

# Unique Solutions to Shipboard Applications



Photo credit Raytheon Company

Our defense product lines are continually expanding to provide customers with unique solutions for applications on shipboard programs. With our extensive knowledge and experience within these industries we are able to provide our customers with superior analysis, products, services and support. While our teaming and partnership approach to the customer's needs sets us apart from the competition.

### Enidine Shipboard Applications/Products

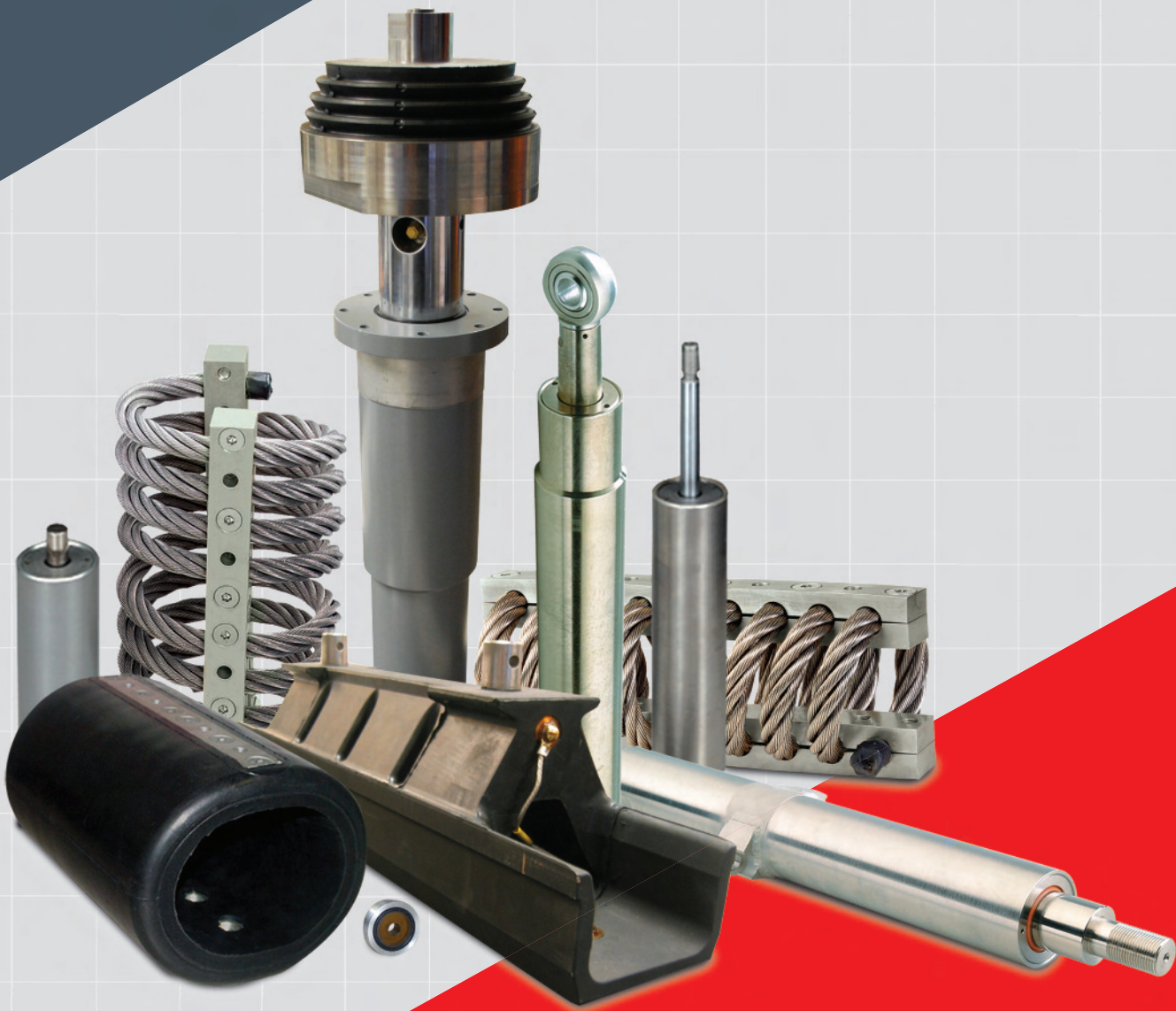
- Electronic Isolation
  - Wire Ropes
  - Elastomers
  - Hydraulic Shock Absorbers
- Weapon Energy Absorption
  - Recoil Management
  - Shock Absorption
  - Stabilization Skids

