



Ministry of Transportation of the Republic of
Indonesia
Directorate General of Civil Aviation

COSCAP-SEA STEERING COMMITTEE MEETING

AI-ASSISTED **RBO** PILOT PROJECT INITIATIVE

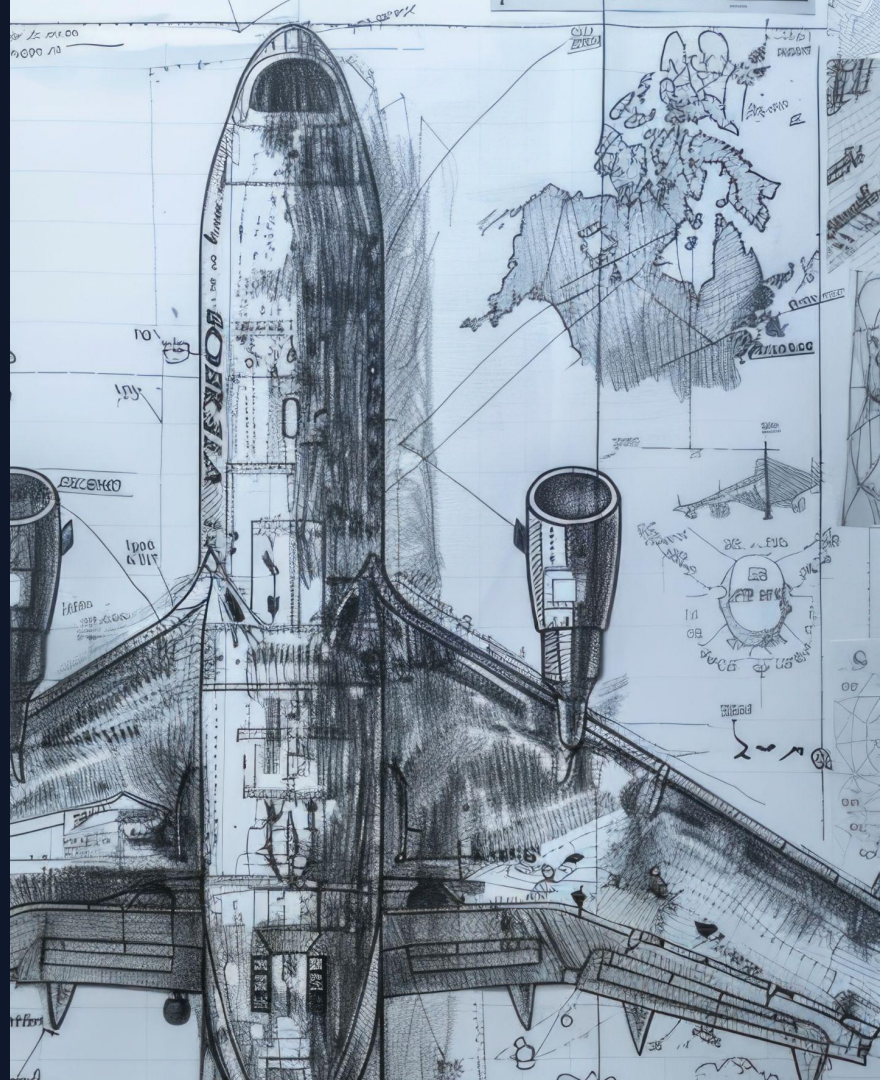
Enhancing Regulatory Oversight through
Data-Driven Prioritization and Safety Intelligence



