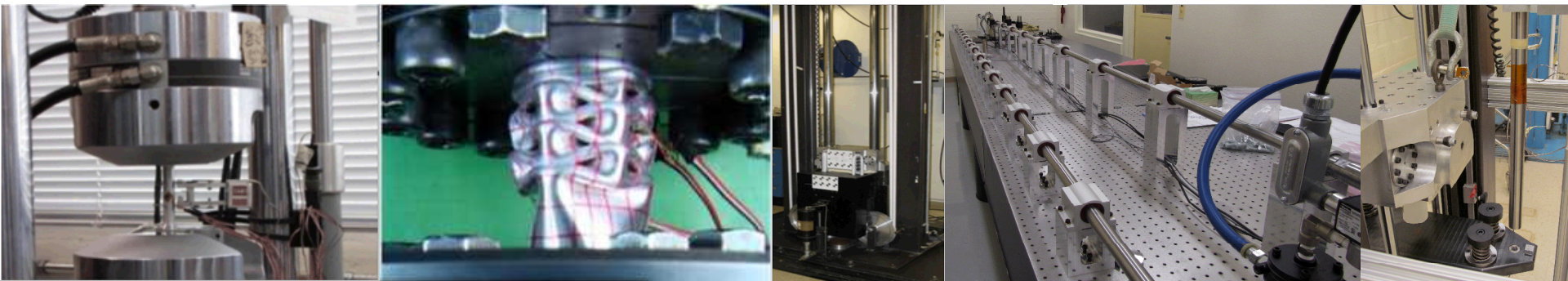


*Exceptional service in the national interest*



# B860/ETEC Mechanical Shock/Impact Capabilities and Beyond

**Bo Song, Sharlotte Kramer, Matthew Spletzer,  
Darrick Jones, Dennis Croessmann**

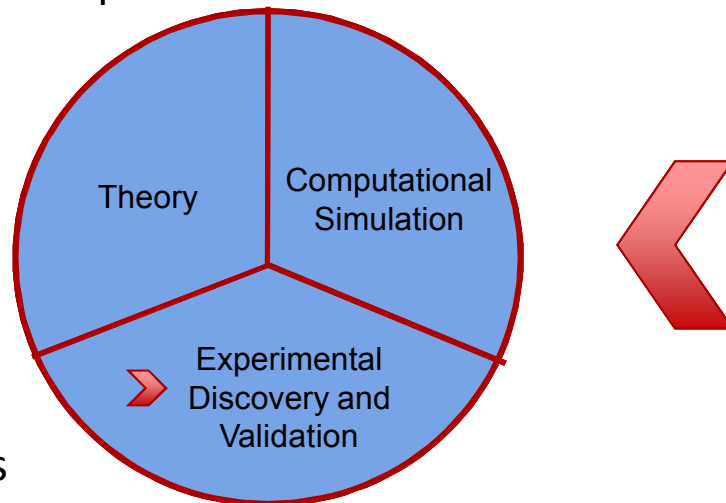


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# Engineering Sciences Center (1500)

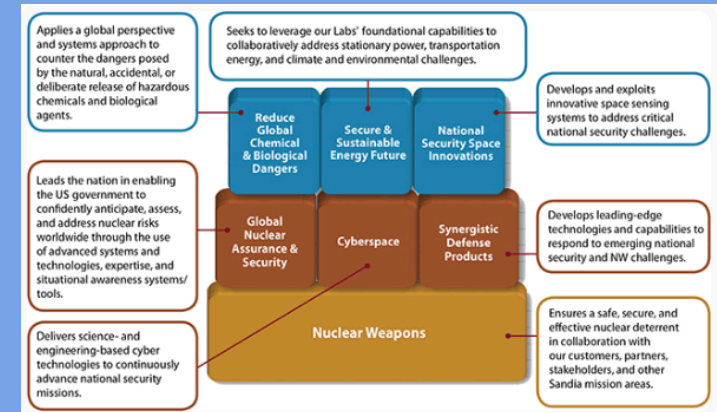
## ■ Center 1500: Engineering Sciences Center

- Navigating a Path to the Future
- Transforming Engineering Sciences through advancing, integrating and applying out technical capabilities to serve the nation



## ■ Groups

- Thermal, Fluid & Aero Sciences (1510)
- ■ Structural Dynamics (1520)
- Validation and Qualification (1530)
- Computational Simulation (1540)
- Solid Mechanics and Shock Physics (1550)



