WDU-36/B Warhead Sympathetic Detonation - Transport Configuration

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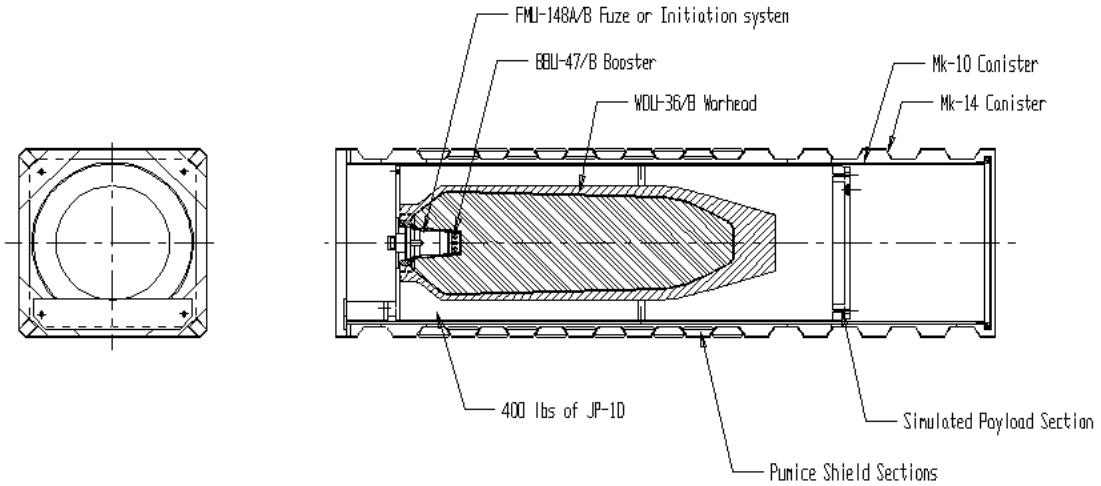
Introduction

- The purpose of the test was to mitigate Tactical Tomahawk (TT) Block IV missile Sympathetic Detonation (SD) in the transportation configuration.

- All testing was conducted at the Naval Air Warfare Center Weapons Division's (NAWCWD) Burro Canyon test area.

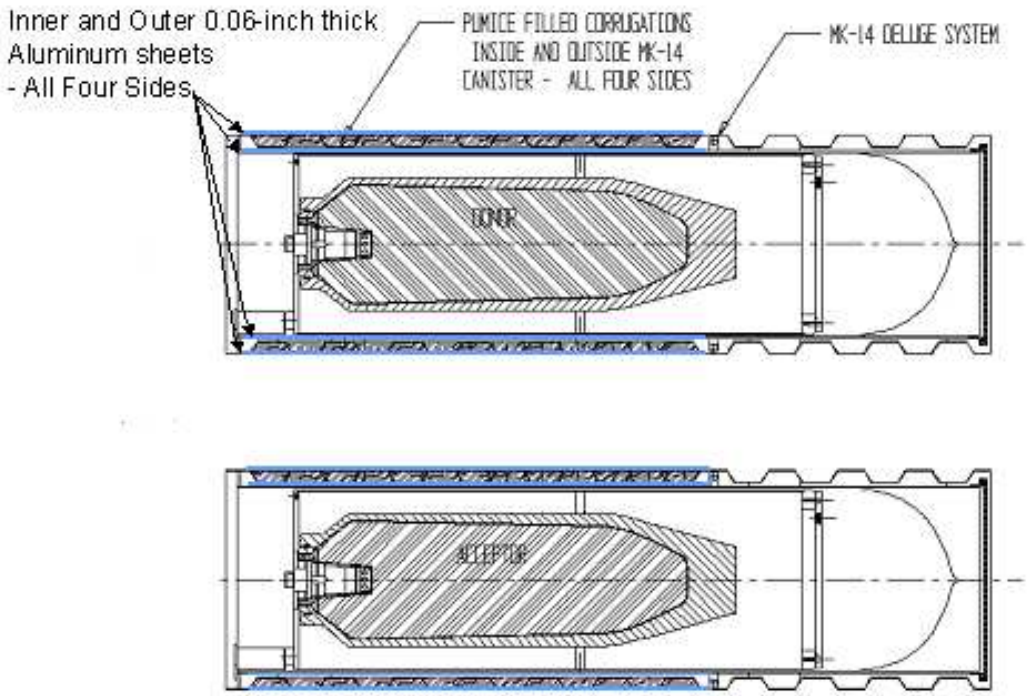
Warhead Test Item Description

- The test items were composed of fueled simulated Tomahawk missile payload sections. Both test items were encanisterized into Mk 14/Mk 10 canisters.



