96TH SHOCK & VIBRATION SYMPOSIUM

ORLANDO

SEPTEMBER 20-24, 2026

INSIDE COVER - PURPOSEFULLY LEFT BLANK

Welcome

WELCOME TO ORLANDO AND THE 96TH 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 the **Shock and Vibration Exchange**.

Thank You

WE WOULD LIKE TO RECOGNIZE OUR TECHNICAL ADVISORY GROUP (TAG) MEMBERS WHO PARTICIPATED ON THE 96TH SHOCK AND VIBRATION SYMPOSIUM SUMMER PLANNING COMMITTEE AND/OR AWARD REVIEW COMMITTEE:

Dr. Joseph Ambrico, NUWC Newport*
Thomas Brodrick, NAVSEA*
Justin Caruana, Cardinal Engineering*
Paul Crvelin, Taylor Devices*
Shawn Czerniak, Hutchinson*
Matt Forman, NSWC Dahlgren*
Sean Frye, Taylor Devices*
Adam Hapij, Thornton Tomasetti*
Kurt Hartsough, 901E&T*
John Hiatt, DEWESoft*
Roger Ilamni, NSWC Indian Head*
Dr. Jim Lightstone, DOT&E*
Luke Martin, NSWC Dahlgren*
Timothy McGee, NSWC Carderock*
Bart McPheeters, Leidos
Calvin Milam, Element US Space & Defense*
Nick Misselbrook, Thornton Tomasetti*
Michael Olsen, HII-NNS*
Joshua Payne, USACE ERDC*
Drew Perkins, SAVE/HI-TEST*
John Przybysz, IDA*
Jeff Rybak, PCB Piezotronics*
Ashley Shumaker, SAVE/HI-TEST*
Troy Skousen, Sandia National Laboratories*
George Vankirk, USACE ERDC*
Mackenzie Wilson, HII-NNS*
Lauren Yancey, HI-TEST Laboratories**
Bill Yancey, HI-TEST Laboratories**

**TAG members in attendance at summer meeting for 96TH S&V program review.*
***TAG members who peer-reviewed award nomination packages*

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Schedule at a Glance

(WITH DAILY OUTLINE AND HOURS)

DAY/DATE	PROGRAM FEATURE TYPE	TIME	PAGE
SUNDAY (09/20)	REGISTRATION (SALON 13)	8:00AM - 5:00PM	
	TUTORIALS	8:00AM - 4:00PM	PG. 7
MONDAY (09/21)	REGISTRATION (SALON 13)	7:00AM - 6:00PM	
	TUTORIALS	8:00AM - 6:30PM	PG. 8-13
	EXHIBIT HALL SETUP (EXECUTIVE BALLROOM)	NOON - 6:00PM	
	WELCOME RECEPTION (EXECUTIVE BALLROOM)	6:30PM - 8:30PM	PG. 14
TUESDAY (09/22)	REGISTRATION (SALON 13)	7:00AM - 6:00PM	
	EXHIBIT HALL OPEN (EXECUTIVE BALLROOM)	7:00AM - 5:00PM	
	TUTORIALS	8:00AM - 11:00AM	PG. 16-17
	GENERAL SESSION I & EXHIBITORS LUNCHEON	11:00AM - 1:00PM	PG. 20-21
	TECHNICAL PAPER SESSIONS & TRAINING	1:00PM - 6:05PM	PG. 22-25
	NEW ENGINEERS & ATTENDEES NETWORKING	6:00PM - 7:00PM	PG. 26
WEDNESDAY (09/23)	REGISTRATION (SALON 13)	7:00AM - 6:00PM	
	TECHNICAL PAPER SESSIONS & TRAININGS	8:00AM - NOON	PG. 28-31
	EXHIBIT HALL OPEN (EXECUTIVE BALLROOM)	9:00AM - 4:00PM	
	GENERAL SESSION II & AWARDS LUNCHEON	NOON - 1:30PM	PG. 32-33
	TECHNICAL PAPER SESSIONS & TRAININGS	1:30PM - 3:30PM	PG. 34-35
	TUTORIALS	3:30PM - 6:30PM	PG. 36-37
	EXHIBIT HALL DISMANTLE	4:15PM - 6:00PM	
	COMMERCIALLY SPONSORED SOCIAL EVENT	7:00PM - 10:00PM	PG. 38-39
THURSDAY (09/24)	REGISTRATION (SALON 13)	7:00AM - NOON	
	TECHNICAL PAPER SESSIONS & TRAININGS	8:00AM - 12:05PM	PG. 40-43
	S&V TAG COMMITTEE MEETING (MTG ROOM)	1:00PM - 2:00PM	PG. 43
	EXHIBIT HALL LAYOUT & VENDOR DESCRIPTIONS		PG. 44-51
	HOTEL MEETING SPACE FLOOR PLANS		PG. 52-54
	CORPORATE ADS		PG. 55+

Food & Beverage Events

(ALL SYMPOSIUM ATTENDEES ARE WELCOME TO ATTEND EVENTS LISTED BELOW)

MONDAY (09/21)	**WELCOME RECEPTION** (EXECUTIVE BALLROOM / EXHIBIT HALL) *BEVERAGES & HEAVY HORS D'OEUVRES* **SPONSORED BY HI-TEST LABORATORIES & SHOCK TECH** **GUESTS OF SYMPOSIUM ATTENDEES ARE WELCOME.*	6:30PM - 8:30PM
TUESDAY (09/22)	**BREAKFAST & NETWORKING** (EXECUTIVE BALLROOM / EXHIBIT HALL)	7:00AM - 8:00AM
	GENERAL SESSION 1: KEYNOTE ADDRESS & EXHIBITORS LUNCHEON (EXECUTIVE BALLROOM / EXHIBIT HALL)	11:00AM - 1:00PM
	ICE CREAM SOCIAL (EXECUTIVE BALLROOM / EXHIBIT HALL)	3:00PM - 3:40PM
WEDNESDAY (09/23)	**BREAKFAST & NETWORKING** (EXECUTIVE BALLROOM / EXHIBIT HALL)	7:00AM - 8:00AM
	GENERAL SESSION 2: AWARDS PRESENTATION AND LUNCHEON (EXECUTIVE BALLROOM / EXHIBIT HALL)	NOON - 1:30PM
	AFTERNOON DESSERT BREAK & PASSPORT PROGRAM DRAWING (EXECUTIVE BALLROOM / EXHIBIT HALL)	3:05PM - 3:40PM
	SYMPOSIUM SOCIAL/DINNER SPORTS & SOCIAL @ THE POINTE **COMMERCIALLY SPONSORED BY HI-TEST LABORATORIES** **GUESTS OF SYMPOSIUM ATTENDEES ARE WELCOME.*	7:30PM - 9:30PM
THURSDAY (09/24)	**BREAKFAST & NETWORKING** (EXECUTIVE BALLROOM / EXHIBIT HALL)	7:00AM - 8:00AM

**PLEASE NOTE THAT ALL MEALS ARE COMMERCIALLY SPONSORED THROUGH EXHIBITOR AND CORPORATE SUPPORTER REVENUES. NO COSTS FOR MEALS ARE DIRECTLY INCLUDED IN INDIVIDUAL ATTENDANCE FEES.*

SAVE
SHOCK & VIBRATION EXCHANGE

SYMPOSIUM WI-FI SPONSOR

PASSWORD: TBD

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SUNDAY
SEPTEMBER 20

TUTORIAL SESSION I
8:00 - 11:00AM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

MIL-DTL-901E SHOCK QUALIFICATION TESTING
Kurt Hartsough (901 E&T)

MEETING ROOM TBD

Instructor will be presenting the requirements for shock qualification testing as detailed in MIL-DTL-901E and interpreted by NAVSEA 05P1. Shock testing theory, MIL-DTL-901E shock test devices and facilities, detailed specification requirements, cost avoidance and clarification and MIL-DTL-901E 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.

TUTORIAL SESSION II
1:00 - 4:00PM

MIL-DTL-901E SHOCK QUALIFICATION TESTING EXTENSIONS
Kurt Hartsough (901 E&T)

MEETING ROOM TBD

Instructor will be presenting the requirements for shock qualification extensions as detailed in MIL-DTL-901E and interpreted by NAVSEA 05P1. Shock extension specification requirements, MIL-DTL-901E 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.

End Sunday Events

MONDAY
SEPTEMBER 21

TUTORIAL SESSION III
8:00 - 11:00AM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

MIL-DTL-901E SUBSIDIARY COMPONENT SHOCK TESTING & ALTERNATIVE TEST VEHICLES
Kurt Hartsough (901 E&T)

MEETING ROOM TBD

The MIL-DTL-901E 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-DTL-901E testing and particularly MIL-DTL-901E extensions offered by the same instructor (Hartsough).

FUNDAMENTALS OF SINE AND RANDOM SHAKER TESTING
Chris Sensor (Siemens)

MEETING ROOM TBD

This tutorial will cover the fundamental concepts of shaker Sine and Random vibration testing. Swept Sine, Sine Dwell, Random, Sine-on-Random, Random-on-Random and Time Waveform Replication test modes will be covered. Additional topics such as response limiting, control channel averaging, kurtosis, and practical shaker considerations will also be discussed. Subjects will be accompanied by live demos of shaker tests, with opportunities for hands on participation by attendees.

ANALYSIS FOR A MEDIUM WEIGHT SHOCK TEST
Josh Gorfain (Quartus Engineering)

MEETING ROOM TBD

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.

PLANNING LIFE CYCLE DESIGN, ANALYSIS, AND SHOCK AND VIBE QUALIFICATION OF NAVY EQUIPMENT

MEETING ROOM TBD

Dr. Christopher Merrill (CM&A Engineering)

This tutorial provides general simple techniques for use in parallel with long term Classical and Numerical Dynamic Analysis of Systems subjected to US Navy shock and vibration requirements over Navy equipment life cycles to maximize accuracy and minimize errors in Dynamic Analysis and Qualification of electronic and mechanical systems. The interaction of the US Navy shock and vibration requirements is a major driver of the efficacy of long-term Dynamic Analysis from the start. Apart from major issues that occur on any major long-term developmental programs, simple, seemingly minor, errors present in the analysis from the beginning can lead to huge cost and schedule impacts generally at the worst time for the program (FAT). Fortunately, there are procedural long-term Dynamic Analysis Quality Control techniques that can be used from the beginning and in parallel during the long-term dynamic analysis to mitigate the risk of such errors. This tutorial will provide examples of types and genesis of such errors, as well as, a process to perform at the beginning and in parallel with the long-term dynamic analysis in order to perform quality control comparisons to mitigate these errors. Finally, the importance of comparison of FAT dynamic test results to dynamic analysis including failure and use of prototyping will be included. The tutorial will end with an exercise where the trainer will attempt to stump the trainee with balky computer model results. The trainee will leave the tutorial with a list of types and genesis of discrete and basic errors, a process chart and algorithm for applying these Quality Control Techniques at the start and in parallel with the long-term dynamic analysis, and insight on improving techniques for planning Life Cycle Design, Analysis, and Shock and Vibe Qualification of Navy Equipment.

