) Chair(s): Mr. Richard Jepsen (Sandia National Laboratories) -	SESSION 19 DS: Post Blast Forensic (8:00am-9:40am / Limited Dist. C) Chair(s): Dr. John Ehrgott (US Army ERDC) -
	All Presenters and Chairs (for Oct 8) are Required to Meet at 7:00AM in Salon 12 for Presentation Loading		
	Meeting Room: Salon 7	*Meeting Room: Salon 8*	*Meeting Room: Salon 9*
8:00	**Yield Estimate of Wasp Prime Using Digitized Nuclear Fireball Films** (AB 33) MAJ Matthew Gettings (Defense Threat Reduction Agency)	**Finite Element Simulation of a Direct-Field Acoustic Test of a Flight System Using Acoustic Source Inversion** (AB 35) Mr. Ryan Schultz & Mr. Eric Stasiunas (Sandia National Laboratories)	**Investigation of Relationships between Crater Geometry and Soil Type and Condition** (AB 36) Mr. Joshua Payne (US Army ERDC)
8:20	**Assessment of Dynamic Performance Characteristics of Piezoelectric Strain Gauges** (AB 34) Mr. Steven Rios (TCU Engineering) & Dr. Patrick Walter (TCU/PCB Piezotronics)	**The Significance of Combined Vibration and Acceleration Environments for Flight Testing** (AB 35) Mr. Richard Jepsen & Mr. Edward Romero (Sandia National Labs)	**Experimental Analysis of Vehicle-Borne Improvised Explosive Devices** (AB 37) Dr. Kyle Crosby, Mr. Josh Payne, Dr. John Ehrgott, & Mr. Denis Rickman (US Army ERDC)
8:40	**Contamination of and Solution for Cable Generated Noise in Accelerometer Signals** (AB 34) Dr. Patrick L. Walter (TCU/PCB Piezotronics)	**The Future of Testing in Combined Environments for Flight Hardware** (AB 35) Mr. Edward Romero, Mr. David Siler, & Mr. Richard Jepsen (Sandia National Laboratories)	**Investigation of Key Parameters for Post-Blast Crater Analysis** (AB 37) Mr. William Myers, Mr. Joshua Payne, & Dr. John Ehrgott (US Army ERDC)
9:00	**Acoustic Measurements in Air Flow** (AB 34) Mr. Robert O'Neil (GRAS Sound and Vibration)		**Effect of Barrier Wall Shielding on the Relationship between Overpressure and Dynamic Pressure from a Detonation** (AB 38) Mr. Denis Rickman, Dr. Kyle Crosby, & Mr. Joshua Payne (US Army ERDC)
9:20	**Dynamic Materials Testing to Blast Testing, Equipment Qualifications** (AB 34) Mr. Mike Hoyer (HBM Test and Measurement)	**Analysis of the Crack Strain Difference of Two Size Experiment Specimen to Shock Load** (AB 36) Mr. Yuanzheng Cheng, Mr. Liping Meng, & Mr. Jian Hu Liu (China Ship Scientific Research Center)	**Forensic Characterization of Small Arms and Propelled Munitions using Image, Chemical, and Metallurgical Analysis** (AB 38) Mr. Cameron Thomas, Dr. Kyle Crosby, & Dr. John Ehrgott (US Army ERDC)

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THURSDAY AM (OCTOBER 8)

	DISCUSSION GROUP **Canadian Naval Perspective on Air Gun based Shock Testing** (8:30am-9:15am / Limited Dist. ABCANZ)	TRAINING **Introduction to MIL-S-901D Heavyweight Shock Testing** (8:00am-10:00am / Unlimited Dist. A)
	All Presenters and Chairs (for Oct 8) are Required to Meet at 7:00AM in Salon 12 for Presentation Loading	
	Meeting Room: Salon 11	***Meeting Room: Salon 12***
8:00 9:00	**Canadian Naval Perspective on Air Gun based Shock Testing** *Limited Distribution to:* *ABCANZ* *(Citizens of America, Britain, Canada, Australia, & New Zealand)* Mr. Jan Czaban (Canadian Department of National Defence) Air gun based shock testing capability has been developed under various cooperative projects sponsored by UK, US and CA navies during the past 15 years. This presentation will review Canadian Naval experiences with the Air-Gun based shock testing technology. Full scale test results from a decommissioned submarine and an operational frigate will be discussed. The use of air guns for conduct of floating and submerged shock test platforms will also be discussed. Measured data results will be used to compare loading characteristics of air gun tests against UNDEX tests.	**Introduction to MIL-S-901D Heavyweight Shock Testing** Mr. Travis Kerr (HI-TEST Laboratories) 8:00am—10:00am 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.

