

FLIGHT PROCEDURES

A GLIMPSE IN TO THE FUTURE

Enhancing aviation safety with intelligent technology

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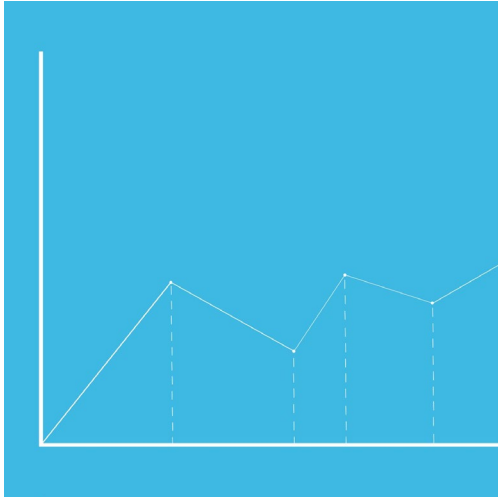


HISTORY

- September 24, 1929, Army lieutenant Doolittle, became the first to use only instrument guidance to take off, fly a set course and land.
- Flight Procedures were first developed by the ICAO Operations Division in 1949 and issued in 1951 and have since been amended numerous times
- Maps/Charts – pencil – overlay - calculator
- In 1966, the Obstacle Clearance Panel (OCP) was created to update these procedures for application to all types of airplanes.
- 1979 - The division of the PANS-OPS into the two volumes
- In 1989 the very first commercially available off the shelf instrument procedure design software (Wavionix)
- 2018 - The division of the PANS-OPS into the three volumes



Manual and Semi-Automated Processes



Current Workflow Challenges

Flight procedure design is complex, time-consuming, and relies heavily on manual interpretation and compliance checks.



Semi-Automated Tools Usage

Semi-automated tools help apply ICAO standards but lack real-time data integration and predictive capabilities.

NAVIGATION Challenges



Technologies Beyond GNSS



Alternative Navigation Systems

INS-GNSS hybrids and eLoran provide resilience and terrestrial backup against GNSS vulnerabilities.

Vision-Based Navigation

Navigation using terrain features enables positioning without relying on GNSS signals.

Quantum Navigation

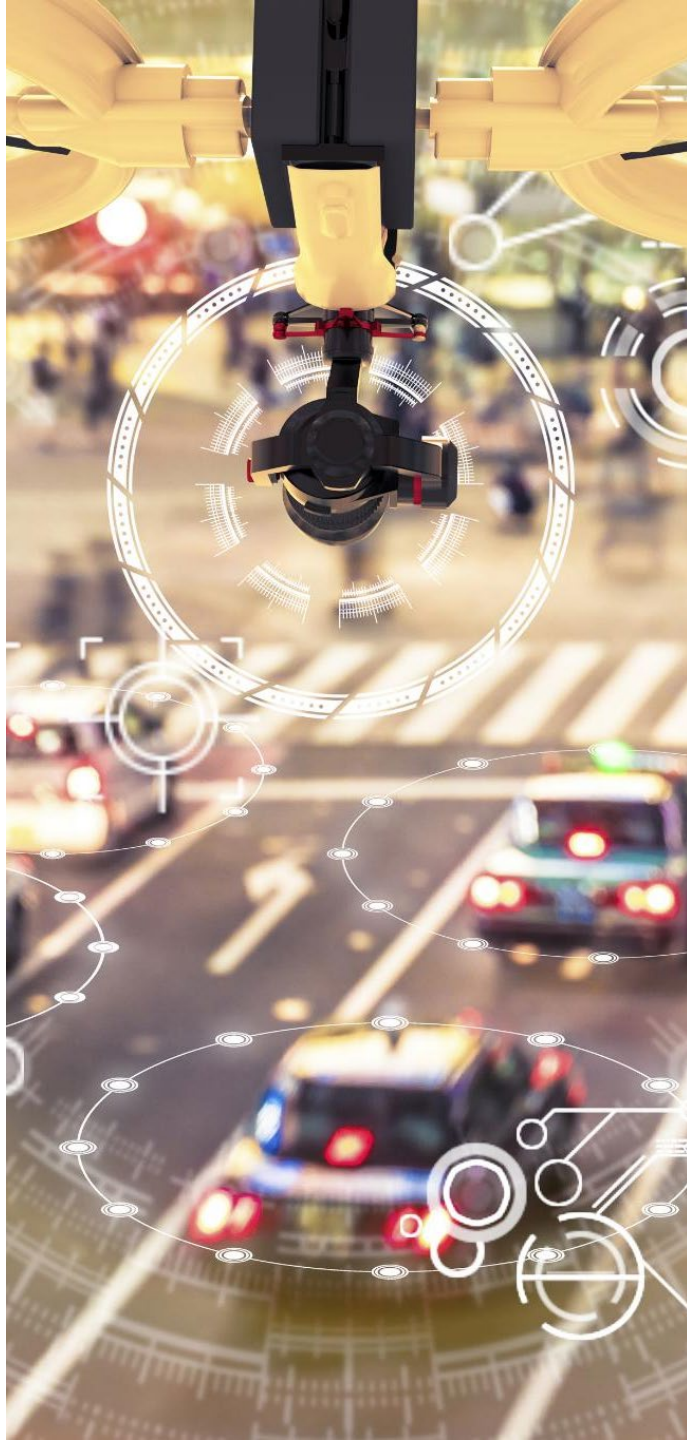
Quantum navigation offers GNSS-independent accuracy through advanced quantum technologies.

