

14085 – Novel High-g Soft Recovery System for 155mm Precision Munitions and Components

Topic Addressed: Gun Launched Precision Munitions and Components and Modeling & Simulation

Relevance to Conference Theme: The 155mm Soft Catch System allows defense contractors and the DoD to high-g gun launch precision weapons; guided munitions weapon systems and components and quickly recover the munitions for evaluation. Data from the on-board-recorder (accelerometers) can be used to compare stresses and loads predicted during the modeling and simulation phase for validation. The process reduces the overall cost and time during development, allowing earlier fielding and reliable munitions for the War Fighter.

Objective of Presentation: The objective of this presentation is to introduce the capability the US ARMY has to gun-launch tactical precision munitions and components and recover them in a quick and easy manner. Accelerometer data from the on-board-recorder (axial and radial) housed inside or at the front of the projectile will be presented and compared to free-flight accelerometer data seen in similar 155mm projectile flights. The overall system operation will be described briefly and demonstrated with video clips and or animations. The benefit of the SCat Gun System to the gun and missile community is a test asset for developing precision munitions and components designed to survive high-g gun launch and have increased reliability, all at a low cost and fast turn-around time.

Abstract: The 155mm Soft-Catch (SCat) Gun Soft Recovery System is located at the US ARMY ARDEC in Picatinny Arsenal, NJ. The Soft Catch System was designed to provide the DoD and defense contractors the capability of launching tactical projectiles (minus High-explosives and canards) and precision guidance components at high-g's and recovering the round in a quick and easy manner. To increase reliability and survivability of precision munitions, modeling and simulation (M&S) is used to verify the design analytically. To compliment the M&S, the SCat Gun System is used to validate and improve the modeling and simulation efforts by experimentally exposing the tactical round or hardware to real gun launch dynamics that include set-back and set-forward g-levels. The addition of the catch system, that immediately follows the 155mm cannon tube, is used to decelerate the projectile within 540 feet by imparting pressure on the front of the projectile and then stopping it in a brake section, where it can then be safely removed from the system and disassembled in the firing bunker for interrogation. This is a cost effective and quick process that brings together the worlds of modeling and simulation and experimentation. Many methods exist to soft catch projectiles but many of these methods require projectile modifications, parachutes or cause damage to the projectile. The system design team has taken these into consideration and designed a system that reduces or eliminates these affects. The soft catch system closes the gap between modeling and simulation and experimentation of precision munitions to help bring early fielding and reliable munitions to the War Fighter. The system uses a 155mm M199 cannon tube mounted inside a modified eight inch M174 gun mount. The system can accommodate various 155mm caliber (39 or 69) cannon tubes as well as an over-pressure cannon tube to fire at permissible impulse maximum pressure (PIMP) up to 25% over-pressure. The system can be used for both slip-band and rotating band projectiles depending on the specific program requirements. An air gap of a few inches separates the muzzle brake and the chain of catch tubes. The projectile is fired from the weapon and experiences free-flight over six feet, where it settles into the catch tube taper and begins to experience deceleration due to the sections of pressurized air and water. There are multiple sections all connected together over 540 feet with the sections of air and water separated by a burst diaphragm and piston, respectively. The burst diaphragm and piston are consumed on each shot and replaced afterwards. The projectile generates shockwaves and it is these shockwaves that play a key role in the deceleration by interacting with the air, water, burst diaphragm and piston. The computational fluid dynamics inside the catch tubes are based on research conducted by the Army Research Laboratory at the Aberdeen Proving Ground, MD (Avi Birk, Douglas Kooker, ARL-TR-2462). It was this paper and Picatinny Arsenal's prior soft-catch technologies that allowed Engineers at Picatinny to bring the system on-line for customers and programs to evaluate their critical system or hardware for precision munitions research and development.