### ITT Aerospace Controls Shipboard Applications/Products

- Hydraulic System Motor Operated Valves
- Hydraulic Pressure and Temperature Switches
- Fuel Control Valves and Actuators
- Engine Fuel, Oil, Filter, Pump - Pressure, Temperature and Flow Switches

ITT Enidine Inc.  
7 Centre Drive  
Orchard Park, New York 14127 • USA  
Phone: 716-662-1900  
Fax: 716-667-1385  
Email: [defensesales@itt.com](mailto:defensesales@itt.com)  
[www.enidine-defense.com](http://www.enidine-defense.com)

# Shock and Vibration Products for Today's Shipboard Industry



## Our Capabilities

### Engineering

Enidine uses Nastran and Visual Nastran Motion software with for dynamic non-linear, 6-DOF system analyses in conjunction with FEA analyses on complex 3D parts, assemblies and systems.

In addition, we have developed proprietary closed form analytical programs to predict the non-linear performance of our products.

Enidine developed system equations in MatLab and Mathcad to simulate non-linear performance and predictive analysis.



### Manufacturing

Enidine has an in-house manufacturing and testing facility for rapid prototype development and manufacturing. This provides the ability to move quickly through the process development and evaluation phase of a project.



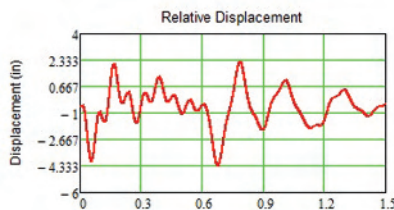
Capabilities for: Design, development, prototyping, testing , qualification and manufacturing all in one 90,000 sq. ft. facility.

Headquarters in Orchard Park, New York, USA  
ISO 9001 and AS9100 Compliant

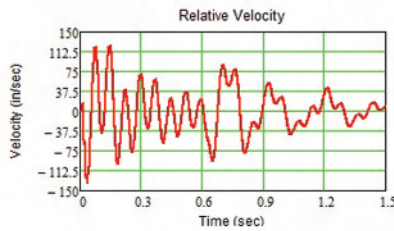
### Application Spotlight

#### DDG-1000 Destroyer Electronic Modular Enclosure (EME) Isolation

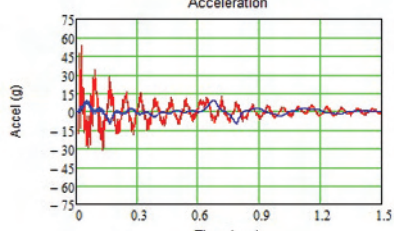
Enidine designed, qualified and manufactures custom vibration isolation and shock absorption products for the Zumwalt DDG-1000 destroyer.



**Max. Deflection (in)**  
max(reD) = 2.23  
min(reD) = -4.316



**Max. Velocity (in/sec)**  
max(Motion<sup>(2)</sup>) = 124  
min(Motion<sup>(2)</sup>) = -135.63



**Max. G-Loading**  
max(Mass\_Accl\_vec) = 9.16  
min(Mass\_Accl\_vec) = -9.75

ShockTrans =  $\frac{\max(\text{Mass\_Accel\_vec})}{\max(\text{Base\_A\_vec})}$   
ShockTrans = 0.17091