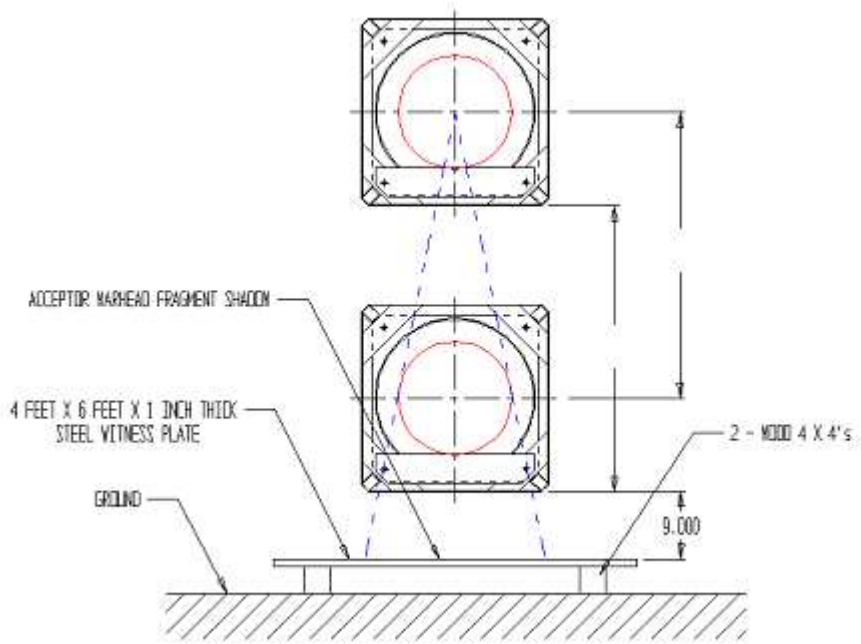
SD Test Set-up With Pumice Added to Mk 14 Canisters

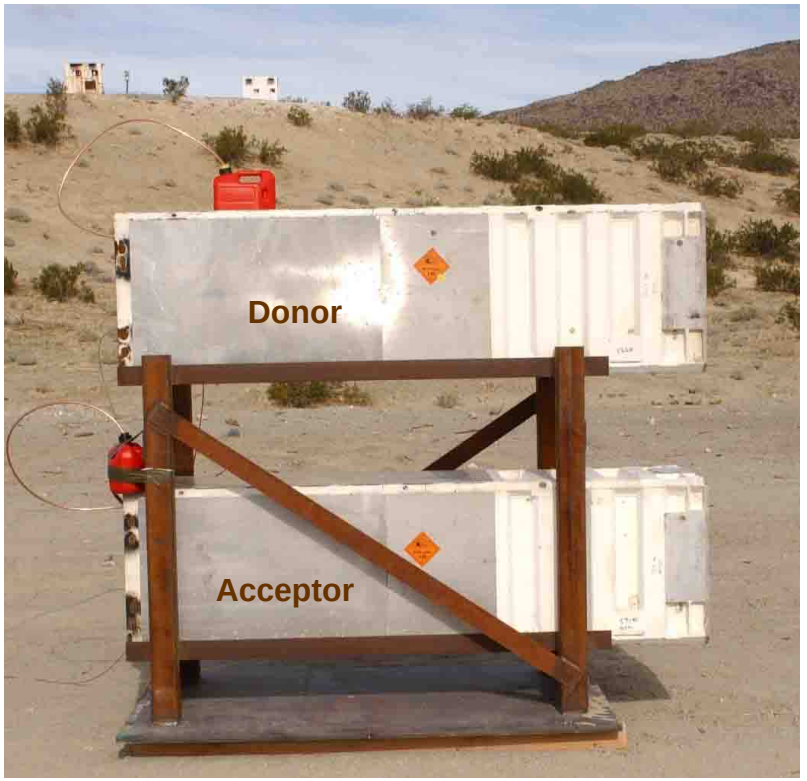
- 2 Mk 14 canister sections were modified by the addition of pumice shielding materials (approximately 1 inch thick) in the areas surrounding the WDU-36/B warhead in the inner and outer corrugations of the canister walls and then covered by 0.06-inch aluminum plate on inside and outside surfaces.