BLAST PRESSURE MEASUREMENTS

MEETING ROOM TBD

Dr. Troy Skinner
Denis Rickman (US Army ERDC)
Mike Sacramone (PCB Piezotronics)

When researchers collect poor blast pressure data, they often conclude “it must be the gauge!” Truth be known, sensors rarely insert themselves into a blast test. Instead, they bravely go into whatever location the test engineer commands, often producing poor data or worse, experiencing an untimely death. These brave, and costly, soldiers deserve better!

To make matters more complicated, there are two sensing technologies to choose from. Quartz piezoelectric and silicon MEMS piezoresistive transducers are both successfully used for air-blast pressure measurements. This tutorial will objectively compare strengths and weaknesses of MEMS piezoresistive and ICP piezoelectric pressure transducers focused only on their applicability to the air-blast environment. The analysis considers measurement errors found in air blast, which include thermal transients, acceleration/strain, and cable length effects. Transducer performance parameters of dynamic range, ruggedness/survivability, and frequency response will be compared.

MONDAY
SEPTEMBER 21

TUTORIAL SESSION IV
NOON - 3:00PM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

AN INTRODUCTION TO ALIASING, FFT, FILTERING, SRS & MORE FOR FEA USERS AND TEST ENGINEERS

MEETING ROOM TBD

Dr. Ted Diehl (Bodie Technology)

Working with either physical test data and/or numerical simulations related to severe mechanical shock, impact, failure, etc. is extremely challenging. Some of the biggest challenges in this type of work are 1) properly collecting the initial raw data while avoiding aliasing [especially from numerical simulations], 2) utilizing robust methods to identify and separate the "noise & distortions" from the "true" frequency-rich content in the data, and 3) determining what portion of the "true" frequency-rich content is meaningful and what does it tell you. For a given problem, the initial appearance of raw time-domain data in this class of work may be vastly different between physical testing and data derived from transient simulation codes (LS-Dyna, Abaqus/Explicit, RADIOSS…). While the data might look different, the rules of DSP (Digital Signal Processing) are the same. Most importantly, understand and utilizing DSP properly is a critical requirement to success in BOTH types of approaches, especially to obtain correlation between physical tests and simulation of the same specific problem.

The 3-hour seminar provides guidance to both simulation analysts and test engineers on how to properly collect and process such data; ultimately uncovering significantly improved results. The course covers highlights of DSP theory in the language of Mechanical Engineering pertinent to simulation analysts and test engineers. This seminar introduces key aspects of working with transient data – specifically, clearly explaining time-domain and frequency domain analysis (DFS, FFT, PSD); data collection (sampling, up-sampling, decimation, and aliasing); filtering (lowpass, highpass, IIR, and FIR), how to avoid aliasing, calculating Shock Response Spectrum (Accel SRS & 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, and more). Simplified demonstrations are presented to solidify key DSP aspects, along with many relevant real-world examples. Both FEA users and experimentalists will benefit from this training.

DATA INTEGRITY

MEETING ROOM TBD

John Hiatt (DEWESoft)

The data integrity training is designed as an overview of the data acquisition process and how each step in the measurement chain can affect your measured data. Primary focus of this session is on the data acquisition system (DAS). We will learn what happens in each step of the process and how to mitigate common measurement errors. The idea is to get the best possible data first time. Its hard to make good decisions with bad data. We also cover DAS specifications so users can be better prepared to compare system specifications.

FUNDAMENTALS OF CLASSIC SHOCK AND SRS SHAKER TESTING

MEETING ROOM TBD

Chris Sensor (Siemens)
Melissa Maze (PCB Piezotronics)

This tutorial will cover the fundamental concepts of shaker shock testing, from field data acquisition to Classic Shock and Shock Response Spectrum (SRS) wavelet synthesis in a vibration controller. The tutorial will cover shock data acquisition and analysis, classic shock pulses, SRS concepts, SRS and Pseudo Velocity Shock Spectrum (PVSS) data analysis, a review of Classic Shock and SRS test methods in MIL-STD-810H (including the "new" method of Te and TE), shock test tailoring and SRS wavelet synthesis for shaker SRS testing. A segment covering specialty shock sensors and instrumentation will also be presented. Subjects will be accompanied by live demos of data acquisition and shaker tests, with opportunities for hands on participation by attendees.

TUTORIAL SESSION IV
NOON - 3:00PM
(CONTINUED)

MONDAY
SEPTEMBER 21

THE HISTORY OF RANDOM VIBRATION
Dr. Tom Paez (Consultant)

MEETING ROOM TBD

Random vibration is the study of the responses excited in structures by stationary (steady-state) and nonstationary stochastic inputs. A necessity for the implementation of random vibration analyses is random signal analysis; it is used to specify the functions that underly random input and response models. Random vibrations are ubiquitous in practice; hence, the theories of random vibration and random signal analysis are used frequently. This presentation defines the terminology and quantities used in random processes and random vibration, and it describes the fundamental operations that can be performed. It also shows how random signal analyses are used in connection with random vibration. The development of the theory of random vibration from the foundational paper written by Einstein (1905) to the present era are described. Course participants are provided with a link to a site with a color copy of the presentation slides as well as MATLAB functions that reproduce many of the examples in the presentation.

NUMERICAL METHODS USING MODERN FORTRAN
Dr. Robert Browning (Battelle)

MEETING ROOM TBD

Abstract pending

INTRODUCTION TO DESIGNING SHOCK MOUNTED SYSTEMS USING SHOCK ISOLATION MOUNT PREDICTION & LOADING ESTIMATES (SIMPLE) SOFTWARE
Dave Callahan (HII Newport News Shipbuilding)

MEETING ROOM TBD

This course will introduce a process for designing and assessing shock isolation systems with special emphasis on applications related to the design of shipboard equipment for shock loads produced by underwater explosions utilizing the analytical software tool “Shock Isolation Mount Prediction & Loading Estimates” (SIMPLE). This process is split into two parts: 1) initial analysis using classic Shock Response Spectrum (SRS) and 2) assessment, confirmation, iteration or comparison of isolation system designs using SIMPLE simulation methods. Attendees will learn how to build six Degree of Freedom (DOF) SIMPLE models of isolated systems, select shock mounts and modify mount properties, select shock inputs, evaluate the isolation system performance and iterate designs rapidly. This course is intended for anyone that desires validation and assurance that shock and vibration mounts are properly selected for equipment racks, consoles, cabinets, and other structures using SIMPLE software. Examples of SIMPLE users are: engineers, program & project managers, equipment integrators, shock and vibration analysts, mount vendors, and shock qualification reviewers/approvers.

MONDAY
SEPTEMBER 21

TUTORIAL SESSION V
3:30 - 6:30PM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

DDAM 101
George D. (Jerry) Hill (SERCO)

MEETING ROOM TBD

The U.S. Navy Dynamic Design Analysis Method (DDAM) has been in general use since the early 1960s. It is a method of estimating peak shock response of equipment and outfitting on naval combatants using normal mode theory, originally extended from earthquake analysis methods. The DDAM requires linearelastic model behavior and employs a statistical method of modal superposition yet has persisted to today as the U.S. Navy required method for shock qualification by analysis. This, in spite of the rapid advancement of dynamic transient simulation technology and techniques for representing nonlinearities including material plasticity and contact behavior. The tutorial will address: how the method works, how the shock spectral input values are presented in DDS-072-1, what is the role of modal weights and participation factors, why has the method persisted including what are its strengths and also what are its weaknesses. The tutorial will provide a basic understanding of the method, requirements, and procedures to those who expect to be involved in shock analysis and will demystify the procedure for many who are current users.

DIGITAL SIGNAL PROCESSING - FILTERING AND THE FOURIER TRANSFORM (GOING FROM TIME TO FREQUENCY DOMAIN)
John Hiatt (DEWESoft)

MEETING ROOM TBD

Two of the most common Digital Signal Processing (DSP) techniques are filtering and transforming data from the time domain to the frequency domain with the Fourier transform (FFT). Both mathematical processes can create unwanted effects on the data. This session will examine these effects on your data and how they can be mitigated. For the Fourier transform, we will also discuss the assumptions, inputs to the FFT and possible reasons FFT's calculated with two different software packages do not match. This training is designed to help new users understand how these processes and how they work to help prevent data processing mistakes.

SOLVING SHOCK AND VIBRATION PROBLEMS: ISOLATION SYSTEMS
Shawn Czerniak (Hutchinson)

MEETING ROOM TBD

This tutorial will be structured in three parts to provide the attendee with: 1) Shock and Vibration fundamentals (Spring-Mass-Damper system, Linear vs Non-Linear, Material selection & Material influence) 2) Various examples of commercially available isolation solutions (Elastomeric, Metallic, Friction Damped, Air Damped, Application examples) , and 3) Real world examples of isolation systems at work (System parameters, Isolation system requirements, Analytical predictions & Shock test videos). The attendee will leave the tutorial with an enhanced understanding of how an isolator designer uses their expertise and available tools to craft a compliant isolation system that meets the needs of their customer.

TUTORIAL SESSION V
3:30 - 6:30PM
(CONTINUED)

AIR BLAST AND CRATERING: AN INTRODUCTION TO THE ABC'S OF EXPLOSION EFFECTS IN AIR AND ON LAND

MEETING ROOM TBD

Denis Rickman (USACE ERDC)

This three-hour course introduces the effects of explosions in air and on land. Topics covered include airblast, soil/rock/pavement cratering, and ground shock phenomena produced by explosive detonations. There is a little math, but for the most part, the focus is on aspects and principles that are of practical use to those conducting (and utilizing) blast-related research. Most researchers in the blast arena have some grasp of explosion effects fundamentals, but very few have a good, broad-based understanding of how it all works. The goal is to provide the participants with enough of an understanding that they can appreciate the various explosion phenomena and those parameters that affect blast propagation and blast loading of objects in a terrestrial setting.

