



World Oil[®] HPHT
DRILLING, COMPLETIONS & PRODUCTION CONFERENCE

October 30–31, 2018

Norris Conference Centers – CityCentre, Houston, Texas

HPHTConference.com

Solutions Where None Exist; Novel Approach to Projectile Arresting Material and Technology

Thomas Merritt – CEO

Chester Whinery -Engineering Technology Lead

Blast Control Systems

Agenda

- Projectile Energy Overview
 - Textile Barrier Philosophy
- Pressure Testing Industry Safety Guidelines
 - Need for Improvement
- Revolutionary Textile Barrier Protection
 - Benefits
 - Testing
 - Research

Pneumatic Pressure Test



Hydrostatic Pressure Test



Hydrostatic Pressure Test



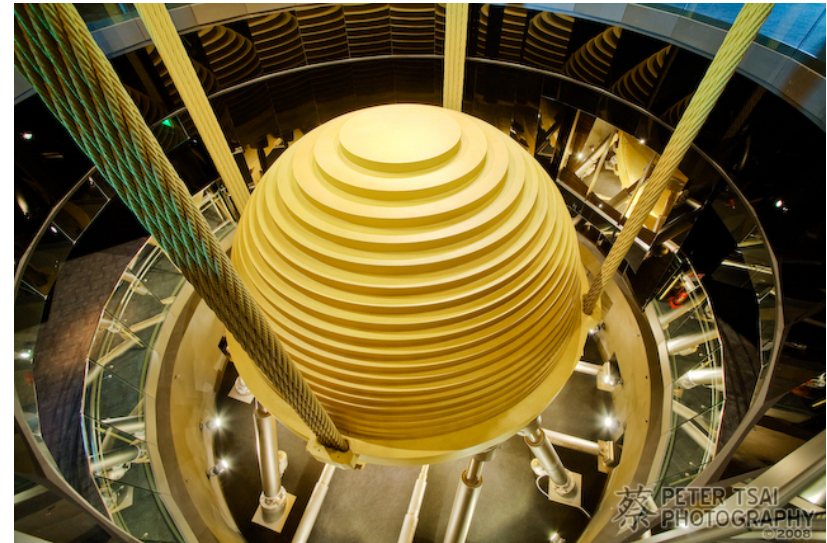
Projectile Energy Overview

- Internal Energy – The entire stored energy in a system (potential + kinetic), vastly differs in a pneumatic or hydrostatic testing event.
- Kinetic Energy – The energy that an object has by virtue of being in motion. The mitigation capability of a Pressure Pro Barrier (Blast Control Systems Textile Barrier) is measured in foot pounds per square inch of impact area.
 - For our purposes, kinetic energy is measured in foot pounds and is the result of forces of compressed fluids accelerating a projectile. The energy is the product of the velocity and weight of a projectile.
- Impact Area – Surface area calculations are performed in order to find various impact area scenarios. For example, for a flange we would use the cross section of the flange.

Projectile Energy Overview Cont.

- Internal Test Loop Volume – Depending on the potential projectile of concern (typically threaded fittings or components and field welded equipment) and the pressure testing event (pneumatic or hydrostatic) volume of the system is taken into account in the projectile analysis. The internal volume is critical in pneumatic testing events.
- Orifice Diameter - The orifice size is the diameter of the hole that will be made when the projectile is ejected by failure. For threaded components and fittings the orifice is the internal diameter of the connected piping.
- Energy Dissipation – the conversion of kinetic energy into work through the work energy theorem. Integral to the revolutionary Pressure Pro Barriers.
 - The barrier captures the projectile by dissipating the energy throughout the barrier. The material stretches a certain distance which then slows the projectile down, ultimately stopping it.

