

# Feasibility Study for Air Launch of Space Based Sensors (or Weapons)

**Company:** MBDA (<https://www.mbda-systems.com>)

**Project open to:** 3rd/4th year undergraduate, Final year undergraduate and Masters students

**Application closing date:** 30th June 2023

**Expected duration of project:** 6-7 months (with potential for descoping)

**Latest start date:** End of October 2023

**Application link:** <https://forms.gle/DA6ymfD9oqoAzXre8>

## Organisation description

A world leader in missiles and missile systems. Our multi-national organisation is made up of around 13,000 employees working across the UK, France, Italy, Germany, Spain and the US, and is the first truly integrated European defence company. As the European champion in our sector, our vision is to continue to grow our presence as a global player. Our mission is to achieve this by establishing ourselves as an industry leader; promoting co-operation and delivering technical and operational excellence to our customers.

We have a rich heritage of designing and producing missiles and missile systems to meet the whole range of current and future operational requirements for the three armed forces (army, navy, air force). We are proud to be a trusted partner to our armed forces and work with them to deliver a cutting-edge portfolio of products.

## Project description

Air-launch-to-orbit systems, also known as air launch systems or air-launched rockets, involve launching a rocket into space from a carrier aircraft that serves as a launch platform. The carrier aircraft typically carries the rocket to a high altitude and then releases it for further ascent into orbit.

One noteworthy air-launch system is the Pegasus rocket, developed by Northrop Grumman. The Pegasus rocket has been successfully deployed from a carrier aircraft, such as the L-1011 Stargazer, since the early 1990s. It has a long history of launching small satellites into orbit, offering a flexible and cost-effective solution for certain payloads.

This project aims to explore the feasibility of using available RAF platforms to place payloads into orbit from air launch. These payloads could be sensors, communications, offensive or defensive in nature. Platforms of interest: Typhoon, Poseidon, Voyager, A400M, C-17.

The task is to carry out concept design for launch vehicle(s) that would be compatible with these platforms and determine the payload that could be placed into orbit (if feasible...).

Each platform will have a different initial mass limit, length limit, and assumed initial flight condition at the end of the separation phase (altitude, flight path angle, and speed).

The project is expected to consider suitable options for each platform:

- Launch options including under wing pylon, weapon bay (Poseidon), ramp launch (A400M, C-17) (assume palletised).
- Design of vehicle to achieve stability at launch and give safe release behaviour.
- Propulsion and fuel options (Liquid fuelled rocket, Solid fuelled rocket, air breathing).
- Single stage or staged.

#### Work Packages:

1. Literature review on the existing configurations of air-launch-to-orbit systems, their performance estimation and limitations to their application. Include examination of options including under wing pylon, weapon bay, and palletised ramp launch.
2. Source or generate operational RAF platform geometries which can be used in separation simulations of launch vehicles. (e.g. from open source A330, B737, etc CAD).
3. Design a launch vehicle in such that it may be safely released, exploring configurations that would be compatible with these platforms and maximise the payload that could be placed into orbit.
4. Undertake an assessment to compare propulsion and fuel options, including the use of single or multiple stages.
5. Make conclusions and suggestions for further work targeted towards implementing air-launch-to-orbit systems on RAF platforms and determine if there is an overall benefit in doing so.

#### Deliverables:

The student is to provide monthly updates to the industrial representative / point of contact from the project kick-off until completion. The following deliverables are to be provided to MBDA at the end of the project (assumed June 2024):

- Student presentation at MBDA Bristol or via a virtual conferencing platform.
- Project dissertation / thesis.

#### Descoping:

Should an interested student not have 6-7 months for this project, it could be descoped to just the first two or three work packages, or the number of platforms investigated could be reduced. If this applies to you, please mention it in your application.

## **Person Specification**

This proposed project is relevant to the field of aerospace engineering and will provide valuable insights into the development of air launch systems for military and civilian applications. The project will require knowledge in aerodynamics, CFD, and aircraft design, making it a challenging and rewarding undergraduate dissertation topic.

### **Requirements:**

- Studying an Aerospace or Mechanical Engineering Degree
- UK national
- Share our values: Passion, Commitment, Team Spirit, Innovation, and Integrity