Resodyn™ ACOUSTIC MIXERS

RAM5 H Saves $25M for Munitions Manufacturer

How ResonantAcoustic® Mixing Delivered Documented ROI at the U.S. Army's Premier Bomb Loading Facility

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OVERVIEW

The McAlester Army Ammunition Plant (MCAAP) in McAlester, Oklahoma is the premier bomb and warhead loading facility of the Department of Defense. [1]

When MCAAP needed a better way to manufacture plastic bonded explosive (PBX), they turned to ResonantAcoustic® Mixing (RAM) technology. Starting with a RAM5 H in 2014, MCAAP used RAM to produce near-net-shape explosive components, eliminating the costly post-cure machining steps that had defined energetics manufacturing for decades. [2]

The return on investment has been substantial. Lawrence Farrar, CEO of Resodyn Acoustic Mixers, confirmed the results in a DOD publication: the RAM5 H operates at one-third of the cost, saving the U.S. Army over $18M as of January 2023, with the system still in service, and an estimated $25M as of 2026. [3]

Solution

- ResonantAcoustic® Technology
- Near-Net-Shape / Mix-in-Case PBX Manufacturing
- Elimination of Post-Cure Machining and Cleaning Waste
- RAM5 H Production-Scale Platform

Achievement

- $25 Million in Savings
- Cost Reduced by 2/3 — Over $1,000 Per Part [3]
- Mixing Time Reduced from Hours to Minutes [4]
- Fully Compliant with Stringent Safety Standards

CHALLENGES

Conventional manufacture of PBX components requires casting explosive material into cylindrical shapes, then machining those shapes down to the precise geometry required for bomb assembly. This multi-step process is slow, labor-intensive, generates significant contaminated waste, and exposes personnel to repeated handling of hazardous material.

Independent research conducted by the Naval Air Warfare Center Weapons Division confirmed the scope of these legacy challenges. Conventional cast-cure processes require a batch mixing bowl that must be cleaned after every production run, generating contaminated waste composite and requiring cleaning solvents at each cycle. Material transfer between the mixing bowl and the final vessel produces additional waste and exposes workers to hazardous conditions at every step. [5]

For MCAAP, operating under stringent safety protocols and continuous pressure to reduce production costs, these legacy constraints represented an ongoing financial burden. The need for extensive post-cure machining alone added over $1,000 in cost per part. [3] A new mixing technology was needed, capable of producing explosive components directly into a near-final shape — reducing downstream machining, limiting waste, and improving worker safety in a single process change.

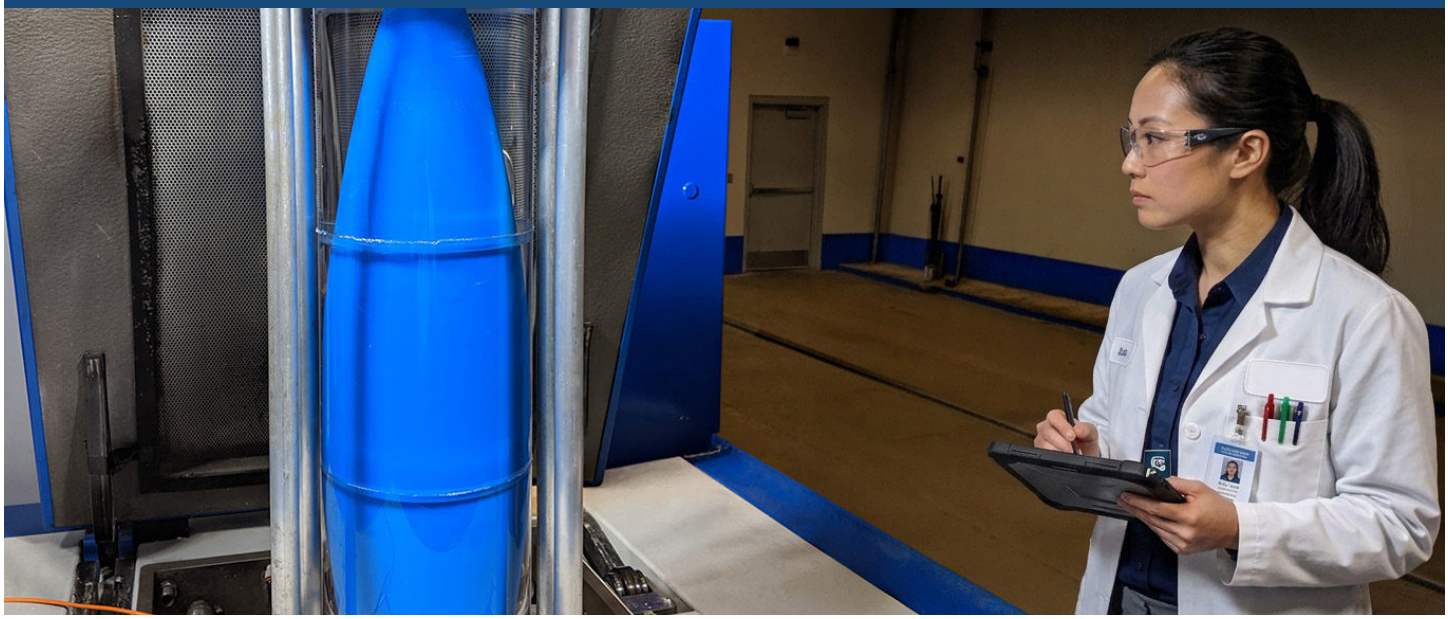
Only RAM makes this possible.