Dissipation of Energy



Barrier Material Deflection/Dissipation

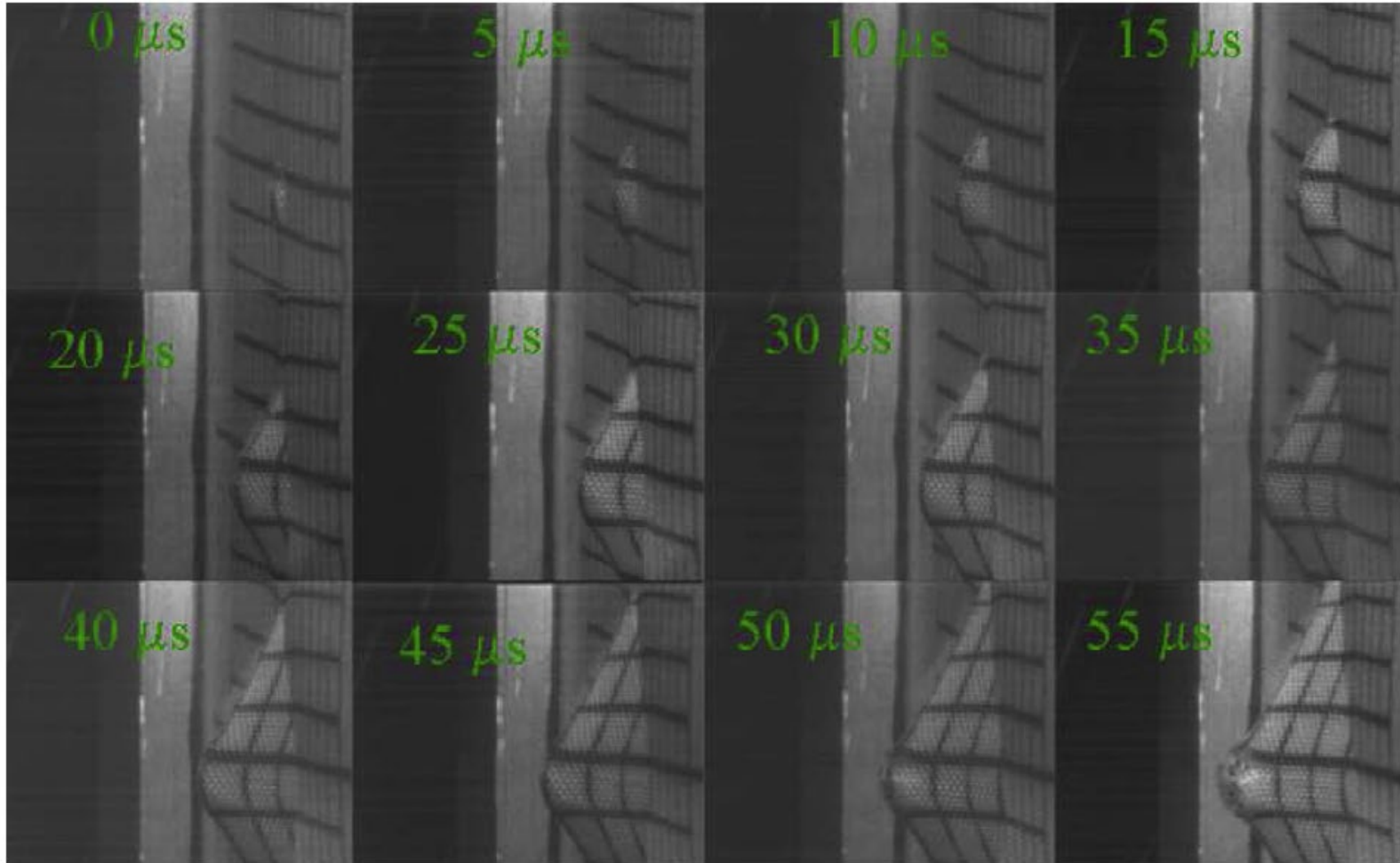


Figure 1. Measurement of strain in fabrics under ballistic impact using embedded nichrome wires, part II: Results and Analysis, by Chocron, Anderson, Samant, Figueroa, Nicholls, Walker, June 2009, retrieved from International Journal of Impact Engineering / Copyright 2009 by Elsevier Ltd.

