

Design for Demilitarization – Be Creative Now or Pay Me later

Synopsis: This presentation will share the progress made while serving on the Army Program Manager (PM) for Demil's Integrated Progress Team (IPT) established in fiscal year 2003 to implement "Design for Demil" (DFD) among the services. The comments on the IPT participation are from the standpoint of a Navy Activity, Indian Head Division, Naval Surface Warfare Center, which is experienced in basic and applied munitions R&D, munitions production and demil.

Abstract: The Army PM Demil Strategic Plan included DFD as a key goal. The program included six pillars deemed important for DFD implementation: establishment of official policy; development of metrics; creation of helpful tools, one of which will be a DFD handbook; publishing lesson learned from demil experience; devising a template of contractual requirements for munitions contractors; and participation on the IPT.

Former practice lead munitions design engineers to focus on performance. As a result there were problems costing time and money and possibly increasing risk when the munition was subjected to demil. These may have involved toxic constituents, hard to disassemble components or other challenges. Demil can drastically raise life cycle cost and diminish readiness. The importance of life cycle management, reaching from the genesis of the munition to the demilitarization, has refocused design.

This presentation will give examples of munitions which have designs leading to problematical demil, such as the Army's Adam Mine; discuss desirable design characteristics such as modularity, energetic material designed for easy demil; resource recovery and recycling; and minimization of toxic materials of construction. All of these can affect the management of the munition throughout its life cycle, not just at its end.

As well, it will discuss progress in educating government and contract design engineers about DFD concepts, progress in informing program managers of the importance of DFD; and success in placing stronger DFD requirement language on acquisition directives.

EXTENDED ABSTRACT

Design for Demilitarization (DFD) - what is DFD and why is my organization interested in this concept? Indian Head Naval Surface Warfare Center's mission is integrally related to the environment and life cycle management of weapons systems. Located about twenty miles south of the Washington, DC beltway, the facility is recognized as a national resource for energetics technology. The base provides research, development, test and evaluation and in-service support of energetics and energetic materials for warheads, propulsion systems, ordnance and

pyrotechnic devices and fuzing for the Navy. Indian Head operates production plants for Navy ordnance such as warheads, rocket motors and cartridge and propellant actuated and cartridge actuated devices. Also located at Indian head NSWC is a permitted treatment, storage and disposal open burn and open detonation facility as well as a car - bottom furnace for closed treatment of materials and equipment contaminated with energetic materials. There are facilities for sawing weapons to access components and energetics and for performing high pressure water washout, both of which can be used to access or remove the energetics which must be done for demil or reuse. In short, Indian Head NSWC is a full service energetics facility with responsibilities from 'cradle to grave.'

The Detachment where the author works is located in Virginia and shares the same mission as the parent facility but specializes in explosives. Designated by Navy Instruction, the Yorktown facility writes documents called Naval Munitions Data, which, relying experimental loading of explosives into a weapon, provide documentation specifying safe loading procedures for conventional ammunition. In conducting studies to support writing the NMDs, a weapon may be loaded with explosives which then may be removed by water washout or melting or other means for additional tests. Other work also includes product improvement programs which can periodically introduce new energetics or designs into a weapon.

The execution of many of the mission responsibilities results in evaluation of assembly/disassembly and loading /downloading techniques. It is this direct interaction with weapons components, the actual energetics and raw batch additives leading to the safe assembly of the weapon that I think gives Indian Head a unique insight into to concepts for DFD. With this background we saw participation in the Army-sponsored Design for Demil Integrated Product Team (IPT) as a way to interact with other organizations responsible for design, testing and demil and to learn from them and to share design for demil history and lessons learned.

Basic Definitions: For those not familiar with the end of the life cycle of a munition, DoD 4160.21-M-1, "Defense Demilitarization Manual", October 21, 1991; Incorporating Change 1 - February 14, 1995, defines:

demilitarization as the act of destroying the military offensive or defensive advantages inherent in certain types of equipment or material. The term comprehends mutilation, dumping at sea, cutting, crushing, scrapping, melting, burning, or alteration designed to prevent further use of this equipment and material for its originally intended military or lethal purpose and applies equally to material in unserviceable or serviceable condition that has been screened through an Inventory Control Point (ICP) and declared surplus or foreign excess; and **disposal** as the process of redistributing, transferring, donating, abandoning, destroying or other disposition of DOD personal property.

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In simpler terms which says it all, Merriam Webster online defines demilitarization as: to rid of military characteristics or uses. Of course, times change and new environmental thinking, security and safety needs are always influencing demilitarization, defining boundaries and pointing in new directions, many of which require research and development.