SD Test Setup

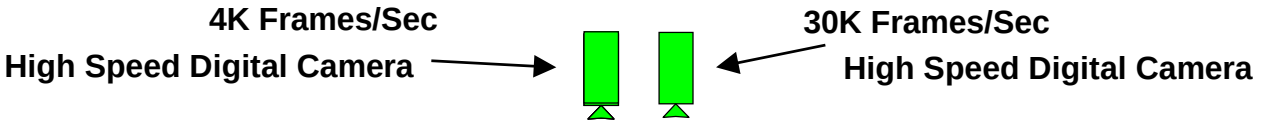
- The acceptor test item was installed in the canisters and suspended horizontally above a 1-inch-thick steel witness plate.
- The bottom of the acceptor Mk 14 canister was 9.0 ± 0.5 inches above the 1.0-inch-thick steel witness plate.
- The steel witness plate was a minimum of 4 feet wide by 6 feet long by 1.0 inch thick.

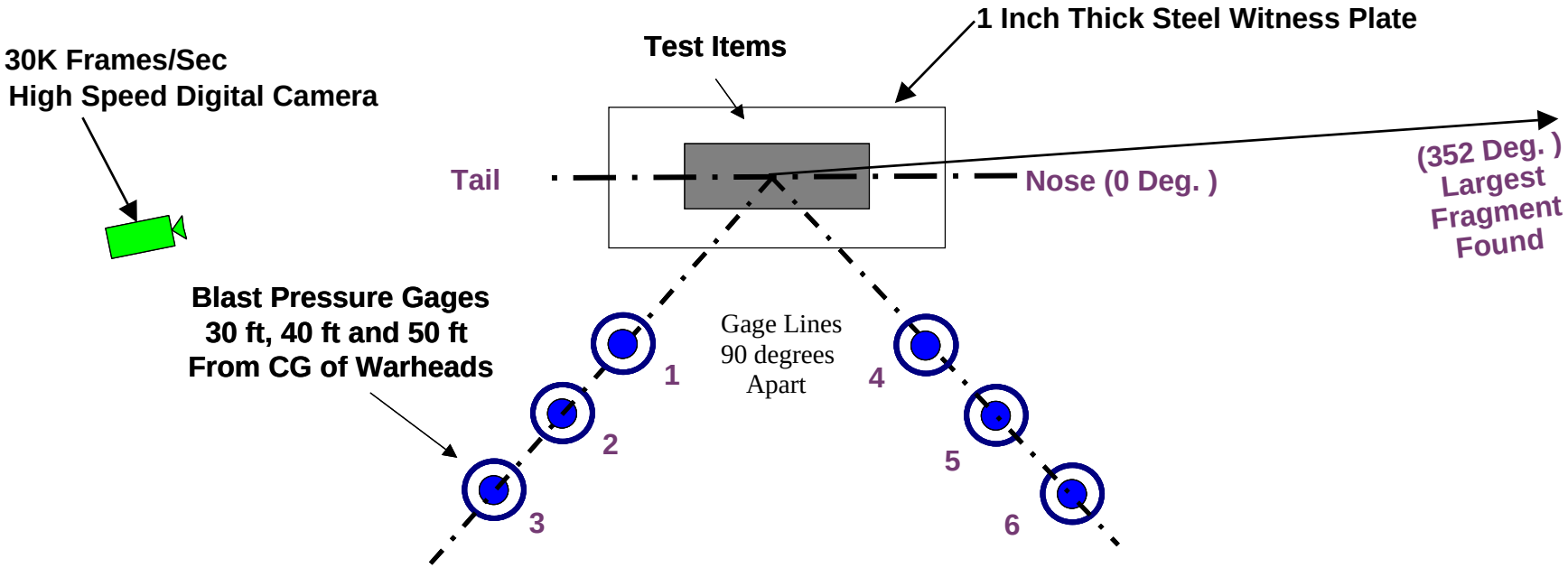




Instrumentation

Pressure transducers were placed in accordance with MIL-STD-2105C .





Overall Post-test Witness Plate

The largest piece of warhead case recovered was 6.5 lb (found 1165 ft down range). It was an asymmetric nose fragment, believed to be from the acceptor. Appearance of all recovered fragments was consistent with at least a Type II (Partial Detonation) reaction.

