



REPLACEMENT OF OCTOL WITH IM EXPLOSIVE IN SMAW HEAA WARHEAD

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Presentation Outline

- Objectives
- Approach
- System Description
- Explosive Selection
- Qualification and Performance Tests
- Summary
- Acknowledgements



Objectives

- Replace SMAW HEAA warhead fill (Octol) with explosive of comparable performance and improved IM characteristics
 - Sponsor directive: only system change will be explosive fill
- Meet current HEAA penetration requirements
- Qualify SMAW HEAA with IM warhead fill (SMAW HEAA-IM Warhead)



Approach

- **Phase I: Explosive Selection**
 - Explosive Selection Committee
 - IM and Performance Testing in SMAW HEAA Warhead
 - Downselection to Final Explosive Fill
- **Phase II: Qualification and Performance Testing SMAW HEAA-IM Warhead**



SMAW HEAA System Description

- Shoulder-launched Multi-purpose Assault Weapon High Explosive Anti-Armor
- DODIC HX06
- Effective against medium armor
- SMAW HEAA consists of:
 - MK 153 MOD 0 Launcher
 - SMAW HEAA Encased Assault Rocket (EAR)
- SMAW HEAA Rocket consists of:
 - Rocket motor
 - Impact fuze
 - Shaped charge, high explosive warhead



SMAW HEAA Encased Assault Rocket



Selection of IM Explosive Candidates



Explosives Assessment

- Explosive Output
- IM Survivability
- Safety & Reliability
- Producibility / Life Cycle Costs



Explosive Candidates

- PBXN-9
 - Used in Navy & Army shaped charge ordnance
 - Good IM in FCO/SCO/BI
 - Bad IM in FI

- PBXN-11
 - Better performance than PBXN-9
 - Good IM in FCO/SCO
 - Bad IM in BI/FI

- PBXW-114
 - Equivalent performance to PBXN-110
 - Good IM in FCO/SCO/BI
 - Potential for significant improvement in FI



Explosive Properties

Explosive	Composition	Manufacture Method	Density, g/cc	FCO/SCO/BI
PBXN-9	HMX/binder	pressed	1.73	V/V/V
PBXN-11	HMX/binder	pressed	1.80	V/V/V
PBXW-114	HMX/Al/binder	cast	1.71	V/V/V
Octol	HMX/TNT	melt (sedimentation) cast	1.82	I/V



Phase I. IM and Performance Tests



Phase I Testing

- Slow Cook-Off
 - 2 rockets with live warhead assemblies and inert rocket motor and fuze, of each explosive fill plus Octol baseline
 - Tests performed at Dahlgren Division, NSWC
- Fragmentation Impact
 - 2 rockets with live warhead assemblies and inert rocket motor and fuze, of each explosive fill plus Octol baseline
 - Tests performed at Dahlgren Division, NSWC
- Penetration
 - 3 warheads of each explosive fill (2 for PBXN-11) plus Octol baseline
 - Tests performed at Dahlgren Division, NSWC
- Flash X-ray
 - 2 warheads of PBXN-9 and PBXW-114 fills plus Octol baseline
 - No PBXN-11 loaded warheads available
 - Tests performed at ARL, Aberdeen, MD



PBXN-11 Loading

- Problems encountered loading PBXN-11 charges
- PBXN-11 tended to adhere to case wall when pressed under conditions used for PBXN-9 charges and caused case deformation
- PBXN-11 charges for tests were pressed as free-standing billets, slipped into warhead case, and then pressed lightly
- Loading process improvement required if PBXN-11 selected



Summary of Phase I Results

Explosive	Density	Current Processibility	Penetration	IM Reactions		
				SCO	Frag Impact (T1 8300 ft/sec, T2 6000 ft/sec)	
PBXN-9	1.744	Yes	passed	(IV)** (2) Deflagration	I (2) Detonation	
	1.744					
	1.750					
PBXN-11	1.769 *	No	passed	(V)** (2) Burn	I (2) Detonation	
	1.803					
PBXW-114	~1.71	Yes	failed	(IV)** (2) Deflagration	I (1) Detonation	(IV)** (1) Deflagration
Octol	1.80-1.85	N/A	baseline	I (2) Detonation	I (2) Detonation	
* 98% TMD is 1.793 gm/cc. 1.769 is 96.7% TMD **Not officially scored; engineering judgement of test results						



IM Explosive Selection

- PBXN-9 Selected
- Based on
 - Performed well in penetration tests
 - IM characteristics
 - Fielded as main charge in other shaped charge warheads
 - Drop in solution
- Place barrier tape between PBXN-5 booster and PBXN-9 explosive
- Informally refer to SMAW HEAA system with PBXN-9 warhead fill as “SMAW HEAA-IM Warhead”



