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BAE Systems Land & Armaments

Development and Verification of the DDG-1000 Anti-Fratricide Munitions Container for 155mm LRLAP

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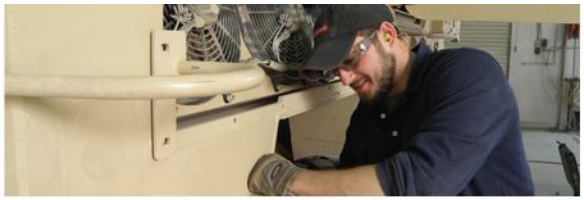



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Abstract #16168

2013 Insensitive Munitions and Energetics Materials Technology Symposium

Loews Coronado Bay, CA

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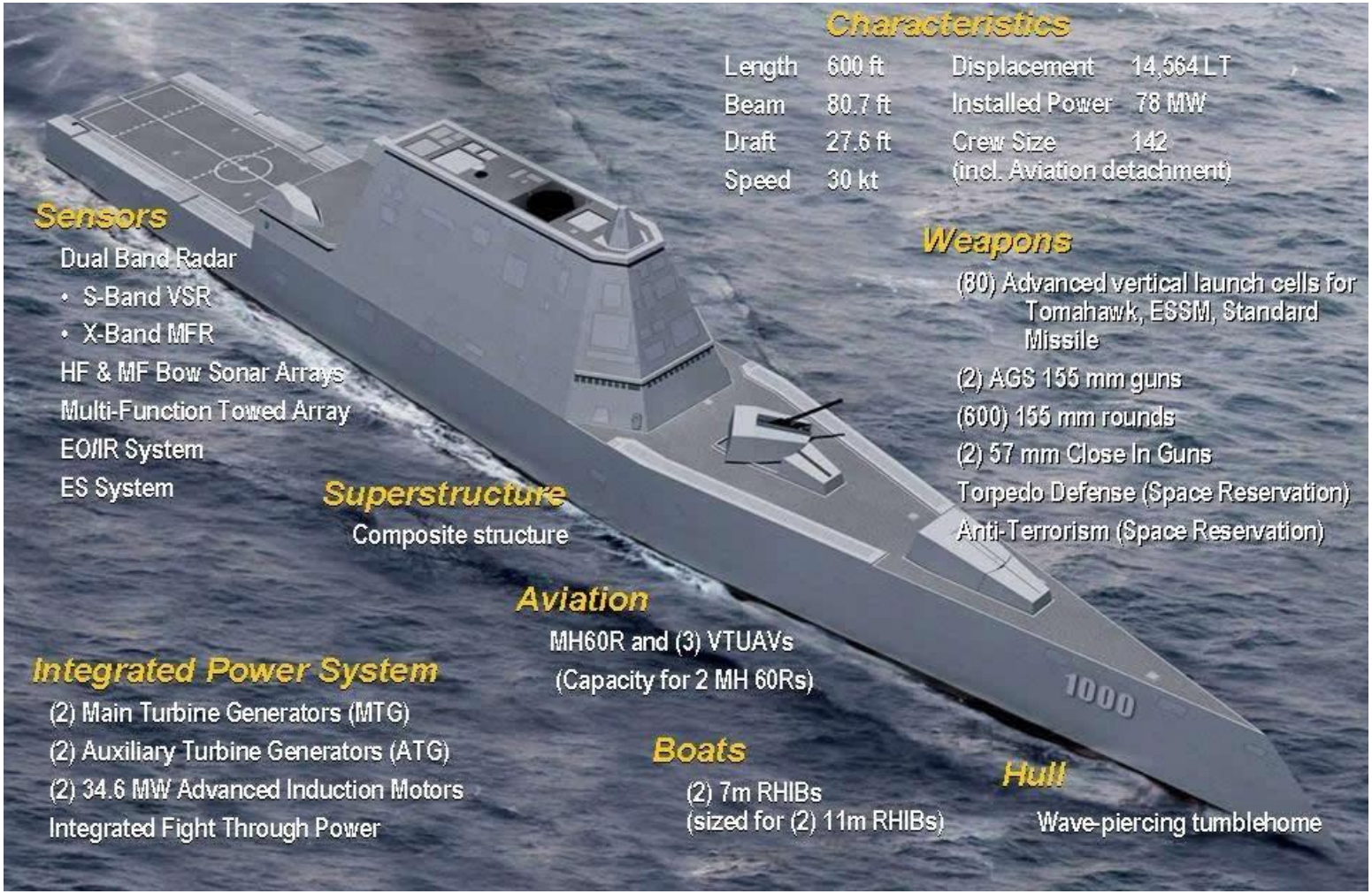
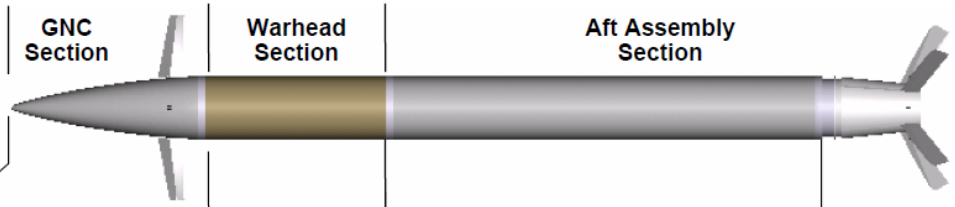
DDG-1000 Zumwalt Class Destroyer