Pre and Post Test CTH Hydrocode Modeling

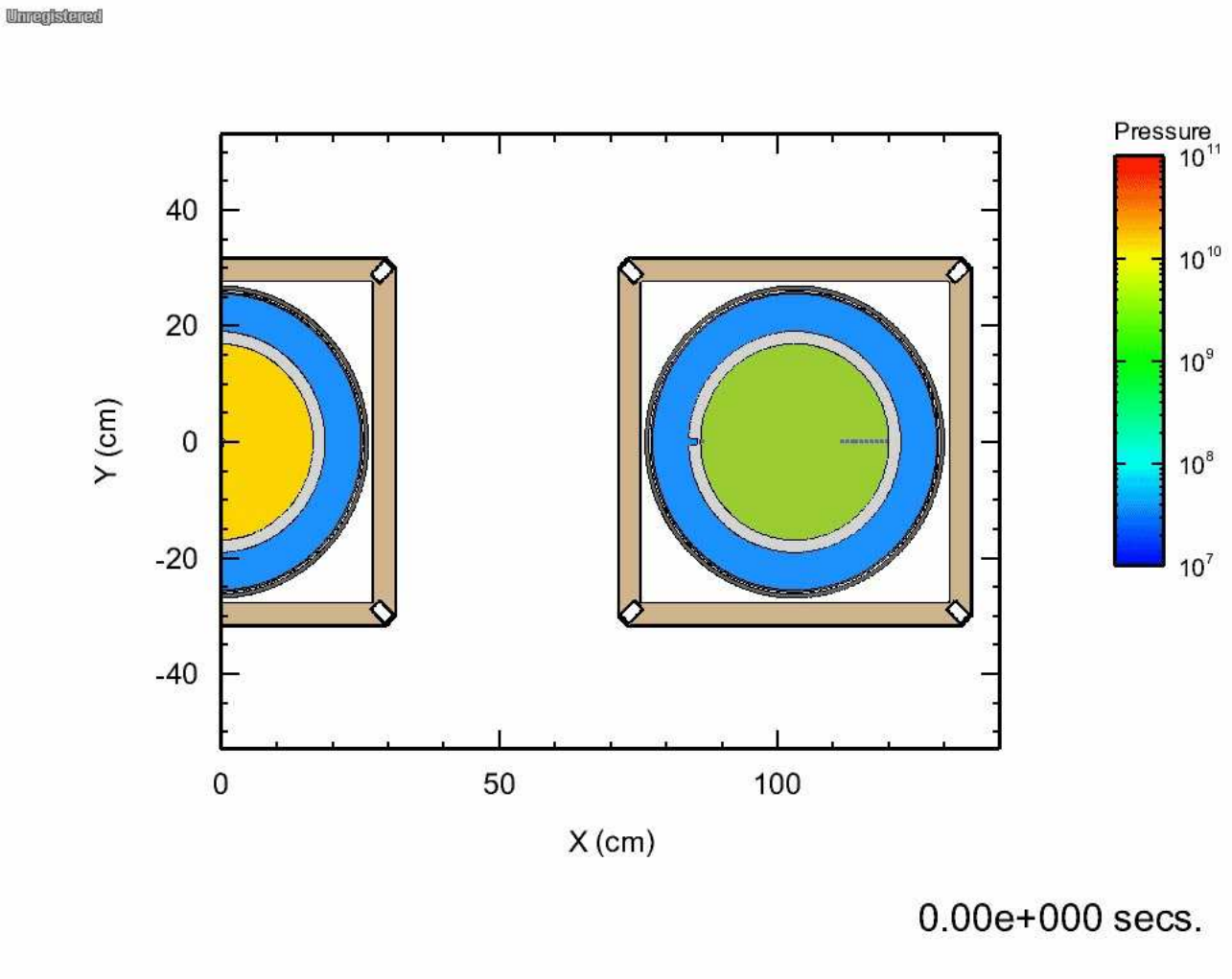
- CTH Hydrocode modeling was performed both before and after the SD test.

