Australian Government
Department of Defence
Defence Science and Technology Group

Effect of Blast Mitigation from Multiple Fluid Containers

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Major Findings

- Introducing a gap between containers reduced the mitigation provided for all experiments in this investigation.
- Water-filled containers always provided some level of blast mitigation even for off-centre charges in this investigation.
- The container size was smaller than the optimum and it is unknown whether the conclusions are valid for optimum container sizes.

Introduction and Aims

The use of IEDs in recent conflicts has resulted in the need to enhance the blast protection provided by armoured vehicles to occupants. Previous work has shown the potential for using water-filled containers in mitigating near-field blast loading and indicated that tall and narrow containers may provide the best protection. As the optimum design may require multiple containers to protect all of the vehicle occupants, the integration issues associated with using multiple containers needed to be investigated. The main issue with multiple containers is whether the protection is as effective with another container in close proximity and whether charges going off between the containers result in a reduction in the mitigation provided. The main aims of the investigation were as follows:

1. Evaluate the mitigation provided by multiple containers in close proximity representing an integrated protection system on a vehicle.
2. Evaluate the effect of a charge placed between two containers representing an integrated protection system on a vehicle.

Experimental Setup

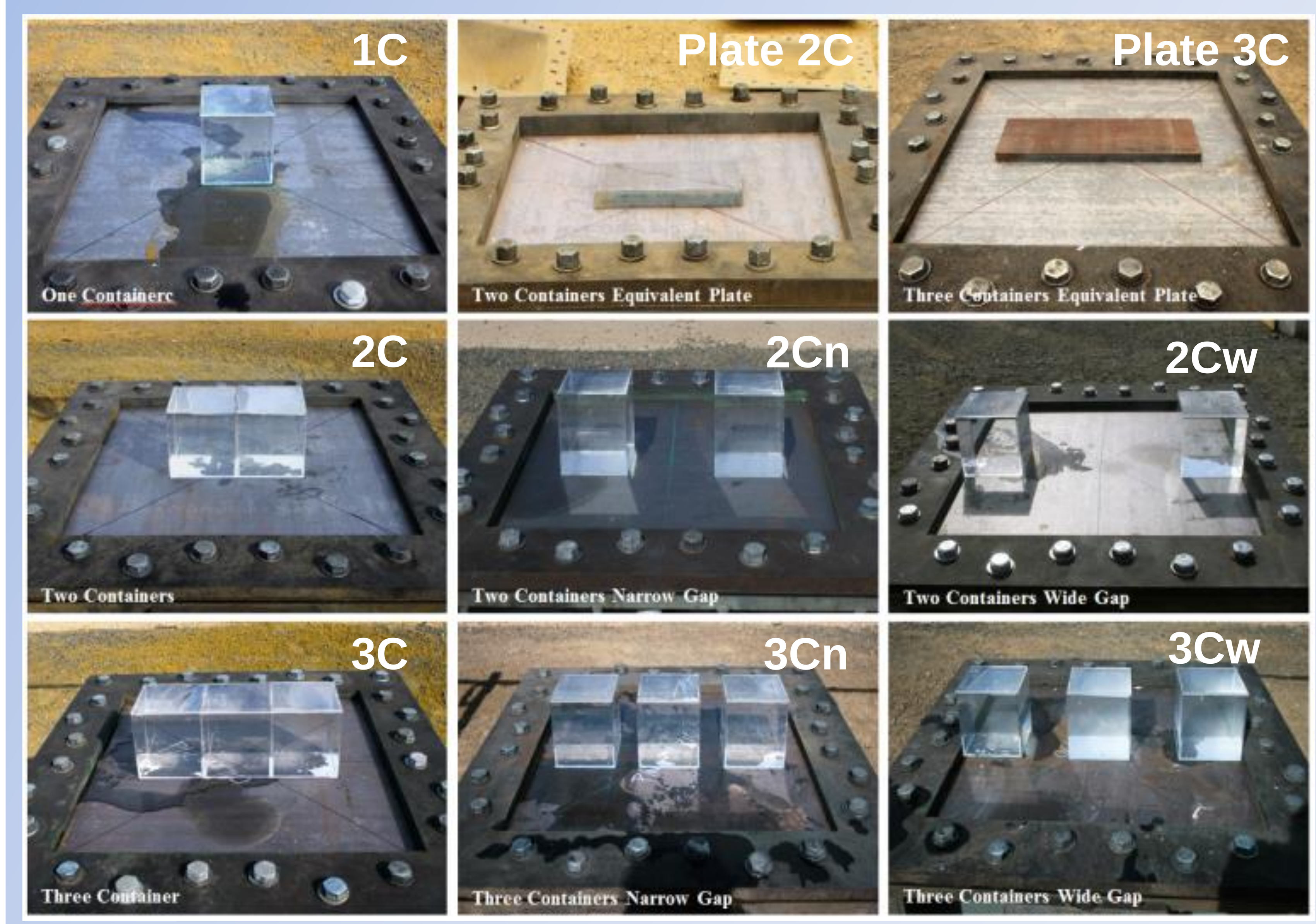
- Charge: 3 kg cylindrical PE4
- Stand-off: 810 mm
- Material: 5.7 mm steel σ_y~ 800 MPa
- Target Size: Aperture is 0.7 x 0.7 m
- Container Size: 150 x 150 x 150 mm
- Container Material: Acrylic

