

CRANE DIVISION

NAVAL SURFACE WARFARE CENTER

Naval Crew Weapons Station Efforts

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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

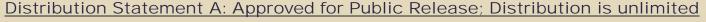
Desert Shield/Storm

- 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**









- 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	AN-47	
5.45 x 39	5N7	AK-74	
5.56 x 45	M855	M16	
7.62 x 51	M80, M59	FN FAL	Ш
	AP M61	FN FAL	
7.62 x 63	M2	M1 Garand	
	AP M2	Wil Garand	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	IVIZ DIVIG	
14.5 x 114	14.5mm API-B32	KPV	
	14.5mm API-BS-41	KPV	
20 x 102	M75		
	APT-M95	M61 Vulcan	
	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	



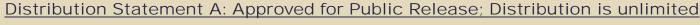


EN 1063

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	AN-41	
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	FINFAL	EN BR7
7.62 x 63	M2	M1 Garand	
	AP M2	Wil Galaliu	
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	IVIZ DIVIG	
14.5 x 114	14.5mm API-B32	KPV	
	14.5mm API-BS-41	KF V	
20 x 102	M75		
	APT-M95	M61 Vulcan	
	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	









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 offthe-shelf materials
 - Does not cover multiple shot grading





- 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.



- 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









- 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-ST	D-303	Threat Information			
Туре	Cla	ass	Caliber	Round	Weapon
I	A		9 x 19	9mm FMJ RN M882	M9
1		В	9 X 19	9mm FMJ RN	Colt Python
II	A		11 x 41	.357 SIG FMJ FN AA 19	S & W Model 29
III	A		7.62 x 39	Type PS	AK-47
1111		В		API BZ M43	A N- 47
IV	A		5.45 x 39	5N7	AK-74
1 V		В	J.43 X 39	7N22 AP	AK-/4
V	A		5.56 x 45	M855	M16
V		В	J.JU X4J	AP M993	WI 10
VI	A		7.62 x 63	M2	M1 Garand
VI		В	7.62 X 63	AP M2	MT Garand
VII	A		7.62 x 51	M80, M59	FN FAL
VII		В		APM61	FNFAL
VIII	A		7.62 x 54R	SOVIET, TYPE LPS	PKM
٧١١١		В	7.02 X 34K	Type B32	Dragonuv
IX		В	12.7 x 108	12.7mm API&T, B32	DShK
X	A		12.7 x 99	M33	M2 BMG
Λ	X	В		M263	MIZ BINIG
XI	A		14.5 x 114	14.5mm API-B32	KPV
ΛΙ	В		14.5mm API-BS-41	KPV	
XII	A		20 x 102	M75	M61 Vulcan
All		В	20 X 102	APT-M95	with vuican
XIII		В	23 x 152	23mm API-T BZT	2A14
XIV		В	25 x 137	APDS-T M791	M242
XV		В	30mm	M789 HEDP	M230
XVI		В	30mm	30 x 165mm BT	GSh-30-1

Existing Standards					
NIJ 0101_06	UL 752	NATO STANAG 4569	EuroNorm EN 1063		
IIA	1,6		EN BR2		
II	2		EN BR3		
IIIA	3		EN BR4		
		Level 2			
	7	Level 1	EN BR5		
	4				
IV	9				
III	5,8	Level 1	EN BR6		
		Level 3	EN BR7		
ļ		I12			
		Level 3			
	10				
	10				
		Level 4			
		LCVCI 4			
		Level 5			

High-Lighted selections represent Warsaw Pact weapons
Distribution Statement A: Approved for Public Release; Distribution is unlimited





Questions?