- Modeling indicated a pressure of 14.33-kbar initial shock to the acceptor warhead at 0.45 ms, two cells into explosive. This was below the 50% point for initiation of PBXN-107 Type II (25-40 kbars)

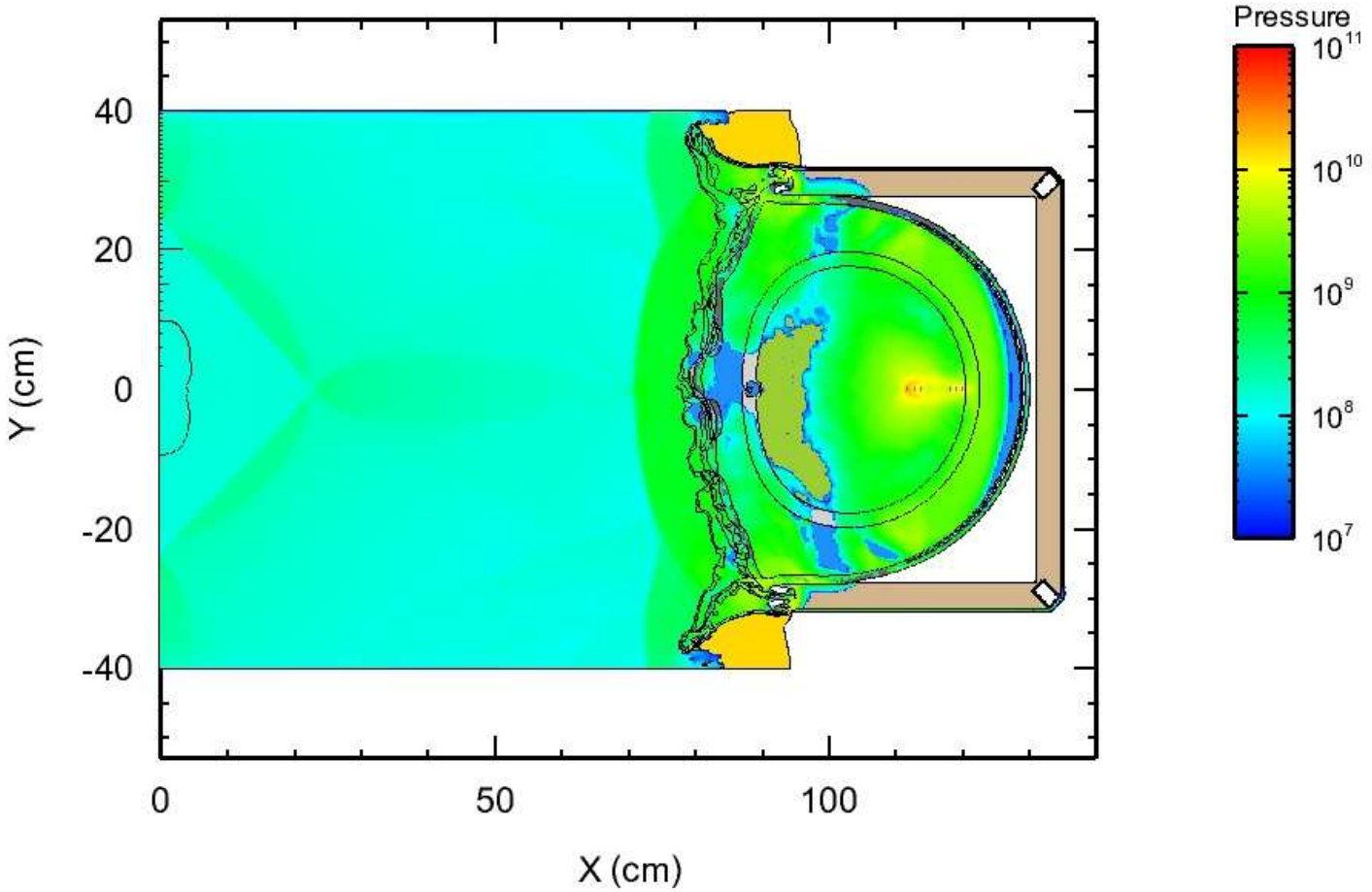
- Post-test modeling indicated a pressure of 35.51 kbars at 0.60 ms reflected pressure off the back surface of acceptor warhead.

- Location of this peak pressure is below the centerline of the acceptor warhead. It is believed the later reaction was due to shock wave reflection inside of the acceptor warhead case.