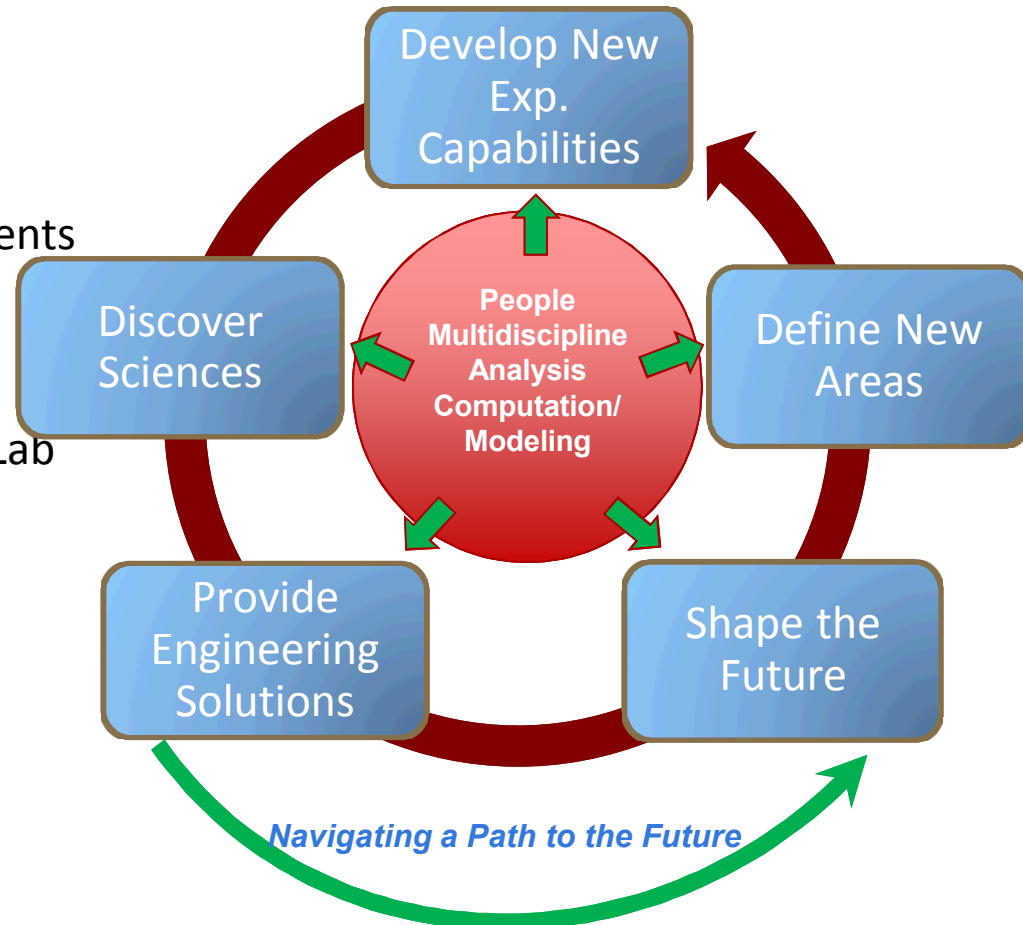
# B860: Environmental Test & Evaluation Complex (ETEC)

- **Research-Development-Application (R-D-A) Spectrum**

- Application-driven R&D
- Analysis guided experiments
- Computation integrated experiments

- **R-D-A Areas**

- ■ Mechanical Shock Lab
- ■ Experimental Impact Mechanics Lab
- ■ Structural Mechanics Lab
- Vibration and Acoustic Lab
- Non-destructive Evaluation Lab
- Climatic and Centrifuge Lab
- Component Dynamics Lab
- Radiography Lab
- Structural Dynamics Lab



# Structural Mechanics and Mechanical Shock/Impact Portfolio

Structural  
Mechanics Lab.