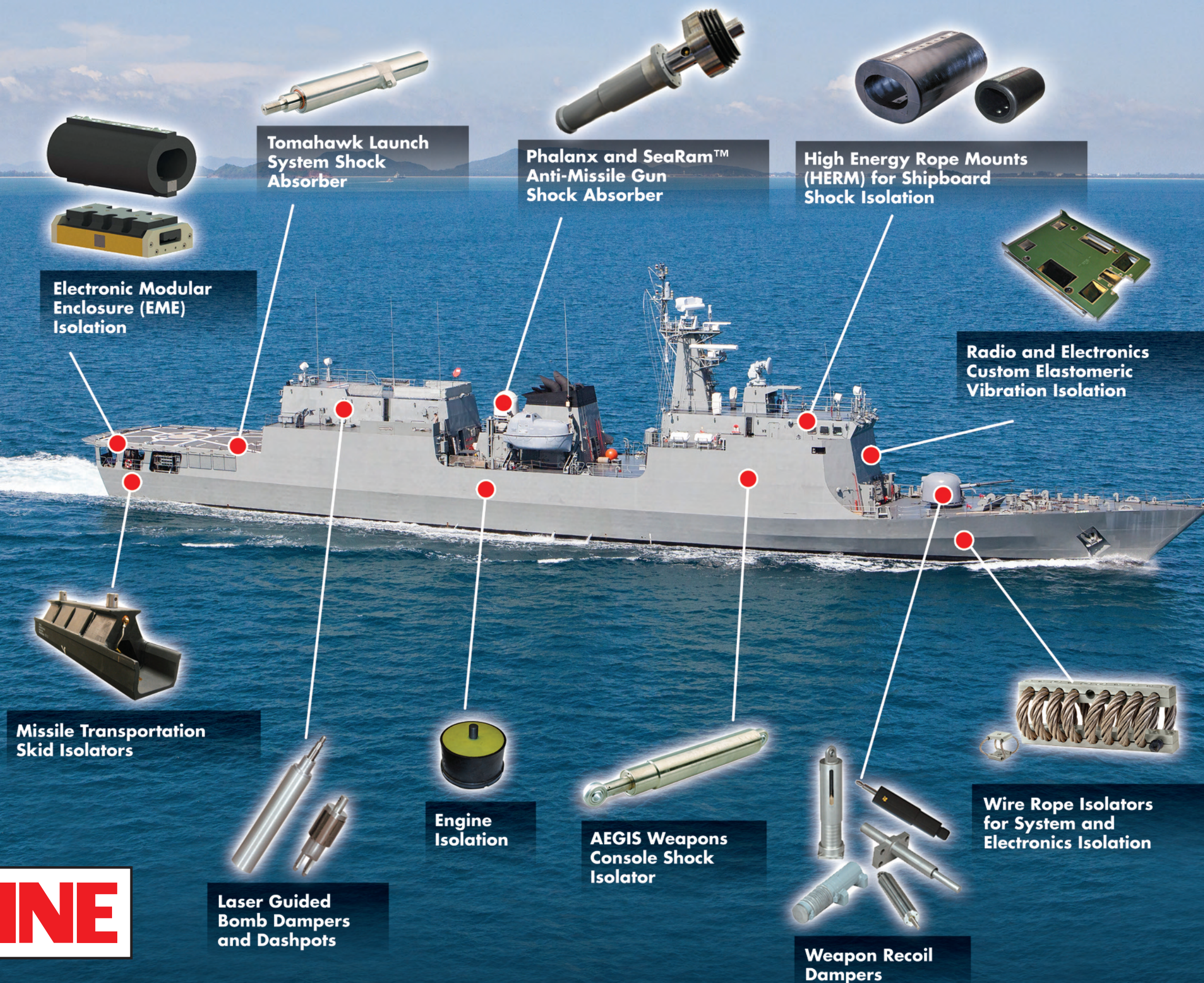
Enidine performs full SDOF or 6DOF, system analysis for any range of full deck shock frequencies for MIL-S-901E barge testing.



# SOLUTIONS FOR SHIPBOARD APPLICATIONS

## SHOCK AND VIBRATION

**ENIDINE**



## Elastomeric & Wire Technologies

### HERMS (High Energy Rope Mounts)

HERM isolators are recommended for most shipboard applications for their ability to attenuate both shock and vibration inputs. HERM isolators offer a wide load range capability in the same envelope size as a standard wire rope isolator. Stiffness and damping performance can be adjusted to meet specific application needs. HERM isolators also exhibit higher load carrying capabilities and higher damping than wire rope isolators.

