

# ARCHIVED REPORT

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## CBU-97/B SFW and CBU-105/B WCMD

### Outlook

- Textron reportedly continues to fill export and FMS orders from the contractor's remaining inventory
- USAF terminated both the CBU-97/B Sensor Fuzed Weapon and CBU-105/B Wind-Corrected Munitions Dispenser programs, with no funding available after FY07
- Since 2012, the Republic of Korea and the Kingdom of Saudi Arabia have both placed orders for the CBU-105/B WCMD
- Textron continues to integrate the CBU-97/B SFW on IAF Jaguar aircraft

### Orientation

**Description.** An air-launched, submunition-dispensing delivery system.

**Sponsor.** The U.S. Air Force sponsored the development and U.S. procurement of this weapon.

**Status.** In FY07, the U.S. Air Force terminated the CBU-97/B Sensor Fuzed Weapon (SFW) and CBU-105/B Wind-Corrected Munitions Dispenser (WCMD) programs.

Textron continues to fill orders from existing inventories.

**Total Produced.** Through 2022, we estimate that the contractor produced at least 5,700 SFW series systems.

**Application.** An air-to-surface weapon system optimized for the destruction of massed tank formations.

**Price Range.** The U.S. Air Force no longer publishes unit price data for the CBU-97/B SFW or CBU-105/B WCMD in annual budget request documentation.

According to earlier Air Force documentation, components of the SFW program carried the following unit prices for the fiscal years indicated:

- CBU-97/B SFW (all-up round): \$346,663 (FY06)
- CBU-105/B WCMD: \$23,073 (FY05)
- CBU-105/B WCMD-ER kit: \$202,205 (FY06)

### Contractors

#### Prime

<b>Textron Systems, Weapons and Sensors</b>	<a href="http://www.textronsystems.com">http://www.textronsystems.com</a> , 201 Lowell St, Wilmington, MA 01887 United States, Tel: + 1 (978) 657-2100, Prime
<b>Rafael Advanced Defense Systems Ltd</b>	<a href="http://www.rafael.co.il">http://www.rafael.co.il</a> , PO Box 2250, Haifa, Israel, Tel: + 972 73 335 4444, Email: <a href="mailto:intl-mkt@rafael.co.il">intl-mkt@rafael.co.il</a> , Licensee

#### Subcontractor

<b>Day &amp; Zimmermann Inc</b>	<a href="http://www.dayzim.com">http://www.dayzim.com</a> , 1500 Spring Garden St, Philadelphia, PA 19130 United States, Tel: + 1 (215) 299-8000, Email: <a href="mailto:mungovsvcs@dayzim.com">mungovsvcs@dayzim.com</a> (Load, Assemble, Pack)
<b>General Dynamics Ordnance and Tactical Systems</b>	<a href="http://www.gd-ots.com">http://www.gd-ots.com</a> , 100 Carillon Parkway, St. Petersburg, FL 33716 United States, Tel: + 1 (727) 578-8100, Fax: + 1 (727) 578-8119, Email: <a href="mailto:mediacontact@gd-ots.com">mediacontact@gd-ots.com</a> (SUU-66/B)

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<b>Kratos Microwave Electronics</b>	<a href="http://www.kratosdefense.com">http://www.kratosdefense.com</a> , 227A Michael Dr, Syosset, NY 11791 United States, Tel: + 1 (516) 802-0900 (Enhanced SFW Kit)
<b>Lockheed Martin Missiles &amp; Fire Control - Orlando</b>	<a href="http://www.lockheedmartin.com">http://www.lockheedmartin.com</a> , 5600 Sand Lake Rd, Orlando, FL 32819-8907 United States, Tel: + 1 (407) 356-2000, Fax: + 1 (407) 356-2080 (WCMD Kit)

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

## Technical Data

**A Note on Components.** In an effort to eliminate some of the confusion inherent in any discussion of the CBU-97/B SFW, we lay out the basic components of the CBU-97/B as follows:

- Each CBU-97/B consists of one SUU-66/B tactical munitions dispenser (TMD).
- Each SUU-66/B houses 10 BLU-108/B Skeet delivery vehicles.

