



COMPOSIFLEX

Advanced Composite Products

LIGHTWEIGHT COMPOSITE BOMB CONTAINMENT DEVICE

Document Prepared By:

June 22, 2007

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Scope

This document describes an innovative, user-friendly, lightweight composite container designed to contain large, potentially-explosive devices and to mitigate damage in the event of an explosion.

Background

Several years ago Honeywell International developed a new bomb containment device (BCD), relying on its Spectra Shield® material to provide the strength and integrity necessary to contain significant bomb explosions.

At the recommendation of Honeywell, Composiflex, Inc., was contracted by the U.S. Navy to manufacture a number of lightweight BCDs based on their original concept. The Navy's interest was focused on the safe transportation of munitions, and their testing of Composiflex's BCD was incredibly successful. A 24" x 24" x 24" box weighing about 60 lbs. easily contained a significant amount of C4 (a highly-volatile plastic explosive). A hand grenade with its shrapnel was also very easily contained.

Product Concept

The basic concept of the containment device is the assembly of three, four-sided boxes—one within the other, per Figure 1. This construction provides a substantial band of unidirectional fibers about each of the three major axes. It also creates an enclosed chamber without a door—commonly the weak link in any BCD.

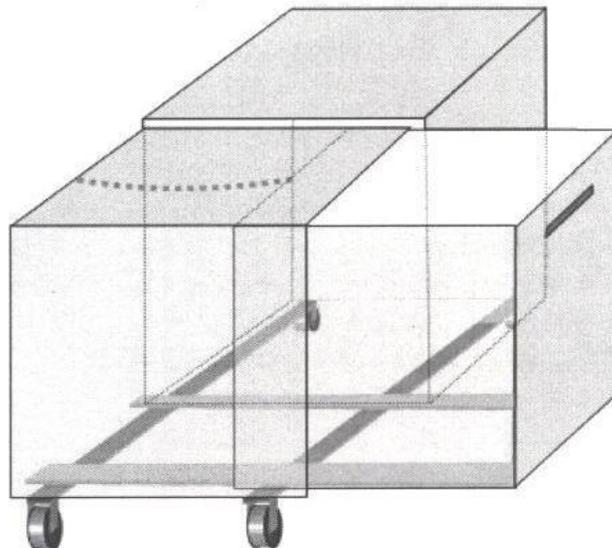


Figure 1: Bomb Containment Device Concept

The inner box houses the explosive device. A simple suspended net or a false floor provides centering of the device in the box. The inner box and the middle box are designed to fit neatly together, completely enclosing explosives within the chamber, which is lined on all sides with an energy absorbing, fire suppressing material such as Blastex. The outer box fits over the middle box and serves two purposes: first, it provides the blast resistant ring in the third axis; and, secondly, it can be finished to provide an aesthetically pleasing, furniture-look exterior so that the BCD remains inconspicuous and is well suited for use in airports, offices, post offices, etc. The size of the BCD is limited only by the imagination and the size of the equipment needed to process the individual components. In its existing autoclave, Composiflex is capable of manufacturing BCDs up to 6' x 6' x 6'.

Experimental Testing

Composiflex has completed several contracts with the U.S. Navy to build numerous BCDs in two different sizes, the largest being 24" x 24" x 24" and weighing approximately 60 lbs. The tests performed on these BCDs were conducted by the Navy in a controlled laboratory setting. An overview of the test results was made available to Composiflex and are described as follows:

Figure 2 shows the inner box with C4 suspended in its center surrounded by walls of foam and Blastex.

Figure 3 shows the assembled BCD on a test stand in the test chamber ready for detonation.



Figure 2: Inner box with C4



Figure 3: Assembled BCD on Test Stand

Figure 4 shows the box after detonation. The C4 explosive was successfully contained, and the BCD was essentially undamaged.

Figure 5 contains the Navy's summary of the test results. Significant to note is that the overpressure (the pressure outside of the BCD) is quite low, only 1.0 PSI. This indicates that the BCD is capable of protecting surrounding environments, including aircraft interiors.

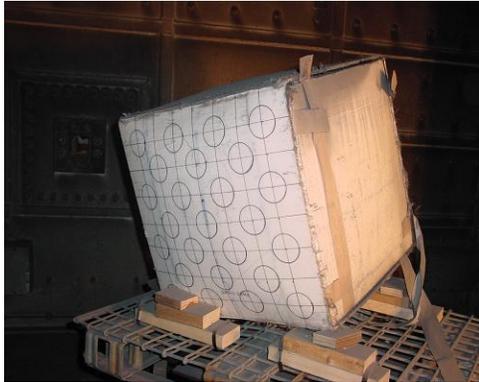


Figure 4: BCD after Detonation

**Test Shot #5 Box³
w/ Foam & Blast-X**

- Result
 - Container survived and remained on table. One corner came off wood spacers. Minimal fireball observed, because less Blast-X used.
 - All hoops survived. Minimal difficulty in disassembly of swollen hoops.
 - Chamber overpressure 1.0 p.s.i.