APRIL 21, 2026



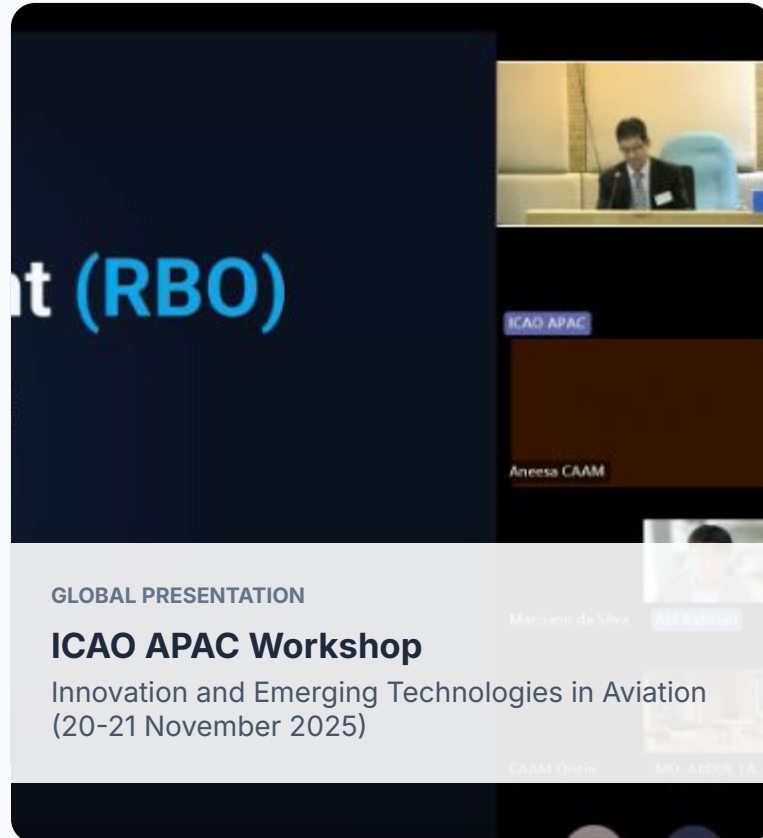
BALI, INDONESIA





INITIATIVE BACKGROUND & CONTEXT

Strategic Foundations and Global Alignment



COSCAP-SEA Partnership

The program is supported by **ICAO COSCAP-SEA** to research the possibilities AI-RBO Pilot Project



Aviation Safety Intelligence

Leveraging emerging technologies to shift from reactive monitoring to predictive safety oversight through data-driven prioritization.



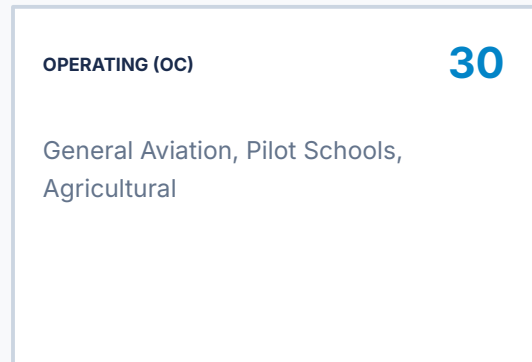
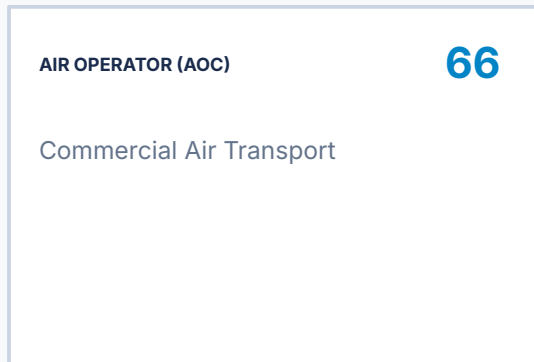
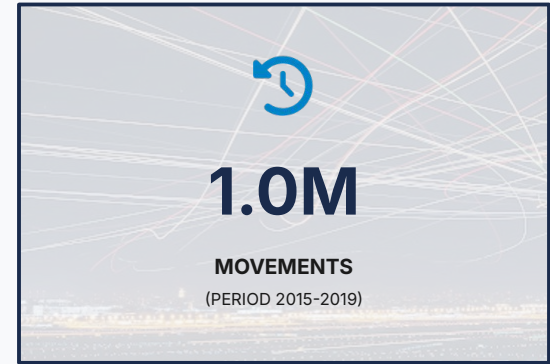
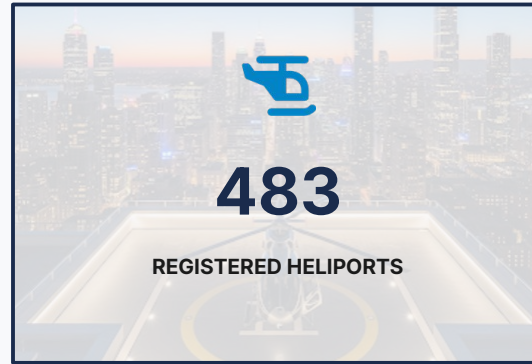
Regulatory Compliance