- Each BLU-108/B Skeet delivery vehicle deploys four BLU-108/B Skeet submunitions.

Thus, each CBU-97/B SFW carries a total of 40 BLU-108/B Skeet submunitions.

**Launch/Carrier Vehicle.** All U.S. and most NATO tactical aircraft, including the B-52, B-1, and B-2 bombers, can carry the SFW.

**Dimensions.** The following data reflect the current production-standard CBU-97/B SFW system. Other than the weight, dimensional data for the BLU-108/B Skeet submunition have not been released.

	<u>SI Units</u>	<u>U.S. Units</u>
<b>SUU-66/B TMD</b>		
Length	1.83 m	6.0 ft
Diameter	39.62 cm	15.6 in
Weight (empty)	97.73 kg	215 lb
Weight (full)	454.55 kg	1,000 lb
<b>BLU-108/B Skeet Delivery Vehicle</b>		
Length	79 cm	31 in
Diameter	13.3 cm	5.25 in
Weight	29 kg	64 lb
Weight (submunition)	3.4 kg	7.5 lb

**Performance.** Detailed performance data remain classified. The U.S. Air Force maintains that the CBU-97/B exceeded its required level of effectiveness by 50 percent or more during operational testing. In 1994, the prime contractor stated that the weapon system had scored 69 successful tests in a row.

Reportedly, the product-improved version has significantly better performance than the original. The Air Force reportedly plans to upgrade the CBU-97/B fuze component, citing issues of reliability and obsolescence. This may also suggest undisclosed problems with the weapon system.

## Variants/Upgrades

The prime contractor, Textron Systems, has thus far developed the following basic models of the SFW system:

<u>Designation</u>	<u>Description</u>
CBU-97/B SFW	SFW, which consists of an SUU-66 TMD carrying 10 BLU-108/B Skeet delivery vehicles with four BLU-108/B submunitions each.
CBU-105/B WCMD	CBU-97/B with the WCMD kit, which allows delivery from an altitude of 40,000 feet (12,192 m).

## CBU-97/B SFW and CBU-105/B WCMD Archived DEC

**Designation**

CBU-105/B  
WCMD-ER

Hornet WAM

**Description**

Adds a wing assembly and a GPS tail assembly to basic WCMD kit, extending the basic WCMD's standoff range to 64.82 kilometers (40.28 stat mi).

Wide-Area Munition, a ground-launched, single-warhead derivative of the SFW using a tantalum warhead lens to increase penetration to 5.5 inches (14 cm).

In addition, the prime contractor promotes the BLU-108/B submunition as compatible with several other weapons systems, including:

- AGM-84H Standoff Land Attack Missile-Expanded Response (SLAM-ER)
- AGM-158 Joint Air-to-Surface Standoff Missile (JASSM)
- M30 Guided Multiple Launch Rocket System (GMLRS)
- MGM-140 Army Tactical Missile System (ATACMS)
- R/UGM-109 Tomahawk
- Various unmanned air vehicles (UAVs) and cruise missile systems

**Modernization and Retrofit Overview.** To date, the major retrofit program for the CBU-97/B involves integration of the WCMD tail kit, which enables the dispenser to correct itself for wind changes and ballistic errors during flight. The enhancement includes:

- Pop-out, movable tailfins
- A central processor to accept targeting data from the launch aircraft before release
- Ballast in the forward portion of the dispenser in order to maintain the correct center of gravity

When mounting the WCMD kit, the CBU-97/B carries the designation CBU-105/B.

In 1996, Lockheed Martin won the competitive development program for the WCMD kit. Originally, the U.S. Air Force projected a unit price of between \$30,000 and \$35,000 for the enhancements, with a total procurement of around 40,000 WCMD kits. On August 3, 1998, the U.S. Air Force approved low-rate initial production (LRIP) of the WCMD kit.