CTH Hydrocode Modeling Configuration



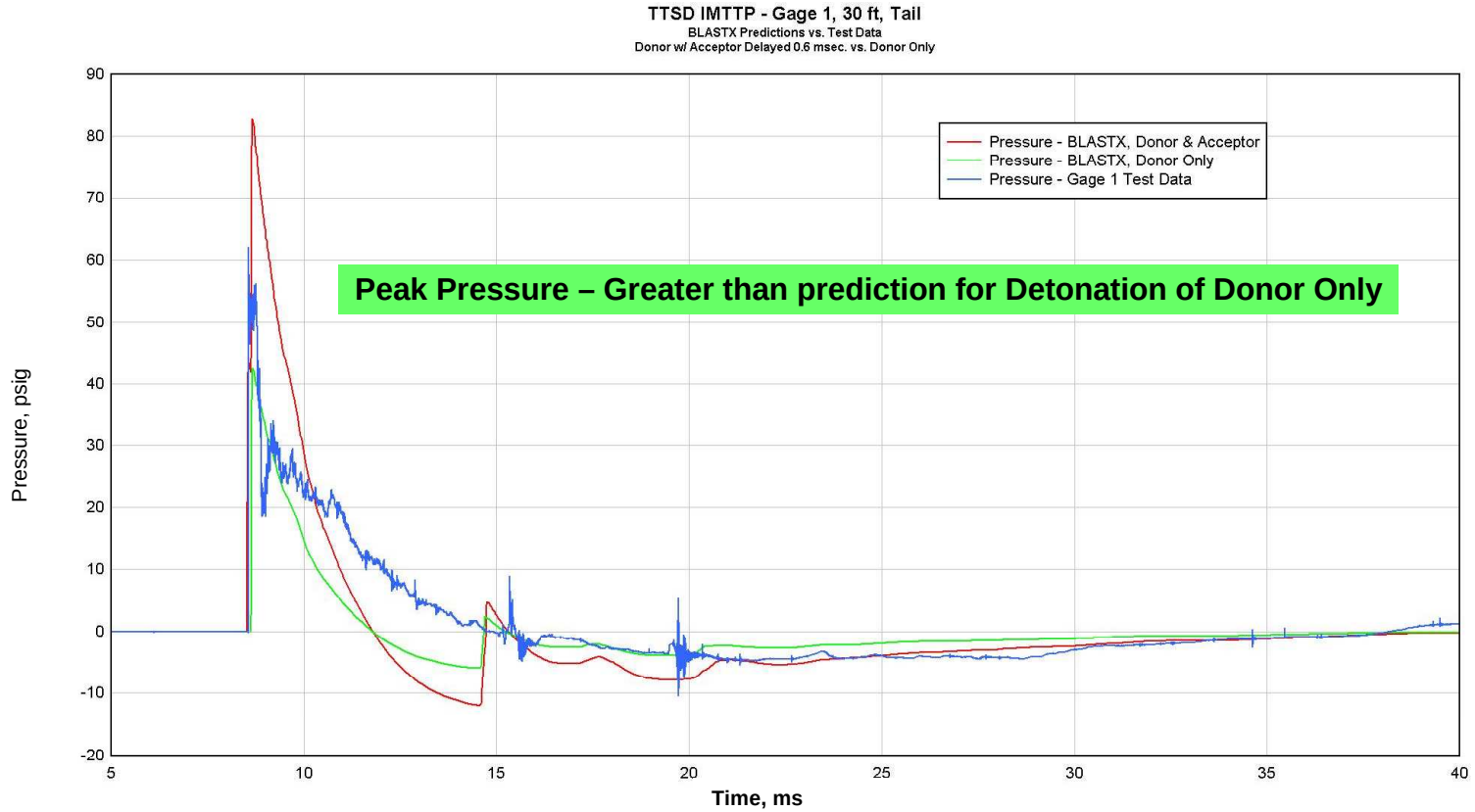
CTH Hydrocode Modeling Results (Post Test)



6.00e-004 secs.

Blast Pressure Data

- All blast pressure gages recorded peak blast pressures greater than the modeling predicted for only the donor detonating. Effect of fuel, shipping container, and pumice was not modeled in Blast X model



Summary

- The SD testing was conducted for dual purposes: 1) to replicate shipping configuration, and 2) to ascertain possible application to the Vertical Launch System configuration (because of similar spacing).
  - This SD test verified that modifications to the Mk 14 container alone were not sufficient to provide a clear “PASS” for SD.
  - The interstitial space between canisters would likely provide sufficient space for a barrier design in order to successfully mitigate SD in the shipping configuration without alteration of the canister.

Recommendation:

Design a dedicated pumice barrier for mitigating sympathetic Detonation in the shipping configuration