155mm Long Range Land Attack Projectile

LRLAP System Overview



GN&C
- DII
- Radome
- Thermal Battery
- DIGNU2
- CCU
- GPS Antennas
- Canard covers
- SES (2)
- HOB Sensor
- DII
- GNC Networks

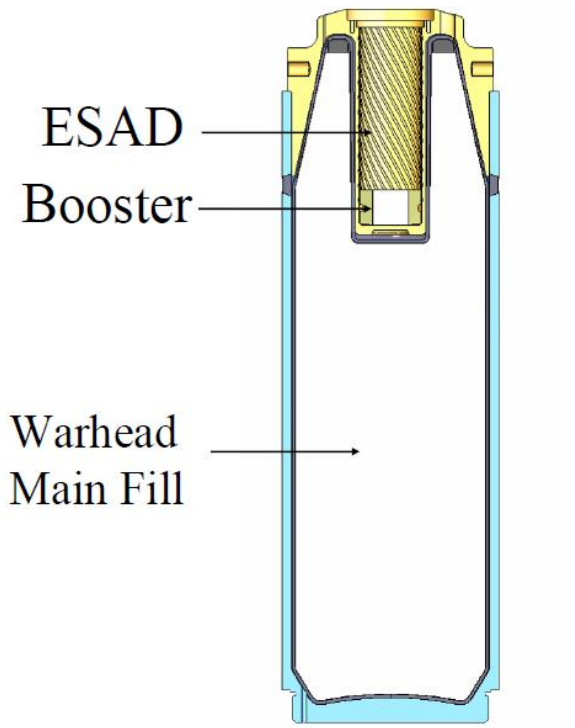
Payload
- ESAD with PD sensor
- HE Warhead
- Warhead ESAD-ISD Interconnect

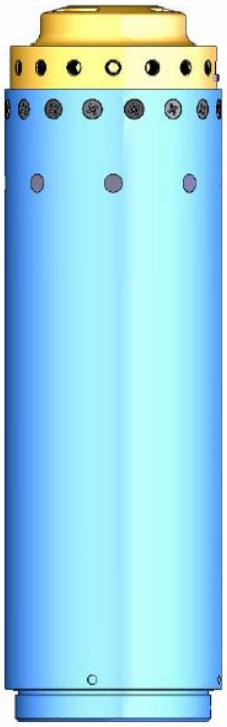
Propulsion
- Case and bulkhead(s)
- Insulation
- Motor ESAD-ISD Interconnect

Tail
- Housing
- Hinge plate
- Fin locks
- Fin cap
- Obturator
- Blast tube/nozzle
- Initiation train
- ISD
- Tail Fins

