Qualification of 120mm Rifled Ammunition in Support of the Expeditionary Fire Support System (EFSS)

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Approved for public release by MARCORSYSCOM on 4/19/07

EFSS Program Overview

Expeditionary Fire Support System is a U.S. Marine requirement for a weapon system that must be:

- All weather
- Ground Based
- Close supporting
- Accurate
- Immediate Response
- Lethal indirect fire

EFSS System Description

An EFSS system consists of:

- Two Prime Movers
- Ammunition Trailer
- 120mm Rifled Mortar
- Full Suite of 120mm Rifled Ammunition

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Mortar and Ammunition Background

TDA (a subsidiary of Thales) developed 120mm Rifled Mortar and Ammunition

- Developed in the early 1970s
- In service with 24 countries, including 4 NATO armies and Japan.
- Over 500,000 rounds fired with no issues.
- Rifled barrel provides a spin stabilized projectile.
- Maximum range of standard rifled ammunition is 8.1km
- GD-OTS teamed with TDA to bring rifled mortar capability to EFSS platform

Approved for Release by TDA

Standard 120mm Rifled Ammunition

TDA's 120mm Standard Ammunition Suite

- High Explosive (HE) – 4.2 kg of TNT
- Practice – 0.5 kg of black powder for spotting
- Illumination – 1.9 kg flare
- Obscurant/Incendiary (Smoke) – 2.8 kg of White Phosphorous

All four types of ammunition share the same Tail Charge Assembly

Approved for Release by TDA

120mm Rifled Ammunition for USMC

USMC funded GD-OTS to upgrade the ammunition to meet qualification requirements of the USN for EFSS

- Insensitive Munitions (IM)
- Environmental and Durability
- Hazard Classification
- Fuze Safety
- Performance Oriented Packaging (POP)
- Electro-static Discharge

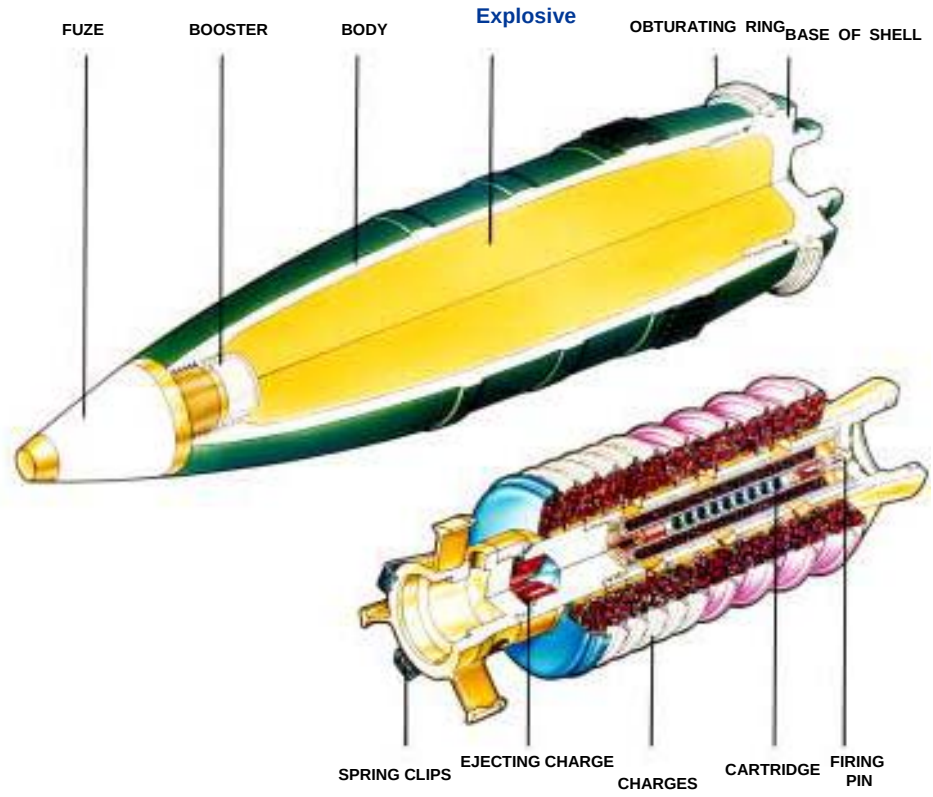
EFSS HE Ammunition Upgrade

Modifications to HE Projectile

- Replace TNT fill with PBXW-128 (HMX based)
- Equip with an M767A1 fuze utilizing a PBXN-5 booster
- Add a fuze venting liner between the projectile body and the fuze