Figure 5: Navy's Summary of Test Results Using C4

The BCD was in such excellent condition after the test that the Navy used it again to easily defeat a hand grenade.

Figure 6 summarizes the results of the hand grenade test. Of greatest importance is the fact that no fragments penetrated the box. All were contained in the box or in the Spectra Shield® hoops.

**Test Shot #6 Box³ w/ Blast-X
(Reused Box from Test Shot #5)**

- Result
 - Container survived and remained on table. No fireball observed.
 - All hoops survived. Minimal difficulty in disassembly of swollen hoops.
 - No fragments outside container.
 - Only 2 fragments found in container, remainder embedded in hoops.
 - X-rays will be taken.
 - Chamber Overpressure 0.33 p.s.i.

Figure 6: Re-use of BCD for Hand Grenade

Product Features & Benefits

Composiflex's BCD has a number of salient features and benefits including:

1. Highly effective protection at minimal weight.
2. Relatively low acquisition cost.
3. Ease of transport to the bombsite: hand carried with handles, or rolled on either casters or a simple dolly system.
4. The containment materials are radiolucent to X-rays, making the unit compatible with standard bomb detection equipment.
5. The opening/closing mechanisms can be designed to allow robotic operation and/or robotic transport.
6. The unit can be designed to aesthetically match any décor.

Potential Applications

A lightweight, portable, aesthetically-finished (if required) BCD has many applications spanning use in public institutions, agencies and the private sector. Some potential applications include:

- Airports—Particularly in the public screening areas where smaller, carry-on bags are scrutinized before boarding and near luggage X-ray machines. The units can be sized appropriately and either located at the site or easily brought to the site because of their lightweight portability. Subject to appropriate protocol, the bomb can be easily loaded into the BCD for quick removal from congested airport environments.
- Aircraft—Planes in flight are at a serious disadvantage if a bomb is detected onboard. Since weight and space are at a premium, this technology is well suited for aircraft applications.
- Government & Office Buildings—Many government buildings are prime targets for terrorists, including embassies, post offices, nuclear power plants, office buildings and other heightened security locations. Because of its lightweight properties and ease of portability, Composiflex's BCD can be utilized in any screening location, potentially minimizing the risk of damage to buildings and loss of human life. The unit allows bomb squads to ingress and egress quickly, and is also well suited to situations when BCDs must enter and/or exit buildings via a staircase.

- Other Bomb Squad Applications—In most situations, bomb squads have the responsibility to neutralize suspected bombs. Utilizing previously introduced blast container solutions can be difficult for bomb squads. Earlier products are quite heavy and can be extremely difficult to transport. In addition, with previous models, there is no easy way to examine the blast container contents without removing them. Transportability, ease of ingress and egress, and X-ray transparency make this BCD a desirable alternative to previous technologies.
- International Markets—Terrorist occurrences continue to escalate worldwide. Lightweight BCDs are clearly of great benefit to meet international bomb security needs.

Conclusions & Commercialization

Development efforts have clearly demonstrated that this technology is able to mitigate the detonation of significant quantities of explosives in a lightweight, portable configuration.

In order to commercialize the technology, products have been designed with user-friendliness in mind. Figures 7 and 8 show a blast containment model that has the appearance of fine furniture. In addition, casters and handles have been incorporated into the design. Custom sizes, hardware, finish and other features are available.



Figure 7: Furniture-like BCD



Figure 8: BCD Open

Company Profile & Additional Background

Certified to ISO 9001:2000, Composiflex is a manufacturer of advanced composite products for the medical, military, aerospace, industrial, ballistic and recreational markets. Composiflex occupies a modern, 34,000-square-foot facility in Erie, Pa. Incorporated in 1986, the company has grown from a two-entrepreneur operation to a global supplier position with 65 full-time employees.

Working closely with its customers to provide innovative, quality products, Composiflex integrates product conceptualization, engineering design, prototyping, process development (when required) and full-scale production.

Of particular interest is Composiflex's involvement in the protection/security industry. Composiflex has supplied armor to military, government, and law enforcement agencies for more than 15 years. Using advanced materials, such as Kevlar® and Spectra Shield®, often in conjunction with ceramic, such as alumina oxide, silicon carbide and boron carbide, Composiflex has designed armor capable of defeating a broad range of ballistic threats.

Some examples of traditional ballistic solutions are shown in Figures 9 through 12. Composiflex has developed solutions for aircraft armor panels for the AC-130 "Spooky" gunship designed to defeat the 50-caliber machine gun (Figure 9). Figure 10 depicts a ballistic shield designed to defeat NIJ Level III (7.62mm x 51 M80 Ball). Photos of ballistic breastplates and an armor panel that fits the floor of a Suburban are also included below.



Figure 9



Figure 10



Figure 11



Figure 12

Under contract by Jacor Corporation, Composiflex manufactured several prototypes of full-scale luggage containers for FAA testing (as shown in Figure 13). This contract was in response to the Lockerbie tragedy.



Figure 13: Ballistic Luggage Container

For more information, contact:

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