NATS problem statement

The North Atlantic (NAT) airspace is a highly congested international flight corridor with no ground-based surveillance capabilities. With no radar coverage across most of the ocean, transatlantic flights are routed along pre-defined daily tracks—known as the **Organized Track System (OTS)**—which are designed primarily for safety and separation, using forecasted wind data. However, once in flight, aircraft are committed to these planned routes, regardless of whether actual weather conditions (winds aloft, turbulence, temperature gradients).

This leads to a fundamental question: ***Given the original flight plan and the weather that was actually experienced during flight, could there have been a more optimal route or trajectory in terms of distance, fuel, or time?*** The current system prioritizes safety—rightly so—but at the expense of dynamic, real-time optimization. As a result, many flights may be flying longer-than-necessary paths, consuming extra fuel, spending more time airborne, and generating avoidable emissions.

The objective of this study project is to develop a baseline route efficiency model that can retrospectively assess the performance of historical flight paths against a set of dynamically computed "ideal" routes. These optimal routes should consider actual weather conditions (rather than forecasts) and reflect objectives such as total distance minimisation, fuel efficiency for fixed time-of-arrival, or time minimisation given a fixed cruise airspeed. At the most basic level, this involves comparing the flown route to a shortest-path or wind-optimal trajectory. More advanced analyses might explore fuel-efficient paths for a given time constraint, or time-minimizing paths for a fixed airspeed, all within the bounds of experienced weather.

Participants will work with datasets such as flight position reports (ADS-B, flight plans) and MET data. With this data, they will:

- Identify and calculate key performance measures like how far the flight actually travelled, how long it was in the air, and how much fuel it likely used.
- Create smart algorithms that suggest better flight routes based on real weather conditions.
- Compare the actual flight route with the improved, weather-aware route to see where time, fuel, or distance could have been saved.
- Build a scoring system to show how close each flight was to its most efficient possible path.

Why this is valuable:
This challenge is a great opportunity to explore exciting topics like planning routes with uncertainty, making flight paths more flexible, and reducing environmental impact. If we can find better routes after the fact, it helps make the case for future air traffic systems that are more adaptive and efficient—while still keeping safety as the top priority.