



***BLU-122 Warhead Program
Precision Strike Technology Symposium
19 Oct 2005***

**Maj Mike Lauden
BLU-122 Program Manager**



Agenda



- Background
 - BLU-122 Program Description
 - Schedule
 - Test Results
 - Issues
 - Summary
 - Challenges
-



Background



- 1999—Hard & Deeply Buried Target Defeat Capability (HDBTDC) Analysis of Alternatives (AoA)
 - Determined That BLU-113 Would Hold The Majority Of The HDBT Target Set At Risk
-



Background (cont.)



- AF/XORW Directed Demonstration Tests To Gather Data To Validate The HDBTDC AoA—Later Named “Divine Thunderbolt”



Divine Thunderbolt



- 2001—Series Of GBU-28s (BLU-113) Dropped Into Seismic Hard Rock In-Situ Source Test (SHIST) Granite Test Bed At White Sands Missile Range
- Results Indicated Potential Areas Of Improvement In Lethality, Penetration, Survivability, And Insensitive Munitions (IM) Characteristics



Results



- 2003—AF Directed BLU-113 Pre-Planned Product Improvement (P³I) Program
 - Resulted In BLU-122 Program And Slightly Modified GBU-28 Weapon System (GBU-28C/B)
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BLU-122 Program Description



- Requirement: AF Form 1067 (Capabilities Document)– 6 Mar 03
 - Hold 25% (50% Objective) More Targets At Risk, Based On Structural Or Functional Kill, As Compared To Baseline BLU-113
 - Interoperable With B-2A / F-15E Without Modification
 - Pass One IM Test
-



BLU-122 Program Description (cont.)



- System Description:
 - 5000lb class penetrator
 - Laser, INS or GPS guidance
 - F-15E (2) and B-2A (8)



BLU-122 Program Description (cont.)



- Program Info: Ending System Development & Demonstration (SDD) Phase; Entering Production Phase
 - ACAT III
 - General Dynamics-OTS (Improved BLU-113 Warhead)
 - Raytheon (PAVEWAY III Integration + Guidance/Tail Kits)
 - Production – 350 units
-



GBU-28C/B System Improvements



- Increased Lethality – More Energetic, Insensitive Fill (781 Lbs)
- Increased Survivability – Higher Strength Case Material, Reduced Loads Transmitted To Fuze
- Increased Penetration – Modified Nose Shape (2.4 Triconic)



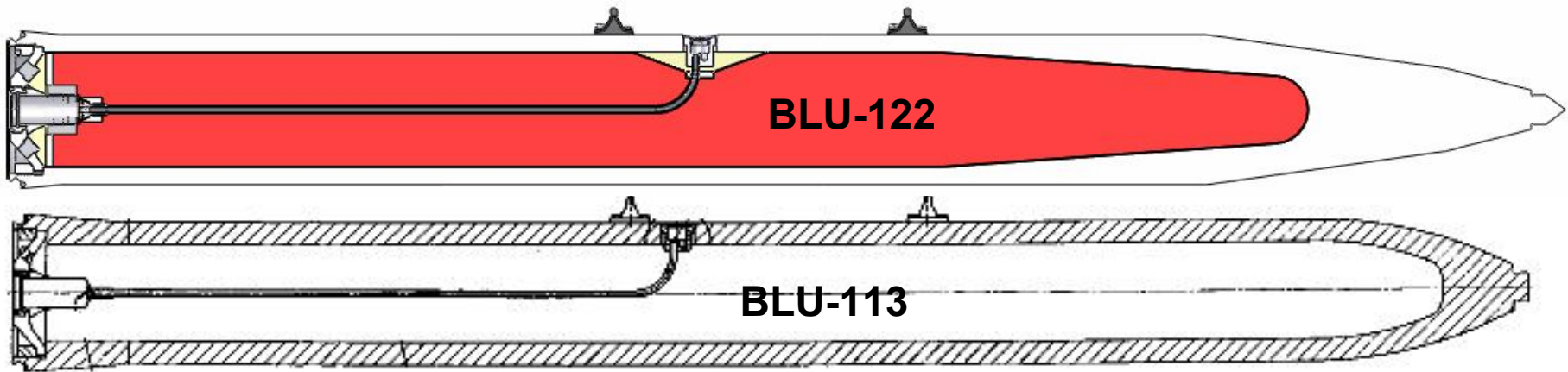
GBU-28C/B System Improvements (cont.)