Unitary Charge Warhead

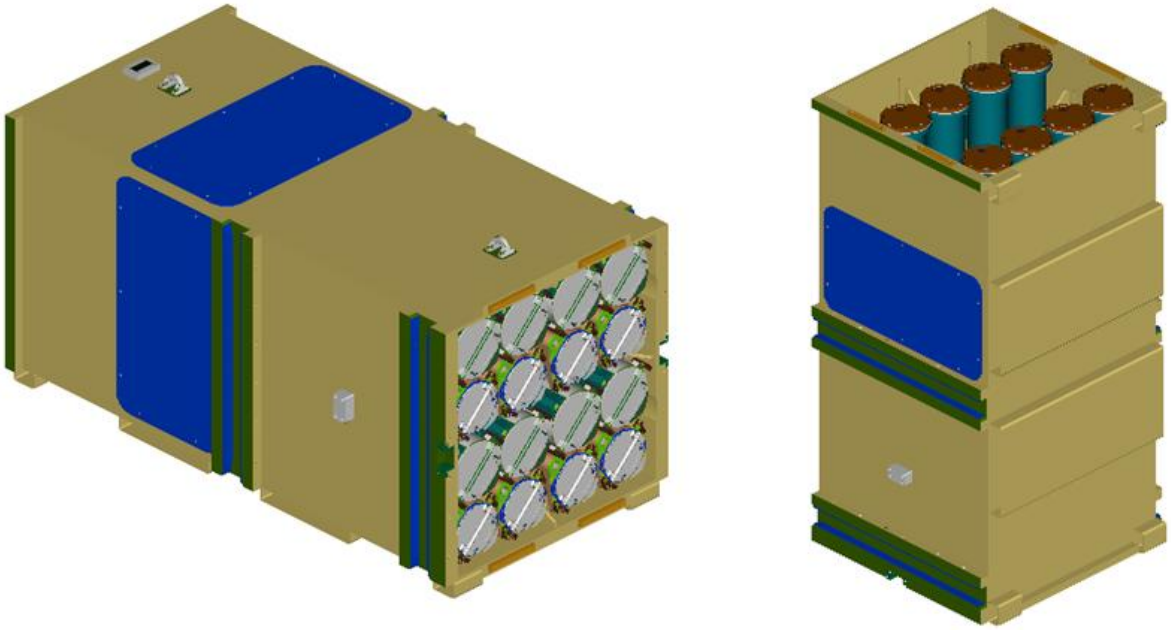
Warhead Section





Munitions Container

- **Designed for automated handling in ship magazine**
- **8 LRLAP projectiles**
- **8 propelling charge**
- **2700 kg fully loaded container gross wt.**



