No Silver Bullets for Conventional Ammunition Demilitarization

Larry Gibbs, Dorothy Olson and Raymond Goldstein

The Conventional Ammunition Demilitarization (demil) program’s estimated liability is $1.2 billion more than the Program Objective Memorandum with the demil stockpile standing at 392,162 tons as of February 2004. The true story may be even worse because those figures do not include 69,880 Army missiles; excess ammunition (ammo) in Korea, Europe and Southwest Asia; or obsolete ammo still in field service accounts worldwide.
The Product Manager for Demilitarization (PM Demil) has life-cycle management responsibility for demilitarizing and disposing conventional munitions for all U.S. military services. A mission goal is to develop capability through research and development (R&D) programs where capability, technology and facilities do not currently exist to ensure effective, efficient ammo demil.

PM Demil relies on its field operating agencies — the Joint Munitions Command at Rock Island Arsenal, IL, and the U.S. Army Aviation and Missile Command at Redstone Arsenal, AL — to reduce the stockpile. The Demil Enterprise’s ability to successfully execute the mission depends largely on significant R&D undertakings led by the Defense Ammunition Center (DAC), a tenant organization of the McAlester Army Ammunition Plant, OK, and the Armaments Research, Development and Engineering Center (ARDEC) at Picatinny Arsenal, NJ.

DAC and ARDEC play crucial roles in the PM Demil Strategic Plan to achieve two key goals: driving demil to higher closed disposal technologies (CDT), and the aggressive pursuit, transition and integration of R&D technologies to enhance demil execution capabilities and processes.

The PM Demil R&D strategy that supports these strategic goals will fund projects that:

- Resolve demil stockpile and demil issues.
- Provide a reasonable return on investment.
- Address technology voids in demil execution capability.
- Enhance safe demil operations and safeguard the environment.
- Provide opportunity for participation by industry, academia, international and governmental interservice agencies and committees.

There are no “silver bullets” to effectively and efficiently demil munitions — it is a complicated and often complex problem. Variations in munitions size,
complexity, filler materials and assembly methods, coupled with the need to provide operators with safe, environmentally compliant and economic processes, continually provide challenges for the demil community. Today, Congress and DOD mandate less reliance on open burn/open detonation (OB/OD) processes and more on environmentally acceptable CDT. By definition, CDT is a primary demil method and is essentially an alternative technology to OB/OD, which includes resource recovery and recycling (R3) and reuse. More than 78 percent of PM Demil’s procurement funding is spent on demil execution using CDT processes.

PM Demil manages two separate R&D programs:

- **Project D51**, the Explosives Demilitarization Technology Program, is managed by DAC. **Project D51** is a DOD Joint-funded, cooperative, interservice, interagency effort dedicated to the maturation of safe, efficient and environmentally acceptable CDT capability and processes.

- **Project F24**, the Conventional Ammo Demil Program, is managed by ARDEC as part of the Army Munitions Standardization, Effectiveness and Safety program. **Project F24** supports a continuing technology evaluation of demil methods for conventional munitions. Like the Joint D51 program, the Army F24 program conducts R&D related to the development and demonstration of new, safe and environmentally acceptable alternatives to OB/OD.

**The Joint D51 R&D Program**

The DAC Technology Directorate centrally manages the D51 Explosives Demil Technology Program and integrates military service requirements through the PM Demil R&D Integrated Product Team (IPT) and the Joint Ordnance Commander’s Group Demil Subgroup. This program leverages resources from Department of Energy national laboratories, academia and industry to promote demil technology development and transition emerging technologies to the government organic base or commercial sector. DAC provides acquisition, technical, engineering and scientific services and support including program management for all R&D projects. The Munitions Items Disposition Action System (MIDAS) database characterizes munitions and MIDAS supports demil R&D applications, forming the bridge between technology R&D and the demil user community.

The Joint program focuses on demil R&D thrust areas to address capability gaps. The accompanying table shows application of select technologies under development, separated by thrust areas.

Examples of past successes are the stationary and transportable Contained Detonation Chambers employed at unexploded ordnance sites, ammunition-peculiar equipment 1995 Near Infrared Propellant Analyzer, cryocycling of high-velocity aircraft rocket (Continued on Page 58.)

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**Explosive Demil Technology Program**

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<tr>
<th>Thrust Area Area Technology</th>
<th>Application</th>
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<tbody>
<tr>
<td>Disassembly</td>
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<tr>
<td>Automated Munitions Disassembly</td>
<td>Submunitions from improved conventional munitions</td>
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<tr>
<td>R3</td>
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<tr>
<td>Explosive D Conversion</td>
<td>Explosive D to Picnic Acid</td>
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<tr>
<td>Propellant Conversion</td>
<td>Single-/double-based propellants to fertilizer</td>
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<td>HMX Requalification</td>
<td>Requalification of reclaimed HMX for military applications/new munitions</td>
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<td>Thin Layer Chromatography</td>
<td>Enables safe reuse of military propellants</td>
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<tr>
<td>Destruction</td>
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<tr>
<td>Detonation Chamber</td>
<td>35 pounds net explosive weight maximum</td>
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<tr>
<td>Photocatalytic Degradation</td>
<td>Organic materials and explosives</td>
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<tr>
<td>Waste Stream Treatment</td>
<td></td>
</tr>
<tr>
<td>MSO</td>
<td>Energetic contaminated carbon</td>
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<tr>
<td>SCWO</td>
<td>Energetic contaminated water</td>
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Life Cycle Management Commands

