

1<sup>st</sup> /2024 SCM

Subject No 10



**INTEGRATED AIR & MISSILE DEFENCE**

**CENTRE OF EXCELLENCE**

Souda Air Base, 73100, Chania

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**1<sup>st</sup>/2024 Steering Committee Meeting**  
**POINT PAPER**

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<b>Date:</b>	02 Aug 2024	Email:	<a href="mailto:info@iamd-coe.org">info@iamd-coe.org</a>

TO: See Distribution  
SUBJECT: **Biomimetics Study**  
No: 10

PURPOSE: To inform SC about the intended initiation of study titled (TBC) "Biomimetics for Unmanned Aerial Vehicles - BioDrone".

BACKGROUND: Biomimetics, the study and imitation of nature's designs and processes, has revolutionized various fields, including radar deception and stealth technologies. By leveraging biological principles and science, engineers can develop advanced materials and systems that enhance the stealth capabilities of military assets. As radar systems become more sophisticated, more advanced biomimetic deception techniques are developed. This includes creating multi-spectral camouflage that can deceive not only radars but also infrared and visual sensors.

Biomimetics also supports all aspects of designing and development of Unmanned Vehicles, providing state-of-the-art novel approaches for challenges related to their morphology, mechanics, materials, actuation, perception, control, behavior and autonomy. It refers to a broad methodology based on exploiting knowledge of Life Sciences, especially of Biology, Neurosciences and Psychology, and getting inspired by the natural world.

Novel solutions to such challenging issues, as well as novel computational modeling and experimental methods, are needed to produce next generation UAVs with high maneuverability, low energy consumption and adequate adaptation to complex environments observed in living organisms, like birds and insects. Making use of soft materials (for their body structures), actuators, sensors and electronics, might bring such UAVs closer to

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the size, performance and robustness of biological organisms, enabling and morphing hybrid designs able to function in a variety of environments.

Furthermore, the exploitation of bio-inspired UAV navigation behaviors allows the expansion of their autonomy and multi-agent capabilities as pursuit, swarming and motion camouflage, while specialized appendages allow their sophisticated interaction with the environment, enabling object manipulation, perching or aerial structure construction. Such bio-inspired capabilities may prove invaluable for Defense applications in UAV and UAS, expanding this field far beyond the currently nominated state-of-the-art, driven in large part by the needs and practices of recent conflicts. Ongoing research into biomimetic principles continues to uncover new possibilities including in radar deception. Collaborative efforts between biologists, materials scientists, and engineers are essential to exploit biological insights and practical technologies to further develop Unmanned systems.

ANALYSIS &  
STATUS:

The proposed BioDrone project will review, classify and analyze the literature on Biomimetic Unmanned Vehicles, emphasizing particularly Unmanned Aerial Vehicles and Systems (UAV/UAS), aiming to determine the advantages and possible disadvantages of the Biomimetic methodology for such systems, especially focusing on the Defense area. Furthermore, it will highlight specific advantages that may be combined to produce a novel BioDrone able to exploit inter alia, AI algorithms to enhance its performance – applicability. In that development modern M&S parameters should be identified/used to showcase part of the suggested study outcomes.

FINANCIAL  
CONSIDERATIONS  
& FUNDING:

Any financial impacts of the aforementioned project (28.175 €) can be covered from the existing budget of the current year (by transferring of appropriations following SC approval as proposal detailed in NU.680/02 Aug 24/ IAMD COE Point Paper) without the need for a supplementary budget.

RECOMMENDATIONS  
& DECISION:

SC members are requested to note the initiation of project titled “Biomimetics for Unmanned Aerial Vehicles - Biodrone”.

FOR THE IAMD COE:



B. Gen (OF-6) Nikolaos MAKRYGIANNIS GRC (AF)  
IAMD COE Director

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