- Incremental Insensitive Munitions Improvements
- Minimal SEEK EAGLE Certification Impact
- Extend Conduit To Accommodate In-Flight Fuze Reprogramming With Joint Programmable Fuze (JPF)



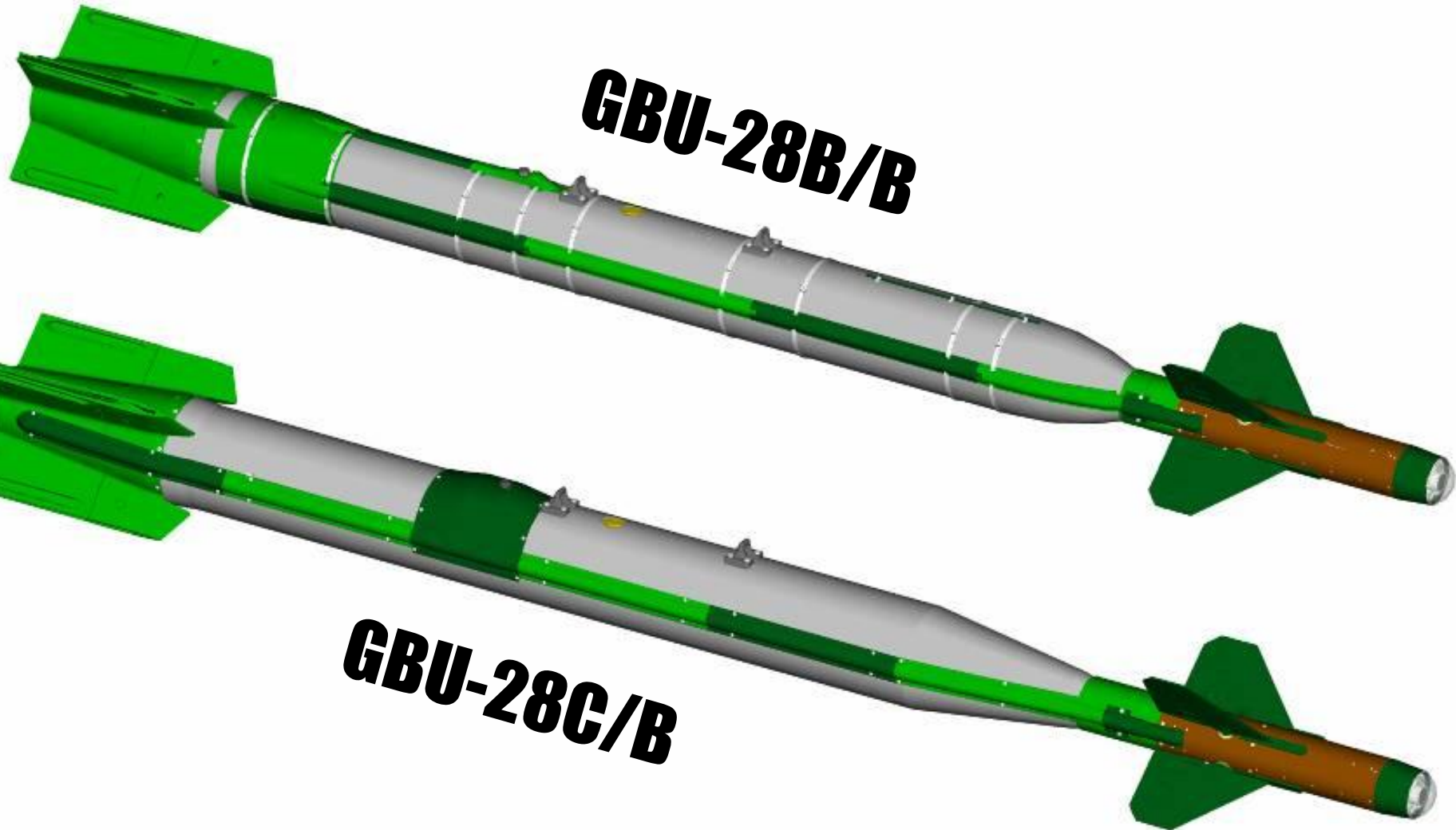
BLU-113 vs BLU-122



	Total Weight	Total Length	O.D.	Case Wall	Explosive Capacity	Explosive	Case Material