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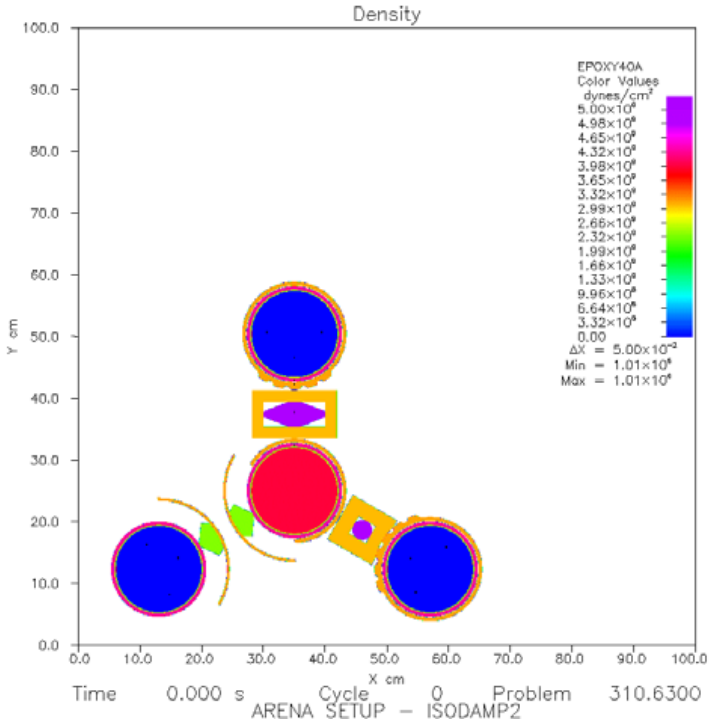
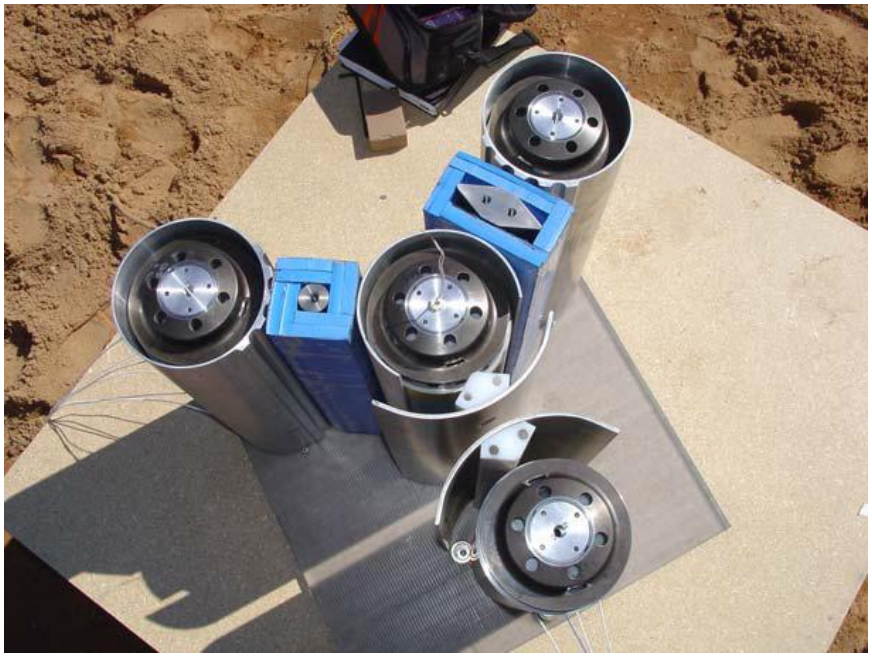
Initial Trade Study and Inert Acceptor Test



Hydrocode Simulation



C4 Filled Donor and
3 Instrumented Inert Acceptors

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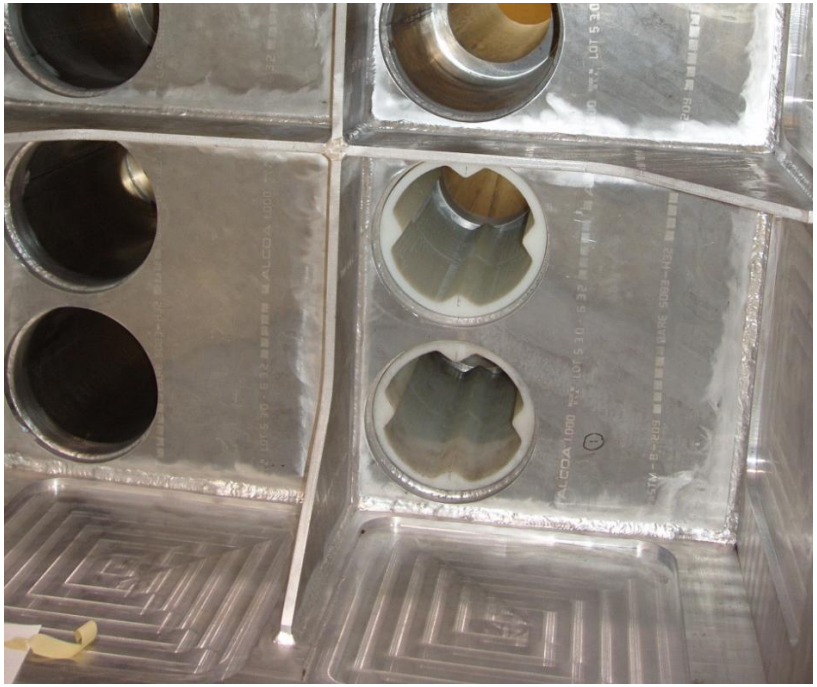
Anti-Fratricide System Development