### *WCMD Growing Pains*

The approved dispenser featured a fin-locking mechanism to keep the munition from spinning. The contractor incorporated this modification into the original Block 1A design after discovering that the fin mechanism could move prematurely after release from the aircraft. Spinning and other inappropriate aerodynamic movements resulted, causing the weapon's

inertial measurement unit to become saturated and the weapon to become uncontrollable. Lockheed Martin developed a fix that consisted of two squibs that lock the fin in place until the appropriate time in the flight path, when the squibs fire and release the fins for proper guidance.

The U.S. Air Force had planned to have the WCMD kit in service by December 1998, some five months ahead of schedule. The supersonic carriage problem caused this schedule to slip. By mid-1999, the program was back on schedule, and the Air Force ordered the modified version of the kit into production.

The U.S. Air Force integrated these kits on an as-needed basis to portions of the CBU-87/B (30,000 kits), CBU-89/B (5,000 kits), and CBU-97/B (5,000 kits) inventories. The initial platforms for the new munition are the F-16 and B-52. Integration with the B-1B, F-15E, and F-117 is also likely.

In 2003, Lockheed Martin secured contracts for development of an extended-range WCMD – known as the WCMD-ER – which adds a wing assembly and a GPS tail assembly to the basic WCMD kit, extending the basic WCMD's standoff range to 64.82 kilometers (40.28 stat mi).

### *CBU-97/B P3I Program*

Under the preplanned product improvement (P3I) program for the CBU-97/B, Textron has developed and integrated several enhancements for the weapon. The program involves the following components:

- A redesigned BLU-108/B warhead, with 16 smaller slugs around the central larger slug. This new warhead design maintains its effectiveness against heavy armor while allowing a much higher capability against soft targets. The new warhead also replaces the original Octal explosive with the PBXW-11, an insensitive explosive.
- A dual-mode seeker of the combined active (laser-based) and passive (infrared) type for the BLU-108/B submunition.
- A new two-component (blast and fragmentation) warhead for the BLU-108/B submunition for use against alternate targets.
- An active laser profile meter (incorporated as a Skeet submunition production cut-in during 1999).

## CBU-97/B SFW and CBU-105/B WCMD Archived DEC

- An improved radar altimeter, allowing the dispenser to cover more ground.

In January 2001, the U.S. Air Force approved the product-improved version of the SFW for serial production. The first deliveries occurred the following June.

These improvements increase the tactical flexibility of the weapon, especially against air defense systems and

soft-skinned vehicles. The improved weapon exhibits a 70 to 100 percent enhancement in performance, with only a 7 percent higher unit price than the original SFW.

In May 2003, the U.S. Air Force issued a draft Request for Proposals for fuze modifications to the CBU-97/B, citing issues of obsolescence, production, and reliability with the existing Alliant Techsystems FZU-39/B fuze.



CBU-97/B SFW

Source: Textron Systems

## Program Review

**Background.** The CBU-97/B Sensor Fuzed Weapon (SFW) is a direct strike application of two programs (portions of which remain classified) that began in the 1970s in response to the growing numerical disparity between NATO and Warsaw Pact tanks:

- The BLU-108/B Skeet anti-armor munition, developed under the Defense Advanced Research Projects Agency (DARPA) Assault Breaker program
- The U.S. Air Force Wide Area Anti-Armor Munitions program

Avco Systems Division was the original developer of the Skeet technology. In 1987, Textron acquired Avco. The contractor now operates as Textron Systems.

**SUU-66/B TMD.** Originally designated SUU-64/B (for use with the CBU-89/B Gator munition), this dispenser replaced the obsolete SUU-30/B, which was limited to subsonic carriage and deployment at higher altitudes of around 304.8 meters (1,000 ft). The SUU-66/B TMD can handle supersonic speeds and delivery at altitudes as low as 60.96 meters (200 ft). It is available in spun (SUU-65/B) and unspun (SUU-64/B and SUU-66/B) versions.