BLU-113/B	4500 lbs	153.50"	14.562"	2.281"	625 lbs	Tritonal	HP 9-4-20
BLU-122/B	4450 lbs	159.00"	15.300"	1.750"	781 lbs	AFX-757 w/ PBXN-110 Aux Booster	ES-1



GBU-28B/B vs GBU-28C/B





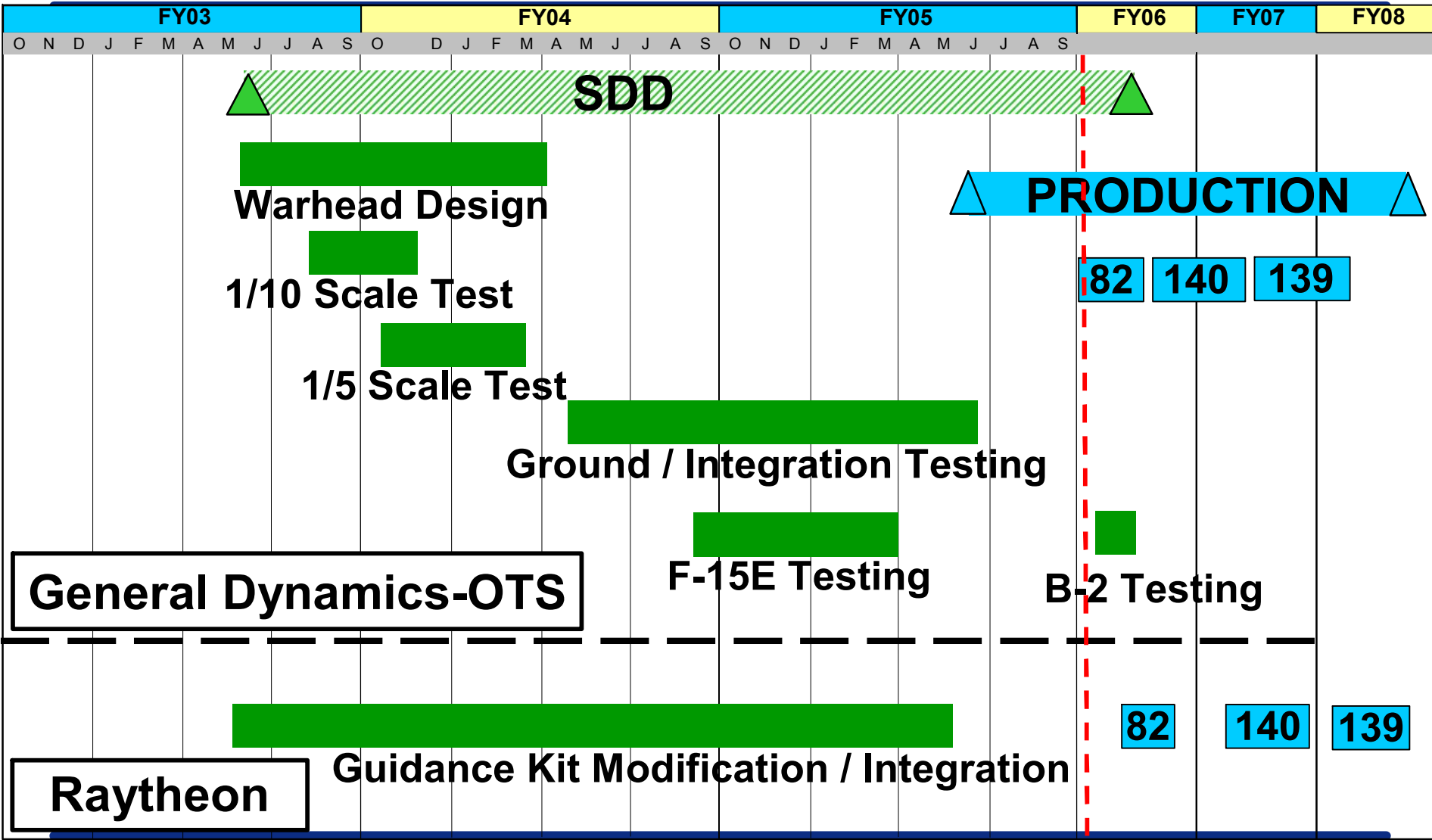
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BLU-122 Program Schedule





