Navy Insensitive Munitions Prioritization Methodology

Presented by

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Introduction

- Joint Services Insensitive Munitions Technical Panel (JSIMTP) Developing IM Technology Roadmap
- Services Developed Technology Rankings Independently
- Presentation Describes the Navy's Methodology and Results

Joint Services IM Technical Panel

Charter: Aimed at providing technical collaboration to meet IM policies:

- Provide advice and recommendations concerning IM **technology** issues to all decision makers
- Review all munitions' acquisition programs to identify windows of opportunity for **technology** integration
- Review Services' procurement planning and make recommendations for **technology** insertion
- Provide technical advice/recommendations to support DoD effort to lower Hazard Classifications for munitions

Membership:

- Each Service provides one member

JSIMTP Roadmap

- JSIMTP requested each Service prioritize IM technology needs
- Intent was to:
  - Establish priorities for technology focus
  - Eliminate duplicative effort
- Results were consolidated and forwarded to DoD IM IPT

Approach

JSIMTP

- Develop Generic Categories
- Assign Reaction Levels to Each Category
- Assign Confinement Levels to Each Category

Navy

- Quantify Reaction Level Score
- Assess Likelihood of IM Event
- Assess Net Explosive Weight (NEW) Factor

JSIMTP Categories

- General Purpose Explosives
- Advanced Penetrator Explosives
- Booster Explosives
- Metal Accelerating Explosives Pressed (Light Confinement)
- Metal Accelerating Explosives Pressed (Heavy Confinement)
- Metal Accelerating Explosives Extruded
- Metal Accelerating Explosives Castable (Light Confinement)
- Metal Accelerating Explosives Castable (Heavy Confinement)
- Underwater Explosives
- Pyrotechnic/Illumination Compositions
- Gun Propellant Large Caliber
- Gun Propellant Medium Caliber
- Solid Rocket Propulsion High Performance
- Solid Rocket Propulsion Minimum Smoke
- Solid Rocket Propulsion Reduced Smoke
- Cartridge Actuated Devices (CADs)
- Propellant Actuated Devices (PADs)
- Thermobaric

Sample JSIMTP Baseline Data

INDEX

IM General Purpose Explosives Assessment

Category	Current Formulations					New Formulations					System Technology					Confinement	Weapon Applications
	FCO	SCO	BI	FI	SD	FCO	SCO	BI	FI	SD	FCO	SCO	BI	FI	SD		
General Purpose Explosives	Explosive 1					Explosive 3					Shielding					HEAVY (H)	BLU-110 (H), Penguin (H), Harpoon (H), BLU-111 (H), JSOW (Unitary) (H), JDAM (H), GBU-24 B/B (H), Tomahawk BLK IV (H), BLU-117 (H), MK-80 Series, Hellfire AGM-114M (H)
	IV	V	V	V	F	V	V	V	V	P					P		
	Explosive 2					Explosive 4										HEAVY (H)	
	I	I	I	I	F	IV	V	V	V	(P)							