Aligned with ICAO Annex 19 and Doc 9734, strengthening Critical Elements 3 (Organization) and 8 (Resolution of Safety Issues).



OPERATIONAL CONTEXT

The Scale of Aviation Oversight in Indonesia





SYSTEMIC CHALLENGES: THE DATA PARADOX

Addressing the "Formula Rich, but Data Poor" Reality

THE DATA PARADOX

*"We are Formula Rich,
but Data Poor."*



RESOURCE DISPROPORTION

Struggling with a disproportionate inspector-to-operator ratio across the region.



FRAGMENTED DATA

Safety data is siloed across disparate databases, leading to rigid inspection cycles.



USOAP FINDINGS

Recurring findings on Critical Element 3 (Organization) and Critical Element 8 (Resolution of Safety Issues).



OUR SAFETY DATA ECOSYSTEM

Comprehensive Sources for Risk Analysis

OPERATIONAL DATA

- Flight Data Analysis
- Aircraft Registration
- Route Complexity
- Ramp Inspections
- Flight Cycles/Hours
- Fleet Age

SAFETY REPORTS

- Accident Reports
- MOR / VOR
- Safety Recommendations
- Serious Incidents
- Pilot Reports
- MISR Data

SAFETY
DATA HUB

ORGANIZATIONAL

- SMS Maturity
- Financial Status
- Reporting Culture
- Personnel Licensing
- Organization Register
- Quality Management

SURVEILLANCE

- Audit Findings
- Enforcement Actions
- Monitoring Results
- NCP / NCF / NAD
- Aircraft Inspections
- Follow-up Process

SHIFTING FROM REACTIVE TO PREDICTIVE OVERSIGHT



PERFORMANCE MONITORING FRAMEWORK

Aligning State and Industry Safety Standards



State Level (SSP)

STATE SAFETY PROGRAMME

Monitoring the overall safety performance of the aviation system at the national level. Focuses on regulatory effectiveness and systemic safety trends.

STATE PERFORMANCE

Measuring the achievement of State Safety Objectives and the effectiveness of oversight activities.



Organization Level (SMS)

SAFETY MANAGEMENT SYSTEM

Evaluating individual operator safety performance through their internal SMS. Focuses on hazard identification and risk mitigation.

ORG PERFORMANCE

Assessing the maturity and effectiveness of an operator's safety culture and reporting systems.

INTEGRATED PERFORMANCE MEASURING & MONITORING SCHEME

A unified approach to ensure safety excellence across the entire aviation ecosystem.



THE PERFORMANCE FORMULA

Quantifying Safety Excellence

$$F(P) = F(C(p), D(p), I(p)) = 100\%$$

The Performance Factor F(P) represents the overall safety health of an organization.



COMPLIANCE C(P)

Adherence to regulatory standards, audit results, and surveillance findings. High compliance is the foundation of safety.



DEVIATION D(P)

Occurrences of accidents, serious incidents, and safety reports. The goal is to minimize deviations to zero.



IMPROVEMENT I(P)


Maturity of the Safety Management System (SMS), reporting culture, and effectiveness of follow-up actions.

