

Future Combat Systems (FCS) Manned Ground Vehicles: Non-Line-of-Sight Cannon (NLOS-C)

Executive Summary

- The Non-Line-of-Sight Cannon (NLOS-C) Demonstrator has achieved a sustained rate of fire of six rounds per minute. The current Paladin howitzer has a maximum rate of fire of four rounds per minute for three minutes, and a sustained rate of fire of one round per minute thereafter.
- The Demonstrator has also shown that a lightweight platform can provide enough stability to mount and fire a 155 mm cannon.
- The Army recommenced firing test rounds from the NLOS-C Demonstrator in June 2005 after incorporating a 38-caliber cannon tube similar to what they expect to use in the final design. Adopting a 38-caliber cannon tube results in NLOS-C having approximately the same range with most munitions as the current M109A6 howitzer.
- Achieving a 19-ton weight limit and C-130 deployability will be difficult without affecting operational effectiveness, survivability, or sustainability. The Army intends for NLOS-C to weigh less than 19 tons in order to be C-130 deployable.
- It will be a significant challenge for NLOS-C, with an automated ammunition handling system, to meet its reliability requirements.

System

- NLOS-C is a tracked, self-propelled 155 mm howitzer system with a two-man crew.
- It is the lead vehicle for the manned ground systems in the Future Combat Systems (FCS).
- The Army will:
 - Procure six to eight prototypes in FY08 for testing
 - Procure 18 Block 0 systems in FY10-FY12 for limited fielding and experimentation
- The cannon will fire six to 10 rounds per minute to ranges of 30+ kilometers (km) (with Excalibur).
- NLOS-C will achieve improved accuracy, even with unguided projectiles. For example, when attacking a target at 20 km, 50



percent of unguided rounds must land within 110 meters of the aim point.

- NLOS-C will respond to fire mission requests within 20 seconds when stationary and within 30 seconds when moving.

Mission

- NLOS-C units will provide cannon fires in support of FCS Brigade Combat Teams and other mechanized brigade combat teams.
- NLOS-C will fire the entire suite of 155 mm munitions, including Excalibur precision munitions, to attack point targets.
- NLOS-C units will be deployable by C-130 aircraft (before installing extra protective armor) to support early deploying forces with cannon fires.

Activity

- The Army intends for NLOS-C to weigh less than 19 tons in order to be C-130 deployable. In 2005, the Army approved a 24-ton design-to-weight requirement for all FCS manned ground vehicles. That requirement stipulates that the propulsion systems and drive trains must support the weight of additional armor that can be added after deployment.
- The Army reduced the NLOS-C reliability requirement from 741 hours to 512 hours mean time between system aborts.
- The Army recommenced firing test rounds from the NLOS-C Demonstrator at Yuma, Arizona, in June 2005 after replacing the 39-caliber cannon tube with a 38-caliber tube to save approximately 1,400 pounds of weight. The original 39-caliber tube had fired 1,193 rounds in NLOS-C tests and the 38-caliber tube has fired more than 300 rounds since June.
- The NLOS-C Demonstrator has achieved a sustained rate of fire of six rounds per minute. The current Paladin howitzer

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has a maximum rate of fire of four rounds per minute for three minutes, and a sustained rate of fire of one round per minute thereafter.

- It has also demonstrated firing stability with a 155 mm cannon on a lightweight chassis, stable suspension on a band track, integration of power electronics and in-hull drive motors, and integration of a hybrid electric drive with a diesel propulsion system.
- The Army is revising the FCS Milestone B Test and Evaluation Master Plan (TEMP) in response to program restructuring. That TEMP will include a separate appendix for the NLOS-C.

Assessment

- Achieving a 19-ton weight limit and C-130 deployability will be difficult without affecting operational effectiveness, survivability, or sustainability. Modifying the design parameters to a 24-ton design-to-weight requirement has significant deployment and operational implications.
- Adopting a 38-caliber cannon tube reduces the range of most munitions by 3-5 km when compared to the 39-caliber tube previously tested. As a result, NLOS-C will have approximately the same range with most munitions as the current M109A6 howitzer.
- It will be a challenge for a two-man crew to conduct continuous 24-hour operations while performing operational missions, maintenance, resupply, and security associated with combat operations.
- The reliability requirement of 512 hours mean time between system aborts is more than an eight-fold increase over the reliability requirement for the Crusader system that

was cancelled in 2002. Likewise, it is over eight times the 62-hour requirement that the current Paladin howitzer was required to achieve at its operational testing in 1992. It will be a significant challenge for NLOS-C, with an automated ammunition handling system, to meet its 512-hour requirement.

- Drafts of the FCS TEMP have not yet adequately integrated NLOS-C Live Fire exercises into future operational testing. Likewise, drafts have not contained an adequate test and evaluation strategy to support fielding of NLOS-C Block 0 production howitzers.
- To assess the effectiveness of NLOS-C, within the FCS system-of-systems, it will require a sophisticated real-time casualty assessment system that can accurately determine the relative impact that indirect fires have upon the outcome of operations.

Recommendations

The Army should:

1. Ensure that FCS operational tests include adequate NLOS-C Live Fire exercises. Supported maneuver units will need opportunities to demonstrate that they can plan and coordinate fires, and the NLOS units will need to demonstrate they can sustain operations while delivering accurate and timely fires.
2. Develop a real-time casualty assessment system for indirect fires that can accurately assess the effectiveness of NLOS-C fires in system-of-system exercises.
3. Develop a test and evaluation strategy to support the fielding of NLOS-C Block 0 production howitzers, beginning in FY10.