COMMON ROADBLOCKS AND LESSONS LEARNED FROM SHOCK QUALIFICATION; PRACTICAL GUIDANCE AND CASE STUDIES

MEETING ROOM TBD

David Callahan (HII Newport News Shipbuilding)

This course will focus on errors and missteps common to the shock qualification process and how they can be avoided by walking attendees through qualification efforts for several real-life examples. The instructor will provide details on the issues which were faced, the utilized testing/analysis methodologies, related 901 requirements, and lessons learned. The end-goal of the training is to provide attendees with a better practical understanding of shock qualification by test and extension. This course is aimed at those who are or will be responsible for shock qualifying naval equipment per 901 requirements. This course assumes the attendees have at least a base understanding of 901 methodologies and requirements. Therefore it is recommended (but not required) that attendees have sat through previous 901 trainings or at least have a base understanding of 901 requirements. There will also be a portion of the tutorial set aside for specific attendee questions and hypothetical scenarios.

MONDAY
SEPTEMBER 21

Welcome Reception

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Shock Tech

ALL SYMPOSIUM ATTENDEES AND GUESTS ARE INVITED TO ATTEND.

6:30 - 8:30PM
HEAVY HORS D'OEUVRES & DRINKS
EXECUTIVE BALLROOM (EXHIBIT HALL)

SAVE Awards & Nomination Instructions

Henry C. Pusey Best Paper Award

KEEP A LOOKOUT IN THE PROGRAM FOR THIS QR CODE! SCAN TO NOMINATE ANY PRESENTATION DESERVING OF OUR ANNUAL ***HENRY C. PUSEY BEST PAPER AWARD.*** FULL AWARD CRITERIA AND NOMINATION FORM AVAILABLE BY SCANNING THE QR CODE.

Award for Excellence in Instruction

NOMINATE ANY THREE-HOUR TUTORIAL DESERVING OF OUR NEW ***AWARD FOR TUTORIAL EXCELLENCE.***

FULL AWARD CRITERIA AND NOMINATION FORM AVAILABLE BY SCANNING THE QR CODE.

Lifetime Achievement Award

THE LIFETIME ACHIEVEMENT AWARD IS BESTOWED TO A MEMBER OF THE SHOCK AND VIBRATION COMMUNITY WHO HAS MADE SIGNIFICANT TECHNICAL CONTRIBUTIONS TO THE FIELD WITH A LIFETIME OF CAREER DEDICATION.

REACH OUT TO DREW PERKINS OR ASHLEY SHUMAKER FOR ADDITIONAL AWARD CRITERIA AND/OR A NOMINATION PACKAGE FOR THIS PRESTIGIOUS AWARD.

TUESDAY
SEPTEMBER 22

BREAKFAST + NETWORKING

7:00 - 8:00AM | EXHIBIT HALL

AFTER BREAKFAST, ENJOY THE OPPORTUNITY TO NETWORK WITH OTHER ATTENDEES AND INTERACT WITH EXHIBITORS.

TUTORIAL SESSION VI
8:00 - 11:00AM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

OVERVIEW OF UNDERWATER EXPLOSION PHENOMENOLOGY & BULK CHARGE WEAPON EFFECTS

MEETING ROOM TBD

LIMITED DISTRIBUTION D (SECURITY PAPERWORK REQUIRED)

Greg Harris (Consultant)

This tutorial will provide an overview of underwater explosion (UNDEX) phenomenology relevant to bulk charge underwater warheads. The phenomenology discussion includes UNDEX shock wave propagation, bulk cavitation effects, and UNDEX bubble dynamics. UNDEX testing and analysis procedures for characterizing the shock wave and bubble performance of explosive compositions will be described. Finally, a brief discussion of the damage mechanisms used by bulk charge underwater weapons such as mines and torpedoes will be given using illustrative examples from UNDEX testing programs and recent naval encounters.

FUNDAMENTALS OF MODAL ANALYSIS

MEETING ROOM TBD

Steff Nelson (Siemens)

The class will focus on hands-on demos related to tap testing modal analysis. It will begin with simple concepts such as what is a mode, what is damping, what is a natural frequency. It will build to more advanced concepts like modal curve fitting and best practices for taking data and setting up a test. Participants will be encouraged to bring a laptop to follow along, with some others being encouraged to participate in the modal hits. Also covered will be frequency response functions and coherence.

INTRODUCTION TO MIL-STD-461 ELECTROMAGNETIC INTERFERENCE QUALIFICATION REQUIREMENTS FOR SHIPBOARD & SUBMARINE ELECTRONICS EQUIPMENT

MEETING ROOM TBD

Jeffrey Viel (Element US Space & Defense))

This 3 hour tutorial provides a comprehensive overview of the Electromagnetic Interference (EMI) requirements and verification criteria for airborne, sea, space, and ground systems and platforms as defined in the most current version of MIL-STD-461G, the Electromagnetic Interference and Control Requirements for electrical and electronic subsystems. This course explains the basic cause and effects of EMI/E^3 within platform installations as well as their operating environments and how equipment and subsystems and platform systems are evaluated against these threats.

This course covers many common issues encountered during MIL-STD-461G/H compliance testing, including lessons learned and comparisons to previous versions of the standard to highlight important changes to these requirements overtime. Essential guidance on test/evaluation planning and formal test procedure development will be provided along with a detailed technical overview of the test & assessment methods defined in the standard.

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TUTORIAL SESSION VI
8:00 - 11:00AM
(CONTINUED)

REMOVING THE BOUNDARY CONDITION HOBGOBLINS IN VIBRATION QUALIFICATION TESTING WITH MODAL TECHNIQUES

MEETING ROOM TBD

Troy Skousen (Sandia National Laboratories)
Randy Mayes (Consultant)

How a modal technique provides a simple modification to the base input mitigating the field-to-laboratory impedance mismatch for high confidence component qualification

Random vibration laboratory testing is used to qualify components to survive in-service responses to system environments. Using realistic research hardware and an analytical rocket system, we show that traditional single degree of freedom (SDOF) shaker test specifications guarantees large response uncertainties when compared with the field environment responses due to the difference in laboratory boundary conditions. A brief review is provided showing how fixed-base mode shapes are derived from test data. A model utilizing fixed-base and rigid body modes of the component on its vibration test fixture is used to decompose the component field motion into a few intuitive responses. This model demonstrates why 6DOF laboratory control can eliminate large uncertainties in traditional SDOF testing with a corresponding boost in qualification confidence. In fact, the model leads to modified base inputs for a greatly improved SDOF or 3DOF test.

RESONANT PLATE SHOCK TESTING FOR PYROSHOCK SIMULATION

MEETING ROOM TBD

Dr. Carl Sisemore (ShockMec Engineering)

Pyroshock is traditionally defined as a decaying, oscillatory structural response to a high-amplitude, high-frequency mechanical excitation. The other distinctive characteristic is the near zero momentum transfer from the shock event. The aerospace industry has long recognized the potentially destructive effect of pyroshock on sensitive electronics and electro-mechanical devices. The aerospace industry frequently utilizes the firing of explosive bolts, nuts, pins, cutters, and other similar pyrotechnic devices to perform operations in their systems due to the simplicity of operation and the high reliability of those mechanisms. Additionally, other non-explosive environments such as the sudden release of strain energy or metal-to-metal impacts can produce effects similar to pyroshock. Resonant plate shock testing is a common technique for simulating pyroshock events in the laboratory. Resonant plate testing can produce a very similar, high-amplitude, high-frequency oscillatory shock response in a test article. The concept is relatively simple, but the application of the test method is an art. There are many variables to consider when designing a resonant plate test: plate size and materials, boundary conditions and damping configuration, impacting mass, impact velocity and interface stiffness. All these variables interplay to create a pyroshock simulation in the test laboratory. This tutorial will provide an overview of resonant plate theory and the practical implementation of resonant plate shock testing. How should resonant plate shock environments and test specifications be defined. How to design resonant plates for frequency and performance. How to select impact hammers and test configurations for successful shock testing. Examples from actual resonant plate shock tests will also be used to demonstrate the theoretical results seen in practice.

TUESDAY
SEPTEMBER 22

BREAKFAST + NETWORKING

7:00 - 8:00AM | EXHIBIT HALL

AFTER BREAKFAST, ENJOY THE OPPORTUNITY TO NETWORK WITH OTHER ATTENDEES AND INTERACT WITH EXHIBITORS.

TUTORIAL SESSION VI
8:00 - 11:00AM
(CONTINUED)

PRIMER ON NONLINEAR SOLID MECHANICS AND ALGORITHMS FOR MODELING OF EXTREME EVENTS

MEETING ROOM TBD

Dr. Kent T. Danielson (US Army ERDC)
Dr. Robert Browning (Battelle Memorial Institute)

The purpose of this course is to introduce nonlinear solid/structural mechanics and associated numerical methods for practical high-fidelity modeling and simulation involving severe loadings, such as high-speed impact/penetration and response to explosive detonations. The intent is to foster better usage of such software, particularly as an initial primer for those more familiar with linear mechanics and static or slower implicit dynamic methods that desire the basics of high-rate modeling. More experienced users might also find the discussions useful in going beyond typical default settings and methods found in common software. In this course, the focus will be entirely on lumped-mass explicit approaches that are typically the most appropriate for high-rate solid/structural dynamics. The material will be given in the context of Lagrangian finite element analysis, but much will be common to meshfree, finite volume, and similar methods. Other topics include performance of the nonlinear fundamental equations and their “weak” characteristics, nonlinear stress, strain and rate measures and their interpretations, material frame indifference and traits of constitutive models, causes and treatments (element technologies) of both shear and volumetric locking, artificial bulk viscosity and hourglass control, and explicit mass lumping and the critical time increment. The recommended prerequisites are a fundamental understanding of basic solid/structural mechanics (stress and strain) and the finite element method.