- Shape of HERM specifically design for MIL-S-901E Heavy Weight shock inputs
  - Lowest profile design for 8 Hz, 14 Hz and 25 Hz deck solutions
- NBC wash down compatible
- Combines friction (Coulomb) damping with viscoelastic damping of elastomer
- Elastomeric compound provides additional stiffness and damping
- Fewer isolation mounts required within the same envelope space
- Designed to meet the requirements of:
  - MIL-S-901E light, medium and heavyweight barge shock inputs
  - MIL-STD-167 vibration
  - MIL-STD-810G environmental testing
- Drop in replacement for standard wire rope mounts
- Improved structureborne noise attenuation over standard wire rope isolators

### MODular Elastomeric Skid Isolators

Enidine MOD Mounts obtain proper stiffness, damping and deflection required to achieve shock mitigating and stabilization performance. The inclined element properly manages elastomer strain levels for the high deflections required for shock mitigation while maintaining stability in the off-axis directions. Enidine also has developed proprietary compounds with the high strength and damping characteristics required to meet the performance and environmental specifications for shipboard shock applications.

- Enidine MOD design uses a series of common elastomeric elements fully vulcanize bonded to a top rail and bottom channel
- MOD assemblies can be assembled together to interface plates and bottom skids to complete full skid assemblies
- Lower profile than standard wire rope or HERM mounts used for system stabilization
- Designed to meet the requirements of:
  - MIL-S-901E light, medium and heavyweight barge shock inputs
  - MIL-STD-167 vibration
  - MIL-STD-810G environmental testing

### Wire Rope Isolators

Standard Wire Rope Isolators are comprised of stainless steel stranded cable threaded through aluminum alloy retaining bars that are mounted for effective shock and vibration isolation. With their corrosion resistant, all-metal construction, Enidine Wire Rope Isolators are environmentally stable, high-performance shock and vibration isolators that are unaffected by temperature extremes, chemicals, oils, ozone and abrasives.

- Full stainless steel options available for corrosion protection
- Enidine wire ropes feature a cost effective patented crimping pattern
- Versatile mounting options and a variety of sizes
- Designed to meet the requirements of:
  - MIL-S-901E light, medium and heavyweight barge shock inputs
  - MIL-STD-167 vibration
  - MIL-STD-810G environmental testing
- Fail-safe design and construction

## Hydraulic Energy Absorption

### Anti-Missile Gun Shock Absorbers

Enidine is globally recognized as the preferred source for energy absorption and hydraulic motion control products. Our experience designing, developing and manufacturing an array of products allows us to utilize that experience into a variety of markets. We have over 5 decades of experience with military and commercial aerospace shock and vibration isolation in the hydraulic market. Many standard designs are capable of >1 million operating cycles without the loss of fluid or performance due to sealing technology and experience.

- Enidine provides the hydraulic shock absorbers for the Phalanx CIWS (close-in weapon system) as well as the SeaRAM anti-ship missile defense system
- Provide critical shock protection of the radar-guided gatling guns, as well as missile and laser protection systems
- The input shock pulses cause the unit to stroke, absorbing energy and limiting acceleration into the system to less than 12 G's
- Enidine designed, tested, manufactured and qualified in-house

### Paveway™ Laser Guided Bomb Dampers

The Paveway family of laser guided bombs has revolutionized tactical air-to-ground warfare by converting bombs into precision guided munitions. Paveway have made up more than half the air-to-ground precision guided weapons used in Operation Iraqi Freedom. Enidine provide the flutter dampers and dashpots installed on every Paveway Bomb.

- Enidine has designed, qualified, and manufactured the flutter dampers and dashpots utilized within the Paveway™ bombs
- Flutter Dampers
  - Control the aerodynamic forces (flutter) on the control surfaces of the laser guided bomb
  - Provide critical shock protection of the radar-guided gatling guns, as well as missile and laser protection systems
- Dashpots
  - Slow the deployment of retracted airfoil surfaces on laser guided bomb wing assemblies

### SIDAS (Shock Isolator, Double Acting Spring)

Enidine is globally recognized as the preferred source for energy absorption and hydraulic motion control products isolating electronics equipment for barge testing. Our 50 years of experience with military shock and vibration isolation is best in the hydraulic market.

- Provides static support and shock isolation for personnel and critical electronics equipment
- Designed and tested to pass MIL-S-901D grade-A heavyweight barge test
  - 8 Hz, 14 Hz, 25 Hz and 40 Hz deck shock frequencies
  - Reduced shock acceleration to 11-14 G's across all inputs and deck frequencies
- Enidine designed, tested, manufactured and qualified in-house
- Custom solutions available upon request