



CRANE DIVISION

NAVAL SURFACE WARFARE CENTER

Naval Crew Weapons Station Efforts

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Distribution Statement A: Approved for Public Release; Distribution is unlimited

Need Arises

- **USS Cole**
 - October 12, 2000
 - Killed 17 injured 39
- **Anti-Pirate patrols in Gulf of Aden and Indian Ocean**
 - Late 2007, US Navy began stepping up anti-piracy efforts when it received permission to enter Somali territorial waters.
 - Jan 2009, the US Navy in conjunction with 20 other nations formed the international anti-piracy fleet, Task Force 151.



Need Arises

- **Iran posturing in the Hormuz Strait**
 - Iranian Navy consists primarily of small patrol boats.
 - Feb. of 2007, began an increase in probing of Iraqi territorial waters
 - March of 2007, held 15 British Marines and Sailors hostage for a short time
 - January 2008, five Iranian patrol boats took aggressive action and “maneuvered within 500 yards of our ships”



Need Arises

- **These missions require tracking and engagement of relatively small boats.**
- **The distances to the vessels are typically short range.**
- **The primary weapons employed are crew-served weapons.**
- **Placing sailors on the gunwales with crew-served weapons to engage a small craft bearing automatic weapons requires protection**



History

- **Desert Shield/Storm**
 - Ballistic shields were installed on selected ships at the crew served weapons stations while serving in the Persian Gulf in support of Operation Desert Shield/Storm.
 - Simple laminated Kevlar panels.
 - Represented current technology at the time
- **Return to the Gulf**
 - In 2003 CGs and DDG received shields for operations in the Gulf.
 - Initially, Desert Shield/Storm armor brought out of storage and reissued.
 - Some new design, but no development with respect to environment, installation constraints, or even threat level completed.



Objectives

- **This project will develop the requirements document and subsequently the performance specification that will be used to purchase shipboard ballistic shields.**
- **This project will improve the ability of all Navy combatant surface ships to meet AT/FP threats through the use of ballistic shields that meet requirements.**
- **Improved ballistic shields will reduce the risk of loss of life.**
- **Standardization of ballistic shield requirements is expected to reduce overall fleet lifecycle cost.**
- **Performance spec will lead to a common ballistic shield product. There is currently no ballistic shield commonality across ship classes.**
- **Formalized performance specs will allow industry the ability to develop innovative off-the-shelf solutions.**

Approach

- **Two document approach.**
 - MIL-PRF document identifying issues unique to the installation and usage of the ballistic shields on naval vessels.
 - MIL-STD document addressing the majority of possible threat rounds both NATO and WARSPACT. It will provide comprehensive testing, qualification, and classification standards adaptable to all future Naval Ballistic Protection needs.



MIL-PRF-32379

- **Does not limit innovation**
 - Does not specify materials
 - Does not specify mounting methodology
- **Encourages all solutions**
 - Covers special considerations for permanent, semi-permanent, and removable designs.

MIL-PRF-32379

- **Documents all considerations and constraints**
 - **Includes**
 - **Material Handling**
 - **Coatings**
 - **Environmental Testing**
 - **Ship Unique Issues (Green water loading, vibrations, etc.)**
 - **Flight Operations**
 - **Storage Provisions**
 - **Ship's Operations**



MIL-STD-3038

- **Reviewed the majority of armor related standards and specs**
 - EN 1063
 - NIJ 0101_06
 - NIJ 0108_01
 - MIL-STD-662F V50 Ballistic Test for Armor
 - STANAG 4569
 - MIL-DTL-46100E Armor Plate Steel Wrought High Hardness
 - MIL-PRF-46103E Armor Lightweight Composite
 - MIL-PRF-46108C Armor Transparent
 - ATPD 2352P Transparent Armor Purchase Specification
 - MIL-B-29604(1) Body Armor Hard Small Arms Protective
 - MIL-DTL-46063H Armor Plate Aluminum Alloy, 7039
 - MIL-DTL-46077G Armor Plate Titanium Alloy Weldable

NIJ 0101.06 and 0108.01

- **NIJ pros/cons**

- **Pros**

- Excellent and comprehensive procedures for body armor applications

- **Cons**

- Limited round sizes; not very many military rounds
- Ambiguous multi-shot placement criteria.

Caliber	Round	Weapon	NIJ 0101_06
9 x 19	(9 mm; .40 S&W)	M9	IIA
	(9 mm; .357 Magnum)	Colt Python	II
11 x 41	(.357 SIG; .44 Magnum)	S & W Model 29	IIIA
7.62 x 39	Type PS	AK-47	
	API BZ M43		
5.45 x 39	5N7	AK-74	
5.56 x 45	M855	M16	
7.62 x 51	M80, M59	FN FAL	III
	AP M61		
7.62 x 63	M2	M1 Garand	
	AP M2		IV
7.62 x 54R	SOVIET, TYPE LPS	PKM	
	Type B32	Dragonuv	
12.7 x 108	12.7mm API&T, B32	DShK	
12.7 x 99	M2 Ball	M2 BMG	
	M2 AP		
14.5 x 114	14.5mm API-B32	KPV	
	14.5mm API-BS-41		
20 x 102	M75	M61 Vulcan	
	APT-M95		
	AP-T M602 (HVAP-T DM-43)		
23 x 152	23mm API-T BZT	2A14	
25 x 137	APDS-T M791	M242	
30mm	30 x 113mm	M230	
	30 x 165mm	GSh-30-1	
	30 x 173mm	GAU-8	

EN 1063

- **EN 1063 pros/cons**

- **Pros**

- Good multi-shot placement methodology
- Included military significant rounds

- **Cons**

- No Warsaw Pact weapons
- Limited threat size.