Phase II. Qualification and Performance Tests for SMAW HEAA-IM Warhead



Qualification and Performance Tests

- Objectives
 - Ensure that SMAW HEAA-IM Warhead meets IM and Hazard Classification (HC) requirements
 - Obtain Final (Type) Qualification of the SMAW HEAA-IM Warhead
 - Verify that replacement of warhead fill has not caused degradation of system performance



Phase II Tests

- Test Items
 - Built by Nammo Talley, Inc.
 - Warheads loaded by IHDIV, NSWC
 - Liners are Government Furnished Material (GFM)
 - Mk 259 Fuzes are GFM
- Testing will be conducted by National Technical Systems (NTS), Camden, Arkansas during March – June 2009



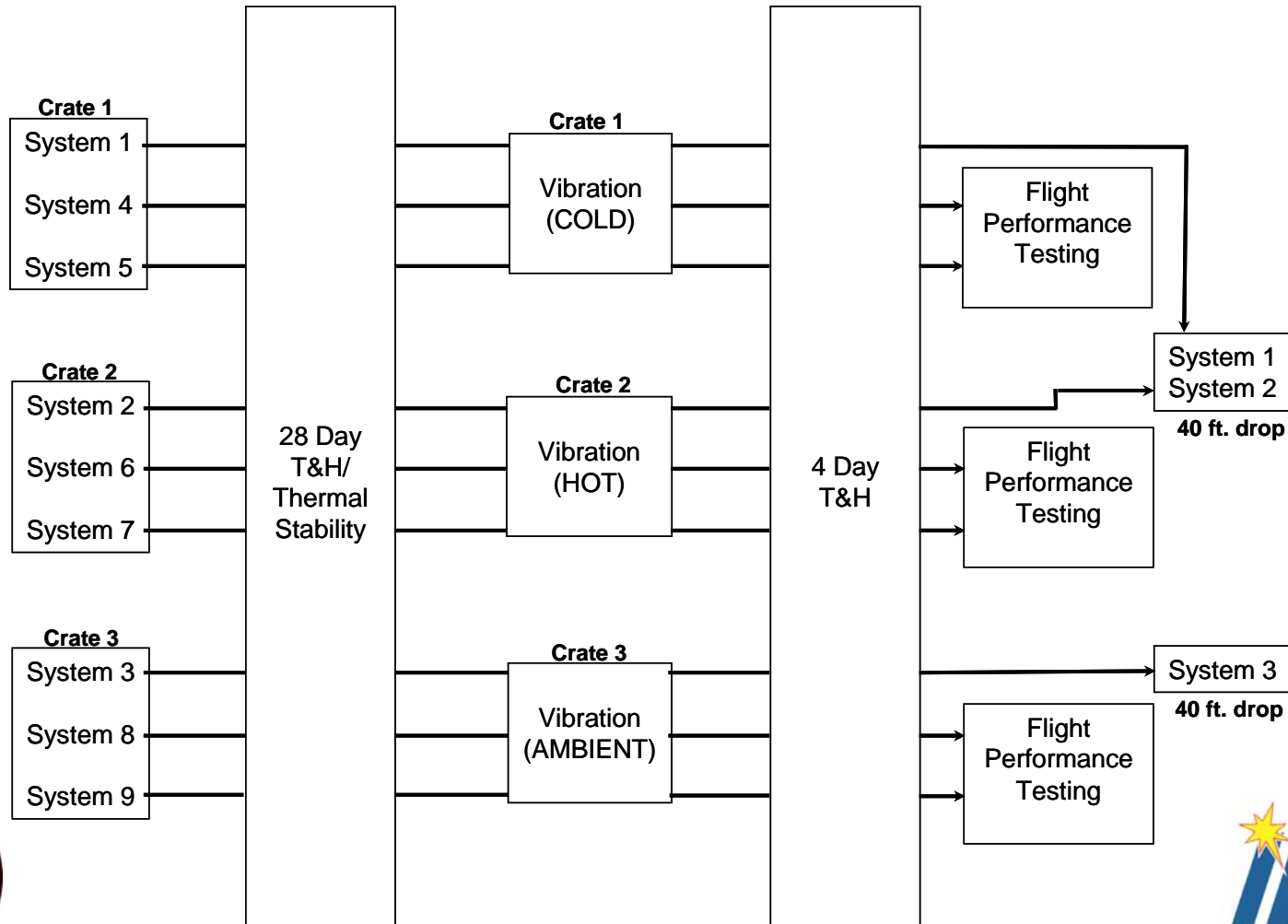
Qualification Tests

Tests harmonized for IM and HC Purposes, but include only a limited subset of HC and FTQ tests, since this effort is only changing the warhead explosive fill and not safety features of the system

- Basic Safety Tests w/ Thermal Stability
- Sympathetic Detonation (Stack Test)
- Fast Cook-Off
- Slow Cook-Off
- Bullet Impact
- Fragment Impact

