

# Design of Unmanned Combat Aerial Vehicles and their Integration into a Strike Aircraft Group - A System of Systems Approach

Felix Kuhnert<sup>1</sup>, Roelof Vos<sup>2</sup>, Tobias Dietl<sup>1</sup>, Prajwal Shiva Prakasha<sup>1</sup>, Björn Nagel<sup>1</sup>

<sup>1</sup>German Aerospace Center (DLR); Institute of System Architectures in Aeronautics, Hamburg, Germany

<sup>2</sup>Delft University of Technology, Aerospace Engineering, Delft, The Netherlands

## Abstract:

Manned-Unmanned teaming with Unmanned Combat Aerial Vehicles (UCAVs) is part of every future fighter concept. However, while much effort is put into design and research, it remains to be seen whether the inclusion of UCAVs yields a better mission outcome. Additionally, there is much uncertainty about the ideal design and the concept of operations. This work aims to change that by addressing all three elements. Using knowledge-based engineering, a set of UCAVs is designed for the suppression and destruction of enemy air defenses. In the frame of a parameter study, physics-based combat simulations are conducted using agent based modeling. The results are analyzed via the Mission Effectiveness, Survivability, Cost, and Lethality. The performance of formations including UCAVs is compared to formation without UCAVs, employing modern tactics. The results show significant improvements in mission outcomes when UCAVs are deployed as a part of a larger manned formation. Optimum results are achieved with UCAVs featuring low observability and balanced specific excess power. The concept of operations has an effect, too. Two UCAVs carrying four anti-radiation missiles each yield a higher overall survivability than four UCAVs carrying two missiles. The inverse holds for overall lethality. The results provide valuable insights into the optimal design and function of UCAVs and the Manned-Unmanned Teaming concept.