TARGET: 100% PERFORMANCE FACTOR



DATA-DRIVEN DECISION MAKING LOOP

Transforming Data into Actionable Safety Oversight

 01

DATA SOURCES

Collecting comprehensive safety and operational metrics from across the aviation ecosystem.

 02

SAFETY ANALYSIS

Identifying trends, patterns, and potential risk areas through advanced analytical modeling.

 03

DECISION-MAKING

Prioritizing resources and surveillance activities based on objective, data-backed risk profiles.

 04

OVERSIGHT & ACTION

Implementing targeted surveillance and safety measures to mitigate identified risks effectively.

SHIFTING FROM REACTIVE TO PREDICTIVE OVERSIGHT



HYBRID ARCHITECTURE & DATA SOVEREIGNTY

Deterministic Logic Combined with Grounded AI Assistance



1. DETERMINISTIC LAYER

Hard-coded logic engine based on Staff Instructions and regulatory standards. Provides quantitative scoring with absolute mathematical certainty.

CORE FUNCTION: Quantitative Scoring & Compliance Logic



2. AI LAYER (RAG)

Retrieval-Augmented Generation. Mandated to retrieve specific CASR paragraphs before issuing advice, mitigating hallucinations.

CORE FUNCTION: Grounded Regulatory Assistant



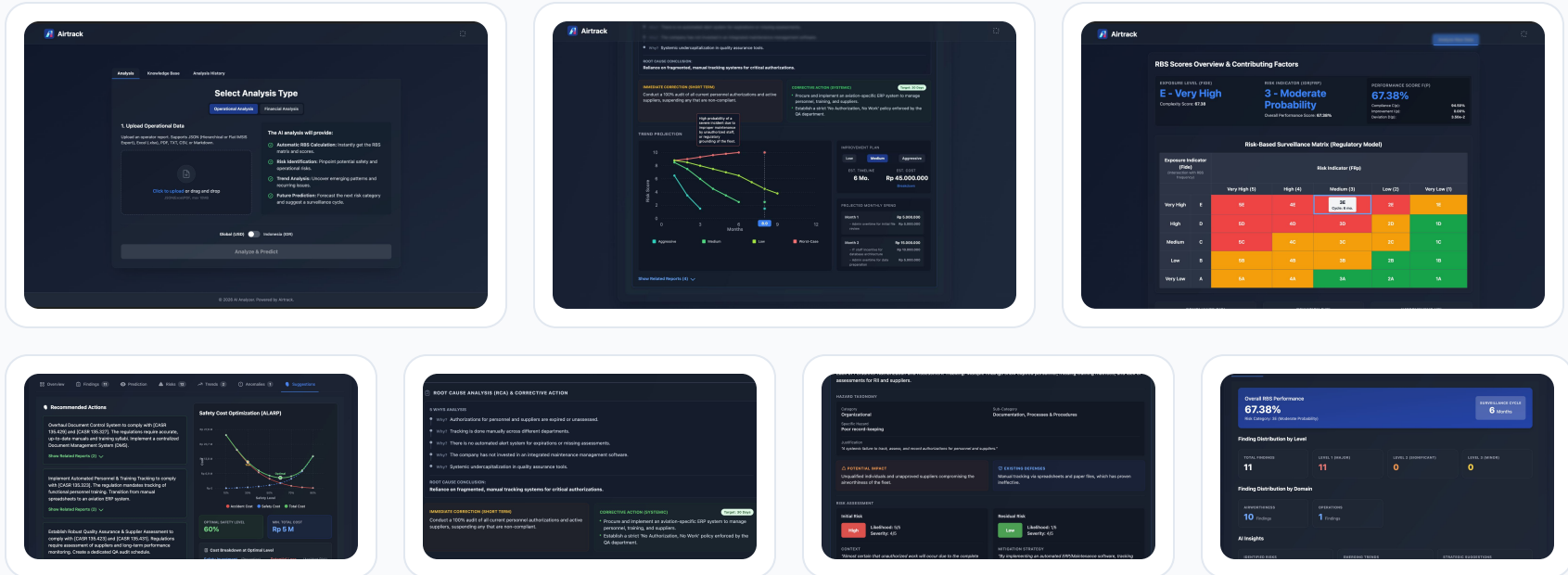
STRICT DATA SOVEREIGNTY

Raw data is processed locally on-premise. Sensitive data is never pushed to public servers.