1. Effect of Multiple Containers (No Gaps)
Tests performed with no containers, 1C, 2C and 3C.
Used for comparison to cases with gaps.

2. Comparison Between Water and Steel (No Gaps)
Tests performed with Plate 2C and Plate 3C to compare the performance of water-filled containers with steel applique panels of equivalent areal density.

3. Effect of Gaps with Multiple Containers (Central Charge Location)
Tests performed with 3C, 3Cn and 3Cw container arrangements to assess the effect of different gap sizes on the blast mitigation provided when the charge is initiated directly above a container.

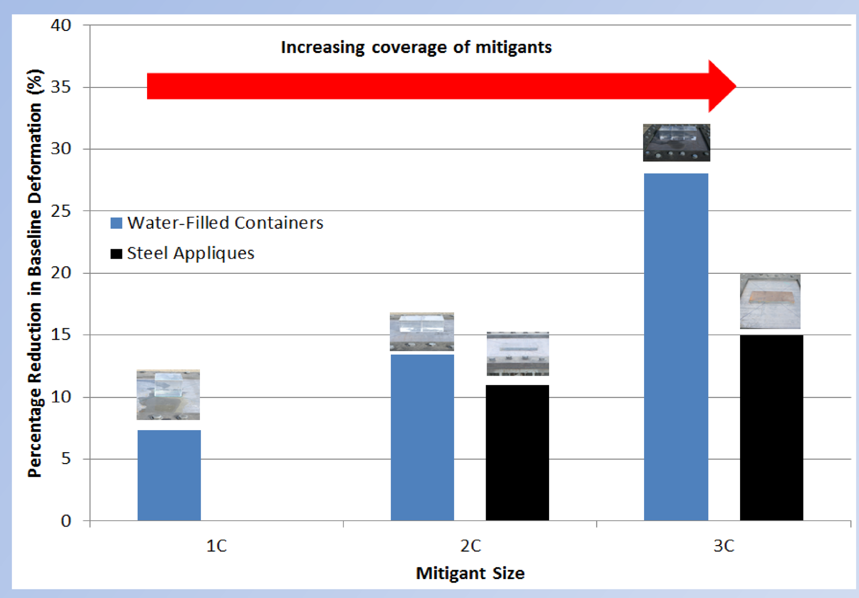
4. Effect of Gaps with Multiple Containers (Off-Centre Charge Location)
Tests performed with 2C, 2Cn and 2Cw container arrangements to assess the effect of different gap sizes on the blast mitigation provided when the charge is initiated between two containers.



Experimental Results

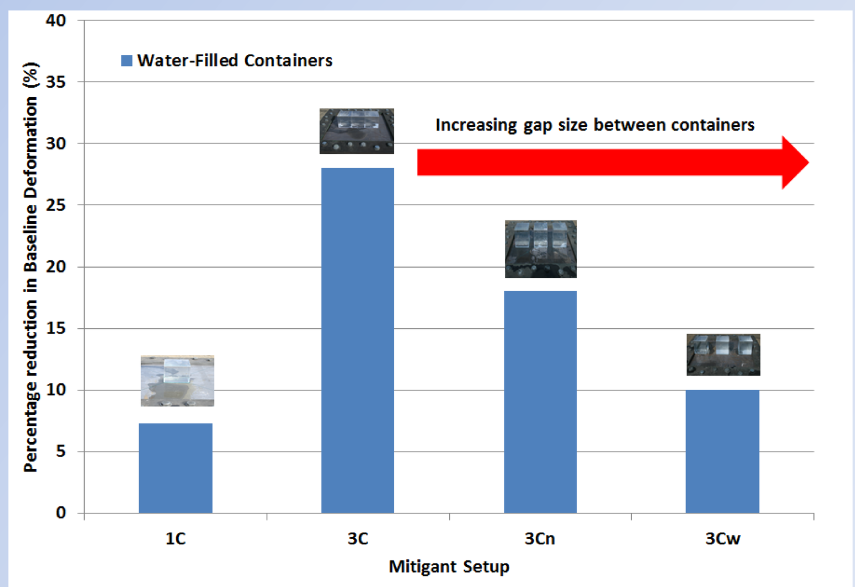
Effect of multiple containers (no gaps) and comparison with steel

1. Larger water-filled containers provide better mitigation.
2. Result is due to their being an optimum container size. (Container size is below optimum)
3. Water-filled containers outperform the steel appliques of equivalent areal density.