Caliber	Round	Weapon	EN 1063
9 x 19	(9 mm; .40 S&W)	M9	EN BR2
	(9 mm; .357 Magnum)	Colt Python	EN BR3
11 x 41	(.357 SIG; .44 Magnum)	S & W Model 29	EN BR4
7.62 x 39	Type PS	AK-47	
	API BZ M43		
5.45 x 39	5N7	AK-74	
5.56 x 45	M855	M16	EN BR5
7.62 x 51	M80, M59	FN FAL	EN BR6
	AP M61		EN BR7
7.62 x 63	M2	M1 Garand	
	AP M2		
7.62 x 54R	SOVIET, TYPE LPS	PKM	
	Type B32	Dragonuv	
12.7 x 108	12.7mm API&T, B32	DShK	
12.7 x 99	M2 Ball	M2 BMG	
	M2 AP		
14.5 x 114	14.5mm API-B32	KPV	
	14.5mm API-BS-41		
20 x 102	M75	M61 Vulcan	
	APT-M95		
	AP-T M602 (HVAP-T DM-43)		
23 x 152	23mm API-T BZT	2A14	
25 x 137	APDS-T M791	M242	
30mm	30 x 113mm	M230	
	30 x 165mm	GSh-30-1	
	30 x 173mm	GAU-8	

MIL-STD-662

- **662 pros/cons**
 - **Pros**
 - **Excellent for categorizing the ballistic limits of a given sample of armor.**
 - **Cons**
 - **Inefficient for acceptance testing**
 - **Doesn't give yes or no for the purpose of acquisition engineering**
 - **Without defined levels, difficult to develop off-the-shelf materials**
 - **Does not cover multiple shot grading**

MIL-STD-3038

- **Selected best practices from among all reviewed documents**
- **Massaged given info**
- **Filled in gaps and loopholes**
 - **Current Standards primarily NATO rounds only.**
 - **Special considerations for tiled solutions**
 - **No obliquity allowances**
 - **Based on advertised muzzle velocity of given threat**
 - **Designed to easily cross-reference between threat round, common weapons, and ballistic properties.**

MIL-STD-3038

- **Does not limit innovation**
 - Does not specify materials
 - Encourages new chemical compositions of existing armor materials.
- **Encourages all solutions**
 - Allows for single shot or multi-shot
 - Allows for ball round or armor piercing



MIL-STD-3038

- **Transparent and opaque**
 - Allows transparent and opaque.
 - Provides small changes based on typical usage
 - Thinner witness plate for transparent
- **More specific shot placement**
 - Multiple required locations for all coupons
 - Special considerations for tiled coupons



MIL-STD-3038

MIL-STD-3038			Threat Information			Existing Standards			
Type	Class		Caliber	Round	Weapon	NIJ 0101_06	UL 752	NATO STANAG 4569	EuroNorm EN 1063
I	A	B	9 x 19	9mm FMJ RN M882	M9	IIA	1,6		EN BR2
				9mm FMJ RN	Colt Python	II	2		EN BR3
II	A		11 x 41	.357 SIG FMJ FN AA 19	S & W Model 29	IIIA	3		EN BR4
III	A	B	7.62 x 39	Type PS	AK-47			Level 2	
				API BZ M43					
IV	A	B	5.45 x 39	5N7	AK-74				
				7N22 AP					
V	A	B	5.56 x 45	M855	M16		7	Level 1	EN BR5
				AP M993					
VI	A	B	7.62 x 63	M2	M1 Garand		4		
				AP M2		IV	9		
VII	A	B	7.62 x 51	M80, M59	FN FAL	III	5,8	Level 1	EN BR6
				AP M61				Level 3	EN BR7
VIII	A	B	7.62 x 54R	SOVIET, TYPE LPS	PKM Dragonuv			Level 3	
				Type B32					
IX		B	12.7 x 108	12.7mm API&T, B32	DShK				
X	A	B	12.7 x 99	M33	M2 BMG		10		
				M263					
XI	A	B	14.5 x 114	14.5mm API-B32	KPV			Level 4	
				14.5mm API-BS-41					
XII	A	B	20 x 102	M75	M61 Vulcan				
				APT-M95					
XIII		B	23 x 152	23mm API-T BZT	2A 14				
XIV		B	25 x 137	APDS-T M791	M242			Level 5	
XV		B	30mm	M789 HEDP	M230				
XVI		B	30mm	30 x 165mm BT	GSh-30-1				

High-Lighted selections represent Warsaw Pact weapons

Questions?