THURSDAY AM (OCTOBER 8)

	SESSION 20 UNDEX II (10:00am-11:40am / Unlimited Dist. A) Chair(s): Mr. Travis Kerr (HI-TEST Laboratories) Mr. Jim Breault (NVT Group—Lansmont)	SESSION 21 Blast Risks to Vehicles & Structures (10:00am-10:20am / Limited Dist. D) (10:20am-11:00am / Limited Dist. C) Chair(s): Mr. Garrett Doles (US Army ERDC) -	SESSION 22 Mechanical Shock: Instrumentation & Modeling/Simulation (10:00am-10:40am / Limited Dist. D) (10:40am-11:20am / Limited Dist. C) (11:20am-11:40am / Unlimited Dist. A) Chair(s): Dr. Jacob Dodson (Air Force Research Laboratory) -
	All Presenters and Chairs (for Oct 8) are Required to Meet at 7:00AM in Salon 12 for Presentation Loading		
	Meeting Room: Salon 11	***Meeting Room: Salon 7***	***Meeting Room: Salon 9***
10:00	**The Recovery Method of the Measured Signal Curve of an Underwater Explosion Shock Pressure** (AB 38) Mr. Xianpi Zhang, Mr. Jian Hu Liu, & Mr. Jianqiang Pan (China Ship Scientific Research Center)	**Dual Stage Energy Absorbing Mechanism to Mitigate Vertical Shock Loading** (AB 41) Mr. Jared Gardner (TKC Global Inc.), Dr. Thomas Plaisted & Dr. Jerome Tzeng (US Army Research Laboratory)	**Analysis of Various Simulations of Complex Components under Mechanical Shock** (AB 42) Mr. Jonathan Hong (Applied Research Associates), Dr. Janet Wolfson (Air Force Research Laboratory)
10:20	**The Coupling Effect of the Static and Shock Load on the Responses of a Ring-Stiffened Cylinder** (AB 39) Mr. Jun Wang, Mr. Jian Hu Liu, & Mr. Yousheng Wu (China Ship Scientific Research Center)	**Comparison of Results from Experiments with Impulse Measuring Device that Quantify Effects of Soil Placement Parameters on Aboveground Impulse** (AB 41) Mr. Garrett Doles & Dr. John Ehrgott (US Army ERDC), Dr. Jon Windham (SOL Engineering)	**The Effect of Boundary Condition Assumptions on the Predicted Dynamic Response of Packaged Electronic Assemblies** (AB 42) Dr. Matthew Neidigk (Sandia National Laboratories)
10:40	**Study for Effective Shock Analysis Methodology with UNDEX Experimental Data using Down Scale Ship Model** (AB 39) Dr. Jeong-Il Kwon, Dr. Jung-Hoon Chung, & Dr. Seok-Jun Moon (Korea Institute of Machinery & Materials)	**Comparisons of Results from Experiments and Simulations with Impulse Devices that Quantify Effects of Charge Parameters, Depth of Burial, and Soil Type** (AB 41) Dr. Neil Williams, Mr. Garrett Doles, & Mr. Stephen Akers (US Army ERDC)	**Characterization of the Endevco 7280A Transverse Sensitivity Performance to Full Scale Range** (AB 42) Mr. Randy Martin & Mr. James Letterneau (Meggitt Sensing Systems)
11:00	**The Equivalence of Shock Environments of the Real Ship and the SFSP to a Heavy Resilient Mount Equipment** (AB 40) Mr. Chen Xuebing (China Ship Scientific Research Center)		**Characterization of Meggitt Sensing Systems' Updated Hopkinson Bar Capability** (AB 43) Mr. James Letterneau (Meggitt Sensing Systems), Dr. Vesta Bateman (Mechanical Shock Consulting)
11:20	**Shock Analysis of an Antenna Structure Subjected to Underwater Explosions** (AB 40) Mr. Mehmet Emre Demir (ASELSAN - Radar and Electronic Warfare and Intelligence Systems Division)		**A Novel Micro-CT Data Based Finite Element Modeling Technique to Study Reliability of Densely Packed Fuze Assemblies** (AB 43) Dr. Pradeep Lall & Dr. Nakul Kothari (Auburn University), Dr. Jason Foley (Air Force Research Laboratory), Dr. Ryan Lowe (Applied Research Laboratory)

