



TATA

TATA ELXSI

TELIPORT

Case Study

AVIONICS PROBLEM STATEMENT

BACKGROUND

More than 2% of global CO₂ emissions are contributed by aviation industry. Use of Aviation Biofuel or the Sustainable Aviation Fuel (SAF), is very limited and their production may not meet the demand even in the next five years. In the next ten years, air travel is going to be doubled, the infrastructure may not cope with the same pace. Avionics, the electronic systems used in aircraft, are highly complex due to the critical functions they perform in modern aviation. Avionics in flight improves not just for the Safety but Efficiency of the flight and reduce carbon footprint. The complexity of avionics systems arises from several factors. Avionics systems integrate numerous components, such as navigation, communication, surveillance, and control systems. These components must work seamlessly together to ensure safe and efficient flight. Failure in any of these systems could have catastrophic consequences, necessitating redundancy and fault-tolerant design. Avionics systems must meet stringent standards set by aviation authorities such as the FAA (Federal Aviation Administration) in the United States or EASA (European Union Aviation Safety Agency) in Europe. Compliance with these standards adds complexity to the development and certification processes. However, adding more and more Avionics System is counterproductive from sustainability and adds further complexity.

Aircraft while on a normal operation, gate (at origin airport) to gate (destination airport) undergoes several phases. Terminal, Take-off, Cruise, Approaching, Taxing. On several occasions, aircraft suffer navigation-denied situations. Means it is in a zone where the source of navigation information is not available (momentarily), Say “GPS-Denied” situation or foggy condition while landing.

Come up with a software solution, which should be developed and executed in three phases.

Phase 1: Idea Generation

Submission Requirements:

Candidates are required to submit a one-pager (PDF document) for the initial evaluation. The one-pager should include the following sections:

- Describe the list of Navigation Sources and different phases of the flight where it cannot be used. A separate paragraph is anticipated.
- Clearly define the problem you aim to solve. Clearly explain the background, theory (if any) etc. so that a common man can also understand and relate to the problem.
- Problem solution: Present your proposed solution concisely. Solution can be an idea, an algorithm, a flowchart etc. Explain the idea so that the reader can understand the novelty in the same.
- Solution Implementation: Describe how your solution can be implemented. Does this need an embedded system, PC based or just analysis? Implementation details should give a practical view of the solution.
- Implementation Strategy: Outline the process steps to implement your solution. This can be better conveyed with a diagram.
- Impact: Explain how your solution addresses the existing problem.

Phase 2: Detailed Presentation

Presentation Elements:

In phase 2, candidates should expand their one-pager into a detailed presentation (PowerPoint slides), incorporating the following slides:

- In-Depth Problem Analysis: Elaborate each phases of the flight and various navigation sources, accuracy. Use industry available data point, statistics etc.
- Solution Overview: Present a comprehensive overview of your solution for each phase of the flight and **how multiple navigation sensors prioritized**. Include figures, block diagrams, flowcharts etc.
- Execution strategy: Outline the detailed plan **(phase, tolerance, additional check by the systems or process step by the pilot)** for executing your solution. How the idea will be implemented in the real world?
- Project execution timeline: Provide a project timeline for implementation. What **are the activities involved, and how will be these activities executed across time?**
- Required Tools: List the tools, technologies and resources needed for you to execute and implement this idea. Tools and resources need to be arranged from candidate side itself. So, please consider using the tools available in the college.

Phase 3: Demonstration

Realization of Ideas:

The third phase is the culmination of your efforts, where candidates bring their ideas to life. It can be any of the following, some examples:

- An algorithm for engaging alternate navigation solution. Outline what is the compromise. Propose what additional software to be developed (propose design), or actions pilot should take (propose same).
 - For example, a lack of navigation source in an approach (landing), means, proposal could be that exercise 'Missed Approach' or Check for Source from ILS. Analyze any safety impact due to such switch. Outline the safety consideration for each change.
- If there is any prioritization between navigation sources, propose same. Justify why the level of priority in each phase of it.

Phase 3 will be an offline and in person event, while phases 1 and 2 will be online evaluation. These steps are explained here, so that candidate can consider relevant problem statements and solutions, which could allow them to meet the 3 phases of evaluation effectively. Solutions selected in each phase will only proceed to the next phase and wait for the response from us for instruction on the next step.