### *TMD Delivers the Goods*

The TMD consists of an aluminum skin that is rolled into a cylindrical shape and then welded. Major features include:

- The aluminum forward bulkhead, welded to the cylinder, which forms the main structure to which the remaining components are attached.
- The strongback – a single piece of aluminum containing two steel inserts for the suspension lugs and attached to the inside of the aluminum cylinder; it provides the strength and rigidity necessary for suspension and carriage.
- Two electrical harnesses. The fuze harness connects the FZU-39 fuze to the proximity sensor and the body harness. The body harness runs the full length of the body and allows the fuze to activate the explosive bolt in the SUU-65/B fin cant mechanism.
- The cutting network, consisting of a manifold and lead, three longitudinal strands of aluminum linear-shaped charges (each with a booster at the aft end), and a circumferential strand of the linear-shaped charge at the aft bulkhead. This component cuts the dispenser body into three pieces to dispense the submunitions and separate the tail section.
- The aft bulkhead, which provides the primary structural support for the aft end of the body; it also acts as a seal for the cargo section.
- The lanyard system, which consists of three sheathed lanyards in two aluminum conduits and three lanyard extractors; it mounts at the top of the body. It releases the fins, initiates fuze arming, and selects the fuzing mode.

## **CBU-97/B SFW and CBU-105/B WCMD Archived DEC**

- The tail solenoid, which pulls the fuze arming lanyard; the nose solenoid pulls the fuze option lanyard.
- The electronics assembly, which contains the circuitry necessary to control the entire operational sequence of the weapon.
- The thermal battery, which powers the electronics assembly and a target proximity sensor; it also charges the three firing capacitors of the electronics assembly. The thermal battery, which is initiated by a firing pin when the arming lanyard is pulled, has an approximate life of 3.5 minutes with (5 minutes without) the proximity sensor.

**BLU-108/B Skeet.** The Skeet is one of the more unique submunitions to achieve operational status. The Skeet was also a development of the Assault Breaker/Wide Area Anti-Armor Munitions program. Data concerning the BLU-108/B remain scarce, as the U.S. Air Force still considers much of the technology of the BLU-108/B Skeet to be sensitive.

### *Affordable Tank Killer*

Evidence suggests the BLU-108/B Skeet anti-tank weapon employs state-of-the-art infrared sensor, logic, microcircuitry, dynamics, and warhead (a flat cone-shaped charge) technologies to provide a small, extremely affordable weapon capable of destroying the largest tank. So far, the only major problem with the Skeet is that the munition was too sensitive to sensor input. In September 1989, the U.S. Air Force ordered Textron to reduce the sensitivity of the Skeet, as it was "overreacting to the battlefield environment." Preferably, the submunition should react only to tanks and other armored vehicles.

**Sequence of Operation.** The typical SFW package consists of an F-16 carrying four SUU-66/B TMDs. This configuration yields a total of 160 Skeet submunitions per aircraft. Because the aircraft does not have to overfly the target area, its exposure to hostile defenses is reduced.

### *Three-Stage Process*

Sometime after the aircraft releases the SUU-66/B TMD, the 10 Skeet delivery vehicles deploy and stabilize, first via a pilot parachute and then via a larger parachute. At a predetermined height, a rocket motor fires to elevate the Skeet delivery vehicle, spinning it to release the four BLU-108/B Skeet submunitions. This centrifugal spinning is similar to that of a sportsman's skeet targets (clays); hence, the name of the munition.

A parachute deploys to allow the individual Skeet seeker (an advanced-design infrared type) to function. When the seeker detects a target vehicle, the flat cone-shaped charge fires into the top of the vehicle. If the Skeet submunition does not detect a vehicle, it self-detonates at a fixed low altitude, with widespread anti-materiel and anti-personnel effects.

### *Why a Flat Cone-Shaped Charge?*

The flat cone-shaped charge warheads of the Skeet rely on a unique principle of applied physics: the Misznay-Schardin effect, which states that certain metals (such as copper) and certain steel alloys (such as tantalum) can explosively form into ultra-high-speed masses capable of penetrating the heaviest armor. All conical-shaped charge (chemical) warheads designed to defeat armor employ the Misznay-Schardin effect.