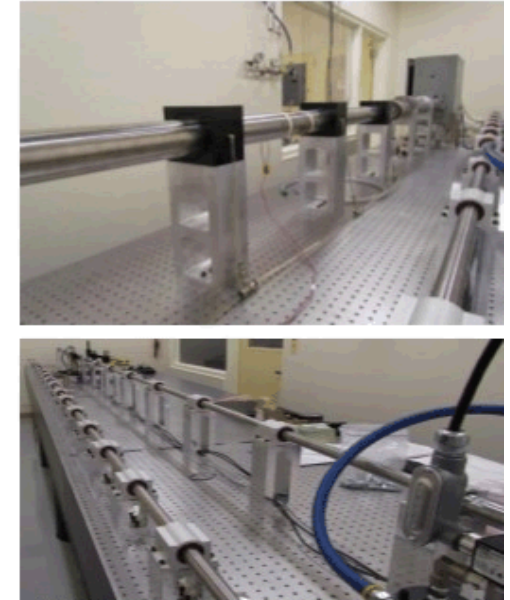
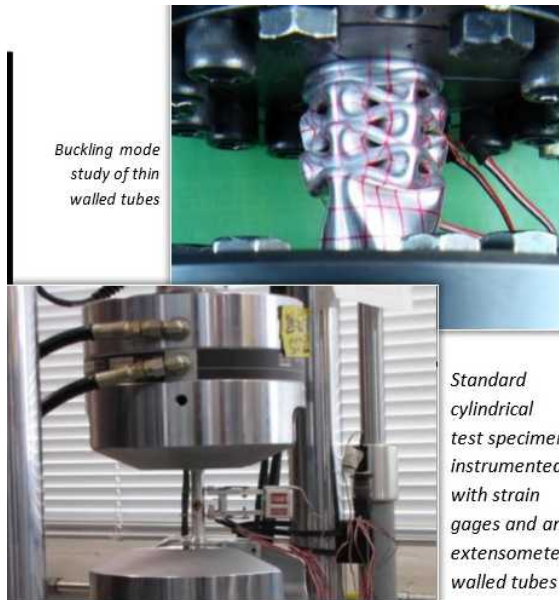
Servo-hydraulic Testing  
Machines, Pressure  
Testing Cage

Mechanical Shock  
Lab.