Sample JSIMTP Baseline Data

INDEX

IM Metal Accelerating Explosives Assessment

Category	Current Formulations					New Formulations					System Technology					Confinement	Weapon Applications		
	FCO	SCO	BI	FI	SD	FCO	SCO	BI	FI	SD	FCO	SCO	BI	FI	SD				
Castable	Explosive A					Explosive B										HEAVY (H)	5"/54 (H) 155mm Artillery (H)	60mm Mortar (H) 81mm Mortar (H)	
	(V) (BV)	(V) (BV)	(V) (BV)	V I	F	V	V	(V) (BV)	IV								120mm Mortar (H)	76mm Unitary (H)	
	Explosive C					Explosive E										HEAVY (H)			
	V	V	V	V	P		V		V										
	Explosive F					Explosive G					Venting					HEAVY (H)			
	III	III	I	I	F	IV		NR	NR	F	V	V							
	Explosive H															HEAVY (H)			
	V	V	IV	V	P														
						Explosive I										HEAVY (H)			
						II	IV	V	III	F									
	Explosive J															HEAVY (H)	Tomahawk WDU-36 (H)		
	V	IV	IV	IV	F														
	Explosive K					Explosive L										HEAVY (H)	ESSM (H)		
	V	V	V	V	(F)	V	V	V	V	P							STANDARD Missile (H)		
	Explosive M															LIGHT (L)	HARM (L)		
	V	IV	IV	IV	F														
	Explosive N					Explosive O										LIGHT (L)	Directional Ordnance	AIM-9X	
	(V)	(V)	(V)	(V)	(P)	(V)	(V)	(V)	(V)	(P)								RAM	
	Explosive P					Explosive Q					Replace Booster					LIGHT (L)	AMRAAM (L) 2.75 "Unitary (L)		
	V	V	V	I	P		IV	V	V	P				V					
	Explosive R															LIGHT (L)	Tomahawk BLU-97 (L)		
	IV	III	V	V	P												JSOW BLU-97 (L)		
	Explosive S															LIGHT (L)			
	I	(I)	V	(V)	P														
	Explosive T					Explosive U										LIGHT (L)	JSOW-SFW (L)		
	I	I	V	V	P	(V) (BV)	III	(V) (BV)	V	P									
	Explosive V															LIGHT (L)	Hand Grenade(L)		
	III	III	III	I	F												Mines(L)		

Approach

JSIMTP

- Develop Generic Categories Ö
- Assign Reaction Levels to Each Category Ö
- Assign Confinement Levels to Each Category Ö

Navy

- Quantify Reaction Level Score
- Assess Likelihood of IM Event
- Assess Net Explosive Weight (NEW) Factor

Factors for Reaction Level and Stimuli Likelihood

Discriminators		Weighting Factor [Rxn_W]				
		FCO	SCO	BI	FI	SD
Type 1 (Detonation)	I	10	10	10	10	10
Type 2 (Partial Detonation)	II	8	8	8	8	8
Type 3 (Explosion Reaction)	III	5	5	5	5	5
Type 4 (Deflagration Reaction)	IV	2	2	2	2	2
Type 5 (Burning Reaction)	V	1	1	1	1	1

Navy Ranking of Weapon Response to Unplanned Stimuli

		FCO	SCO	BI	FI	SD
Relative Likelihood of Experiencing IM Threats in a Shipboard Environment [L_E]		8	1	3	3	5

Relative Likelihood Of Experiencing A Given IM Threat

Net Explosive Weight Factor

NEW	[NEW_W]
< 0.5 lbs.	1
0.5 lbs - 2lbs	5
2.01 lbs - 10 lbs	10
10.01 lbs - 50 lbs	25
> 50 lbs	100

NEW Factors

Weapons were grouped into broad NEW categories to account for effects of large systems compared to small.

Category	Generalized Net Explosive Weight
General Purpose Explosive	> 50 lbs
Advance Penetrator Explosives	> 50 lbs
Booster Explosives	< 0.5 lbs.
Metal Accelerating Explosives Pressed (Light)	2.01 lbs - 10 lbs
Metal Accelerating Explosives Pressed (Heavy)	10.01 lbs - 50 lbs
Metal Accelerating Explosives Extruded	0.5 lbs - 2lbs
Metal Accelerating Explosives Castable (Light)	2.01 lbs - 10 lbs
Metal Accelerating Explosives Castable (Heavy)	10.01 lbs - 50 lbs
Underwater Explosives	> 50 lbs
Pyrotechnic / Illumination	0.5 lbs - 2lbs
Gun Propellant Large Caliber	> 50 lbs
Gun Propellant Medium Caliber	> 50 lbs
Solid Rocket Propulsion High Performance	> 50 lbs
Solid Rocket Propulsion Minimum Smoke	10.01 lbs - 50 lbs
Solid Rocket Propulsion Reduced Smoke	10.01 lbs - 50 lbs
Cartridge Actuated Devices (CADs)	< 0.5 lbs.
Propellant Actuated Devices (PADs)	0.5 lbs - 2lbs
Thermobaric	> 50 lbs