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THURSDAY AM (OCTOBER 8)

	TRAINING Introduction to Medium Weight Shock Testing (10:00am-Noon / Unlimited Dist. A)	TRAINING
	All Presenters and Chairs (for Oct 8) are Required to Meet at 7:00AM in Salon 12 for Presentation Loading	
	Meeting Room: Salon 12	*Meeting Room: TBD*
10:00	**Introduction to Medium Weight & Lightweight Shock Testing** Mr. Jeff Morris (HI-TEST Laboratories) 10:00am—Noon 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.	**Blast Effects in Air, Water, & Soil** Dr. Charles Robert Welch (Consultant) 10:00am—11:00am Abstract TBD
11:00		

SYMPOSIUM EXHIBITORS

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[1] Hosting the Dinner Social (100% commercially hosted) on Wednesday Evening

[2] Sponsoring the Ice Cream Social in Exhibit Hall on Wednesday Afternoon

Altair's corporate culture thrives on seeking out business and technology firsts to radically change the way organizations design products and make decisions. We are focused on the development and broad application of simulation technology to synthesize and optimize design, processes and decisions for our clients' improved business performance.

Ryan Reid
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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.

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ATK Aerospace (Orbital ATK) 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.

Mark Stephens
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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.

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Brüel & Kjær Sound & Vibration Measurement A/S supplies integrated solutions for the measurement and analysis of sound and vibration. As a world-leader in sound and vibration measurement and analysis, we use our core competences to help industry and governments solve their sound and vibration challenges so they can concentrate on their primary task: efficiency in commerce and administration.

Jenn Mowry
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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.

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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.

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The **Defense Threat Reduction Agency's (DTRA)** focus is to keep WMD out of the hands of terrorists and other enemies by locking down, monitoring, and destroying weapons and weapons related materials. We also assist Combatant Commanders with their plans and responses to WMD events and develop and deliver cutting-edge technologies to assist with all of these endeavors.

Jake Rosenthal
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Dewesoft is a total solution company. We do complete hardware design, manufacturing, software development, sales, marketing and support within the same organization. Dewesoft was founded back in year 2000. Today our products are used in many applications by global market leaders around the world. We positioned ourselves between global market leaders with innovative software and hardware solutions. We gained trust by keeping close relations with our customers and offering best possible support on all levels from sales down to technical support.

Shelly Horvath
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Diversified Technical Systems is the world's leading manufacturer of data acquisition systems and sensors for the experienced test professional. For over 21 years, DTS systems have been at the forefront of collecting life-saving data on human injury and survivability. Unique features like ultra-small size, flexible configurations, IEPE sensor compatibility and 24/7/365 technical support have made DTS the #1 choice in crashworthy data acquisition systems worldwide.

Matt Millard
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Combining the best of industry leading innovation with the best manufacturing practices, **Dongling** is the world's leading manufacturer of vibration, shock and shake testing machinery. With the most extensive lineup of vibration testing solutions in the industry and an industry-best lead time of 16 weeks or less, we not only are able to specify a vibration testing solution best suited to your needs, but we're able to ensure that you're able to meet your testing objectives on time and on budget.

Kevin Westhora
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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.

