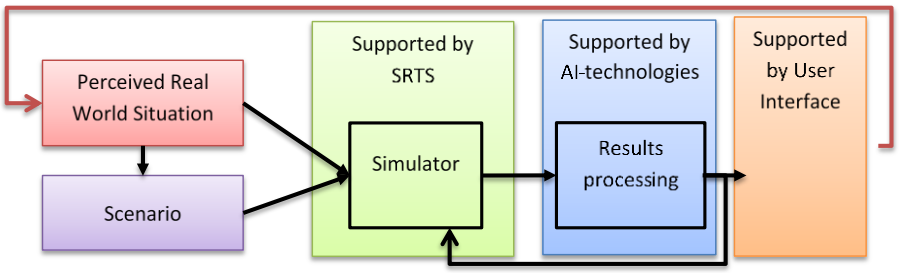

ONSIM

Publishable Executive Summary

INTELLIGENT ONLINE SIMULATION SUPPORT FOR OPERATIONAL BATTLE MANAGEMENT

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AIRBUS DEFENCE & SPACE MBDA MISSILE SYSTEMS ThalesRaytheonSystems FOI

1 Introduction

This document summaries the activities and results of the project Intelligent Online Simulation Support for Operational Battle Management carried out by the consortium consisting of the Swedish Defence Research Agency (FOI), Airbus Defence and Space, Germany, MBDA France, and Thales Raytheon Systems, France.

This project was managed and funded under EDA OB study contract 14.CAT.OP.054.

2 Objectives

The objectives of the study are as follows:
- ONSIM aims to provide simulation based decision aids for operational level military planning of air operations.

Through this extensive and fully automated war gaming like simulation it may be used to:
- explore possible tactical options for blue and red forces in the planning phase to compute the risk and the benefit of each decision over the operation campaign, or
- provide decision support during ongoing operations, considering the risk and benefit of the current decision.

3 Project organization

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4 Project Results

The purpose of this study is to investigate tools for gaining decisive advantages in operations by increasing the pace of decision making and thereby getting inside the opponent's OODA-loop (Observe-Orient-Decide-Act). This study is focusing on constructing a conceptual design of a decision support system for air combat and long-range weapon battle management using embedded simulations closely integrated with novel AI methodologies. The conceptual design is based on tools from the research frontier of simulation and AI technologies, and operational requirements. These requirements are to provide support for key decision making of the commander within a few minutes for course of action development for the next phase of an air campaign. This is done by extrapolation and evaluation by measures of effectiveness of a future red and blue air battle, and presentation of results through a user interface.

The conceptual design allows showing how key technologies can be closely integrated in novel operational decision support for air combat and long-range weapon battle management.

For air battle management this specifically includes integrating AI technology such as decision trees with simulation of air combat using FLAMES for evaluation by measures of effectiveness. Decision support is then provided regarding resource management of aircraft by user interfaces showing estimated outcomes of alternative blue management decisions, and visualization of specific simulation run output focusing on both missiles and air combat in different visualizations.

The computational part of the decision support demonstrator design consists of the following components:

- a decision tree where each red row contains the set of possible red actions to take. Each red decision is followed by the set of possible blue responses,
- a simulator, capable of capturing a snapshot of the real-world state, which can be used for predicting the consequences of different blue actions and red responses,
- a goodness function, capable of comparing the results from different simulation outcomes, and assigning outcome of simulation results,
- a user interface, capable of displaying possible decisions for each sequence.

The simulator component is built upon the FLAMES simulation framework, and utilizes the collection of models bundled with FLAMES. The simulation gives AI access to the expected future outcome of each action it can take. Assuming the simulation is a representing the real world correctly this allows the user to take the optimal action for a given state, Figure 1.

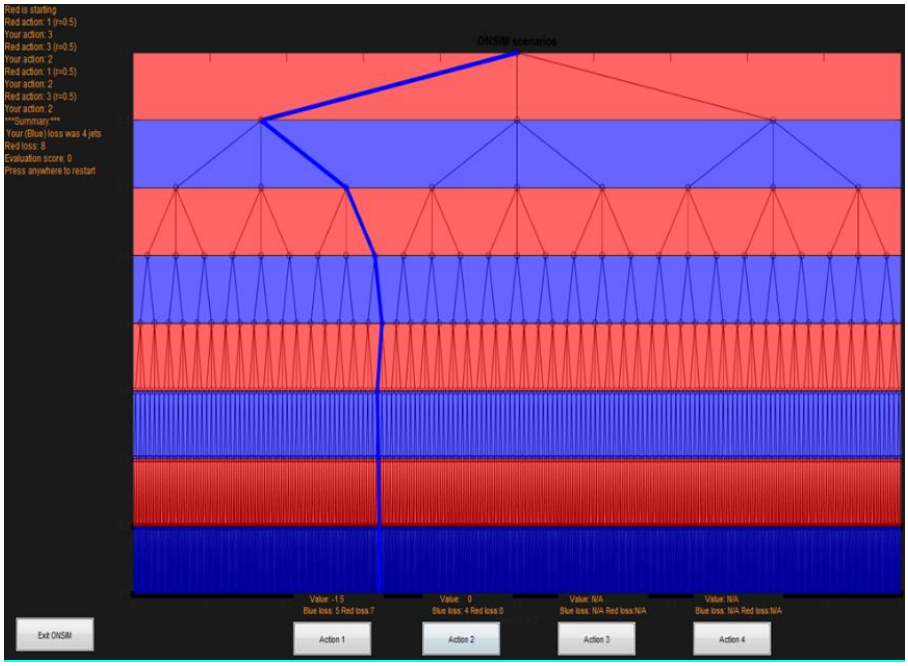

Figure 1. An example of a tactical control panel of a scenario playout. The thick blue line is a played out example scenario (Actions={1,3,3,2,1,2,3,2}, in this case the blue loss was 4 aircraft and red loss was 8 aircraft). The coloured background shows which side took action. ONSIM gives support through the expected value of each branch (orange text above each action button) and a suggested action for each blue move based on the FLAMES simulations. In this way ONSIM can help to minimize the blue loss and maximize the red loss.

Without knowledge of the future, decision makers can only guess which choice is the best therefore we let random decision become a baseline result. With random decision making blue will lose 8.12 aircraft on average and in the worst outcomes it will lose up to 28 aircraft. If blue side is given access to ONSIM decision support the average loss will be 5.0 aircraft and eight aircraft in the worst outcome.