Navy Algorithm

The category score was calculated as follows:

$$\text{Category Score} = \Sigma\,(Rxn_w \bullet L_E) \bullet NEW_w$$

Where:

Rxn_w is the weapon response to unplanned stimuli,

L_E is the relative likelihood of experiencing a given IM event in the shipboard environment, and

NEW_w is the weighting factor for the generalized net explosive weight

Navy Algorithm Results

Navy Ranking							
Category	FCO	SCO	BI	FI	SD	Score	Ranking
General Purpose Explosive	16.0	1.0	3.0	3.0	50.0	7300	2
Advance Penetrator Explosives	16.0	1.5	4.5	4.5	27.5	5400	4
Booster Explosives	8.0	1.0				9	18
Metal Accelerating Explosives Pressed (Light)	40.0	1.5	4.5	10.5	27.5	840	12
Metal Accelerating Explosives Pressed (Heavy)	40.0	5.0	6.0	6.0	27.5	2113	8
Metal Accelerating Explosives Extruded	44.0	5.5	16.5	16.5	50.0	663	13
Metal Accelerating Explosives Castable (Light)	12.0	3.5	4.5	3.0	5.0	280	14
Metal Accelerating Explosives Castable (Heavy)	44.0	3.5	4.5	4.5	27.5	2100	9
Underwater Explosives	16.0	2.0	3.0	15.0	50.0	8600	1
Pyrotechnic / Illumination	28.0	2.0	4.5	6.0	5.0	228	15
Gun Propellant Large Caliber	16.0	3.5	6.0	15.0	5.0	4550	5
Gun Propellant Medium Caliber	16.0	2.0	3.0	3.0	5.0	2900	6
Solid Rocket Propulsion High Performance	28.0	7.5	10.5	9.0	5.0	6000	3
Solid Rocket Propulsion Minimum Smoke	40.0	10.0	30.0	30.0	5.0	2875	7
Solid Rocket Propulsion Reduced Smoke	16.0	3.5	4.5	6.0	5.0	875	11
Cartridge Actuated Devices (CADs)	8.0	1.0	3.0	3.0	5.0	20	17
Propellant Actuated Devices (PADs)	12.0	1.0	4.5	3.0	5.0	128	16
Thermobaric	8.0	1.5	3.0	3.0	5.0	2050	10

Navy Prioritization

Ranking	Categories
1	Underwater Explosives
2	General Purpose Explosive
3	Solid Rocket Propulsion High Performance
4	Advance Penetrator Explosives
5	Gun Propellant Large Caliber
6	Gun Propellant Medium Caliber
7	Solid Rocket Propulsion Minimum Smoke
8	Metal Accelerating Explosives Pressed (Heavy)
9	Metal Accelerating Explosives Castable (Heavy)
10	Thermobaric
11	Solid Rocket Propulsion Reduced Smoke
12	Metal Accelerating Explosives Pressed (Light)
13	Metal Accelerating Explosives Extruded
14	Metal Accelerating Explosives Castable (Light)
15	Pyrotechnic / Illumination
16	Propellant Actuated Devices (PADs)
17	Cartridge Actuated Devices (CADs)
18	Booster Explosives

Summary

- Navy IM technology needs were developed
- Other factors will be applied prior to assigning specific task priorities
  - Windows of opportunity for technology insertion
  - Fleet requirements for specific weapon systems
  - Evolving procurements and inventory postures
- Navy results were provided to JSIMTP
- JSIMTP aggregated Services' data into joint roadmap
- DoD IM IPT Chairman pursuing funding options