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Exhibitor Passport Program

HOW IT WORKS:

- Each Symposium attendee is given a "Passport" with a listing of participating exhibitors.
- Participating exhibitors are provided a custom stamp/sticker.
- As the attendees visit the participating exhibitors, exhibitors "stamp" the passport of the attendee.
- Attendees who collect the stamp of at least 20 participating vendors are entered into the drawing.
- Prizes range from gift cards to gadgets to new exhibitor products!
- *Drawing to be held during the Wednesday afternoon break (3:05 - 3:40pm).*

Thank You to the exhibitors participating in the Passport Program:

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TUESDAY
SEPTEMBER 22

EXHIBITORS LUNCHEON
(GENERAL SESSION I)
WITH KEYNOTE ADDRESS
11:00AM - 1:00PM

EXECUTIVE BALLROOM

11:00AM—11:10AM	**CALL TO ORDER** Mr. Drew Perkins, SAVE / HI-TEST Laboratories
11:10AM—11:15AM	**KEYNOTE INTRODUCTION** Dr. Kent Danielson, USACE ERDC
11:15AM—NOON	**KEYNOTE ADDRESS:** ***SIZE SCALING IN IMPACT CRATERING AND THE DART IMPACT*** Dr. James D. Walker, Southwest Research Institute
NOON—1:00PM	**LUNCH** **FOLLOWED BY EXHIBITOR MEET & GREET**

Enjoy time to peruse the exhibit hall and meet the vendors.

DON'T FORGET TO GET STARTED ON YOUR PASSPORT PROGRAM ENTRY FORM!
DRAWING TO BE HELD DURING WEDNESDAY'S AFTERNOON BREAK IN THE EXHIBIT HALL.
PRIZES TO INCLUDE:

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EXHIBITOR APPAREL & SWAG

EXHIBITORS LUNCHEON
(GENERAL SESSION I)
WITH KEYNOTE ADDRESS
11:00AM - 1:00PM

TUESDAY
SEPTEMBER 22

Meet the Speaker

DR. JAMES D. WALKER
DIRECTOR & ACTING INSTITUTE SCIENTIST

Dr. James D. Walker is Director of the Engineering Dynamics Department and an acting Institute Scientist at Southwest Research Institute, where he oversees a multi-disciplinary effort investigating the dynamic response of materials and structures and where he has worked for 38 years. His work includes and combines large scale numerical simulations, analytical techniques, and experiments. Among his recognitions is a Best Paper Award at the 2012 Hypervelocity Impact Symposium for a paper studying the size-scaling behavior of momentum enhancement in impact cratering. He is author of the text Modern Impact and Penetration Mechanics, published by Cambridge University Press in 2021. Dr. Walker is the recipient of three NASA Group Achievement Awards. In 2004 he was included in Popular Science's third annual list of "Brilliant 10" scientists. He was awarded the 2005 ASME Holley Medal for his work in the Space Shuttle Columbia accident investigation and the 2014 TAMEST O'Donnell Award in Technology Innovation. He is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA), the American Society of Mechanical Engineers (ASME), a Ballistics Science Fellow of the International Ballistics Society (IBS), and a recipient of the Distinguished Scientist Award from the Hypervelocity Impact Society (HVIS). He is a former president of both HVIS and IBS and served on the board of directors of AIAA. Dr. Walker was a member of the DART Investigation Team. He resides with his wife and daughters in San Antonio, Texas.

KEYNOTE ADDRESS: SIZE SCALING IN IMPACT CRATERING AND THE DART IMPACT

On Monday, September 26, 2022, at 6:14 p.m. Central Daylight Time, the Double Asteroid Redirection Test (DART) spacecraft impacted the asteroid moonlet Dimorphos at 6.14 km/s (13,700 miles per hour). This impact altered the orbital speed of the 150-meter-across moonlet about its primary asteroid Didymos by 2.7 mm/s. This impact demonstrated the ability to deflect an asteroid using the planetary defense technology of hypervelocity kinetic impact.

SwRI has studied high speed impacts for many years. When a high speed or hypervelocity impact occurs, a crater is formed. Size scaling of this event is of interest, meaning, for example, how the resulting crater properties change as the initial impactor size increases, so that we can compare impact craters formed in the laboratory vs. large impact craters such as produced by NASA's DART impact. While the crater depth normalized by impactor diameter is fairly insensitive to initial impactor size, there are other aspects of the cratering process where dimensionless results show a strong dependence on the initial size of the impactor. These include (all appropriately normalized) crater diameter, mass of material liberated as ejecta, and momentum of the ejecta material. Examples of experiments (with SwRI's powder and large two-stage light gas guns) and computational results and comparisons are presented, including impacts into metals, concrete, rocks, and rubble piles for impact speeds ranging from 2 to 6 km/s. To reproduce the observed scaling behavior in large scale numerical simulations it is necessary to use target material constitutive models that include finite length scales (nonlocal models).

The ratio of the change in momentum in the target to the initial momentum of the impactor is referred to as β. The preliminary estimate for β from the DART impact is 3.6, meaning that an additional 2.6 times as much momentum was transferred to the asteroid due to the crater ejecta as was brought in by the impacting spacecraft. (A pre-DART-impact experiment into a rubble pile at SwRI gave a β of 3.4.) A final DART β requires a number we do not know today, namely the mass of the impacted body. In 2024, the European Space Agency launched a follow-on mission to the Didymos system to determine the mass of Dimorphos and also to look for an impact crater. The Hera spacecraft arrives at Didymos this December. Both the DART and Hera missions will be discussed in the talk.

TUESDAY (SEPTEMBER 22)

	SESSION 1: **RAPID AND COST-EFFECTIVE APPROACH FOR NAVAL SHIP SHOCK DESIGN, ANALYSIS, AND EQUIPMENT QUALIFICATION** 1:00-3:00PM / UNLIMITED DIST. A CHAIR(S): Nick Misselbrook (Thornton Tomasetti) Turkka Jappinen (Helsinki Shipyard)	*SESSION 2:* **BLAST RESPONSE & MODELING** 1:00-3:00PM / UNLIMITED DIST. A CHAIR(S): Andrew Bowman (USACE ERDC) William Furr (USACE ERDC)	*SESSION 3:* **DYSMAS I** 1:00-3:00PM / LIMITED DIST. D CHAIR(S): Roger Ilamni (NSWC Indian Head)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
	(##) following each paper title indicates associated page number in the abstract book appendix.		
1:00	**Early-stage ship design, modeling & tailored specifications for equipment** *Roope Kotiranta (Nesti Oy), Juha Virtanen (VTT Technical Research Centre of Finland Ltd), Turkka Jappinen (Helsinki Shipyard)*	**Effect of Finite Element Modeling Approach on Predicting Residual Strength of Damaged Infrastructure** *2LT Thomas Vellenga (US Army), Dr. Eric Williamson & LTC Christopher Graves (USMA)*	**Shock Wave Propagation and Floating Platform Response to Buried Seabed UNDEX: Campaign 3 Test Summary 2026** *Roger Ilamni (NSWC IHD), Greg Harris (ATR), Swen Metzler & Sven Diedrchsen (WTD-71), Manfred Krüger & Adrian Salah (iABG)*
1:25	**Shock and Whipping Analysis with ABAQUS** *Juha Virtanen (VTT Technical Research Centre of Finland Ltd), Roope Kotiranta (Nesti Oy), Turkka Jappinen (Helsinki Shipyard)*	**Numerical Characterization of Far-Field Blast Loads Related to Mild Traumatic Brain Injury** *Dr. Andrew Bowman, Paul Sparks Dr. Catherine Stephens, Dr. Andreas Frank, & Jason Roth (US Army ERDC)*	**UNDEX Shock Wave Loading for Charges on the Sea Bottom: Quantifying Differences Between In-Water and In-Sediment Shock Wave Propagation** *Greg Harris & Katherine Knowles (ATR), Roger Ilamni (NSWC IHD)*
1:50	**Shock analysis for Electrical Podded Propulsion** *Juha Virtanen (VTT Technical Research Centre of Finland Ltd), Turkka Jappinen (Helsinki Shipyard)*	**Numerical simulation of the PABLO-I near-field blast experiment using CTH and Viper Blast** *Dr. Peter McDonald, Dr. James Wurster, & Andrew Nicholson (Viper Applied Science), Dr. Photios Papados (US Army ERDC)*	**Estimating Seabed EOS Parameter Values from Observational Data for UNDEX Simulations** *Dr. Emily Guzas, Dr. Eugenia Stanisauskis Weiss, & Dr. Joe Ambrico (NUWC Newport)*
2:15	**Equipment shock qualification using Hybrid Method (combined calculation and residual shock testing)** *Henri Lotvonen (Nesti Oy), Kalle Vehvilainen (Vibrol Oy), Turkka Jappinen (Helsinki Shipyard)*	**Interesting Instrumentation Readings and Approaches Related to Arena Blast Testing** *Dr. Jason Florek, David Holgado, Justin Huong, & Dr. Rodrigo Mourao (Stone Security Engineering)*	**Updates on Simulating Near-Field UNDEX Against Submerged Concrete Structures** *Dr. Joe Ambrico, Dr. Emily Guzas, & Dr. Ryan Chamberlin (NUWC Newport), Dr. Jay Ehrgott (US Army ERDC), Roger Ilamni (NSWC Indian Head)*
2:40	**Case study examples of equipment qualification process - Hybrid method in practice** *Kalle Vehvilainen, Jarkko Keinänen, Aki Kinnunen, & Aki Karvonen (Vibrol Oy)*	**Higher-Order Hypoelastic-Plastic Beam Elements in Three-Dimensions for Explicit Dynamics** *William Furr & Dr. Kent Danielson (US Army ERDC), Dr. Arun Srinivasa & Dr. J.N. Reddy (Texas A&M University)*	**Predicting Weapon Effects on Critical Underwater Infrastructure: Data Gaps and Future Need** *Joshua E. Payne, Jeffrey R. Holmes, John Q. Ehrgott (ERDC), Emily Guzas (NUWC NPT), Roger Ilamni (NSWC IHD)*

3:00 - 3:40

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Ice Cream Social

EXECUTIVE BALLROOM (EXHIBIT HALL)