Connie Dague
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ETS Solutions offers affordable, high quality vibration test equipment. Utilizing extensive and innovative technical expertise ETS delivers a reliable long term solution to meet your test requirements. All systems comply with the European CE standards with full testing and certification from TUV-SUD Product Service GmbH .

EXHIBITOR DESCRIPTIONS (CONT.)

Mike Hoyer
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For over 60 years, the name **HBM** stands for reliability, precision and innovation all over the world. HBM's product range covers sensors, transducers, strain gages, amplifiers and data acquisition systems as well as software for structural durability investigations, tests and analysis. The potential fields of application can be found in every branch of engineering and industry in both virtual and physical test and measurement.

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.

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.

Shinichi Hirokawa
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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.

Jonathan Hatton
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iX Cameras designs and manufactures a wide range of high-end, high-speed digital cameras. The revolutionary i-SPEED 726 features a 3 megapixel sensor capable of recording 8,500 full frames/second, 1080p HD images at 12,500 frames/second, 720p HD images at 23,000 frames/second, and top speeds in excess of one million frames/second.

EXHIBITOR DESCRIPTIONS (CONT.)

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.

Chris Wilcox
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m+p international is a worldwide provider of high-quality test and measurement solutions for vibration control, noise & vibration analysis and general data acquisition. By working closely with our customers, we understand their applications from an engineer's point of view and this is apparent in our products. A policy of continuous research and development, which has led to many pioneering solutions, ensures that our products demonstrate superior performance and quality.

Jennifer MacDonell
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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.

Albert Prosuk
aprosuk@muellerbbm-vas.com

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.

Noise & Vibration Technologies Group, LLC

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.

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.

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.

EXHIBITOR DESCRIPTIONS (CONT.)

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.

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$^{\text{SM}}$, and a Lifetime Warranty to deliver Total Customer Satisfaction.

Douglas Firth
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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.

Neil Donovan
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SHOCK TECH designs, manufactures and tests shock attenuation and vibration isolation mounting systems for the most demanding environments. We provide solutions for your equipment's dynamic protection problems and are experts at quick-turn, affordable results.

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 54 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.

Bruce Swanson
sales@spektra-usa.com

SPEKTRA was founded in 1994 and has since developed into one of the leading suppliers of calibration, measurement and test systems and services in the fields of vibration and acoustics. The five main pillars of our business activities are: measurement and test systems, calibration systems CS18, vibration control systems VCS, vibration and shock exciters, and calibration and environmental services, metrological testing.

EXHIBITOR DESCRIPTIONS (CONT.)

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.

Steve Astulfi
sastulfi@tritekdatasystems.com

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.

Joann Klamer
joann@vibrationresearch.com

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.

VIBRO/*DYNAMICS® LLC*

Gary Forshall
gforshall@vibrodynamics.com

Since 1964, **Vibro/Dynamics** has been the leader and pioneer in the design and manufacture of vibration isolation and shock control systems. Our Products and Services are designed to effectively reduce transmitted shock and vibration and to provide an adjustment means to precisely level, align, and properly support industrial machinery. We also provide systems that protect machinery and building structures from incoming vibration caused by machinery, railroads, earthquakes, etc.

Michelle Lively
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Vision Research designs and manufactures the industry's broadest line of digital high-speed cameras for use in a wide variety of industries. The Phantom line of ultra high-speed cameras is targeted at applications in science, engineering and research where the phenomena under study is too fast to see, and too important not to.