Current Status



- F-15 Flight Testing Complete
 - B-2 Flight Testing in Progress
 - Environmental & Safety Testing Complete
 - IM Testing In Progress
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Current Status (cont.)



- JPF Reprogramming Capability Complete
 - BLU-122 Warhead In Production
 - GBU-28C/B Guidance/Air Foil Groups In Production
 - Low Cost Telemetry Capability Effort Under Way—One Year Effort
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QTAR Scenario Performance



Warhead	Total Targets	Threshold	Objective	Projected Kills
BLU-113 (Baseline)	111	-	-	69
BLU-122	111	87 (25%)	104 (50%)	106 (54%)

- Results From QTAR Model, 17 Mar 04
- Assumes 100% Weapon Reliability

EXCEEDS 50% IMPROVEMENT OBJECTIVE



Case Survivability



- Warhead Case Peak Strain Values Verified Using LaBombA And OTI*HULL Calculations

Concrete Strength (psi)	BLU-113 Strain (%)	BLU-122 Strain (%)
5000	4.64	3.13
6000	4.71	3.48
7000	4.84	3.67
8000	5.13	3.9
10000	5.26	4.04

30% INCREASE IN CASE SURVIVABILITY



Environmental Testing



- 28-Day Temperature & Humidity Test—Passed
 - Vibration Test—Passed
 - 4-Day Temperature & Humidity Test—Passed
 - 40 Foot Drop—Passed
-



IM Testing



- Bullet Impact—Passed
- Fragmentation Impact—Passed
- Fast Cook-Off
 - BLU-122 deflagrated in both tests
 - Failed Test, but performed better than BLU-113

REQUIREMENT TO PASS ONE IM TEST



IM Testing (cont.)



- Slow Cook-Off
 - BLU-122 deflagrated in first test
 - Failed test, but performed better than BLU-113
- Sympathetic Detonation
 - Type III reaction in first test
 - Second test scheduled for 19 Oct 05
- Shaped Charge Jet Test—Planned For Spring 2006



Arena Tests



- Three Tests Conducted
 - One Vertical
 - Two Horizontal
 - Results Indicated A 70% Increase In Blast Performance Based Upon Measured Peak Pressure
-



Arena Test Video





Sled Tests



<u>Date</u>	<u>Fuze</u>	<u>Target</u>	<u>Result</u>
2 Jun 04	Accel Package	18 ft/5000 psi Concrete	Explosive Ignition
14 Oct 04	Accel Package	18 ft/5000 psi Concrete	No Reaction *
5 Jan 05	FMU-143 (60 ms)	18 ft/5000 psi Concrete	High Order