E-LABS FREDERICKSBURG, VIRGINIA - USA

	SESSION 4: **ELECTRONICS EVALUATION AND SENSING FOR HIGH-G ENVIRONMENTS** 1:50-3:00PM / LIMITED DIST. D CHAIR(S): Dr. Adriana Moura (ARA) Dr. Matthew Neidigk (Sandia Natl Labs)	*VENDOR SESSION A:* **EXHIBITOR PRESENTATIONS INCLUDING CASE STUDIES, NEW DEVELOPMENTS, TESTING & PRODUCTS** 1:00-3:00PM / UNLIMITED DIST. A CHAIR(S): Dr. Ted Diehl (Bodie Technology)	*TRAINING I:* **MIL-STD-167 QUALIFICATION AND BEST PRACTICES** 1:00-2:00PM / UNLIMITED DIST. A 
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
	(##) following each paper title indicates associated page number in the abstract book appendix.		
1:00	**Development of a New Embedded Device Acceleration and Pressure Test (EDAPT) Capability** *Dr. Adriane G. Moura, Zach Jowers, Jared Hammerton, & Dustin Landers (ARA), Dr. Matthew Neidigk (Sandia National Labs)*	**A Method to Predict Non-Linear Performance of a Damped Spring-Mass System** *Michael Czajka (Taylor Devices)*	**MIL-STD-167 Qualification and Best Practices** *Thomas Borawski* *(NSWC Philadelphia)* 1:00-2:00PM
1:25	**Evaluating 6DOF Impact Dynamics and Deceleration in Water Entry Air Drop Flight Tests** *Zach Jowers, Dr. Adriane G. Moura, Dustin Landers, James Scheppegrell, & Dr. Alain Beliveau (ARA), Samuel Schemmer (AFRL)*	**Robust Salvaging of Shock Acceleration Data** *Dr. Ted Diehl (Bodie Technology, Inc.)*	
1:50	**Dynamic Evaluation of Embedded Fuze Environments Across MIL-STD Temperatures** *Dustin Landers, Dr. Adriane G. Moura, Zach Jowers, & Dr. Alain Beliveau (ARA), Fahad Abumohaimed (AFRL)*	**High Speed Imaging in confined and remote locations** *William Spinelli (Photron)*	
2:15	**Modeling Embedded Fuze Reliability in Penetrating Munitions** *Dalton Gavin & Dr. Michael Nixon (Torch Technologies), Dr. Matthew Neidigk (Sandia National Labs)*	**High Damped Elastomeric Shock Mount** *Timothy Manta (ITT Enidine)*	
2:40	**Numerical Comparison of Through Hole vs Surface Mount Component Survivability** *Dr. Matthew Neidigk (Sandia National Laboratories)*	**Comparing TWR and iTWR for Hydraulic and Electrodynamic Shaker Control** *Dr. Brynna Neff (Crystal Instruments)*	

3:00 - 3:40

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Ice Cream Social

EXECUTIVE BALLROOM (EXHIBIT HALL)

E-LABS FREDERICKSBURG, VIRGINIA - USA

TUESDAY (SEPTEMBER 22)

	SESSION 5: **SHOCK STANDARD ACROSS AUKUS** 3:45-6:10PM / UNLIMITED DIST. A CHAIR(S): Nicolas Misselbrook (Thornton Tomasetti)	*SESSION 6:* **MIMO VIBRATION** 3:45-4:55PM / UNLIMITED DIST. A **ISOLATION I** 5:00-6:10PM / UNLIMITED DIST. A CHAIR(S): Troy Skousen (Sandia National Labs) Dr. Luke Martin (NSWC Dahlgren)	*SESSION 7:* **DYSMAS II** 3:45-6:10PM / LIMITED DIST. D CHAIR(S): Roger Ilamni (NSWC Indian Head)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
3:45	**Demystifying UK MAP01-470** *Nicolas Misselbrook, Gavin Colliar, & Alan Ferguson (Thornton Tomasetti), Helen Peterson (UK MOD SDA-NATG-VR)*	**Multi-Exciter Testing Developments** *Norman Trepanier, Eric Brogmus, & Bryan Taylor (Raytheon)*	**Internal Blast Modeling of Post-Detonation Combustion of an Aluminized Explosive Utilizing DYSMAS** *Colin Burns & Dr. Jeff St. Clair (NSWC IHD)*
4:10	**The Australian Shock Standard** *Ian Leaver (Thornton Tomasetti), Lachlan Maloney & Matt Solon (Directorate of Naval Engineering, Australia)*	**Optimization and assessment of shaker placement in multi-exciter multi-axis vibration testing** *Ruben Araújo, Umberto Musella, Dr. Alberto Garcia de Miguel, & Dr. Bart Forrier (Siemens Digital Industries Software)*	**DYSMAS Simulations of Naturally Fragmenting Munitions** *Jim Warner, Brian Howell, & Sean Tidwell (NSWC IHD), Tim App (ATR)*
4:35	**MIL-DTL-901E: The US Shock Standard** *TBD*	**OPEN**	**Internal Blast Testing in Support of DYSMAS Afterburn Modeling Development for Non-ideal Explosives** *Colin Burns & Dr. Jeff St. Clair (NSWC IHD)*
5:00	**UK Shock Testing Facilities** *Gavin Colliar, Nicolas Misselbrook, & Alan Ferguson (Thornton Tomasetti)*	**Performance Comparison of Arch Mounts™ and Wire Rope Isolators** *Andrew Liberatore, Darko Gjoreski, & Richard Rakowski (Shock Tech, Inc.)*	**Large-Scale UNDEX Prediction of Novel Underwater Formulations using Equations of State Calibrated from Small-Scale Data** *Orlando Andres Mulero Flores & George McDaniel (NSWC IHD)*
5:25	**AUS Shock Testing Facilities** *Ian Leaver, Gavin Colliar, & Alan Ferguson (Thornton Tomasetti)*	**Amplitude-Specific Equivalent Damping Characterization of Wire Rope Isolators for Reduced-Order Shock Modeling** *Chris Sjoroos (IDC)*	**Machine Learning for UNDEX Shock Holing Rule** *Horacio Nochetto (NSWC IHD), Sujan Bashyal (ATR)*
5:50	**Comparison of AUKUS Shock Qualification Standards** *Nicolas Misselbrook & Ian Leaver (Thornton Tomasetti), Helen Peterson (UK MOD SDA-NATG-VR), Brian Lang (NSWC Carderock)*	**Dynamic Simulation of the Shock Resistance of Rubber Isolators** *Dr. Jun Han, Simu Hub*	**Topic Title TBD** *Authors TBD*

	SESSION 8: **STRUCTURAL RESPONSE AND HAZARD EVALUATION** 3:45-5:20PM / LIMITED DIST. D **TEST FACILITIES & QUALIFICATION SPECS** 5:25-6:10PM / LIMITED DIST. D CHAIR(S): Jeffrey Holmes (US Army ERDC) Marcus Barksdale (US Army ERDC)	*VENDOR SESSION B:* **EXHIBITOR PRESENTATIONS INCLUDING CASE STUDIES, NEW DEVELOPMENTS, TESTING & PRODUCTS** 3:45-6:10PM / UNLIMITED DIST. A CHAIR(S): Lauren Yancey (HI-TEST)	*TRAINING II:* **INTRODUCTION TO UERDTOOLS** 3:45-5:45PM / LIMITED DIST. D 
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
3:45	**Overview of the Magazine Earth Cover Update/Reassessment study, Experiment 10 (MERCURY 10)** *Jeffrey Holmes, Joshua Payne, Dr. Paul T. Mead, Dr. T. Neil Williams, Dr. John Q. Ehrgott, Jr., & Mr. Denis D. Rickman (US Army ERDC)*	**Real-Time Resonance Compensation to Improve the Accuracy of Blast Wave Pressure Measurements** *Dr. Thomas Gerber, Alan R. Szary, Douglas Firth, & Patrick Rule (Precision Filters, Inc.)*	**Introduction to UERDTools** *Rachel McIntyre* *Brian Lang, & Ari Bard* *(NSWC Carderock)* 3:45 - 5:45pm
4:10	**Experiment Plan to Quantify HD 1.3 Thermal Hazards in Test Cubicles** *Adam Mayatt (US Army ERDC)*	**Validating a WRI Solution through Simulation and Experimental Methods** *Ozzie Irowa (Socitec)*	
4:35	**OPEN Small Magazine Volatility Testing of HD 1.3 and 1.4 Materials** *Jonathan Dahlem & Dr.John Q. Ehrgott, Jr. (US Army ERDC), Jeremy Grey (US Coast Guard FORCECOM)*	**Development of a MIPS Resonant Beam Shock Test Machine** *Dr. Carl Sisemore (ShockMec Engineering)*	
5:00	**OPEN**	**Viper Blast for Advanced Airblast Simulations** *Dr. Peter McDonald (Viper Applied Science)*	
5:25	**Tube and Breech Fatigue Lab Overview** *Lucas Smith (US Army DEVCOM-AC-WSEC), Scott Lobdell (US ARMY/DEVCOM-AC-WSEC/Benet Labs)*	**Modernizing Vibration Test Automation via REST API and AI-Assisted Implementation** *Jacob Willett (m+p International)*	
5:50	**Restructuring of UFC 3-340-01 Chapter 12** *Dr. Eric Kjolsing & Mark Weaver (Karagozian & Case), John Geringer (US Army Corps of Engineers Protective Design Center), Brett Williams (US Army ERDC)*	**Vibration at Cryogenic Temperatures** *Roger Rutz (Experior Laboratories)*	

End Tuesday Events

WEDNESDAY (SEPTEMBER 23)

BREAKFAST WITH THE EXHIBITORS
EXECUTIVE BALLROOM | 7:00-8:00AM

	SESSION 9: **TEST EQUIPMENT MODELING & SIMULATION** 8:00-9:35AM / UNLIMITED DIST. A CHAIR(S): Calvin Milam (Element Defense) Gregory Budriss (NSWC Philadelphia)	*SESSION 10:* **EXPERIMENTAL VIBRATION TECHNIQUES** 8:00-9:35AM / UNLIMITED DIST. A CHAIR(S): Dr. Peter Vo (Raytheon) Jade Vande Kamp (Vibration Research)	*SESSION 11:* **SHOCK QUALIFICATION ANALYSIS** 8:00-9:35AM / LIMITED DIST. D CHAIR(S): Jordan Poehler (NSWC Carderock) Isabel Catugas (NSWC Carderock)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
8:00	**Can a theory of wave propagation through layered media explain how resonant plate anvil design affects the shock pulse energy content?** *Dr. Nancy Winfree & Joshua Nowlin (Sandia National Laboratories), Dr. Carl Sisemore (ShockMec Engineering)*	**Sine-on-Random Tolerances: Comparing Expected Statistical Variation and MIL-STD Compliance** *Jade Vande Kamp (Vibration Research)*	**Effects of Meshing Practices on Linear Elastic Modal Structural Response** *Ian Larson (NSWC Carderock)*
8:25	**Fluid Structure Interaction due to Seismic Airgun Loading** *Dr. Daniel Clark (Thornton Tomasetti)*	**Controlling out harmonic distortion on a hydraulic shaker** *Raman Sridharan (Data Physics Corporation)*	**Effects of Meshing Practices on Elastic Plastic Structural Response** *Katherine Jordan (NSWC Carderock)*
8:50	**Development of Numerical Simulation for Lightweight Shock Test** *Keisuke Terada & Daisuke Morimoto (Japan Marine United Corporation)*	**Towards automated lumped parameter model identification of electrodynamic shakers** *Dr. Mattia Dal Borgo & Umberto Musella (Siemens Digital Industries Software), Francesco Bentivoglio & Dr. Emiliano Rustighi (University of Trento)*	**Mass Feedback Effects on Deck Environments** *Serena Sauers (NSWC Carderock)*
9:15	**Enhanced and Accurate Upsampling for Derivative-Sensitive Shock Signals** *Dr. Ted Diehl (Bodie Technology, Inc.)*	**Experimental and Numerical Packing of Glass Microbeads for Electronic Encapsulation** *Joseph Erwin (Sandia National Laboratories)*	**Standard Shock Qualification of Mast Mounted Equipment** *Timothy McGee, Rachel McIntyre, Jake Mason, & Matt Stevens (NSWC Carderock)*