In August 2004, the Army Chief of Staff approved an initiative created by the Assistant Secretary of the Army for Acquisition, Logistics and Technology and the Army Materiel Command CG for the two organizations to create Life Cycle Management Commands (LCMCs). These LCMCs allow the Army to bring together relevant acquisition, logistics and sustainment teams to support Soldiers. The entire community will be involved in shortening the acquisition process and rapidly fielding equipment to Soldiers. This initiative supports the Army’s goal to transform to a more lethal and agile force that requires a smaller logistical footprint to sustain itself.
To create the first four LCMCs, the Aviation and Missile Command, Communications-Electronics Command, Joint Munitions Command and Tank-automotive and Armaments Command have been realigned with the program executive offices (PEOs) with which they work. In some cases, LCMC commanders may be dual-hatted as PEOs. The PEOs for Simulation, Training and Instrumentation; Joint Chemical and Biological Defense; Air, Space and Missile Defense; and Enterprise Information Systems are not initially affected. The Research, Development and Engineering Command retains its technology mission and remains strategically and operationally linked to the new LCMCs and PEOs.
motors and base hydrolysis of cartridge-actuated devices/propellant-actuated devices (CAD/PAD) at Tooele Army Depot, UT.

There are exciting Joint projects on the horizon including combinations of existing equipment, equipment developed under Joint programs and new technologies to create integrated demil and recycling facilities. At Anniston Munitions Center, AL, a Missile Recycling Center will incorporate a new methodology to disassemble and recycle Multiple Launch Rocket System rockets. In the Republic of Korea, a Munitions Demil Facility will include Propellant Conversion, Molten Salt Oxidation (MSO) and Super Critical Water Oxidation (SCWO) units. At Hawthorne Army Depot, NV, the demil facility will incorporate a Hot Gas Decontamination unit and enhanced incineration and recovery capabilities. At McAlester Army Ammunition Plant, the Cryofracture Facility, developed under the ARDEC program, incorporates robotic disassembly and induction heating technologies from the Joint and Army programs.

DAC leads the PM Demil R&D IPT, which evaluates all R&D programs and prioritizes competing technologies using an analytic hierarchy process. The process comparatively ranks technologies based on criteria for demil capability, technical synergism and environmental, safety and technical risk. All services have input to the prioritization process and participate in project evaluations.

The Army F24 R&D Program

The ARDEC Energetics, Warheads and Environmental Technology Directorate provides centralized management of the Army F24 Conventional Ammo Demil Program and integrates requirements through PM Demil R&D IPT and the DAC Technology Directorate. While the program includes new destruction technology, an emphasis is placed on first attempting to develop CDT capability and processes. The program seeks broad-based applications with opportunities for partnering and leveraging with other government agencies, private industry and academia. Where possible, dual-use technology is identified and pursued. Presently, projects are underway in the areas of plasma arc thermal treatment, cryofracture, recovery of magnesium from pyrotechnic munitions and MSO.

R3 Processes

Plasma arc thermal treatment uses super-hot (25,000 F) plasma to destroy the energetics in munitions with no environmental impact. Inorganic materials are melted into a nonhazardous glassy slag or recoverable metal layer. The plasma is created by electrical energy input into a gas flowing through a torch, which is contained in a furnace. This plasma furnace allows demil of pyrotechnic and smoke munitions, fuzes and CAD/PAD items, which are difficult to process by any other means. Two prototype systems have been built and are undergoing systems qualification; a stationary system at Hawthorne Army Depot and a mobile system at a commercial site in West Virginia.

Cryofracture is a process whereby munitions are frozen in liquid nitrogen and then fractured using a hydraulic press. The fractured pieces are then treated via thermal deactivation or separated for disposal or recovery allowing demil of small, steel-bodied, high explosive-loaded munitions such as grenades, mines and submunitions found in improved conventional munitions (ICMs) and cluster bomb units (CBUs).

A prototype process has been built and is undergoing demonstration and validation of demil capability and processes at the McAlester Army Ammunition Plant. There is also a project underway to integrate the cryofracture and mobile plasma processes into a transportable, mobile configuration allowing a complete, modular, munitions demil facility capable of being disassembled, relocated by tractor-trailers and reassembled at a desired site quickly. The system will be capable of demilitarizing small-to-medium-sized, explosive-containing, conventional munitions such as hand grenades, anti-personnel mines,
medium-caliber projectiles and submunitions downloaded from CBU, ICM and large-caliber artillery projectiles.

Magnesium recovery from obsolete pyrotechnic munitions is an important CDT project using R3 processes. A prototype process with an initial capacity to produce 90,000 pounds per year of recovered magnesium is being designed for installation at Crane Army Ammunition Activity, IN, in FY06. Successful technology implementation will yield a significant savings over the virgin material cost and eliminate dependence on a single supply source.

Starting as a DAC initiative and later transitioning to ARDEC, the MSO program is a flameless oxidation process enabling destruction without incineration for a wide variety of bulk munitions, energetic materials and related by-product wastes with virtually no environmental impact. A pilot program demonstrated the process with plans for prototype system installation at Blue Grass Army Depot, KY, in FY06.

Demil R&D technology is the cornerstone supporting strategic initiatives for reducing the U.S. demil stockpile, developing and providing additional supply sources and ensuring demil processes are safe and environmentally sound. Demil capabilities, technologies and processes are resulting from joint collaborative team efforts within the Demil Enterprise to ensure R&D programs are adequately funded, integrated and synchronized to ensure effective transition to impact demil execution. A myriad of exciting demil R&D challenges and solutions are just over the horizon and the total R&D program’s synergy will provide the silver bullet — much needed solutions to help tackle conventional ammo demil.

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Supplying our troops on the front line with quality ammunition of the right type and in the right quantity is a critical challenge in time of war for the logistics community. In the coming years, an equally daunting challenge will be demilitarizing obsolete ammo from field service accounts worldwide. (U.S. Army photo.)