The Defense Logistics Agency (DLA) handles surplus government property. Field activities under the DLA comprise the Defense Reutilization and Marketing Service (DRMS) which manages disposal of hazardous property for DOD activities, getting the most use or value out of each item and minimizing environmental and safety risks and costs. DRMS manages the DOD surplus property sales program. Excess property that is not reutilized, transferred or donated may be sold to the public as surplus.

Looking at environmental impact, the Resource Recovery and Recycling Program (R3) conserves natural resources, reduces waste products and returns revenue to the military services. The Precious Metals Recovery Program significantly reduces the need for DOD to purchase metals such as gold, silver and platinum family metals by recycling excess and surplus scrap containing precious metals.

There are many components of weapons systems that can be refurbished and reused as units, removed and reprocessed for weapons use or by reclaiming raw materials for sale or reuse, the R3 above.

This then, brings us to demilitarization. "Certain property is demilitarized (i.e., rendered useless for its originally intended purpose). Surplus property with inherent military characteristics must undergo "demil." Offensive and defensive weapons and associated material are demilitarized prior to sale or as a condition of sale. (Wikipedia, Sep 2008). The next paragraphs point out some documents which create constraints on popular demil methods. For example, dumping at sea, an extreme method is not now allowed by Federal regulations

There are many DOD regulations to ensure the security and safety of demilitarized weapons to define what must be demilitarized and regarding environmental impact. Three of the several demil documents are DoD 4160.21-M-1, "Defense Demilitarization Manual" and, October 21, 1991; Incorporating Change 1 - February 14, 1995; DoD 4160.21-M, "Defense Materiel Disposition Manual", August 18, 1997; and specific guidance for property identified as Munitions List Items (MLI)/Strategic List Items (SLI) is found in DoD 4160,2 1-M-1, Defense Demilitarization and Trade Security Control Manual. These instructions are under the authority of DoD 4140.1 -R, "Department of Defense Materiel Management Regulation. There are exceptions from this authority such as nuclear

weapons. The Defense Reutilization and Marketing Service (DRMS) operations are also applicable to Federal civil agency excess and surplus property turned-in to a Defense Reutilization and Marketing Office (DRMO), for disposition under applicable interagency agreements.

Because DFD is a process which can make the entire life cycle of a weapons system greener or reduce the carbon footprint (in today's vernacular), less costly to demil, easier to modernize or upgrade there are many reasons why an organization such as ours is interested in the policy. Since the Facility where the author works and wherein he author's experience lies, this presentation abstract focuses on demil of conventional ammunition containing energetic materials, and participation in the U.S. Army Design for Demil IPT.

Environmental pressures have made the use of the traditional treatment method of munitions at the end of the life cycle, open burning/open detonation less acceptable. Alternative treatment methods known as "closed demil technologies" were implemented as research and development and evaluation fielded new methods. In closed technologies pollutant releases are contained and minimized or eliminated. In about 1996, by dollars spent, closed demil technologies overtook OB/OD as the primary overall method of demil. (Conventional Munitions Design for Demilitarization Implementation Plan, U.S. Army Product manager for Demilitarization, Jan 04.) In addition, demil began to be looked at as an asset, producing components and materials which could be recycled or reused or sold, and Resource Recovery and Recycling (R3), as it known as, includes more than 70% of demil operations today. More sophisticated demil methods began to show design decisions made very early in the ammunition life cycle would have a dramatic impact on end-of-life-cycle demil operations in cost (time to disassemble) is a large part of cost), complexity, environmental footprint and opportunity for R(3).

The Army and many others in DOD saw the value in "design for demil." No coordinating body existed in the DOD to implement a DFD program in the ammunition design community. The stand up of the Program Manager for Joint Services and the Product Manager for Demilitarization (PM Demil) within the Program Executive Office for Ammunition (PEO AMMO) changed this. Under charter the PM Demil has the responsibility for the life cycle management of recycling, demilitarization and disposal of energetic materials and munitions for the Army, Navy, Air Force, Marines and other Department of Defense and U.S. Government Activities. PM Demil is the Single Manager for Conventional Ammunition (SMCA) for demil management and intends to assure a design for demil approach early in the life cycle or during ammunition system modifications or product improvements. Almost 70% percent of the cost of a product is set by decisions made early in the engineering process. (Executive Summary, "Retooling Manufacturing: Bridging Design, Materials and Production", Committee on Bridging Design and manufacturing, National Research Council, ISBN 978-0-309-09266. (Executive Summary available online at www.nap.edu.) As a result, PM Demil directed that a "design for demil" IPT be established to determine how to develop and implement a design for demil program.