9:35 - 10:00

COFFEE BREAK
with the Exhibitors
EXHIBIT HALL / EXECUTIVE BALLROOM

BREAKFAST WITH THE EXHIBITORS
EXECUTIVE BALLROOM | 7:00-8:00AM

	SESSION 12: **BALLISTICS I** 8:00-9:35AM / LIMITED DIST. D CHAIR(S): David Lichlyter (US Army ERDC) Daniel Rios-Estremera (US Army ERDC)	*VENDOR SESSION C:* **EXHIBITOR PRESENTATIONS INCLUDING CASE STUDIES, NEW DEVELOPMENTS, TESTING & PRODUCTS** 8:00-9:35AM / UNLIMITED DIST. A CHAIR(S): Catherine Stephens (US Army ERDC)	*TRAINING III:* **PRELIMINARY DESIGN ASSESSMENT STRATEGIES FOR STRUCTURAL INTEGRITY IN SHOCK & VIBRATION** 8:00-8:45AM / UNLIMITED DIST. A 
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
8:00	**Theoretical Reliability-Based Analysis of Armor Subjected to Fragmentation from Cluster Munitions** *Daniel Rios-Estremera & Dr. Joseph Jordan (US Army ERDC)*	**Reducing Shipboard Vibrations by Application of Polyurethane Shock Mounts in a Double Resiliently Mounted Generator Set** *Danny Smit (Vulkan)*	**Preliminary Design Assessment Strategies for Structural Integrity in Shock & Vibration** *Dr. Charles Hull (Lockheed Martin)* 8:00-8:45AM
8:25	**Development of Fast Running Detailed Finite Element Projectile Models** *Logan Rice, Dr. Mark Adley, David Lichlyter, & Dr. Darren Rice (US Army ERDC)*	**CHAMP – Critical High-value Asset Monitoring Platform** *Dylan Pike (enDAQ/Hutchinson)*	
8:50	**Using EPIC to Build a Machine Learning Database for Steel Penetration** *David Lichlyter (US Army ERDC)*	**Better Data from Imperfect Footage: Advances in Image Motion Analysis** *Daniel Bissell (Image Systems)*	
9:15	**Joint DTRA/AFLCMC Penetration Experiments Against Pristine and Blast-Damaged Rock Targets** *Mark Green (Geomechanics Research & Analysis)* *Full list of contributing authors provided in Abstract Book*	**Topic TBD** *Kurt Hartsough (901 Engineering & Training)*	

9:35 - 10:00

COFFEE BREAK
with the Exhibitors
EXHIBIT HALL / EXECUTIVE BALLROOM

WEDNESDAY (SEPTEMBER 23)

	SESSION 13: **UNDEX SIMULATION & DOUBLY ASYMPTOTIC APPROXIMATION** 10:00-NOON / UNLIMITED DIST. A CHAIR(S): Dan Provenzano (NSWC Philadelphia) Christina Backes (NSWC Philadelphia)	*SESSION 14:* **ANALYSIS TECHNIQUES** 10:00-NOON / UNLIMITED DIST. A CHAIR(S): Garrett Wiles (NSWC Dahlgren) LeeYung Chang (NSWC Carderock)	*SESSION 15:* **DYSMAS III** 10:00-NOON / LIMITED DIST. D CHAIR(S): Roger Ilamni (NSWC Indian Head)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
10:00	**Efficient Simulation of Submarine Underwater Blast Using the Doubly Asymptotic Approximation (DAA)** *Jason Krist (Siemens)*	**A Parameterized Shock Waveform Model for Improved Mechanical Shock Synthesis** *Garrett Wiles (NSWC Dahlgren)*	**High Fidelity Modeling of Shock Holing Against a Generic Submarine Pressure Hull** *Rachael Busby & Dr. Jeff St. Clair (NSWC IHD)*
10:25	**Underwater Shock and Whipping Analysis of Composite Naval Ship Structure using Trident DAA Software** *Dr. Sergio G. Arias, Dr. Lei Jiang, Dr. T.S. Koko & Tom MacAdam (Lloyd's Register Advisory)*	**Parametric Optimization of Box and Removal (BARC) Models for Shock Testing** *Jason Krist (Siemens)*	**Shock Holing Testing Against a Scaled Pressure Hull** *Rachael Busby & Dr. Jeff St. Clair (NSWC IHD), Reece Roehsler & Jason Craft (NSWC Carderock), Katherine Knowles (ATR)*
10:50	**Validation of a Geers-Hunter UNDEX Loading Model Coupled with OpenRadioss Using Viper CORAL** *Andrew Nicholson, Dr. Peter McDonald, & James Wurster (Viper Applied Science), Eliott Cucciol (ENSTA University)*	**AI Surrogate Models for Shock and Vibration Analysis of a Ship Structure** *Jason Krist (Siemens)*	**High Speed, Scaled Weapon Penetration Testing Against a Populated Maritime Structure** *Andrew Cammenga & David Spencer (NAWC China Lake), Rachael Busby, Horacio Nochetto, & Dr. Jeff St. Clair (NSWC IHD)*
11:15	**OPEN**	**Finite Cell Method for Quick-Turn Vibration Analysis and MAC-Based Correlation** *Jason Krist (Siemens)*	**DYSMAS Simulations of High Speed Weapon Penetration Against a Populated Maritime Structure** *Horacio Nochetto, Rachael Busby, & Dr. Jeff St. Clair (NSWC IHD)*
11:40	**OPEN**	**Prediction of NASA ShockSat Frangible Joint Shock Environments – Deriving the Forcing Function** *Joshua Gorfain (Quartus)*	**Topic Title TBD** *Authors TBD*

Tip

DON'T FORGET TO VISIT THE EXHIBIT HALL AND COMPLETE YOUR "PASSPORT" FOR A CHANCE TO WIN GIFT CARDS, GADGETS, & MORE!

	SESSION 16: **HYDROSTATIC IMPLOSION AND UNDEX** 10:00-NOON / LIMITED DIST. D CHAIR(S): Dr. Ben Medina (NSWC Carderock) Dr. Joe Ambrico (NUWC Newport)	*TRAINING IV:* **SHOCK RESPONSE SPECTRUM PRIMER** 10:00-11:30AM / UNLIMITED DIST. A 	*WORKING GROUP:* **DYNAMIC ENVIRONMENTS QUALIFICATION WORKING GROUP** 10:00-NOON 
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
10:00	**Composite Pressure Vessel Hydrostatic Implosion Modeling and Testing Part 1** *Dr. Benjamin Medina & Elio Cusi (NSWC Carderock)*	**Shock Response Spectrum Primer** *Dr. Carl Sisemore* *(ShockMec Engineering)* 10:00 - 11:30AM	**Dynamic Environments Qualification Working Group** *Troy Skousen & David Soine* *(Sandia National Laboratories)* 10:00AM - NOON *The goal of dynamic environments qualification is to demonstrate that designs can withstand vibration inducing in-service loads while performing as required. Qualification evidence is often collected through laboratory testing intended to mimic field environment conditions with some conservatism. The objective of the Dynamic Environments Qualification Working Group is to shepherd the advancement of ideas and methods for shock and vibration environments qualification through test and analysis in the Shock & Vibration Symposium community. It is a forum to bring together the people that will lead the community to advance the state of the art in dynamic environments qualification. Collaborative discussion will include:* *• Discuss and evaluate effectiveness of sessions, tutorials, trainings, and discussion groups held at the symposium this year.* *• Identify thoughts, traditions, and standard practices that may be holding us back.* *• Sharing thoughts on the research needed to advance the state of the art.* *• What actions should the working group take within and external to the Shock and Vibration Symposium?*
10:25	**Composite Pressure Vessel Hydrostatic Implosion Modeling and Testing Part 2** *Elio Cusi & Dr. Benjamin Medina (NSWC Carderock)*		
10:50	**Automated high fidelity lethality assessments of SubVALUE model** *Gregory Gorman, Nicholas Valm, Christopher Craig, & Adam Hapij (Thornton Tomasetti), Rebecca Dickey (NSWC Carderock)*		
11:15	**An Application of the IDU framework to create ML Models for Hydrostatic Implosion** *Dr. Abilash Nair, Nicholas Valm, Christopher Craig, & Adam Hapij (Thornton Tomasetti) Dr. Benjamin Medina & Elio Cusi (NSWC Carderock), Dr. Joe Ambrico (NUWC Newport)*		
11:40	**OPEN**		

SEE A PRESENTATION WORTHY OF OUR HENRY C. PUSEY AWARD?
REMEMBER TO NOMINATE THAT PAPER USING THE PROVIDED QR CODE!