Design Constraint

- Maintain equivalent lethality
- Similar ballistics



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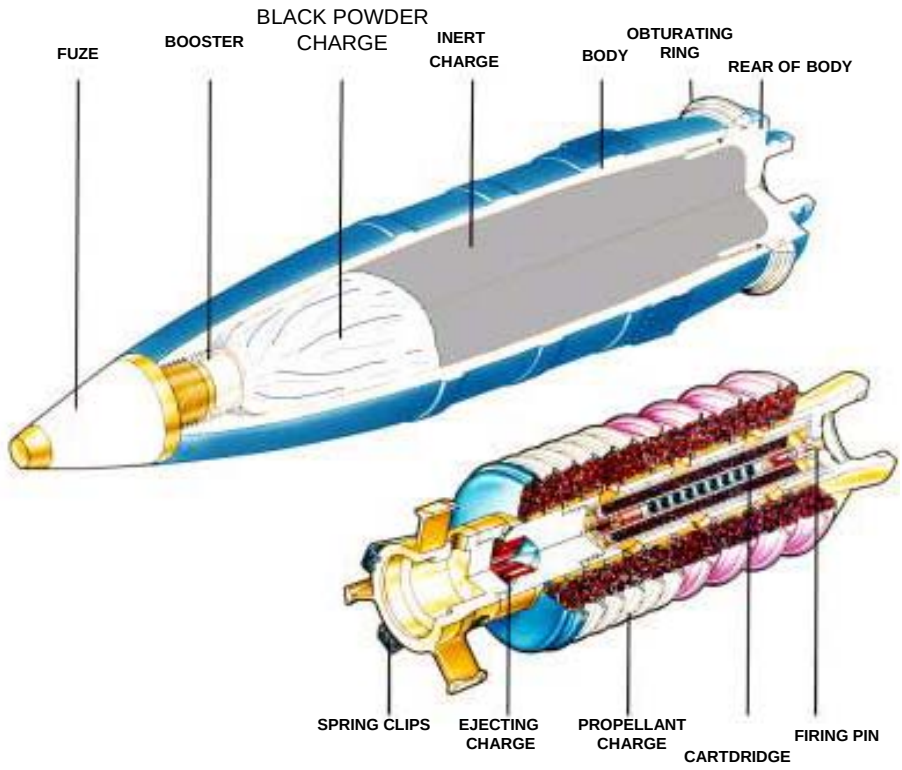
EFSS Practice Ammunition Upgrade

Modifications to Practice Projectile

- Equip with an M767A1 fuze utilizing a PBXN-5 booster
- Add a fuze venting liner between the projectile body and the fuze

Design Constraint

- Maintain spotting ability
- Same ballistic to EFSS HE



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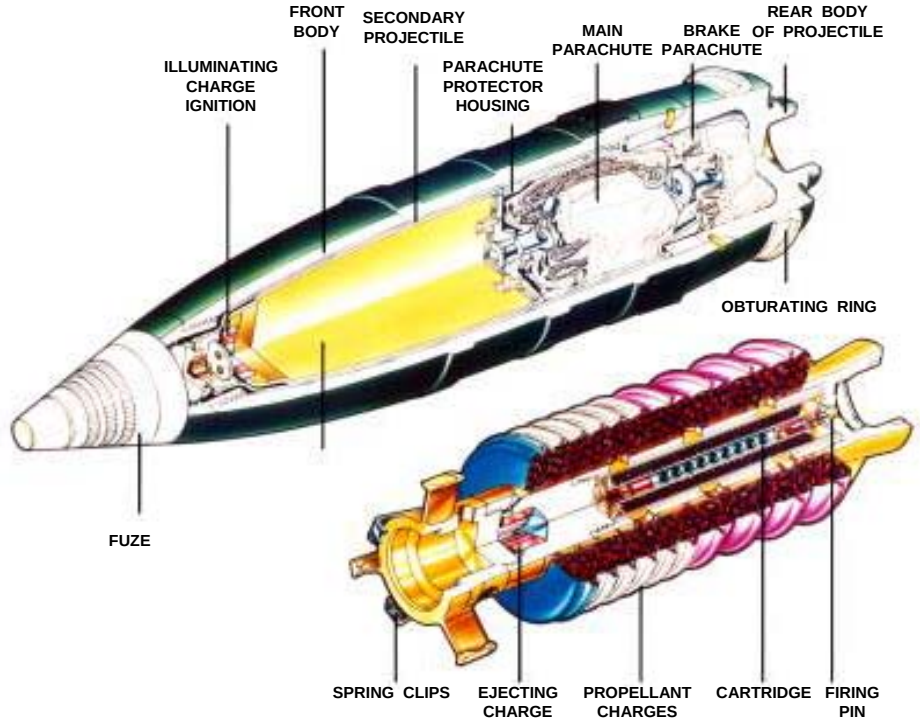
EFSS Illumination Ammunition Upgrade