Near-Net Shape and Mix-In-Case Manufacturing

With RAM, explosive material can be processed in two ways that no other mixing technology can provide: near-net-shape and mix-in-case. The blade-free design eliminates the bowl, the transfer, and the cleanup. Munitions can be molded to near-final shape to limit machining, or mixed directly in their final casing.

"At this point you have no machine to clean up, you have no mixing bowl to clean up, and you eliminate all of the material that's hung on to the plumbing associated with the alternate casting method."

— Dr. Andrew P. Nelson, Naval Air Warfare Center Weapons Division [6]



SOLUTION

ResonantAcoustic® Mixing technology, pioneered by Resodyn Acoustic Mixers, uses low-frequency, high-intensity acoustic energy to homogeneously mix powders, pastes, and viscous materials without impellers. Because RAM requires no integrated mixing bowl, the desired end item — a warhead case, bomb casing, or igniter — can become the mixing container itself.

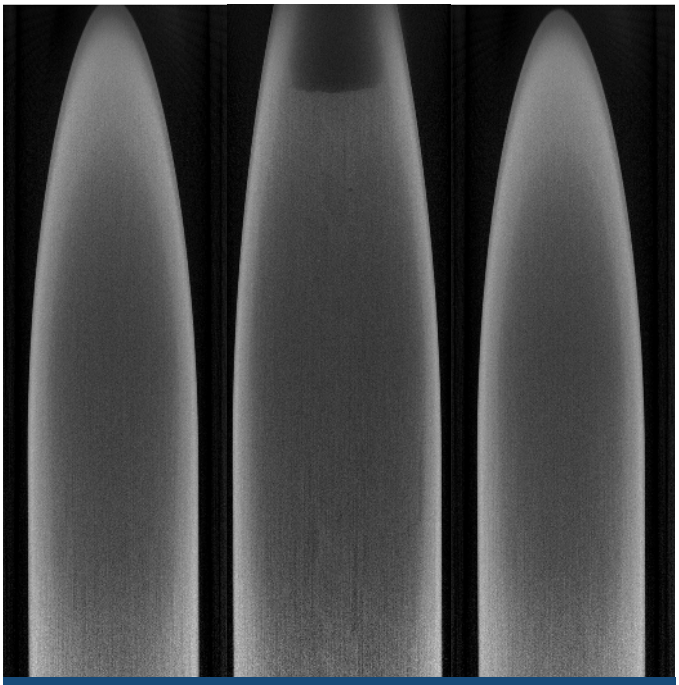
Conventional mixers require a dedicated bowl that operators must fill, clean, and prepare between every production run. RAM eliminates that process entirely, along with the waste and handling exposure it generates.

The Naval Air Warfare Center Weapons Division, in research awarded the 2018 ESTCP Project of the Year, successfully demonstrated this capability by manufacturing warheads from plastic bonded explosive formulations in situ, with warheads tested and confirmed to match the safety and performance of materials produced using conventional methods. [7]

MCAAP began using the RAM5 H, capable of mixing a 5-gallon batch, in 2014 to mix BLU-109 components into near-net-shape products, substantially reducing part costs over their previous manufacturing method. [2]

Near-Net-Shape Manufacturing Eliminates Costly Machining

By producing PBX components directly into near-final shapes, RAM substantially reduces the machining required from cylindrical stock. Costs drop by 2/3, at more than $1,000 per part. [3] Across more than a decade of production volume at MCAAP, that per-part savings has compounded into an estimated $25 million in total savings for the U.S. Army.



Testing is performed on near-net-shape and mix-in-case rounds to ensure superior quality, safety, and performance.

Waste Reduction and Worker Safety

Because RAM can mix directly inside near-net-shape molds, cleanup solvent requirements drop sharply and material handling is reduced at every stage of the process. The financial and environmental impact has been studied by independent military research. Dr. Andrew Nelson of the Naval Air Warfare Center Weapons Division, presenting findings from SERDP/ESTCP Project WP-201507, stated directly:

> *"The bottom line is that the RAM operation decreases the cleanup solvent by almost 80% and the hazardous waste by greater than 60%."* [6]

Lower disposal costs, reduced solvent procurement, and fewer labor hours spent on hazardous cleanup are direct and measurable results — all documented contributors to the ROI realized at MCAAP.

Mixing Time Reduced from Hours to Minutes

RAM reduces the mixing time of explosive contents from hours to minutes. [4] Faster throughput reduces labor costs and compresses production cycle time without requiring expansion of facility infrastructure.

Safety by Design

RAM mixes through acoustic energy with no impellers or rotating parts. This design removes the metal-to-metal contact that represents a genuine ignition risk in energetics manufacturing, and the system operates fully within MCAAP's stringent safety, environmental, and quality standards. [4]

CONCLUSION

The results at MCAAP represent one of the most thoroughly documented ROI cases for ResonantAcoustic® Mixing technology in the defence sector. Over a decade of near-net-shape production using a RAM5 H has saved an estimated $25 million for the U.S. Army. [3]

U.S. Army and U.S. Navy military researchers have independently documented that RAM reduces cleanup solvent by almost 80%, cuts hazardous waste by greater than 60%, and enables near-net-shape manufacturing that no legacy mixing technology can replicate. [5][6][7] The RAM5 H at MCAAP has been in continuous service since 2014 and remains in service today.

Contact Resodyn Acoustic Mixers, Inc. to discuss revolutionizing your mixing process for advanced energetics manufacturing.

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