Single Strand – Energy Dissipation

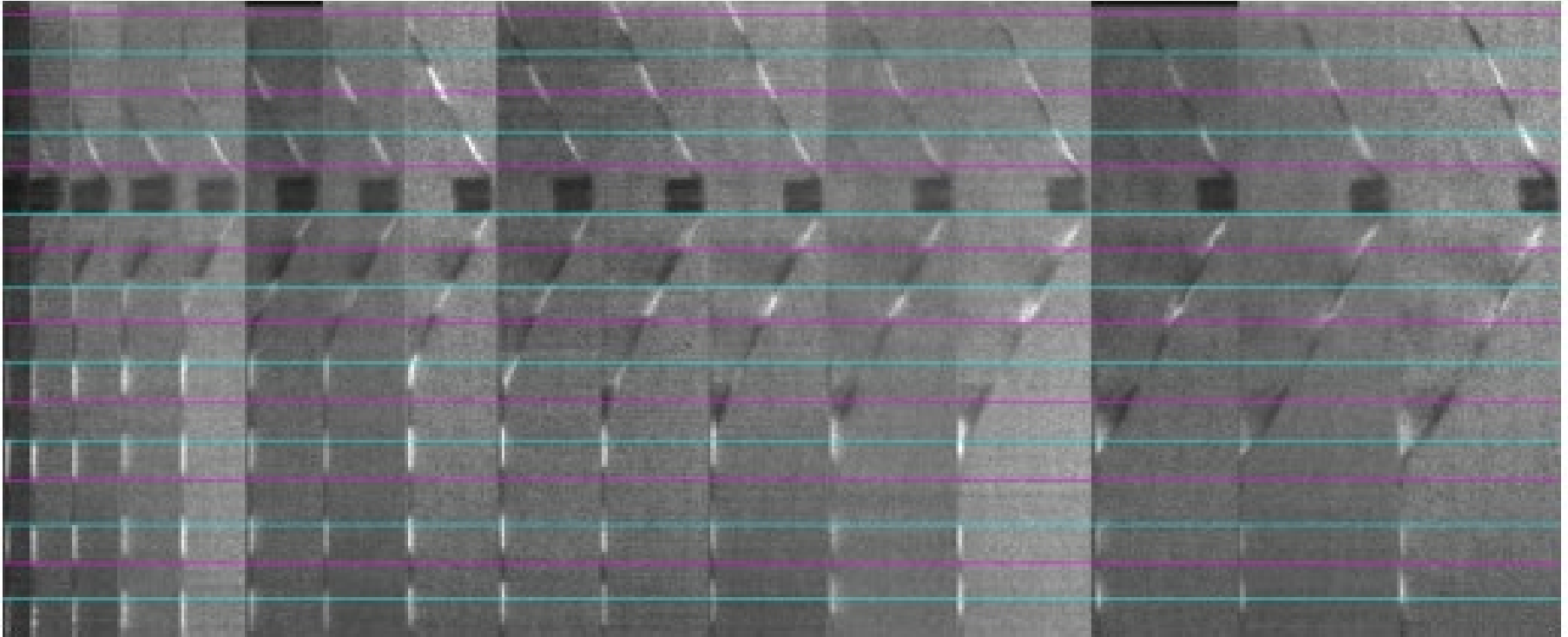


Figure 1. Modeling of Fabric Impact with High Speed Imaging and Nickel-Chromium Wires Validation, by Sidney Chocron, September 2011, retrieved from Journal of Applied Mechanics / Copyright 2011 by ASME.

Pressure Testing Safety Guidelines

American safety regulation standards related to pressure testing are nonexistent or minimal at best.

- Related recommendations include, “owner should engineer the proper barrier for projectile containment”.

UK safety regulation standards are more enlightening as some limit test volume and pressure in pneumatic testing. Some describe potential projectiles, calculations to attain projectile energy and scratch the surface on adequate barrier sizing.

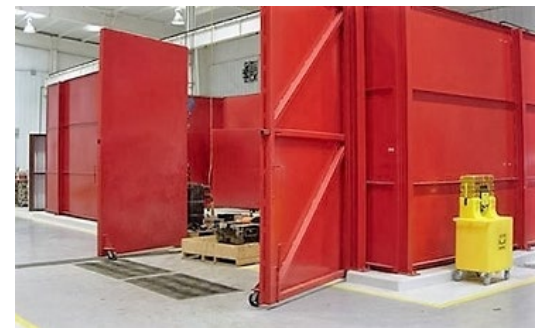
Most companies simply evacuate a predetermined area, which requires a thorough blast analysis, which is typically not performed and the evacuated distance is still in the affected zone of potential projectiles.

Pressure Testing Safety Guidelines – Need For Improvement

- BCS is in the early stages in the development of a consortium aimed to develop a nationally recognized standard for barrier protection associated with pressure testing.

Industry Trends in Projectile Containment

- Old methods of projectile containment systems include concrete bunkers, steel walls, steel walls lined with lumber and simply evacuating an area during the test.
- Advantages: cheaper and readily available material, easier initial design, provides adequate projectile mitigation if properly designed.
- Disadvantages: predetermined size that cannot easily adapt to changes in test article size and testing pressure. Permanent, every article must be moved into booth, typically causing manufacturing inefficiencies. Major construction cost included with the initial build. Cannot be easily added to Offshore Rig, creating personnel downtime and safety concerns for those inside affected area.



