

## Fact Sheet: Validation of Command-Detonation Munition Residues Testing (ER20-5018)

### Technology Description

Command detonation (CD) enables a munition to be fired in static position at a testing location where energetic residues can then be collected and analyzed. This technology enables quantification of energetic residues early in the acquisition process, before a munition is certified for live fire from a weapon system, and it provides critical data for environmental impact assessment. Key uncertainties in this practice are whether the required replacement of the munition's fuze with a fuze simulator and static upright positioning accurately represent residue loading as it occurs during live fire. This study leveraged energetic residue data from previous SERDP-funded CD tests of 60 mm and 81 mm IMX-104 mortar munitions that used fuze simulators developed by CRREL (CFS) and the DEVCOM Armaments Center (AFS). Residues from these previous CD tests were recovered from deposition on snow—a clean, sensitive medium.



Figure 1. Example CD setup of an 81 mm mortar cartridge

### Performance Assessment

Live-fire loading rates of IMX-104 compounds were successfully determined for 60 mm and 81 mm mortar munitions initiated upon impact with snow. Depositional plumes from live fire were sampled, processed, and analyzed in the same manner as previous CD tests of the study munitions. CD was found to have successfully reproduced total compound loading from live fire of the 60 mm munition ( $p = 0.76$ ) but significantly underestimated live-fire loading from the 81 mm munition ( $p < 0.01$ ). While CD underestimated loading of some compounds, its general utility was supported by correct order-of-magnitude prediction across both munitions.

Observed differences were hypothesized to be the result of necessary modifications to the firing train.

### Cost Assessment

The cost of implementing CD technology to new, in-development munitions was estimated as minor, on the order of \$100K, relative to costs associated with potential future remediation efforts, range restrictions, and acquisition modifications. Validation results are extensible to other sampling mediums, with the potential to leverage related munition performance tests.

### Tech Transfer

Validation results have been transferred to armaments and ammunition stakeholders, and the technology has since been applied to a previously untested insensitive munition to determine its residue loading.

### More Information

ER20-5018 Project Webpage

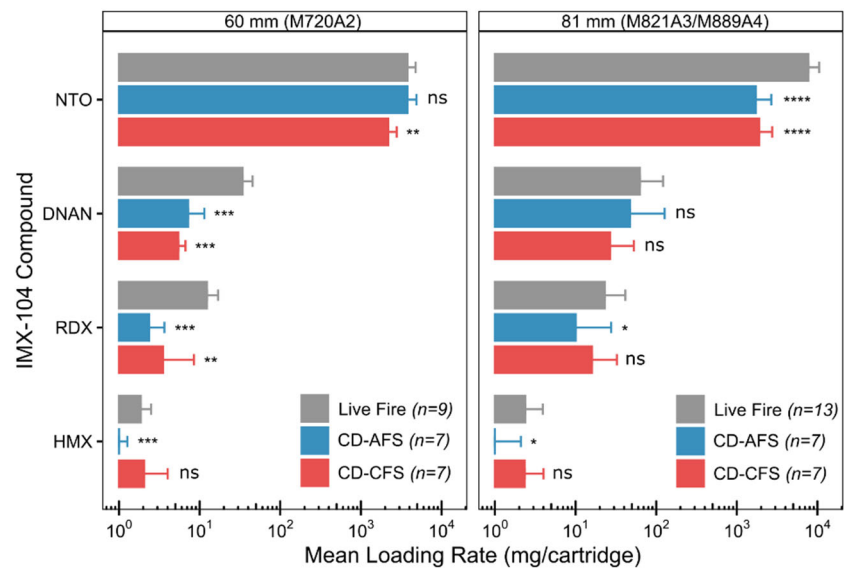


Figure 2. Comparisons of residue loading between live fire and CD for the study munitions. Differences (Wilcoxon test) from live fire noted as: ns  $p \geq 0.05$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; and \*\*\*\*  $p < 0.0001$ .

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