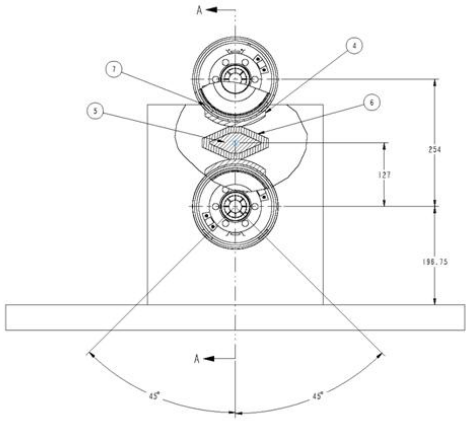
Initial Munitions Container Anti-Fratricide Liner

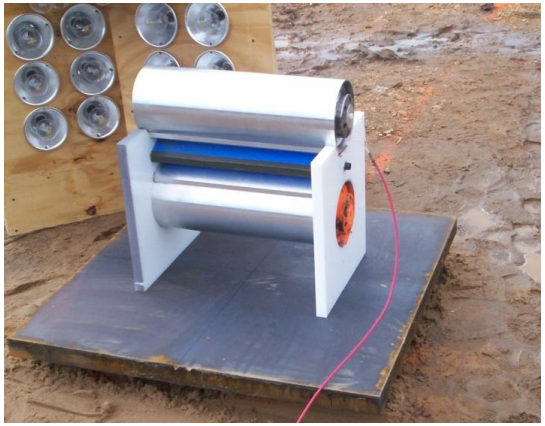
Engineering SD Demonstration of Initial Concept

Engineering test scored as failure, acceptor WH detonated

Alternate Concept

- **Failure Review Board (FRB) was formed**
- **Multiple failure paths evaluated and examined**
  - **CTH hydrocode analysis at NAWC, China Lake, CA**
  - **HULL hydrocode analysis at GD-OTS, Niceville, FL**
- **Modified diamond bar from initial trade study showed greatest potential**
- **Repeat engineering test at NTS, Camden, AR Oct 2007**
  - ***Success!***





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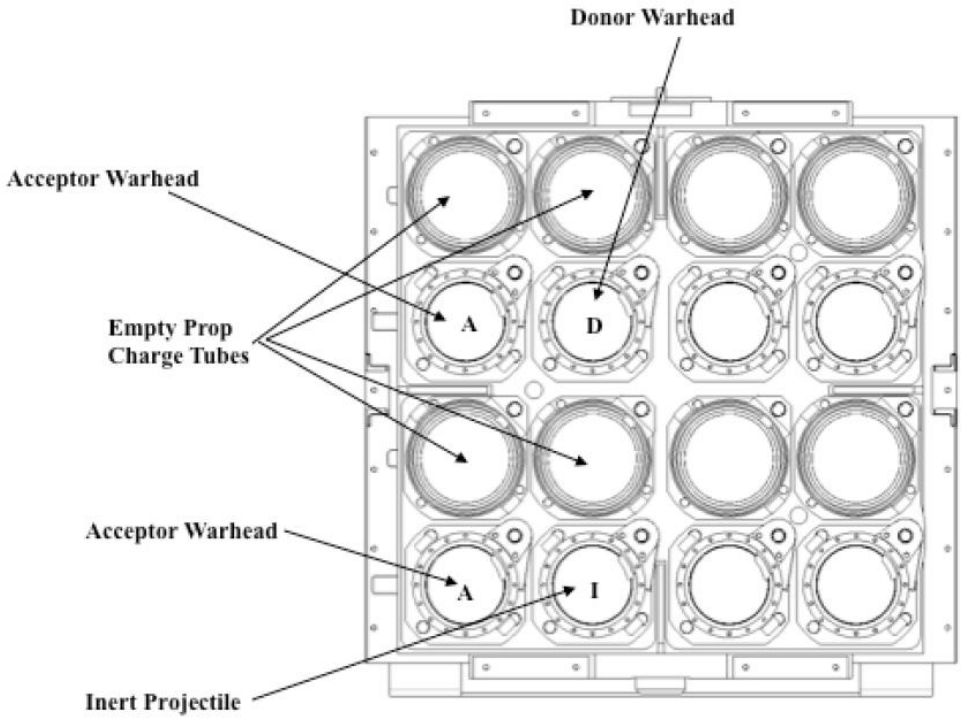
IM and Hazard Class SD Test