The first IPT organizational meeting occurred on 7 May 03 at Picatinny Arsenal with about 32 multiservice members. Other Navy participants included NSWC Crane, IN; Naval Air Systems Command, PMA-201; Marine Corps, Systems Command, Quantico, VA and Navy Ammunitions Logistics Center, Mechanicsburg, PA. A representative, Mr. William Houchins, on assignment from Office of Secretary of Defense to Dahlgren NSWC, although not formally joining the IPT, added additional Navy emphasis through the Joint Ordnance Commanders Group Demil/Disposal Group. He proposed an initiative of creating a “design for demil handbook” which is now at the forefront of the IPT agenda. Mr. Gary Mescavage of U.S. Army ARDEC, Picatinny Arsenal, NJ, (973) 724-3349, gary.mescavage@us.army.mil has been the IPT Leader from the stand up of the IPT. The original IPT Charter dated 7 May 2003, included 27 members and has fluctuated in numbers and sponsoring organizations over the years.

Quickly formed were three subcommittees, the names of which describe the goals: Metrics, Policy and Design for Demil Handbook. Metrics for documenting DFD have proven challenging to document and this is a continuing effort. Time to disassemble may prove a good metric. The National Academy of Sciences states in systems approach to design and engineering the cost of a product (consider weapons as a product) over its lifetime is considered. Gathering the necessary data may be expensive and arbitrary in assessments of life cycle costing: first there is acquisition including design, development and manufacturing; second there is operating cost or cost of ownership. Third, says the Academy, there “is the environmental impact of manufacturing processes and end of life recycling or disposal. The ownership cost is particularly relevant in defense systems which may last for generations, and “design decisions can have a profound impact on the adaptability of defense systems to modifications or retrofits.” (Retooling Manufacturing: Bridging Design, Materials and Production,” National Academy of Sciences (<http://books.nap.edu/catalog/11049.html>)). “Metrics for quantifying all these assessments are challenging. Accurate assessment is difficult because gathering the necessary data is expensive and also may be subjective or arbitrary. One reason is that recycling is often done by widely distributed small businesses that operate with a variety of business models making the economics of the industry opaque.”

The policy is driven by documents such as executive orders such as and federal acquisition documents. These will be briefly discussed historically in the presentation but the goal of the DFD IPT was to put “teeth onto the requirement, and that has finally occurred with the with the signing of the Design for Demil Policy Letter by the Undersecretary of Defense for Acquisition, Technology, and Logistics dated 4 Aug 08. “To Implement Design for Demilitarization, Military Departments, Defense agencies and the U.S. Special Operations Command will include in their acquisition documentation for all pending (i.e. pre-milestone A) and future conventional ammunition programs how they intend to address demilitarization requirements throughout system design. Six specific requirements for Design for Demilitarization of conventional ammunition are attached to the

letter. Mr. Jose Gonzalez of the OUSD (AT&L) is the Undersecretary's point of contact at 703-693-9203. Armament Research, Development, Development and Engineering Center is the Army point of contact at 703-693-9203.

The Design for Demil Handbook will be an on-line living document to explain to the design engineer what is expected in design for demil and will be located on a web site under the auspices of the Army. The handbook will also give demil lessons learned, sources of information to assist in design and templates.

The presentation will discuss specific examples of designs that have presented demil problems. When open burning or open detonation were the primary demil techniques, engineers and designers did not need to be concerned with demil issues. Performance was the primary concern. Design had little impact on the performance of efficient demil. Mr Mescavage discusses implementation of Design for Demil (DFD) in the Joint Services in a recent presentation at the 16th Global Demil Symposium and Exhibition, Salt Lake City, Utah, 5-9 May 2008. He gives an example of a weapon which is problematical for demil, inadvertently by design, Use of a depleted uranium salt in a polymer used in the mine body requires the use of cryogenic fracture to separate the uranium matrix from the mine. Other examples of demil problems related to Navy Weapons will be outlined.

Design for Demil is a major change in design approach, but with an investment early in the life cycle, it will improve lifecycle management and control the end of life cycle demil cost.

Lauritzen, E. K. , Egebart, C. L. and Larson, S. G. , "The Challenge of Demilitarization and Disposal of Ammunition – Environmental & Economic Considerations of Weapon Systems," presentation at the ISSC Seminar no. 560/01, Trends in Weapon Development in the 21st Century, Brussels, 3,4 May, 2001.