WEDNESDAY
SEPTEMBER 23

AWARDS LUNCHEON
(GENERAL SESSION II)
NOON - 1:30PM

EXECUTIVE BALLROOM

NOON—12:05PM	**CALL TO ORDER** Mr. Drew Perkins (SAVE / HI-TEST Laboratories)
12:05PM—12:15PM	**HENRY PUSEY BEST PAPER AWARD** PRESENTED TO: TBD
12:15PM—12:20PM	**AWARD FOR EXCELLENCE IN INSTRUCTION AWARD** PRESENTED TO: TBD
12:20PM—12:40PM	**LIFETIME ACHIEVEMENT AWARD** PRESENTED TO: TBD

Henry Pusey Best Paper Award

PRESENTED TO:
"To Be Announced"

Award for Excellence in Instruction

PRESENTED TO:
"To Be Announced"

Lifetime Achievement Award

PRESENTED TO:
"To Be Announced"

AWARDS LUNCHEON
(GENERAL SESSION II)
NOON - 1:30PM

	SESSION 17: **ELASTOMERIC ISOLATION** 1:30-3:05PM / UNLIMITED DIST. A CHAIR(S): Dr. Peter Vo (Raytheon) Grete Bressner (Hutchinson)	*SESSION 18:* **VIBRATION DATA ANALYSIS** 1:30-3:05PM / UNLIMITED DIST. A CHAIR(S): Matt Forman (NSWC Dahlgren) Dr. Vasant Joshi (NSWC Indian Head)	*SESSION 19:* **BALLISTICS II** 1:30-3:05PM / LIMITED DIST. D CHAIR(S): Christopher Shackelford (US Army ERDC) Glynn Harrington (US Army ERDC)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
1:30	**Bushing Dynamic Stiffness Estimate from Random Vibration Testing** *Dr. Ricky Stanfield & Dung Chi Pham (Corvid Technologies), Richard Rakowski & Darko Gjoreski (Shock Tech)*	**Possible Usage if General Spectral Density Theory for Environmental Specifications** *Neil Loychik (LANL)*	**Development and Implementation of Machine Learning Models for Fragment Terminal Performance Predictions** *Christopher Shackelford, David Lichlyter, Dr. T. Neil Williams, & Dr. John Q. Ehrgott, Jr. (US Army ERDC)*
1:55	**Considerations when Defining Test Environments to Characterize Isolator Performance: Highlighted by a Newly Developed Elastomer** *Grete Bressner (Hutchinson Aerospace & Industry)*	**Using Advanced Mathematics to Enhance Vibration testing While Reducing Overall Costs** *Stewart Slykhous (Spectral Dynamics)*	**Investigation into Momentum Transfer from Building and Earthworks Collateral Debris** *Dr. Zane Roberts (US Army ERDC)*
2:20	**Design and Dynamic Characterization of a Stewart Platform Inspired Passive Vibration Isolator** *Dr. Peter Woerner (KDS Dynamics)*	**FFT Spectrogram for Damping Logarithmic Decrement** *Dr. Ricky Stanfield (Corvid Technologies)*	**Comparative Analysis Between Predictive Methods and Experimental Data of Shaped Charge Jet Penetration into Concrete** *Glynn Harrington (US Army ERDC)*
2:45	**Resonant characteristics of the Payne Effect** *Noah Zimmerman, Dr. Peter Vo, Jay Paz, & Teri Stoner (Raytheon)*	**Open**	**Extension of the Forerstal Penetration Equations to Concrete Perforation Incorporating Velocity-Dependent Target Resistance** *Dr. Kyle Crosby (US Army ERDC)*

3:05 - 3:40

Dessert Break & Passport Program Drawing

EXECUTIVE BALLROOM/EXHIBIT HALL

Join us for a sweet afternoon treat and the announcement of prize winners for the Passport Program. This is also the last opportunity to visit with our exhibitors!

Participants do not need to be present to win.

	TRAINING V: **INTRODUCTION TO MULTI SHAKER TESTING** 1:30-3:05PM / UNLIMITED DIST. A	*TRAINING VI:* **INTERPRETING FINITE ELEMENT RESULTS** 1:30-2:30PM / UNLIMITED DIST. A	*WORKING GROUP:* **MIL-DTL-901 WORKING GROUP** 1:30-3:05PM / LIMITED DIST. D
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
1:30	**INTRODUCTION TO MULTI SHAKER TESTING** *Raman Sridharan* *(Data Physics/NVT Group)* 1:30 - 3:00PM	**INTERPRETING FINITE ELEMENT RESULTS** *Bart McPheeters* *(Leidos)* 1:30 - 2:30PM	**MIL-DTL-901E WORKING GROUP** *The working group will consist of a series of preselected discussion topics in common areas of concern (e.g. fastener tightening, mass ratios, SRF calculation, etc.) and then an open floor for Q&A.* MODERATORS: *Thomas Brodrick, NAVSEA 05P1* *Ryan Shorts, NSWC Carderock* *Domenic Urzillo, NSWC Carderock* 1:30 - 2:30PM
1:55			
2:20			
2:45			

3:05 - 3:40

Dessert Break & Passport Program Drawing

EXECUTIVE BALLROOM/EXHIBIT HALL

JOIN US FOR A SWEET AFTERNOON TREAT AND THE ANNOUNCEMENT OF PRIZE WINNERS FOR THE PASSPORT PROGRAM. THIS IS ALSO THE LAST OPPORTUNITY TO VISIT WITH OUR EXHIBITORS!

PARTICIPANTS DO NOT NEED TO BE PRESENT TO WIN.

WEDNESDAY
SEPTEMBER 23

TUTORIAL SESSION VII
3:30 - 6:30PM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

SHOCK TEST FAILURE MODES
Kurt Hartsough (901 E&T)

MEETING ROOM TBD

This tutorial will cover examples of shock test failures typically experienced by equipment exposed to MIL-DTL-901E shock levels. MIL-DTL-901E provides guidance for designers responsible for meeting the requirements of MIL-DTL-901E. 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.

QUANTITATIVE METHODS FOR SURVIVABLE ELECTRONICS PACKAGING FOR COMBINED LOADING OF THERMAL AND HIGH AMPLITUDE MECHANICAL SHOCK
NOTE: LIMITED DISTRIBUTION D (SECURITY PAPERWORK REQUIRED)
Dr. Matthew Neidigk (Sandia National Laboratories)
Dr. Adriane G. Moura (Applied Research Associates)

MEETING ROOM TBD

Fuze electronics intended for hard target defeat must survive both MIL-STD thermal cycle environments and extreme mechanical shock. Fuzes are often potted to prevent printed circuit board (PCB) flexure associated with component failure during impact. Potting techniques, or packaging strategies, may vary significantly by vendor and are often developed through trial and error. In many cases they are proprietary. Some packaging strategies include the application of elastomeric coatings to PCBs and components, or the use of epoxy underfills beneath components. Because most packaging materials are polymers, the disparity in thermal expansion between them and other fuze materials leads to a whole new series of problems during thermal cycling. As such, the DoD and the DOE have devoted considerable effort in the areas of material characterization, model development, and experimental validation, all with the goal of identifying survivable packaging strategies for use in both conventional and nuclear weapon stockpiles. Upon completion of this course, the user should have a basic understanding of the properties of common packaging materials, modeling and simulation tips and tricks, and latest developments in the design and evaluation of survivable packaging strategies for high-g electronics.

INTRODUCTION TO WEAPONS EFFECTS AND SHIP COMBAT SURVIVABILITY ANALYSIS
Jan Czaban (Zenginworks Limited)

MEETING ROOM TBD

This short course provides a practical understanding of naval ship combat survivability and methods to assess the effects of various weapons. The introduction will review terminology, concepts and current practice involved in setting, achieving and verifying survivability requirements. Naval threats and weapon types will be reviewed and methods for predicting their resultant loads and damage mechanisms explained. Primary weapons effects will include attacks from underwater explosions, above water explosions, internal blast, fragments and ballistic projectiles. Sample problems will be provided to demonstrate how to estimate the extent of damage sustained by ship structures and how to apply and interpret damage using standard terms of capability degradation. Methods for hardening ship systems and structures will be reviewed with an introduction provided to explain dynamic load effects tolerance, armour systems and simplified pass/fail global design assessment techniques. The course material will be entirely based on public domain sources and includes a comprehensive list of references and applicable military standards.

REVIEW OF PRACTICAL VIBRATION/SHOCK MITIGATION METHODOLOGIES

MEETING ROOM TBD

Dr. Daryoush Allaei (QRDC)
Prof. Arezoo Emdadi (Missouri Univ. of Science and Technology)

Real-world vibration and shock mitigation strategies fall into three main categories: Source control - reduce vibration or shock load where it originates, Path control - interrupt or attenuate transmission, and Receiver protection - isolate or harden the sensitive system.

Source Mitigation Techniques (Eliminate or Reduce Excitation) is the most effective when feasible. Common Methods include balancing rotating components (reduces centrifugal forces), precision alignment of shafts and couplings, reducing excitation forces (lower speeds, smoother profiles), soft start / ramp control (limits transient shock), process redesign (e.g., replacing impact processes (inducing shock waves) with continuous ones), and eliminating resonance at the source avoids amplification downstream. Even small improvements here often yield large system-wide benefits.

Path Mitigation Techniques (Interrupt Transmission) address or modify how vibration or shock load travels through structures. Some of the well know methods are isolation using elastomer mounts (rubber, neoprene), spring isolators, and air mounts. The main idea is to reduce transmissibility when operating frequency > √2 × natural frequency. Damping treatments is another approach that is most effective near or at resonance frequency. Some of the damping treatments include viscoelastic damping layers, constrained layer damping (CLD), and tuned mass dampers (TMDs). One may modify structure by increasing stiffness (shift natural frequency), adding mass (lower response amplitude at high frequency), and introduce discontinuities (break transmission paths). It is noted that isolation works best for steady-state vibration while damping is critical for transient and resonant conditions.

Receiver Mitigation Techniques (Protect the Payload) is applied when source/path control is limited or impractical. Some of these methods are isolating systems, such as equipment mounts, floating platforms, and shock-mounted enclosures. Shock protection methods include foam packaging (energy absorption), wire rope isolators (high durability), and hydraulic dampers (high-energy shock). Structural hardening includes reinforced components, ruggedized electronics, and potting or encapsulation. It is noted that receiver isolation should consider payload fragility curves (G-level vs duration) while over-isolation can introduce instability or excessive motion.

Practical application of these methodologies will be discussed.

MIL-DTL-901E ENGINEERING TOPICS

MEETING ROOM TBD

Domenic Urzillo (NSWC Carderock)

MIL-DTL-901E Engineering topics is a follow-on course to the MIL-DTL-901E 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-DTL-901E testing, digital data filtering, shock response frequency, shock test fixture design fundamentals and FSP deck simulation fixtures.


WEDNESDAY
NIGHT SOCIAL
7:30 - 9:30PM
SPORTS & SOCIAL
RAISING THE SPORTS BAR
SPORTS & SOCIAL
SPORTS BAR & GRILL
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.9 MILE WALK
(ABOUT 10 MINUTES)

5 MINUTE UBER
(APPROXIMATE)

ALL ATTENDEES & GUESTS

All symposium attendees and guests are welcome!

PLEASE WEAR YOUR CONFERENCE BADGE FOR ENTRY.

DINNER & DRINKS

Full dinner and drinks will be provided.