*** INTERNAL PLUMBING REMOVED**



Sled Test

Explosive Ignition



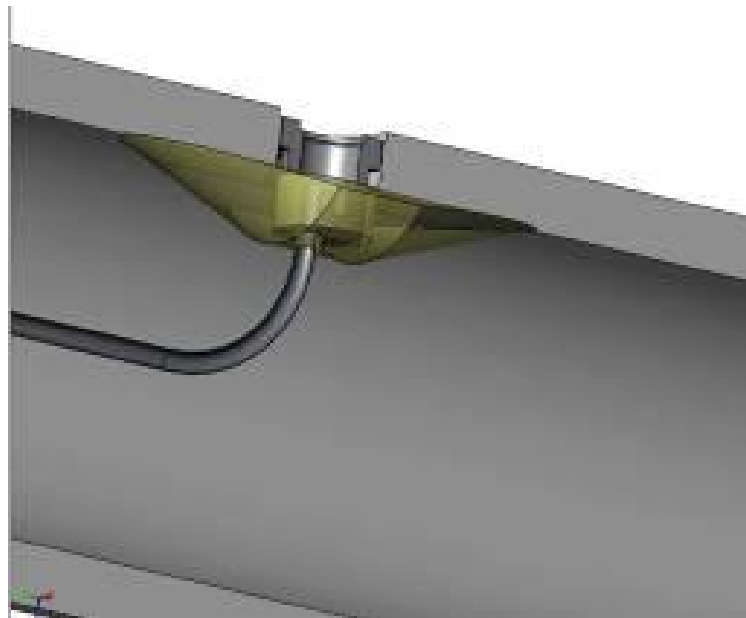
- Warhead Explosive Reaction Observed In Sled Test #1 At 30ms
 - Explosive Survivability Verified In Sled Test #2 Without Plumbing Or Fuze Initiator (FZU)
 - Fixes:
 - Internal ramp added around FZU well—reduced thermal shock
 - Charging tube material changed from steel to Polyester Ethel Ketone (PEEK)
-



Sled Test Explosive Ignition (cont.)



- Survivability Of Ramp Design Verified During Flight Test
- Final Configuration Verified In Sled Test #3





Sled Test #1



BLU-122 Sled Test #1

2 Jun 04

Eglin AFB, FL



Sled Test #2



BLU-122 Sled Test #2

14 Oct 04
Eglin AFB, FL



Sled Test #3



BLU-122 Sled Test #3

5 Jan 05

Eglin AFB, FL



F-15E Flight Tests (Dec 04)



Mission	Guidance	Warhead	Fuze	Notes
Flight #1	GBU-28A/B	Inert	Accel Package	Limited Data
	GBU-28A/B	Inert	Accel Package	Good Data
Flight #2	GBU-28A/B	Live Fill	Accel Package	Self Initiation*
	GBU-28A/B	Live Fill	Accel Package	Self Initiation*

*** Fuze timed out before ignition**



WSMR Drops Dec 04



**PENETRATED 20-22% MORE
THAN BLU-113**



F-15E Flight Tests (Mar 05)



Mission	Guidance	Warhead	Fuze	Notes
Flight #3	GBU-28A/B	Live Fill	FMU-143 (120 ms)	Fuze Dud
Flight #4	GBU-28A/B	Live Fill	FMU-143 (60 ms)	High- Order
	GBU-28B/B	Live Fill	FMU-143 (60 ms)	High- Order
Flight #5	GBU-28B/B	Live Fill	FMU-152	Fuze Dud
	GBU-28B/B	Live Fill	FMU-152	Fuze Dud



WSMR DT20b





WSMR DT20c



UNCLASSIFIED

DIVINE THUNDERBOLT
20c

03/24/2005

UNCLASSIFIED



WSMR Drops Mar 05



Apparent Craters (Non-Excavated)



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Fuze Well Test Anomaly



- Fuze Well Separated From BLU-122 Bomb Case
- Occurred During Penetration Of Granite Target
- No Fuze Well Failure During Other Eight Tests In Similar Targets
- Analysis By General Dynamics Found No Design Flaws
- Placed On Watch List





FMU-143 (60ms Delay)



<u>Warhead</u>	<u>Date</u>	<u>Target</u>	<u>Result</u>
BLU-113	Mar 04	UTTR-Granite	High Order
BLU-122	Jan 05	Eglin Sled Test	High Order
BLU-122	25 Mar 05	SHIST	High Order
BLU-122	25 Mar 05	SHIST	High Order

