



MuRoC

Publishable Executive Summary

Multi-Robot Control in Support of the Soldier

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1 Introduction

This document summaries the activities and results of the project MuRoC – Multi Robot Control in Support of the Soldier carried out by the consortium Diehl BGT Defence, SENER and ECA.

This project was managed and funded under EDA contract 13.R&T.OP.625.

2 Objectives

The objective of this study is to develop parts of the Strategic Research Agenda (SRA) of the EDA CapTech Guidance and Control. The SRA needs more development in the area of technologies for multi-robots control laying the ground work for cooperative projects implementing those parts of the agenda.

3 Project organization

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4 Project Results

The aim of this study was to survey the market in multi-robotics research with a focus on control and man machine teamwork from the guidance and control perspective. The study proposed promising "quick-win" technologies when such were identified, clearly showing advantages but also limitations, for the current/next generations, as well as technologies that need longer time to develop in support of robotic capabilities for future generations of unmanned systems in CSDP operations.

A network was build up including stakeholders in the field of multi robot development. These were mostly companies and universities showing that this field of technology is still mostly R&T. But also different MoDs and other military contacts are part of the network representing the potential future user of multi robot systems. Information among the stakeholders was gathered in WP100 using two different types of questionnaires. The first was addressed to the MoDs and military point of contacts. It included mostly questions dealing needs and expectations of a multi robot system from the user's point of view. The second questionnaire was addressed to industry and academic institutes. It dealt mostly with the current availability of multi robot systems and future risk in development of such systems.

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An overview about current ongoing research studies in the field of multi robot systems was given in WP200.

In addition to this information from participating stakeholders a literature research was performed in WP300 to investigate the current TRL of technologies required for multi robot systems. In total 72 technologies were identified and their TRL was determined based on more past and current research publications. For this more than 200 publications were analyzed.

Based on the results of the first three work packages a gap analyzes was performed to identify the difference between “what is needed” and “what do we have”. For this 12 potential MRS scenarios were identified from the EDA studies UGS-LIS and SMUVO.

In WP500 a roadmap was developed. Taking the results from WP400 long-, mid- and short-term gaps were identified. Finally in WP600 it was exemplary shown with simulations how such a gaps could be closed and how the benefit using MRS instead of single robots could look like.

5 Conclusions

In this project it was shown how military forces can benefit from cooperatively working robot systems (MRS: Multi Robot Systems) in different scenarios.

There are several key technologies with a high maturity level ready to be applied in short term (by 2020). The joint use of them could result in the deployment of systems applicable to current missions. These potential systems would be limited because there is a significant group of strategic technologies that will not be ready before the medium (by 2025) or long term (by 2040). Tele-operated systems are ready and fully tested with a lot of other available technologies that allow developing systems for some of the operational cases identified. The main problem of tele-operated systems is the limited number of robots that can be operated in parallel.

Semi-Autonomous operation and moving technologies/capabilities might shorten development times if the right investment is made. This provides to multi robot systems a wider field of operation.

The case of fully autonomous systems is complicated because it implies solving a lot of complexities, technical and moral, especially in operation case in which people are involved.

The MuRoC project has clearly shown the interest for cooperatively working robot systems not only on industry and academic side but also on military side. Work on this field is mostly still R&D but significant progress has been achieved in the last couple of years for different required technologies. Most of the scenarios identified in the UGS-LIS and SMUVO studies to be performable by single robots can be accomplished by cooperatively working multi robot systems with an even higher performance.