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TRANSPORTATION

Transportation not provided. Walking distance or short Uber/Lyft recommended.

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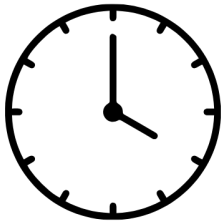
THURSDAY (SEPTEMBER 24)

ATTENDEE BREAKFAST
EXECUTIVE BALLROOM | 7:00-8:00AM

	SESSION 20: **MIL-STD-167 VIBRATION & SHIPBOARD TEST METHODOLOGIES** 8:00-9:35AM / UNLIMITED DIST. A CHAIR(S): Kaitlyn Riggs (NSWC Philadelphia) Kervin Michaud (NSWC Philadelphia)	*SESSION 21:* **NEXT GENERATION SHOCK RESPONSE SPECTRUM** 8:00-9:35AM / UNLIMITED DIST. A CHAIR(S): Dr. Evan Saunders (Sandia National Labs) Ryan Powers (NSWC Philadelphia)	*SESSION 22:* **PACKAGING & ISOLATING FOR SHOCK SURVIVABILITY** 8:00-9:35AM / LIMITED DIST. D CHAIR(S): Andrew Cunningham (NSWC Carderock) Richard Clayson (Sandia National Labs)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
8:00	**Shadow of Additive Manufacturing** *Thomas Borawski (NSWC Philadelphia)*	**SRS-based transfer functions: A numerical study** *Daniel Bluedorn (Sandia National Laboratories)*	**Shock Qualified Payload Stowage Solutions for Submarine Applications** *Teresa Gangi (NUWC Newport)*
8:25	**Standards Driven Synthesis and Delivery of Shaker Test Programmes** *Neil McRae & Gavin Colliar (Thornton Tomasetti)*	**Modal Shock Response Spectrum** *Dr. Evan Saunders, Troy Skousen, & Dr. Randy Mayes (Sandia National Laboratories)*	**High Energy Rope Mount Isolator Relaxation** *Javier Garcia-Rivera (Raytheon)*
8:50	**Update to Shipboard Vibration test Methodologies** *Dr. Luke Martin (NSWC Dahlgren), Thomas Borawski (NSWC Philadelphia)*	**Shock Time Series Synthesis via Multiple Wavelet Ensemble Method** *Syed Raza, Dr. Dustin Harvey, & Adam Watts (Los Alamos National Laboratory)*	**Predicting Complex Shock Failure Modes of Specialized Packaging and Handling Systems Using Explicit Non-Linear FEA** *Aayush Gandhi (Naval PHST Center)*
9:15	**OPEN**	**OPEN**	**Validating FEA Models for Wire Rope Isolation Systems Against Analytical Methods** *Justin Lam (Naval PHST Center)*



SESSION BREAK
9:35 - 10:00AM

ATTENDEE BREAKFAST
EXECUTIVE BALLROOM | 7:00-8:00AM

	SESSION 23: **BLAST CHARACTERIZATION** 8:00-10:00AM / LIMITED DIST. D CHAIR(S): DeBorah Luckett Weatherspoon (USACE) Roosevelt Davis (AFRL)	*PANEL:* **HOW TO MAXIMIZE AI WHILE KEEPING HONEST TO MIL-SPECS (901/167/3010)** 8:00-10:00AM / UNLIMITED DIST. A	*TRAINING VII:* **INTRODUCTION TO LIGHTWEIGHT AND MEDIUM WEIGHT SHOCK TESTING** 8:00-9:30AM / UNLIMITED DIST. A
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
8:00	**Plastic Bonded Explosive Performance Under Vacuum** *Noah Meisner, Michael Vena, Nicholas Oberts, & Joseph Magallanes (Karagozian & Case, Inc.), Daniel Portillo (Southwest Research Institute)*	**How to Maximize AI While Keeping Honest to MIL-Specs (901/167/3010)** *The session will consist of a series of presentations introducing the topic prior to a panel-moderated open discussion .* Presenters/Moderators: *Allison Vella (Leidos)* *Additional Members TBD* 8:00-9:30AM	**Introduction to Lightweight Shock Testing and Medium Weight Shock Testing** *Jeff Morris* *(HI-TEST Laboratories)* 8:00-9:30AM
8:25	**Autonomous Momentum Gage for MutiPhase Flow** *Dr. Paul Cammarata, Damian Camo, Raul Reyes, Grant Spear, & Dr. Sean Cooper (Applied Research Associates), Dr. Robert Abernathy & Kiran Shah (DTRA)*		
8:50	**Empirical Data of the Blast Overpressure (BOP) Environment Inside a Department of War Tactical Breaching Training Facility** *DeBorah Luckett Weatherspoon, Dr. Kellan Sullivan, & Dr. Catherine Stephens (US Army ERDC)*		
9:15	**Blast Dose Accumulation Methodology** *Noah Meisner, Joseph Hamilton, Dr. Youcai Wu, Dr. William Chen-Mertens, Jonathan Raygoza, Isabela Cardenas, Dr. Joseph Magallanes (Karagozian & Case, Inc.), Dr. Michael Shields (Johns Hopkins University), Dr. Allison Nelson & Dr. Pamela VandeVord (Virginia Tech)*		

SESSION BREAK
9:35 - 10:00AM

THURSDAY (SEPTEMBER 24)

	SESSION 24: **INSTRUMENTATION FOR DYNAMIC TESTING** 10:00-NOON / UNLIMITED DIST. A CHAIR(S): Dr. Bryan Joyce (NSWC Dahlgren) Davin Jahnke (NSWC Philadelphia)	*SESSION 25:* **LAB & FLIGHT PYROSHOCK** 10:00-NOON / UNLIMITED DIST. A CHAIR(S): Paul Prete (NSWC Philadelphia) Austin Glenwright (NSWC Philadelphia)	*SESSION 26:* **SHOCK TESTING & METHODS** 10:00-10:45AM / UNLIMITED DIST. A **COMBINED SHOCK & VIBRATION CHARACTERIZATION & TESTING** 10:50-NOON / UNLIMITED DIST. A CHAIR(S): Peter Zawycky (NSWC Philadelphia) Kevin Behan (Applied Physical Sciences)
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
10:00	**High-G Shock Accelerometers: Damped vs. Undamped** *James Nelson (PCB Piezotronics)*	**Isolation Properties of CubeSat Mount Assembly** *Darko Gjoreski, Richard Rakowski, & Shane Jansen (Shock Tech)*	**Submarine underwater explosion testing** *Johan Jeppsson (Saab)*
10:25	**An Improved Flash Test for Pressure Transducer Design** *John Hilton, Cameron Stekelenburg, Steve Carter, & Joseph VanDeWeert (Kulite)*	**Damping Treatments and Boundary Conditions in Resonant Plate Shock Testing and Their Effect on the Plate's Modal Response** *Dr. Carl Sisemore (ShockMec Engineering)*	**Shock Qualification of Hazardous Equipment using a Portable Shock Test Machine** *Liam Rayner & Gavin Colliar (Thornton Tomasetti)*
10:50	**OPEN**	**Reusable Aerial Delivery Equipment** *Dr. Daryoush Allaei & Drew Holsenback (QRDC), Prof. Arezoo Emdadi (Missouri Univ. of Science and Technology)*	**OPEN**
11:15	**High-speed Imaging & Python Scripting for Vibration Extraction** *Prof. Kyle Gilroy (Vision Research/Phantom Cameras)*	**OPEN**	**Combined Vibration and Shock Testing Development** *Dr. Jim DeClerck & Dr. Cora Taylor (Michigan Technological University), David Soine & Steve Carter (Sandia National Laboratories)*
11:40	**MIL-DTL-901 Subsidiary Shock Program Development Updates – Principal Unit Testing and Model Development** *Matt Forman & Dr. Bryan Joyce (NSWC Dahlgren)*	**OPEN**	**Investigation of nonlinear response in mixed shock and random vibration environments** *Alex Sutherland, Dr. Angela C. Montoya, & Dr. Garrett D. Nelson (Sandia National Laboratories)*

1:00 - 2:00

SAVE TECHNICAL ADVISORY GROUP (TAG) MEETING

MTG ROOM TBD

The annual meeting of the members of the SAVE Technical Advisory Group (TAG) will convene to review the 96th Shock & Vibration Symposium and discuss plans for 2027.

	SESSION 27: **STRUCTURAL RESPONSE & FRM DEVELOPMENT** 10:00-NOON / LIMITED DIST. D CHAIR(S): Gabriel Riveros (US Army ERDC) Ernesto Cruz (US Army ERDC)	*TRAINING VIII:* **AN INTRODUCTION TO DYNAMIC ANALYSIS** 10:00-11:00AM / UNLIMITED DIST. A 	*WORKING GROUP:* **MIL-STD-810J DISCUSSION GROUP** 10:00-NOON / UNLIMITED DIST. A 
	MEETING ROOM TBD	MEETING ROOM TBD	MEETING ROOM TBD
10:00	**Bridge and Pier Vulnerability: Subscale Deck Breaching Experiments for Fast-Running Model Enhancement** *Gabriel Riveros (US Army ERDC)*	**An Introduction to Dynamic Analysis** *Bart McPheeters (Leidos)* 10:00 - 11:00AM	**MIL-STD-810J Discussion Group** Presenters/Moderators: *William Barber (AI Signal Research)* *Dr. Michael Hale (Trideum)* *Randy Patrick (US Army Yuma)* *Dr. Luke Martin (NSWC Dahlgren)* *Matthew Lucas (US Army ATEC)* *Additional Members TBD* This group discussion will delve into structural and technical changes to the shock and vibration test methods in MIL-STD-810 that are currently in progress. *Contributors will cover all updates, including both Climatic and Dynamic Environmental Test Methods.*
10:25	**Effects of Varying Vent Geometries on Blast Intrusion of Externally Detonated Bare Charges in Scaled Structures** *Patrick Camacho, Bowen Woodson, Shelby Buckley, & Austin Hopkins (US Army ERDC)*		
10:50	**Characterization of Simplified Surrogate Munition (58)** *Marcus Barksdale, Austin Hopkins, & Bowen Woodson (US Army ERDC)*		
11:15	**A Physics-Informed Empirical Model for Structural Breaching under Contact or Near-Field Explosive Loading** *Ernesto Cruz-Gutierrez (US Army ERDC)*		
11:40	**OPEN**		

1:00 - 2:00

SAVE TECHNICAL ADVISORY GROUP (TAG) MEETING

MTG ROOM TBD

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