Textile Barrier Enclosures/Applications

- Pressure Pro Textile Barriers are revolutionizing the pressure testing industry. The barriers are engineered for each application as the layering of the barrier can be adjusted depending on the potential projectile.
- Advantages: lightweight projectile arresting textile material weighs approximately $\frac{3}{4}$ lb per square foot for the standard 4-layer Pressure Pro barrier. Mobile barrier protection available, which can be used for multiple applications. Can be installed in a permanent fashion. Can be installed where heavy barriers cannot be used such as offshore rigs. Barriers can be fastened together with proprietary Torque Lock System making the barrier size adaptable to each application as operations change.
- Disadvantages: proprietary material and proprietary manufacturing processes create a higher investment price than most clients envision. Standard 4-layer barrier starts near \$100/square foot.



Pressure Pro Applications

- Blast Blanket Wrap Around Enclosures – Wrapping a Pressure Pro® barrier around equipment and connecting the barrier back to itself is a simple and efficient way to form a portable enclosure. This minimizes the enclosure size and can alleviate the need to design and install a rigid support structure.

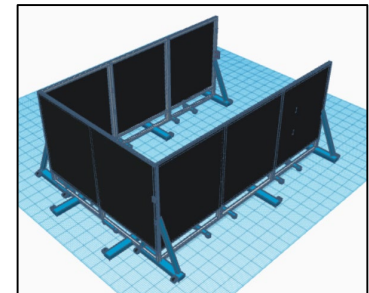
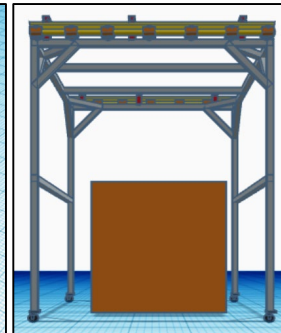
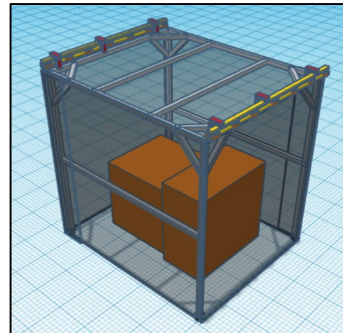
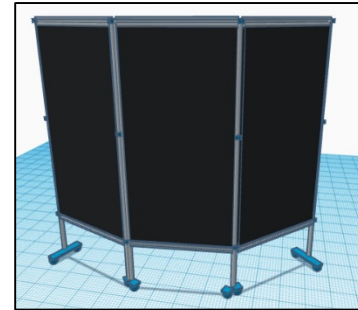
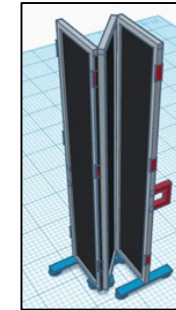


- Equipment Covers - Custom fitted protective equipment covers. These are commonly installed on the high pressure units (HPUs) that supply the pressure to components for pressure testing. They are custom designed to fit specific equipment models and feature available access ports for lines, hoses and gauges where needed.



Pressure Pro Applications

- Line Wraps – The LWX™ Line Wrap is an enclosure and restraint system for high pressure piping and hoses. This product offers 360-degree protection from high pressure fluid jet and projectiles and also restrains the equipment in a failure event. It is a whip check on steroids.
- Mobile Barrier Systems - Blast Control offers several mobile barrier options. These include our PPX Portable Partition Barriers as well as numerous variations of our other systems. Customized barrier protection to fit pressure testing requirements.



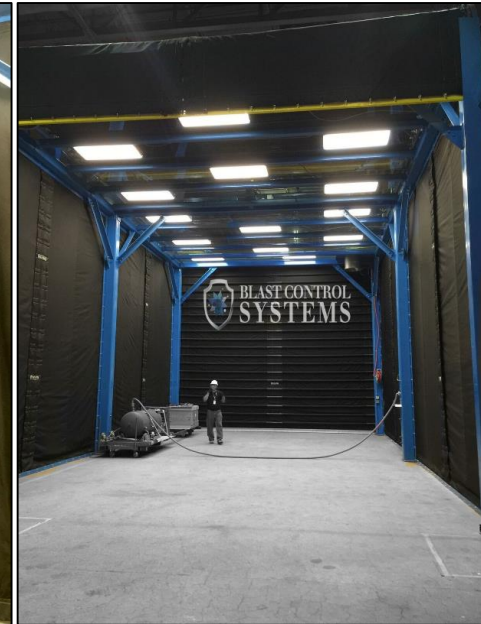
Pressure Pro Applications

Rail Mounted Blast Curtains – Blast Control's modular Altrac trolley rail system is used to form retractable barrier curtain arrangements. This is beneficial when applying barriers to stationary equipment such as manifolds on offshore drilling rigs.

