# Development of a cascaded avoidance system for e-VTOL aircraft

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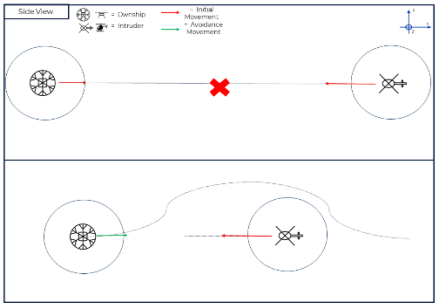
One of the most important aspects to ensure a safe flight is to manage to detect and avoid other aircraft. Currently, most avoidance systems which have been certified were made for manned aircraft. These systems are very complex and computationally heavy with limited performances for Urban Air Mobility (UAM). With the changes happening in the aerospace industry and the importance of reaching full autonomy, it is crucial to find a reliable solution which is more suited for autonomous aircraft, which must follow the following requirements:

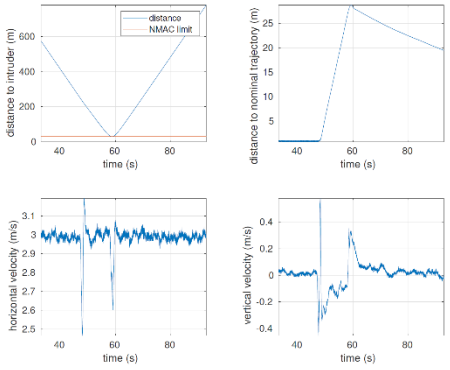
- The system must be able to avoid any obstacles from agnostic inputs.
- It must be a reactive system that is able to solve conflicts whilst taking into account the performances of the aircraft.
- It is essential that it complies with the local regulators' environment. This translates into two requirements:
  - It has to be deterministic and verifiable to ensure that it can solve conflicts in any scenario in the operational environment.
  - It also needs to be integrable with a network of the pre-planned flight paths to ensure that it stays within the authorized flying space.
- Finally, it needs to return to the nominal flight path once the conflict is cleared.

These requirements led me to develop a novel approach for avoidance based on a multi-layered algorithm, with increasing complexity depending on the criticality of the situation. The responses range from deceleration to online avoidance.

This system was integrated in the simulation set-up and then tested on a range of scenarios to ensure that it respected all the requirements listed above.




*One of the scenario used to test the DAA system*




*Metrics from the simulation of the avoidance scenario*

The results highlight the efficiency of the system which diverges as little as possible whilst not breaching the Near Mid-Air Collision (NMAC) volume. Throughout the maneuver, the system keeps the aircraft within its physical limits.

This project allowed to develop a novel approach for detect and avoid system and tested it in simulation with successful results. However, this can still be improved by testing with a proper flight campaign to ensure that the simulated results are valid. The system should also be properly integrated on a production level with the rest of the autonomy stack to ensure the requirements are followed.