However, extremely critical technology involving the geometry and manufacture of the metal liner and shaped charge is required if the Misznay-Schardin effect is to function properly. Development of the charge was difficult, as the design and manufacturing parameters had to be precise. Textron Systems is among the world leaders in the development of such technology.

A flat cone-shaped charge warhead functions in the following manner: a uniquely shaped (130° to 150°) explosive charge within a cylindrical casing fires to create an explosive pressure wave. This wave implosively forges a precisely shaped metal disc, known as a lens or liner, into an armor-penetrating slug. The purity, thickness, diameter, contour, and curvature of the lens, as well as the shape of the explosive pressure wave, are critical in the forging of the final slug shape.

The transformation from lens to final slug shape typically occurs in 100 to 150 microseconds, with terminal velocities on the order of 2,743.2 meters per second (9,000 fps). Textron Systems' long-rod, flat cone-shaped charge warheads have demonstrated high effectiveness over long ranges. They have successfully defeated advanced armor targets.

### *Budget Casualty?*

According to U.S. Department of Defense budget request documentation, the U.S. Air Force terminated both the CBU-97/B SFW and CBU-105/B Wind-Corrected Munitions Dispenser programs, with no additional funding provided after FY07. The SFW and WCMD budget lines no longer appear in the annual Air Force budget request documentation.

## **CBU-97/B SFW and CBU-105/B WCMD Archived DEC**



CBU-97/B SFW Strike

Source: U.S. Department of Defense

## **Funding**

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The U.S. Air Force no longer maintains budget lines in its annual budget request documentation for procurement of the CBU-97/B Sensor Fuzed Weapon and the CBU-105/B Wind-Corrected Munitions Dispenser kit.

## **Worldwide Distribution/Inventories**

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**Export Potential.** With the termination of the SFW and WCMD programs by the U.S. Air Force, Textron Systems is exploring the near-term potential of the export market in order to keep the programs active. Still, while several nations have expressed an interest in acquiring this technology, the sensitivity of this weapon may severely limit its export potential for the foreseeable future.

In June 2012, the Defense Security Cooperation Agency reported that the Republic of Korea had submitted a request worth \$325 million for the procurement of 367 CBU-105/B WCMDs.

In August 2013, the U.S. Air Force awarded Textron a contract worth \$640.79 million to procure 1,300 CBU-105/B WCMDs under the FMS program for the Kingdom of Saudi Arabia.

In May 2014, the Republic of Korea submitted an FMS request worth \$190 million for the procurement of 361 CBU-97/B SFWs and 18 WCMD tail kits.

**Country.** Republic of Korea, Saudi Arabia, United States.

**CBU-97/B SFW and CBU-105/B WCMD Archived DEC**

**Forecast Rationale**

Both the CBU-97 Sensor Fuzed Weapon and CBU-105/B Wind-Corrected Munitions Dispenser received their combat baptism in the aftermath of the 9/11 terrorist attacks. During the opening phase of Operation Iraqi Freedom, U.S. forces used CBU-105s to attack Iraqi tank formations guarding Baghdad.

Reports suggest that the U.S. Air Force was pleased with the performance of the weapon system. Nevertheless, the U.S. Department of Defense decided to cease all procurement of the CBU-97/B SFW and CBU-105/B WCMD after FY07.

***Export Sales***

Since this decision, Textron Systems has been exploring the near-term potential of the export market to keep the programs active. The self-neutralization and self-destruct functions of the BLU-108/B submunition are especially attractive to nations attempting to comply with the Ottawa Convention.

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***Export Limitations***

Although several nations have expressed an interest in acquiring this technology, the sensitivity of this weapon continues to severely limit the potential scope of exports. Thus far, Textron has reportedly been able to fill export orders from its existing CBU-105/B WCMD inventory without restarting the production line.

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