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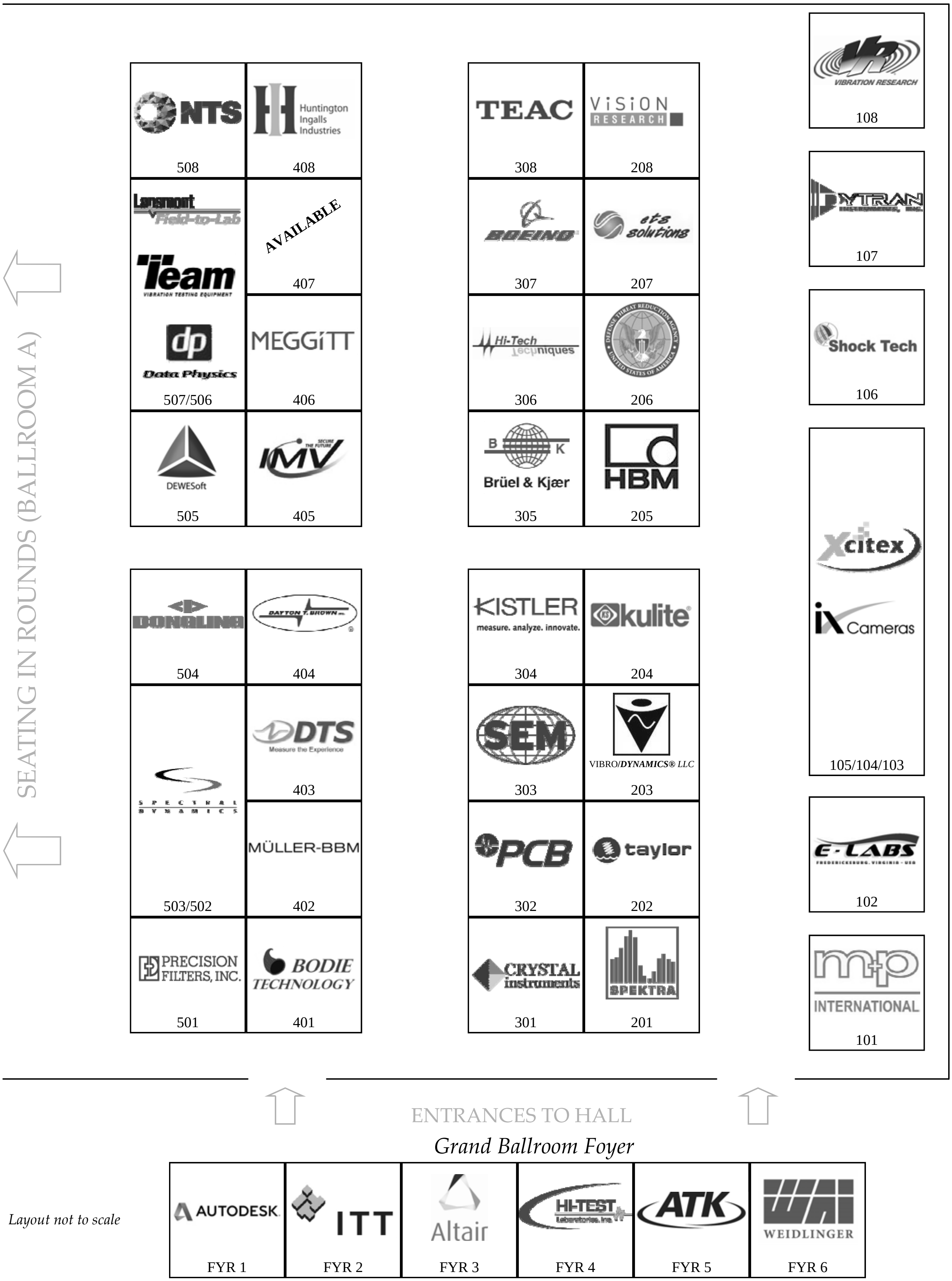
Weidlinger Associates has been one of the world's leading structural engineering and applied mechanics consultants since its founding in 1949. With a staff of more than 300, the firm has seven U.S. offices and an office in the United Kingdom. Weidlinger investigates, designs, rehabilitates, and protects 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
lholber@xcitex.com