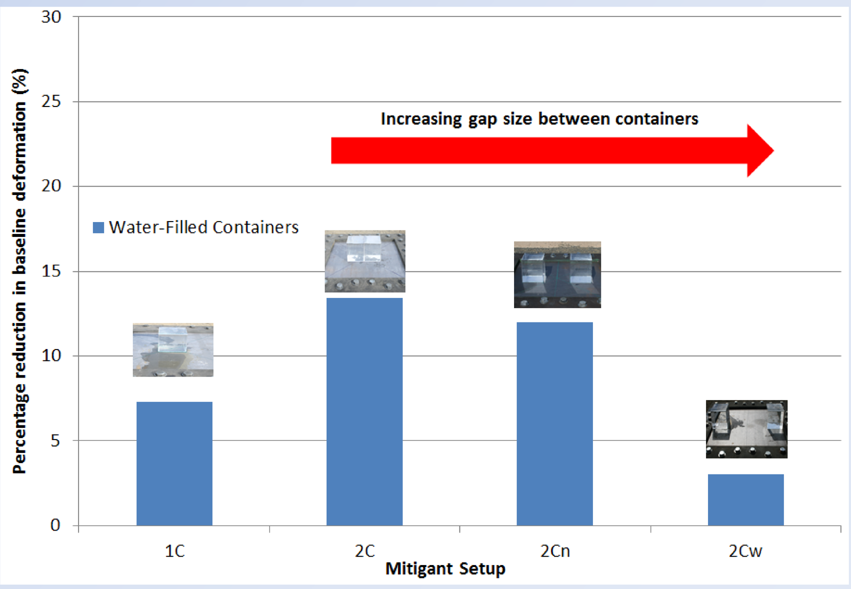
Effect of gaps with multiple containers (Centre Charge Location)

1. Increasing the gap size reduces the mitigation provided.
2. It is currently unknown whether this would be the case for the optimum container size.



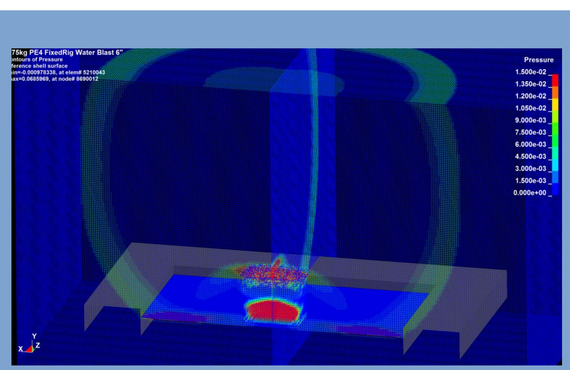
Effect of gaps with multiple containers (Off-Centre Charge Location)

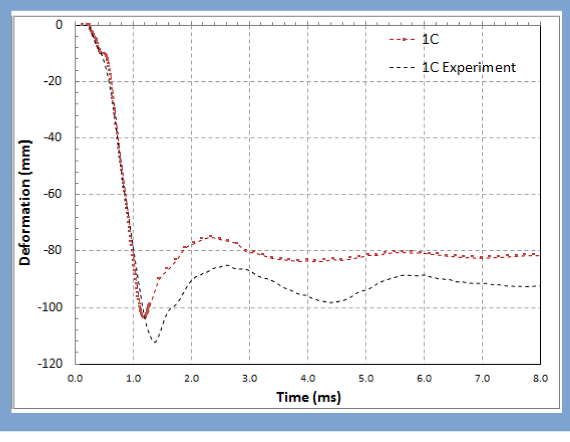
1. Increasing the gap size reduces the mitigation provided.
2. No containers provided less mitigation than the baseline case.
3. It is currently unknown whether this would be the case for the optimum container size.



Preliminary Modelling

1. Models setup using 3D quarter symmetry in LS-DYNA.
2. Results capture basic trends but currently over-predict the mitigation provided by the water.
3. Ongoing work to develop validated 3D models of these experiments to facilitate engineering design using water-filled





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