Signals of Opportunity and 5G PNT

SOOP uses RF signals from LEO satellites; 5G PNT supports urban air mobility with enhanced timing.

ARTIFICIAL INTELLIGENCE





AI in FPD

Automation

AI can automate some manual FPD tasks, improving compliance with ICAO standards and enhancing safety margins (Obstacle & terrain data, fuel efficiency, noise abatement).

Validation and Compliance checking

Automatically check compliance with regulatory criteria (e.g., obstacle clearance, minimum altitudes) and detect potential conflicts or violations faster than manual review.

Navigation Optimization

Suggest optimal paths based on aircraft capabilities and airspace constraints and simulate multiple scenarios to find the most efficient and safe procedure.

Predictive Safety Analysis

Use predictive models to assess risk (e.g., CFIT, missed approach hazards) and analyze historical incident data to identify design weaknesses.

Steps and Integration



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Data Ingestion and Processing

AI ingests terrain, obstacle, aeronautical, NOTAM, and weather data to start the workflow.

Automated Compliance and Optimization

AI applies ICAO SARPS, performs compliance checks, and optimizes procedure designs efficiently.

Human Review and Decision Making

Designers review AI outputs focusing on strategic decisions and regulatory validation.

Dynamic Updates and Monitoring

The AI-assisted workflow enables continuous updates and monitoring, enhancing safety and responsiveness.

Advantages and Limitations



Benefits

AI accelerates design cycles, lowers costs, and improves safety through automated compliance checks and optimization.

AI Data Processing Capabilities

AI processes large datasets, integrates real-time updates, and balances safety, fuel efficiency, and environmental impact.

Oversight

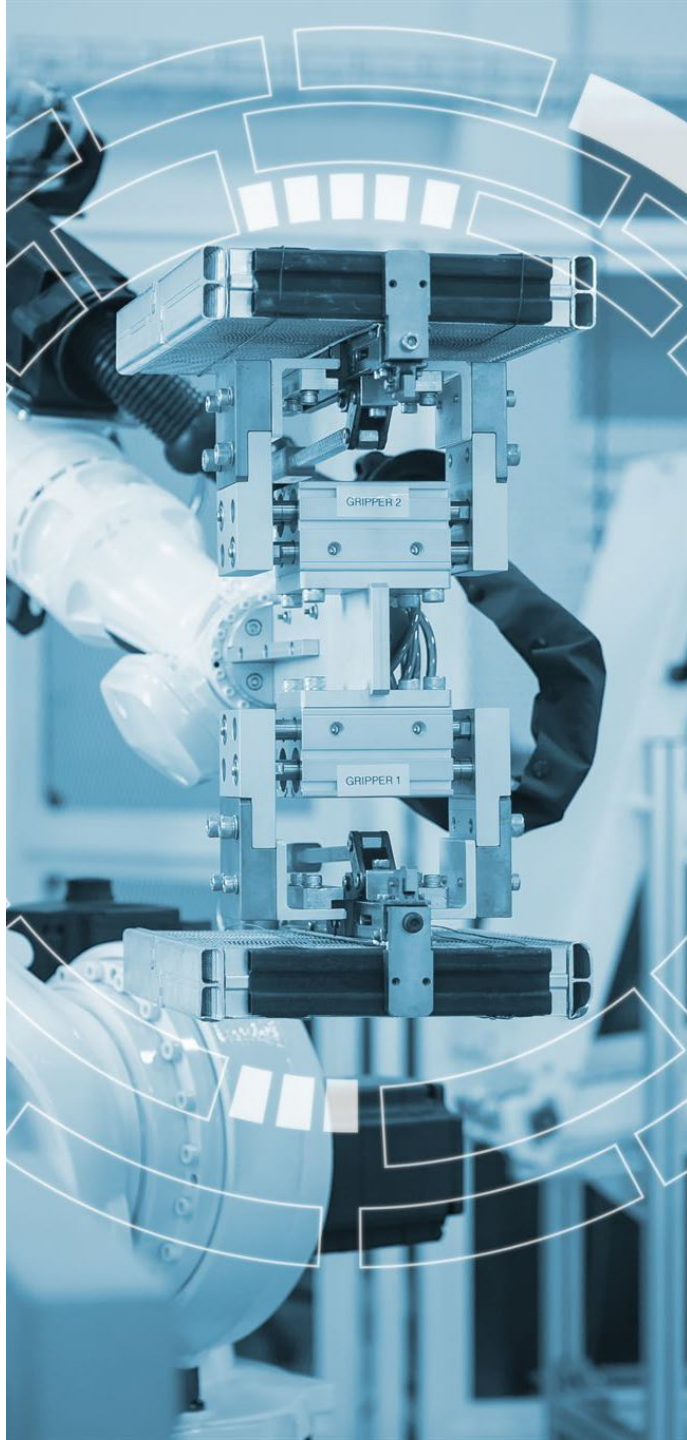
Regulatory transparency, data quality, and human oversight are critical to ensuring safe and compliant AI FP designs.