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

BALLROOM B


NTS
508
Huntington Ingalls Industries
408
TEAC
308
VISION RESEARCH
208
VIBRATION RESEARCH
108
Lansmont Field-to-Lab
Team VIBRATION TESTING EQUIPMENT
Data Physics
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DYTRAN INSTRUMENTS, INC.
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Hi-Techniques
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DEFENSE THREAT REDUCTION AGENCY UNITED STATES OF AMERICA
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Shock Tech
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IMV SECURE THE FUTURE
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Brüel & Kjær
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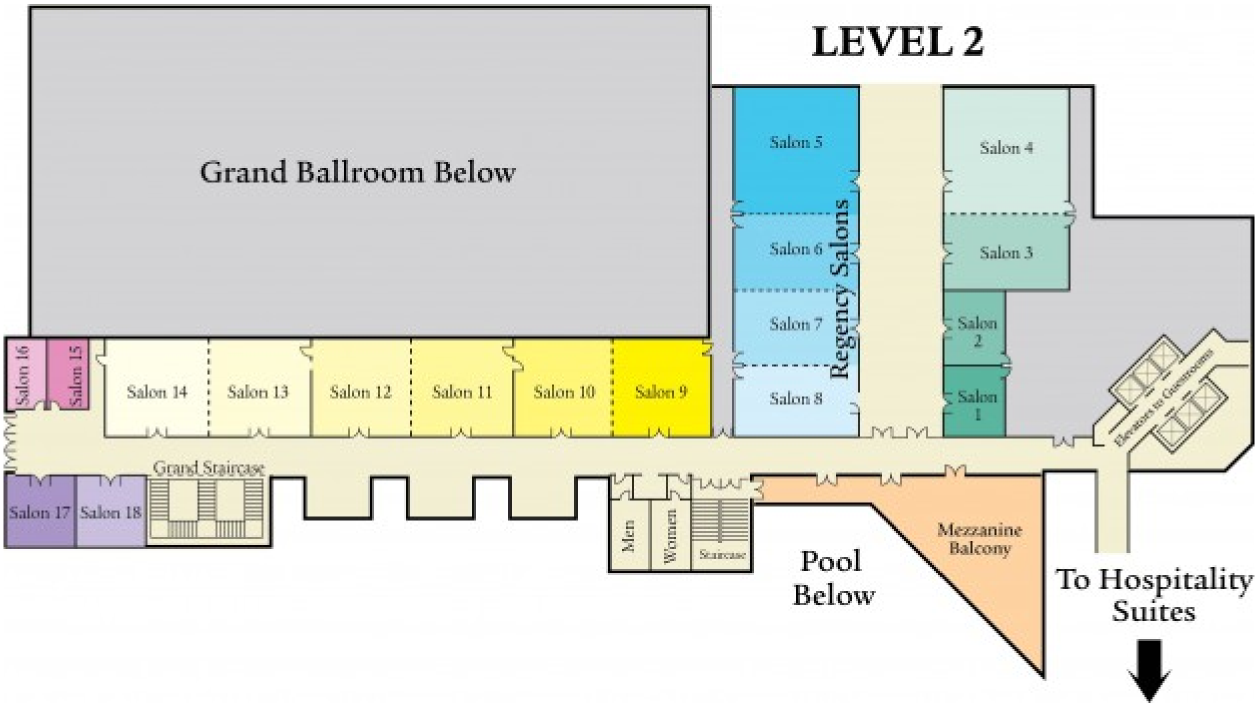
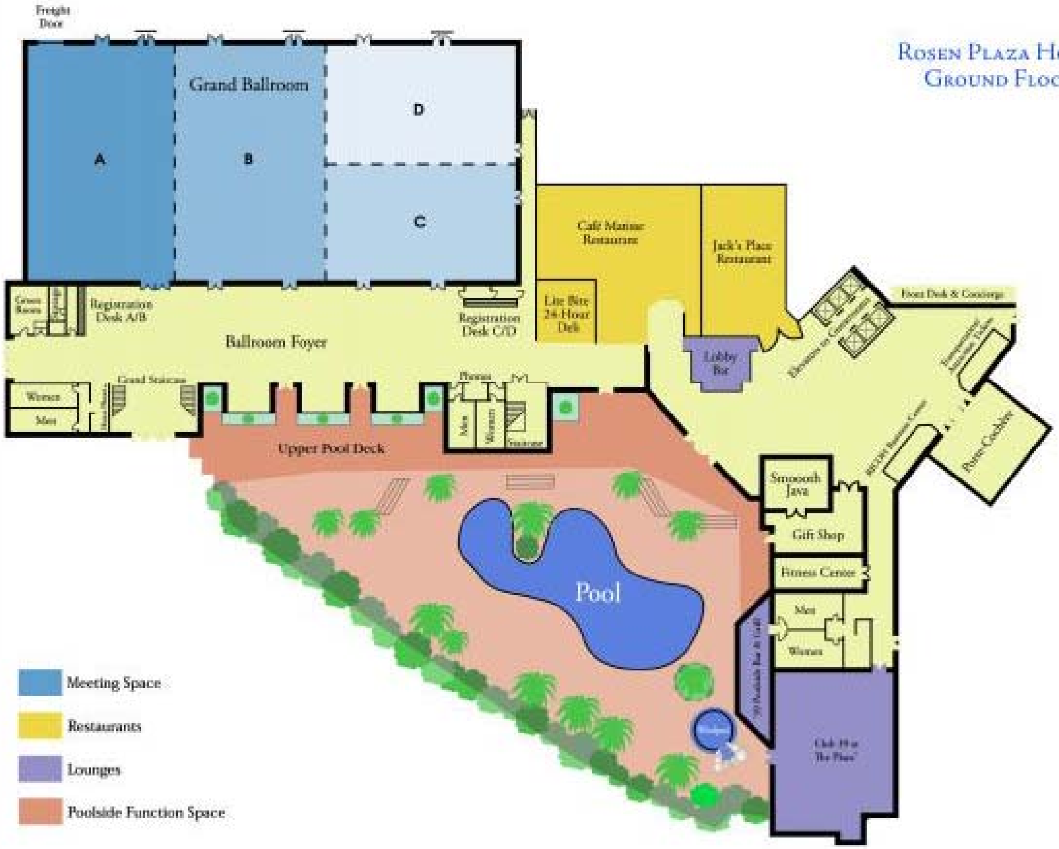
HBM
205
Xcitex
iX Cameras
105/104/103
SEATING IN ROUNDS (BALLROOM A)
DONGLING
504
DAYTON T. BROWN INC.
404
KISTLER measure. analyze. innovate.
304
kulite
204
SPECTRAL DYNAMICS
503/502
DTS Measure the Experience
403
SEM
303
VIBRO/DYNAMICS® LLC
203
MÜLLER-BBM
402
PCB
302
taylor
202
E-LABS FREDERICKSBURG, VIRGINIA - USA
102
PRECISION FILTERS, INC.
501
BODIE TECHNOLOGY
401
CRYSTAL instruments
301
SPEKTRA
201
m+p INTERNATIONAL
101
ENTRANCES TO HALL
Grand Ballroom Foyer
AUTODESK
FYR 1
ITT
FYR 2
Altair
FYR 3
HI-TEST Laboratories, Inc.
FYR 4
ATK
FYR 5
WEIDLINGER
FYR 6