Modifications to Illumination Projectile

- Equip with an M762A1 fuze

Design Constraint

- Maintain flare ability
- Similar ballistics



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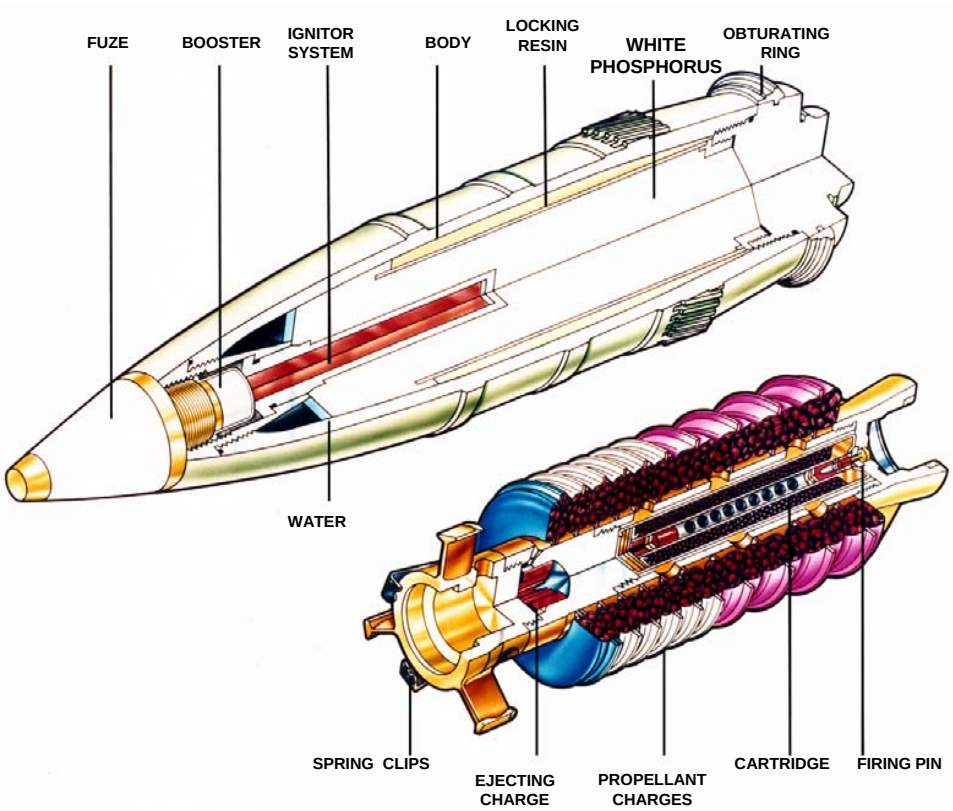
EFSS Smoke Ammunition Upgrade

Modifications to Smoke Projectile

- Equip with an M767A1 fuze utilizing a PBXN-5 booster
- Replace Comp B igniter with PBXN-9