Drop Tables; Slide Table;  
Resonant Beam/Plate;  
Package Tester

Experimental  
Impact Mechanics  
Lab

Split Hopkinson Bars,  
Dropkinson Bar



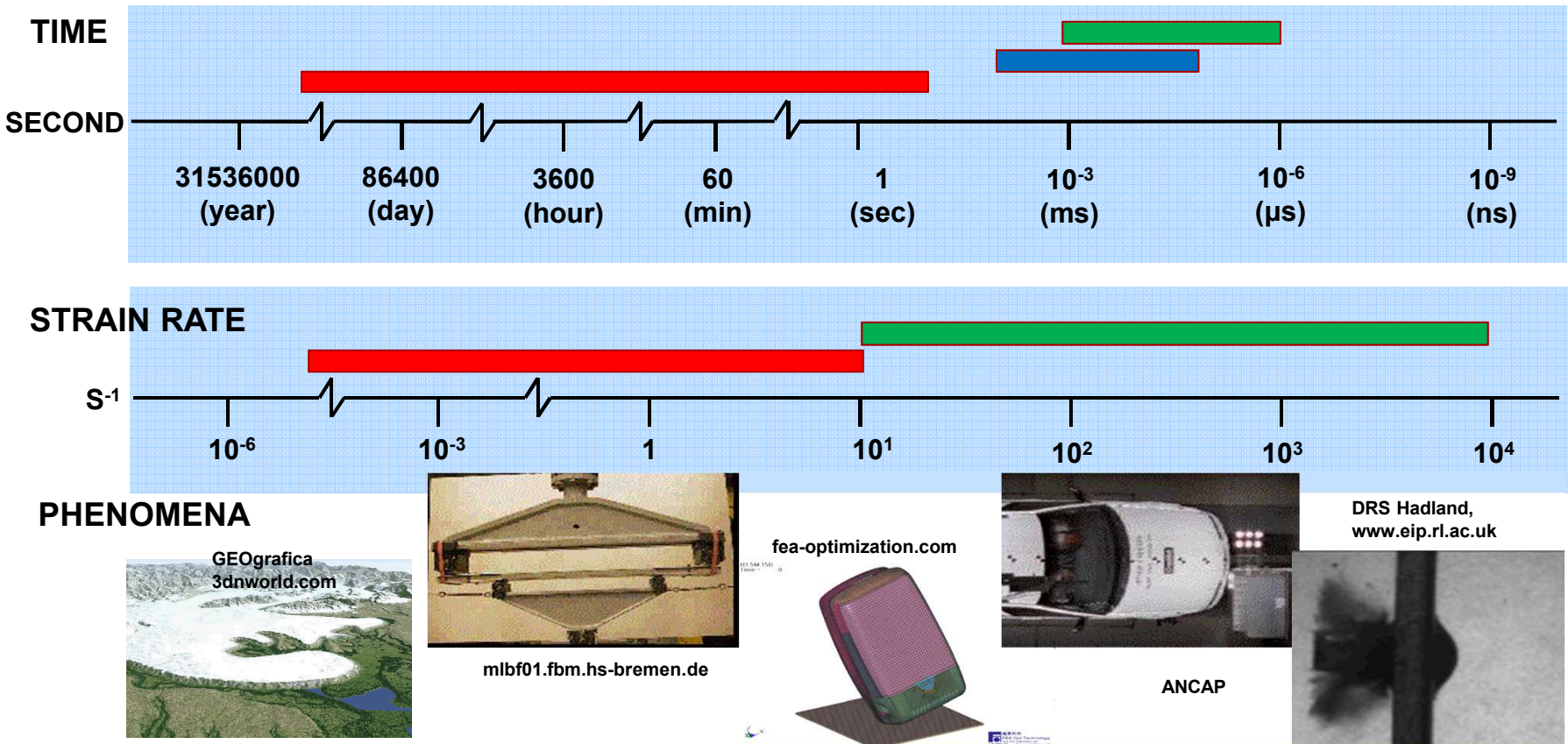


# Structural Mechanics and Mechanical Shock/Impact Capacities

Structural Mechanics Lab.

Mechanical Shock Lab.

Experimental Impact Mechanics Lab

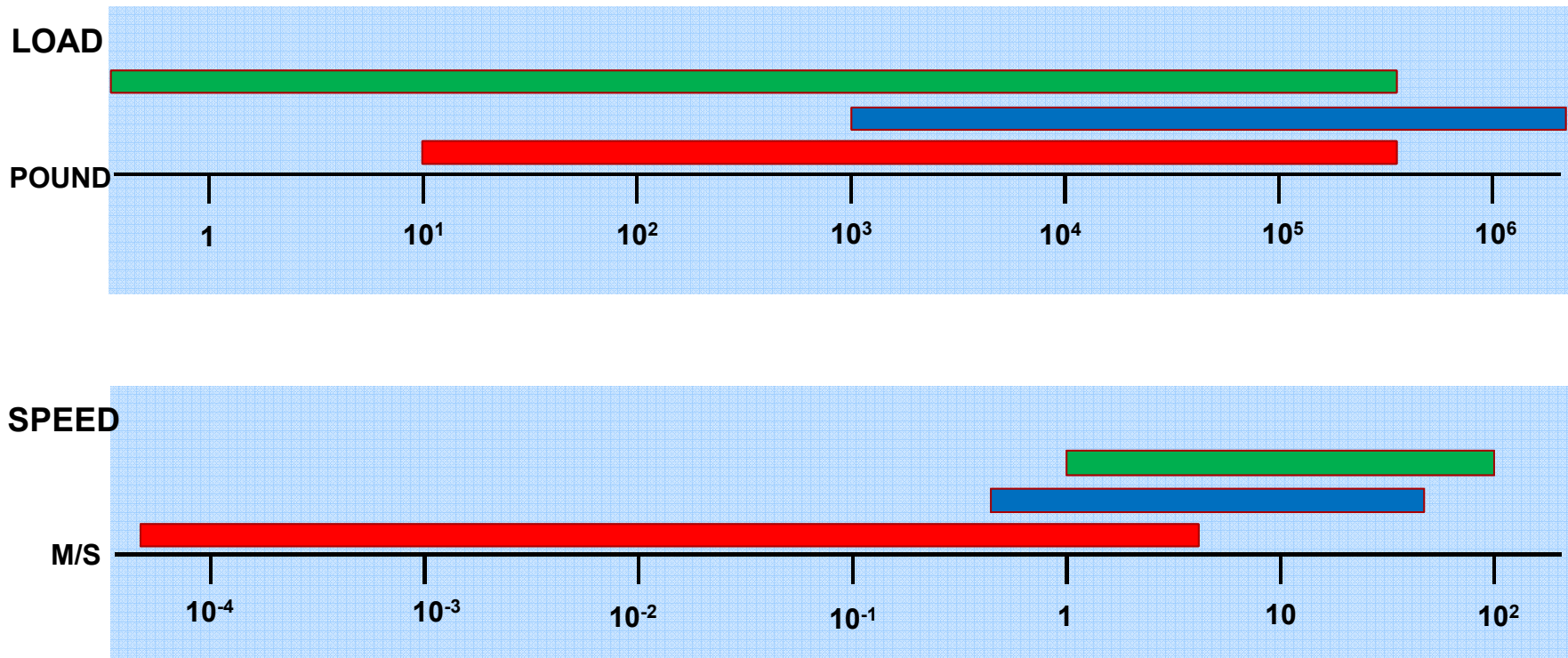


# Structural Mechanics and Mechanical Shock/Impact Capacities

Structural  
Mechanics Lab.