- **Tactical donor and two acceptor warheads in container**
- **Mass equivalent steel GNC and RM sections used for confinement**
- **Conducted SD-1 test at NTS, Camden, AR June, 2012**



SD-1 Results

- **Above: Aft Container, post test**
- **Upper Right: Forward view, post test**
- **Right: Acceptor WH case**

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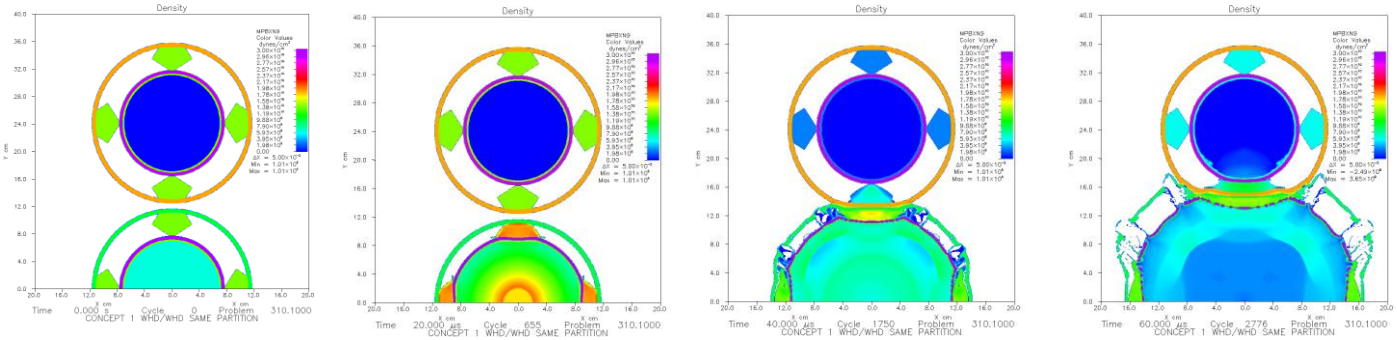
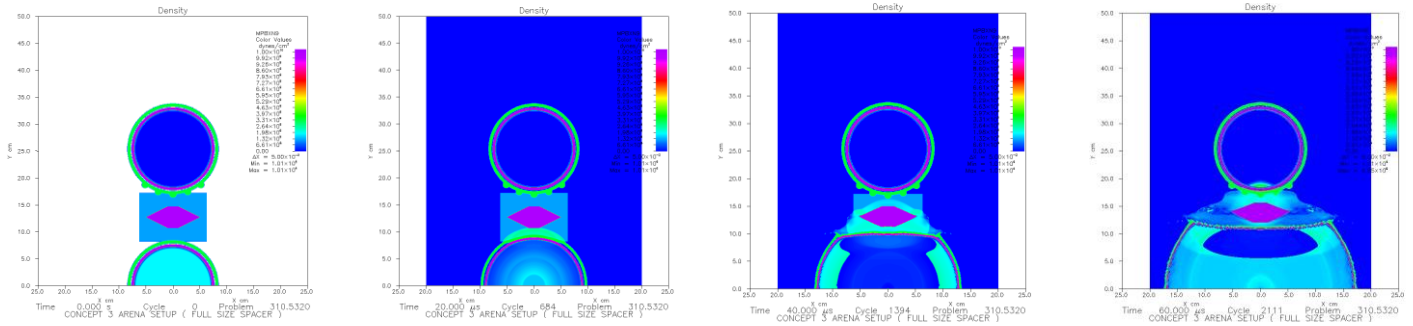
Hydrocode Modeling



Initial Concept at 20 μ-second Intervals



Simulation of Diamond Bar at 20 μ-second Intervals

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Conclusions

- **Munitions container well positioned to pass SD test with Warhead, Rocket motor, and Propelling Charge**
  - Munitions Reactions Evaluation Board (MREB) scored SD-1 as a PASS in October 2012
- **IPT FRB collaborative effort with U.S. Navy and contractors was a success**
- **Special thanks to:**
  - Bryan Baudler, IWS-3C, bryan.baudler@navy.mil
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