Design Constraint

- Maintain obscurant ability
- Similar ballistics



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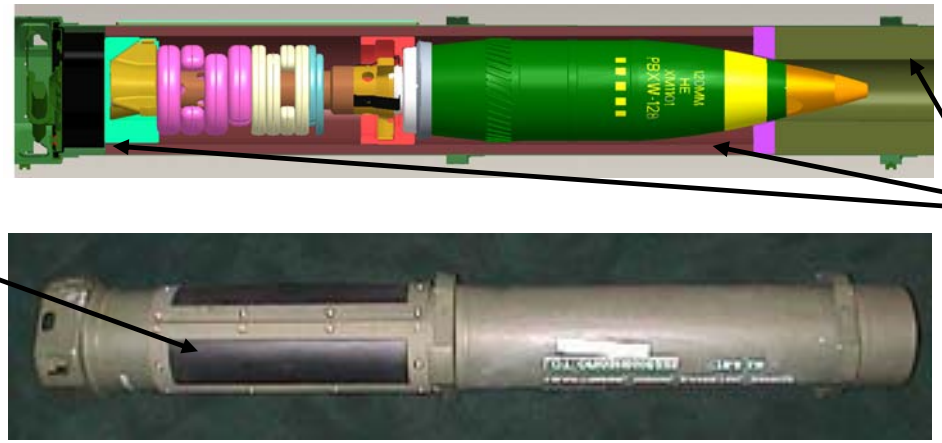
EFSS Container Assembly Upgrade

PA117 Vented Container Assembly for HE, Practice, and Illumination rounds

- Blow out panels allow pressure release
- Foam packaging separates and returns to resin form when heated
- Fuze has room to completely detach from projectile with heat and pressure



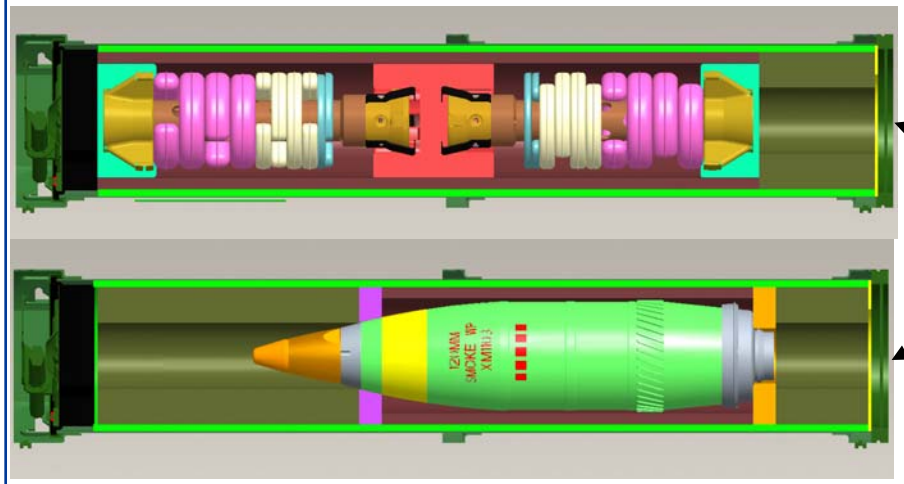
Blowout Panels allow pressure release from inside the container

Foam cushions and sleeves melt and separate to prevent insulation of heat

EFSS Container Assembly Upgrade

PA103A2 Container Assembly for Smoke only

- Blow out panel allow pressure release from the bottom of the container
- Foam packaging separates and returns to resin form when heated
- Smoke projectiles are stored and transported vertically to prevent air gaps in the white phosphorous resulting in poor ballistic performance



A Blowout Panel in the bottom of the container allows pressure release

Environmental/Durability Qualification Test Plan

45 EFSS rounds of each ammunition type were tested (including vibration and drop testing)

- High Temp (+160F)
- Low Temp (-65 F)
- Low Pressure Altitude
- Temperature Shock