Future Potential

AI can enhance efficiency and resilience, becoming a key enabler for future airspace management and operations.

Challenges:

- Regulatory acceptance: require rigorous validation.
- Explainability: AI decisions must be transparent.
- Data quality: Accurate terrain, obstacle, and navigation data.



Roles and Benefits

Automated Compliance Checking

AI automates validation against ICAO standards, ensuring accurate and efficient compliance checks.

Dynamic Data Integration

Integrates NOTAMs and GNSS updates to maintain valid procedures under changing conditions.

Explainable Compliance

Documents decision reasoning clearly, supporting regulatory approval and transparency.

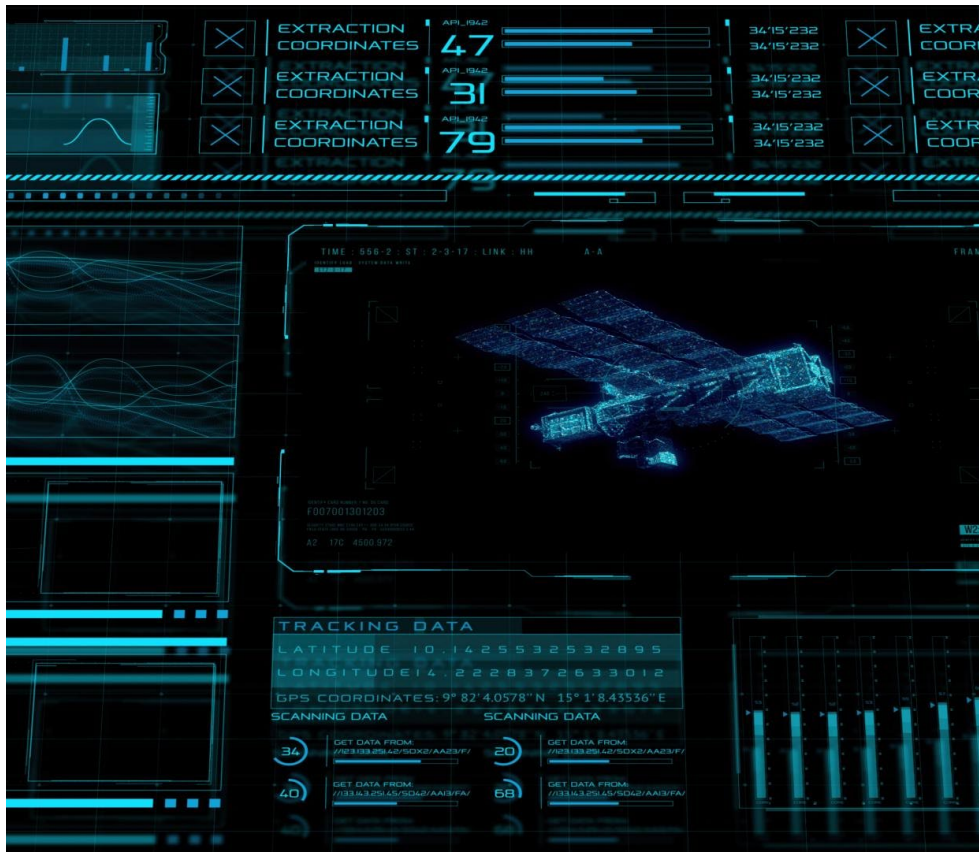
Probabilistic Safety Margins

Uses Monte Carlo simulations to assess risks with variable conditions for improved safety.

Future Vision



Dynamic and Integrated Airspace



AI-Driven Flight Procedures

AI continuously updates flight procedures based on real-time airspace data to improve safety and efficiency.

Integration with UTM and ATM

Seamless integration with Unmanned Traffic Management and Air Traffic Management systems enhances coordination and control.

Predictive Analytics for Safety

Predictive analytics enables proactive safety measures and efficient airspace usage in complex environments.

Resilient Navigation Systems

Robust navigation systems maintain operational integrity even in contested or challenging environments.



Comparing Traditional and AI-Assisted Design

Manual Design Challenges

Traditional flight procedure design is labor-intensive, time-consuming, and incurs high manual costs.

AI-Assisted Efficiency

AI-assisted design reduces cycle time to days and lowers manpower costs through automation and monitoring.

Optimization and Safety

AI enables long-term savings through optimization and improves safety margins via probabilistic risk assessments.



THANK YOU