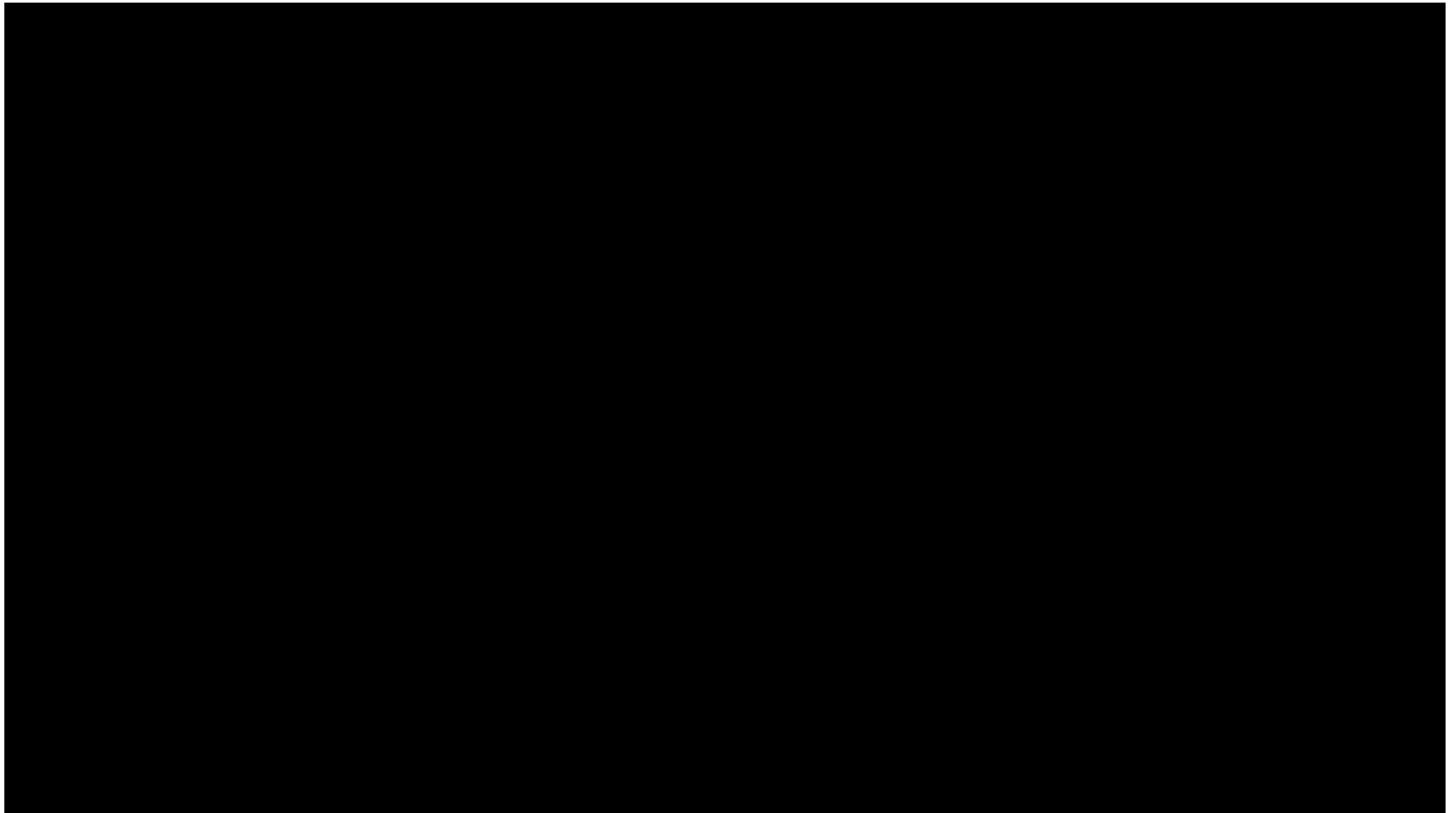


Pressure Pro Applications

Pressure Test Booths – Custom designed support structures are available for specific applications. Barriers can be connected to existing structure that is sufficiently strong enough for the application. Blast Control offers a wide array of pressure test enclosures ranging from small to very large and semi-permanent to mobile and modular.



Pressure Pro Textile Barrier Testing



Continued Development

- Industry Safety Regulations
- Projectile Energy and Test Data
- Textile Material Development
- Manufacturing Advancements



Questions?

Please Drop Off a Business Card If You Would Like a Blast Control's Overview Document Sent to You. Thank You!

Chester Whinery

Chester.Whinery@blastcontrol.com

903-983-3100

Thomas Merritt

Thomas.Merritt@blastcontrol.com

903-983-3100

www.BlastControl.com



BLAST CONTROL