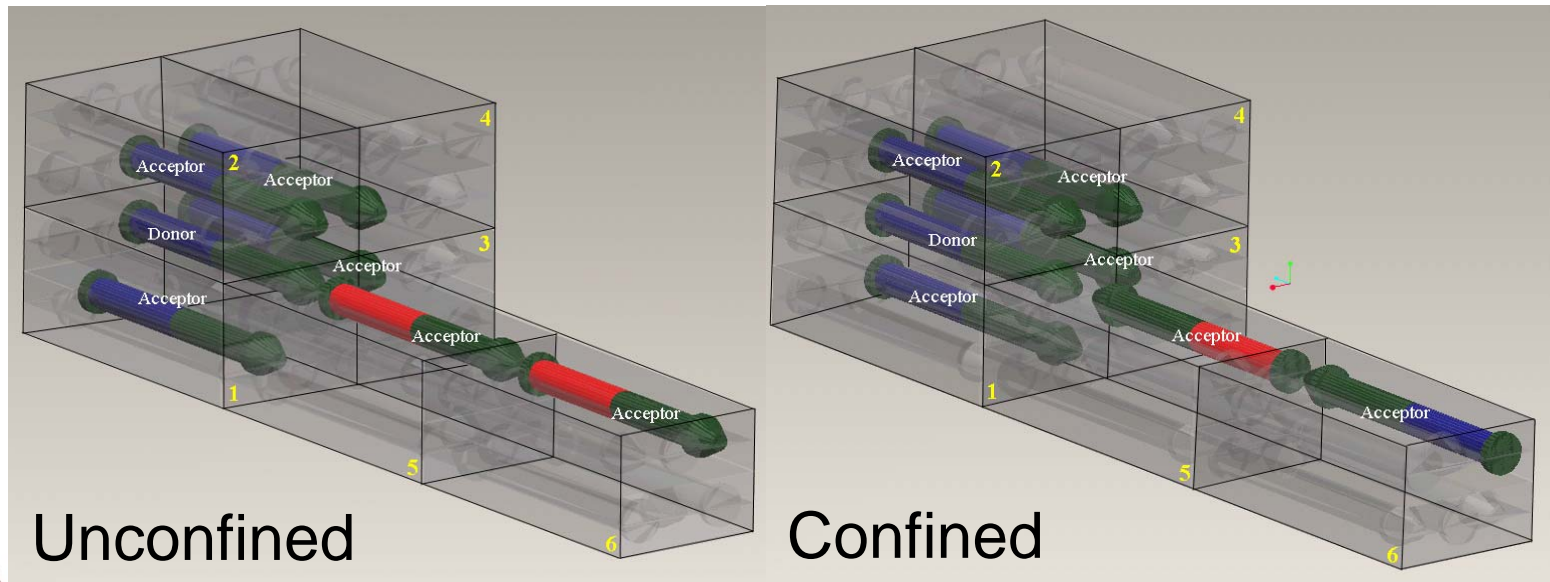


Basic Safety Tests w/ Thermal Stability



Sympathetic Detonation

- IAW MIL-STD-2105C and STANAG 4396
- Both unconfined and confined stack tests
- Various configurations of rounds in each test
- Expected results: Passing reaction



Unconfined

Confined



Fast Cook Off

- IAW MIL-STD-2105C, STANAG 4240, & NAVSEAINST 8020. B
- Two FCO Tests
 - (1) test with 6 All-Up Rounds in shipping container
 - Expected result: Type I Detonation
 - (1) test with single, bare EAR with live warhead assembly and spotting cartridge, and inert rocket motor and fuze
 - Expected result: Type V Burn



Slow Cook Off

- IAW MIL-STD-2105C and STANAG 4382
- (2) tests conducted on bare EARs containing live warhead assemblies and inert rocket motors, fuzes and spotting cartridges
- Expected result: Type IV Deflagration at warhead level



Bullet Impact

- IAW MIL-STD-2105C and STANAG 4241
- (2) tests on bare EARs containing live warhead assemblies and inert rocket motors, fuzes, and spotting cartridges
- Expected result: Type V Burn at warhead level



Fragment Impact

- IAW MIL-STD-2105C and STANAG 4496
- (2) tests on bare EARs with live warhead assemblies and inert rocket motors, fuzes, and spotting cartridges
- Expected result: Type I Detonation



Performance Testing

- Flight performance testing on All-Up Rounds at hot, cold, and ambient temperatures
- Static penetration testing on warhead-only assemblies against RHA
- Accelerated aging and vibration profiling sequence, followed by static penetration, on warhead-only assemblies
- Flight performance and penetration testing conducted IAW Weapon Specification



Summary

- PBXN-9 selected as IM explosive for SMAW HEAA warhead
- Qualification test plan received concurrence from WSESRB and Hazard Classification offices
- Warheads have been loaded
- Test items have been built
- Qualification and performance testing is underway



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 - Project Manager: Will Betush
 - Project Engineer: Glade Hansen



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