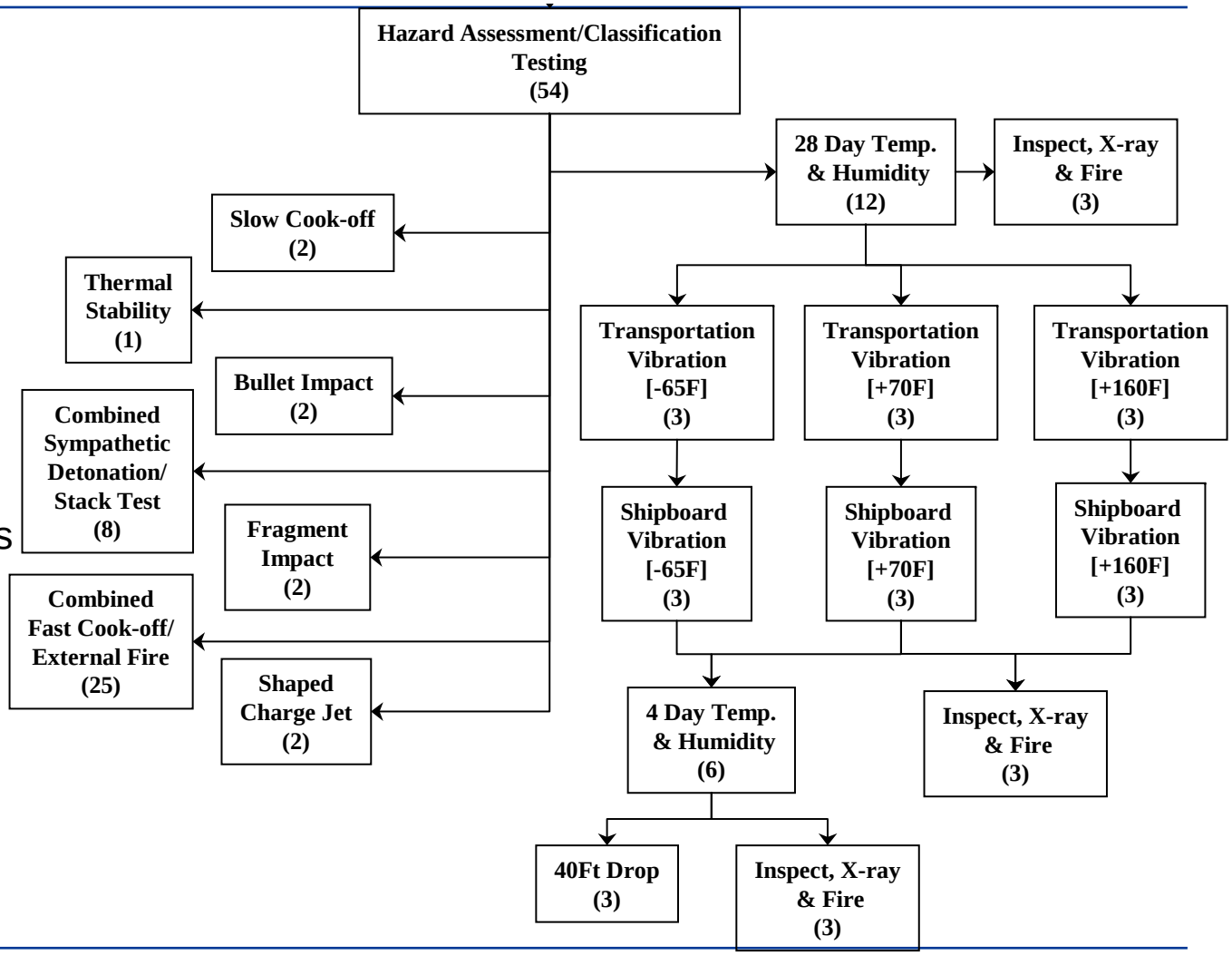
Test facilities included

- NSWC Dahlgren
- NSWC Crane
- Hawthorne

Hazard Assessment/Classification Qualification Test Plan

54 EFSS rounds of each ammunition type were tested

Testing required to meet MIL-STD-2105C, Hazard Assessment Tests for Non-Nuclear Munitions



EFSS Qualification Results

EFSS AMMUNITION QUALIFICATION STATUS April 16th, 2007							
	IM TESTS						
EFSS Round Types	**Slow Cook-Off**	**Fast Cook-Off**	**Fragment Impact**	**Bullet Impact**	**Sympathetic Detonation Confined**	**Sympathetic Detonation Unconfined**	**Shape Charge Jet**
HE	V	IV	III	V	Pass	Pass	I
Illumination	V	IV	III	IV	Pass	Pass	Not scheduled
Smoke Projectile	III	III (Mixed Pallet)	III	IV	Pass (Mixed pallet)	Pass (Mixed pallet)	Not scheduled
Smoke Tail Charge Assembly	IV		III	IV			Not scheduled
Practice	V	IV	III	IV	Pass	Pass	Not scheduled

IMRB reviewed the EFSS ammunition qualification results

- Testing reviewed and results officially scored
- Approved for submission for final qualifications

EFSS Qualification Conclusion

- All qualification testing in accordance with the basic test plan have been completed
- Testing conducted at the following locations:
  - NSWC Dahlgren
  - NSWC Crane
  - NSWC Indian Head
  - Hawthorne
  - Eglin AFB
- Strategic plan for future improvements being evaluated
- IOC scheduled for late September of 2007