FMU-143 (60ms) IS 4 SUCCESSES / 4 TESTS



FMU-143 (120ms Delay)



<u>Warhead</u>	<u>Date</u>	<u>Target</u>	<u>Result</u>
BLU-113	May 01	SHIST	Fuze Dud
BLU-113	May 01	SHIST	High Order
BLU-113	May 01	SHIST	Low Order*
BLU-113	Sep 01	SHIST	Fuze Dud
BLU-113	Sep 01	SHIST	High Order
BLU-113	Sep 01	SHIST	Fuze Dud
BLU-113	Sep 01	SHIST	High Order
BLU-113	Oct 03	UTTR-Granite	Fuze Dud
BLU-113	Sep 03	UTTR-Granite	Fuze Dud
BLU-122	23 Mar 05	SHIST	Fuze Dud

FMU-143 (120ms) IS 4 SUCCESSES / 10 TESTS



FMU-152 (JPF)



<u>Warhead</u>	<u>Date</u>	<u>Target</u>	<u>Result</u>
BLU-113	Mar 04	Eglin Sled Test	High Order
BLU-113	Apr 04	Eglin Sled Test	High Order
BLU-122	26 Mar 05	SHIST	Fuze Dud*
BLU-122	26 Mar 05	SHIST	Fuze Dud**

*** 60ms Delay**

**** 180ms Delay**



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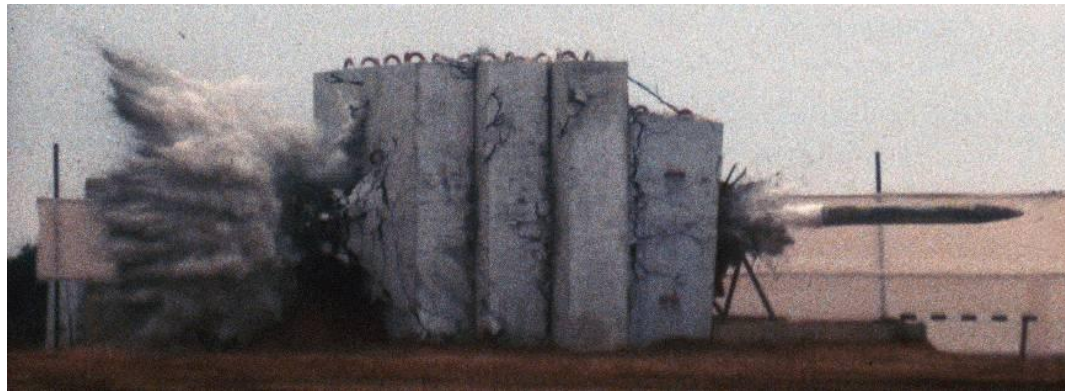
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BLU-122 Summary



- 54% More Targets Held At Risk
- 20%+ Improvement In Penetration
- 70% Improvement In Blast Performance
- 30% Improvement In Survivability
- Better IM Characteristics
- Hard Target Fuze Still An Issue





We Need A Hard Target Fuze!!



- FMU-143 G/B (60 ms Delay) Only Fuze Reliable Enough To Employ Operationally
 - JPF Not Characterized Against Hard Targets
 - BLU-122 Demonstrated Survivability Exceeds That Of JPF
 - Portion Of BLU-122 Target Set Does Not Have A Capable Fuze
-



Questions?



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Acronyms



ACAT	Acquisition Category
AoA	Analysis of Alternatives
BLU	Bomb Live Unit
FZU	Fuze Initiator
QTAR	Query Tool for AoA Analysis Results
GBU	Guided Bomb Unit
GPS	Global Positioning System
HDBTDC	Hard and Deeply Buried Target Defeat Capability
IM	Insensitive Munitions
INS	Inertial Navigation System
JPF	Joint Programmable Fuze
P³I	Pre-Planned Product Improvement
PEEK	Polyester Ethel Ketone
SDD	System Development and Demonstration
SHIST	Seismic Hard Rock In-Situ Source Test
WSMR	White Sands Missile Range