Layout not to scale


LEVEL 2
Grand Ballroom Below
Salon 5
Salon 6
Salon 7
Salon 8
Regency Salons
Salon 4
Salon 3
Salon 2
Salon 1
Salon 16
Salon 15
Salon 14
Salon 13
Salon 12
Salon 11
Salon 10
Salon 9
Grand Staircase
Salon 17
Salon 18
Men
Women
Staircase
Pool Below
Mezzanine Balcony
Elevators to Guestrooms
To Hospitality Suites

2ND FLOOR


Freight Door
Grand Ballroom
A
B
C
D
Rosen Plaza Hotel
Ground Floor
Café Marine Restaurant
Jack's Place Restaurant
Lite Bite 24-Hour Deli
Green Room
Storage
Registration Desk A/B
Registration Desk C/D
Ballroom Foyer
Lobby Bar
Front Desk & Concierge
Elevators to Guestrooms
Transportation Attraction Tickets
Business Center
Porte-Cochère
Grand Staircase
Women
Men
Phones
Men
Women
Staircase
Upper Pool Deck
Smooth Java
Gift Shop
Fitness Center
Men
Women
Pool
Poolside Bar & Grill
Club 19 or "The Place"
Meeting Space
Restaurants
Lounges
Poolside Function Space

1ST FLOOR