EUROPEAN DEFENCE AGENCY

Fact sheet

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Course Correction Fuze Integration into Artillery

Course Correction Fuzes (CCFs) offer a solution for improved battle effect by reducing dispersion of artillery fire, and that at a moderate cost compared to precision guided ammunitions, for example. Reduced dispersion of artillery fire has many benefits. Operating with smaller risk areas makes it possible to use artillery closer to own troops, civilian population and in the proximity of non-military targets. A reduced dispersion also means a higher concentration of shells in a target area, or less ammunition use to reach the desired effect. Today there are several CCF solutions mature enough to make CCF procurement and integration in artillery systems feasible. From an overall perspective a CCF has several appealing properties when it comes to system integration: CCFs are in principle interchangeable with standard fuzes and can also be programmed in a similar way with a fuze setter. On the other hand, testing, qualification and integration of CCF into an artillery system is a more complex procedure than qualification of ordinary fuzes. A pooling and sharing program among EDA participating Member States (pMS) can significantly lower the procurement and integration costs as parts of the qualification processes might be performed on an international EDA interest group level.

Study Purpose

The European Defence Agency (EDA) has commissioned the Swedish Defence Research Agency (FOI) and the Netherlands Organisation for Applied Scientific Research (TNO) to study the integration of Course Correction Fuzes into artillery systems in EDA pMS. The aim is to support the identification of potential synergies in the field of precision engagement and to allow the promotion of further cooperative initiatives at European level.

ECF Prototype
(Photo: Peter Alvå, FOI)

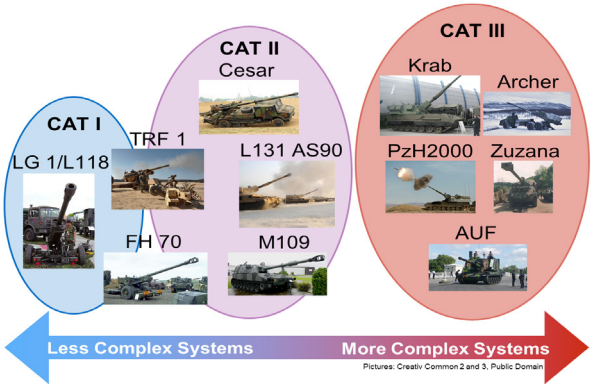
2-D Guidance Fuze
(Photo: Diehl BMT Defence GmbH & Co)

Course Correction Fuze

During the study, several CCFs were identified as available products or solutions currently under development. Five solutions were selected, based on the amount of available information, as a basis for an integration analysis of CCFs with different artillery systems. The selected CCF solutions cover a wide spectrum in terms of technological readiness: from solutions validated only in lab environments to mature solutions successfully tested and fielded in operations. Some of the CCFs apply airbrakes to reduce the down range dispersion (1D) and others use fixed or movable canards that reduce both down range and cross range dispersion (2D). The guidance and navigation solutions include both doppler radar and military or civil GPS.

Artillery systems in Europe

Member States and nations which have concluded administrative agreements with the EDA use many different artillery systems in their armed forces. The study shows a fragmented picture with a large mix of modern and legacy systems. In the analysis of artillery systems in Europe, a categorization of system complexity (manual, semi-automatic and automatic) was applied to explore if sys-



tems of similar level of complexity require comparable levels of technical modifications. A successful integration of CCFs into Member States' artillery systems may require modifications to the hardware of different subsystems or modifications to the software in the fire control systems. The identified synergies in the integration and qualification process presented in the study enable opportunities for a European collaboration.

Integration

The integration of CCF into an artillery system involves multiple interfaces where physical and geometrical requirements are as important as communication and software data formats. Some interfaces are system specific, typically those between the projectile, magazine and projectile loader. Other interfaces are more generic and shared by all users. A more developed set of standards, including all interfaces, will lower the threshold for CCF integration in artillery systems and enable a wider use.

In the study, subsystems and components influenced by the integration of a CCF were considered. Based on these subsystems the integration readiness level for a selected set of CCF solutions to three levels of artillery system complexity was determined. The analysis shows that the necessary modifications for an integration that have the largest impact are related to the ammunition with CCF itself and the components required to program the CCF (i.e. the fuze setter and fuze setter interface).

Test and evaluation plan

A test and evaluation plan was formulated that presents a generic Test and Evaluation Master Plan (TEMP) for the integration of CCF into service or planned artillery weapon systems. TEMP is intended as a document laying out the necessary safety testing and assessment procedures for the integration of CCFs into artillery systems that are already qualified/fielded or those that are currently in a development phase.

Results

The study shows that opportunities for pooling and sharing exist even though many different systems are currently in use in the various participating Member States. These opportunities can be turned into effective cooperation that in turn can lead to significant cost reductions for future CCF integration. Several countries use the same type of artillery systems and thus share the same CCF integration approach. For them, the most straightforward way in terms of CCF integration is to be part of a common integration programme. Nevertheless, collaboration opportunities are likely to be possible even between states using different systems where synergies can be found in terms of similar subsystem characteristics like calibre, fire-control software or ammunition type. In a broader perspective, the joint development of ballistic calculation software and fuze setter standards as well as interface definitions and data protocols for CCFs are recommended actions for an efficient integration of CCFs into artillery systems.

At present, several CCF solutions are almost ready for market release which means that future price decreases can be expected. EDA pMS are recommended to follow the development of CCF solutions, to prepare for an introduction and to participate in multi-national activities aiming at reducing the cost for future CCF system integration.

EDA Smart Munition Working Group (SMWG) will further investigate the synergies among pMS concerning CCF. For additional information contact **cat@eda.europa.eu**

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Action Plan

- *Standards for CCF programming: Investigate and prepare standards for CCF programming.*
- *Algorithms and software for CCF ballistic calculations: Investigate and prepare standards for ballistic calculations, software and Fire Control System communication interfaces for CCF solutions.*
- *Qualification of ammunition and CCF solutions: Investigate aerodynamic and mechanical integration of CCF solutions with existing ammunition. A reference Test and Evaluation Master Plan (TEMP) was developed in this study as a basis for future work.*
- *Qualification of artillery systems: Investigate users interest and potential collaboration on a programme for CCF integration for nations using the same artillery systems.*