

White Paper

Toward an AI-Assisted Aviation Safety and Operational Support System

From Pilot Training to Future Intelligent Flight Assistance

1. Executive Summary

Modern aviation is one of the most sophisticated operational systems ever created. Every flight involves tight coordination of works between pilots, engineers, dispatchers, air traffic controllers, weather services, maintenance systems, operational procedures and regulatory oversight etc. To maintain safety, aviation personnel must continuously process enormous amounts of operational information, often under time pressure and in rapidly changing environments. For example, before a helicopter flight departs, flight crew may already need to review a wide range of operational information including but not limited to weather forecasts, aircraft technical status, fuel calculations, payload limitations, NOTAMs, alternate aerodromes, route restrictions, terrain considerations, and operational regulations etc. As aviation operations become increasingly data-driven and dependent on rapidly changing real-time operational information, which is particularly in helicopter operations, and in the future low-altitude economy operations, UAS and eVTOL operations, the cognitive burden placed on aviation personnel will continue to increase.

At this technology advancement juncture, Artificial Intelligence (AI) now presents a new opportunity.... Not to replace aviation professionals, but to assist them.

This White Paper proposes a roadmap toward the development of an AI-Assisted Aviation Operational Support System capable of providing:

- additional operational “brain power”,
- intelligent knowledge support,
- operational cross-checking,
- real-time situational assistance, and
- future predictive monitoring capability.

The project begins from:

- AI-powered pilot training and aviation knowledge systems,

and progressively expands toward:

- safety oversight support,
- operational preparation assistance,
- real-time operational monitoring, and
- future intelligent flight assistance systems.

The philosophy behind the project is simple:

Help aviation personnel make better, faster, and safer operational decisions.

2. Background

Civil aviation today operates through a highly distributed and decentralized operational structure. Aviation safety is maintained through professional training, standard operating procedures, layered regulatory systems, engineering redundancy, and disciplined operational coordination. This system has been extremely successful.

However, modern aviation operations are also becoming increasingly information intensive. Operational personnel must continuously monitor and interpret weather developments, airspace restrictions, aircraft system status, maintenance information, operational procedures, air traffic flow, operational risks, and human performance considerations etc. In many situations, critical operational decisions must be made within very limited time. This challenge is particularly significant in helicopter operations, UAS and eVTOL operations, and future urban air mobility environments, where operational conditions may change rapidly and reaction time may be limited due to low level flying.

At the same time, aviation data remains highly fragmented. Operational information could be distributed across weather systems, operational manuals, maintenance records, flight planning systems, air traffic systems, pilot knowledge, engineering knowledge, and organizational procedures. Human operators remain responsible for integrating these fragmented information sources into safe operational decisions.

The emergence of AI technologies now creates the possibility of developing systems capable of assisting aviation personnel by:

- organizing information,
- interpreting operational conditions,
- cross-checking operational constraints,
- identifying overlooked issues, and
- assisting situational awareness.

In other words, AI may become an additional layer of operational brain power for aviation personnel.