Mechanical Shock  
Lab.

Experimental  
Impact Mechanics  
Lab



# Structural Mechanics and Mechanical Shock/Impact Capacities

Structural  
Mechanics Lab.

Mechanical Shock  
Lab.

Experimental  
Impact Mechanics  
Lab

Science.energy.gov

www.military.com

www.dli.mn.gov

Human hair  
~ 50  $\mu\text{m}$  wide

SPECIMEN SIZE

METER

$10^{-5}$

$10^{-4}$

$10^{-3}$

$10^{-2}$

$10^{-1}$

1

10

DISPLACEMENT

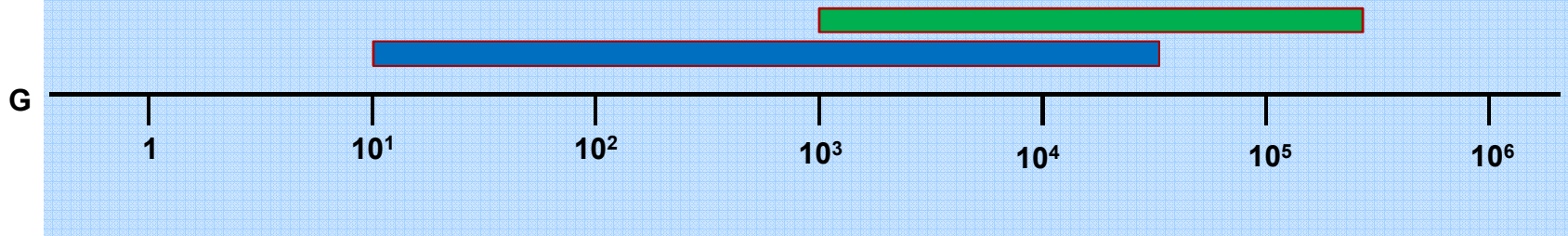
# Structural Mechanics and Mechanical Shock/Impact Capacities

Structural  
Mechanics Lab.

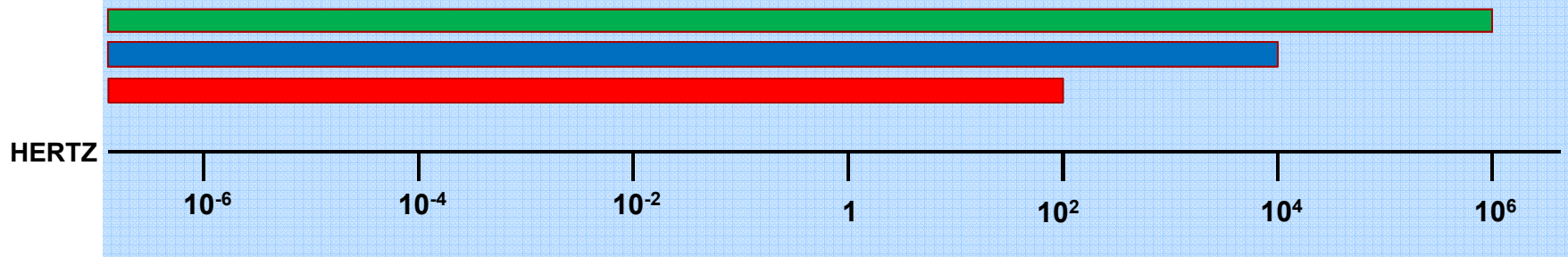
Mechanical Shock  
Lab.

Experimental  
Impact Mechanics  
Lab

ACCELERATION



FREQUENCY



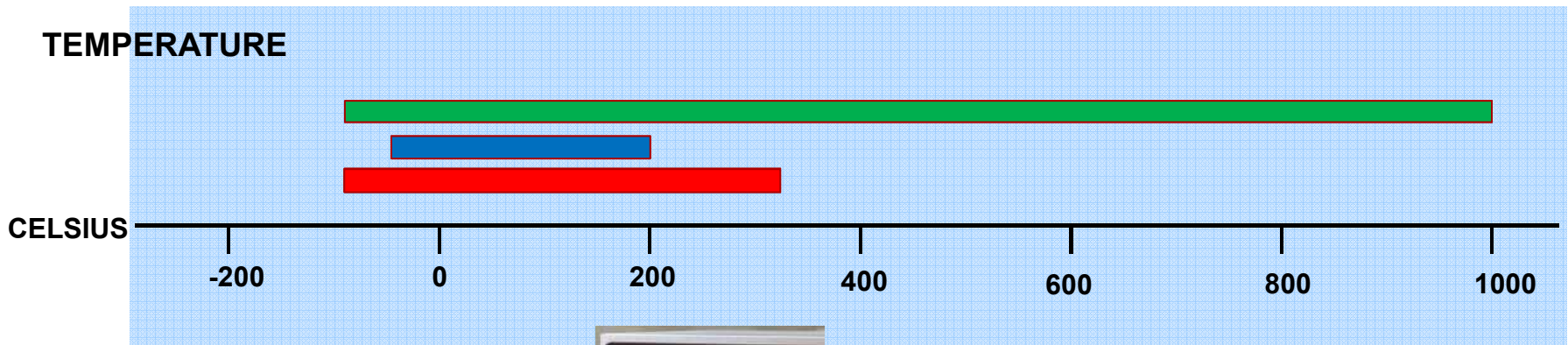


# Structural Mechanics and Mechanical Shock/Impact Capacities

Structural  
Mechanics Lab.

Mechanical Shock  
Lab.

Experimental  
Impact Mechanics  
Lab



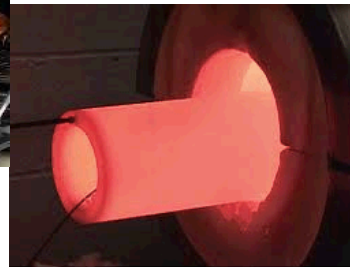
[www.youtube.com](http://www.youtube.com)



[Tipsforsurvivalists.com](http://Tipsforsurvivalists.com)



[www.psfk.com](http://www.psfk.com)



[www.industrialheating.com](http://www.industrialheating.com)

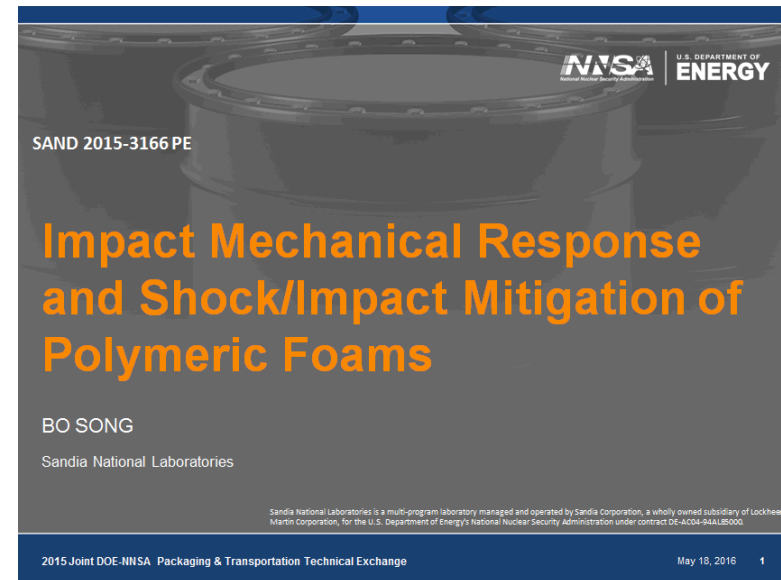


[www.townwest.com](http://www.townwest.com)

# Shock/Impact Mitigation Activities

- Shock/impact mitigation material characterization

- Structural Mechanics Lab:
  - Honeycombs, polymeric foams, springs, etc
- Experimental Impact Mechanics Lab:
  - Polymeric foams (silicone foam, epoxy foam, polystyrene foam, TDI foam, PMDI foam, Tuf-Foam, syntactic foam, etc)
  - Rubbers (silicone, polyurethane, EPDM, etc)
  - Composites, fabrics, soft metals, etc



- Shock/impact mitigation component characterization

- Mechanical shock Lab/Experimental Impact Mechanics Lab/Structural Mechanical Lab
  - Component survivability/functionality under normal/hostile environments
  - Qualification of shock mitigation response of components
  - Experimental validation of shock/impact models for shock mitigation applications