AUTOMATED RBS DASHBOARD

Real-Time Performance and Risk Monitoring



UNIFIED OPERATIONS VIEW: DATA INGESTION, ANALYSIS, AND REPORTING



THE AI ANALYSIS PROCESS

From Raw Data to Predictive Insights

01

DATA INGESTION

Upload operational reports and regulatory documents in multiple formats.



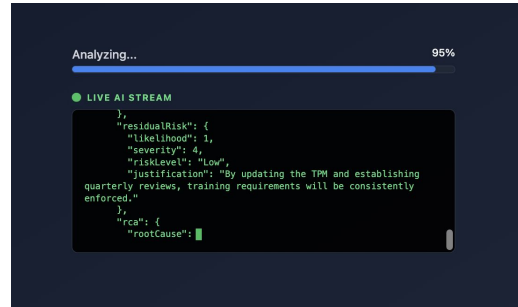
JSON EXCEL PDF CSV

Supports Indonesian Aviation
Regulations (CASR, AC).

02

LIVE AI STREAM

Real-time analysis of safety metrics and risk factors.



Automated Root Cause Analysis (RCA) and
Justification.

03

PREDICTION

Forecasting risk categories and
surveillance cycles.

OUTPUT:

Risk Rating

Cycle

Trends

ALARP

Financial Planning



COMPLEXITY VS. PERFORMANCE MATRIX

Determining the Risk Profile for Targeted Oversight

COMPLEXITY RATING (A TO E) →

Risk-Based Surveillance Matrix (Regulatory Model)					
Exposure Indicator (Fide) <small>(Intersection with RBS frequency)</small>	Risk Indicator (FRp)				
	Very High (5)	High (4)	Medium (3)	Low (2)	Very Low (1)
Very High E	5E	4E	3E Cycle: 6 mo.	2E	1E
High D	5D	4D	3D	2D	1D
Medium C	5C	4C	3C	2C	1C
Low B	5B	4B	3B	2B	1B
Very Low A	5A	4A	3A	2A	1A



PERFORMANCE INDICATORS

- Compliance Factor (Audits, Surveillance)
- Deviation Factor (Accidents, Incidents)
- Improvement Factor (SMS Maturity)
- Reporting Culture & Follow-up Process



COMPLEXITY INDICATORS

- Fleet Size & Average Aircraft Age
- Number of Aircraft Models & Routes
- International vs. Domestic Operations
- Organization Size & Employee Count



DEEP RISK ASSESSMENT & RCA

Systemic Analysis of Organizational Hazards

INITIAL RISK

HIGH

Likelihood: 5/5 | Severity: 4/5

"Almost certain that unauthorized work will occur due to the complete breakdown of tracking systems."

RESIDUAL RISK

LOW

Likelihood: 1/5 | Severity: 4/5

"By implementing an automated ERP/Maintenance software, tracking failures become rare."

5 WHYS ROOT CAUSE ANALYSIS

1. Authorizations for personnel and suppliers are expired or unassessed.
2. Tracking is done manually across different departments.
3. There is no automated alert system for expirations or missing assessments.
4. The company has not invested in an integrated maintenance management software.
5. Systemic undercapitalization in quality assurance tools.

SYSTEMIC CORRECTIVE ACTION:

Procure and implement an aviation-specific ERP system. Establish a strict 'No Authorization, No Work' policy.

HAZARD TAXONOMY:

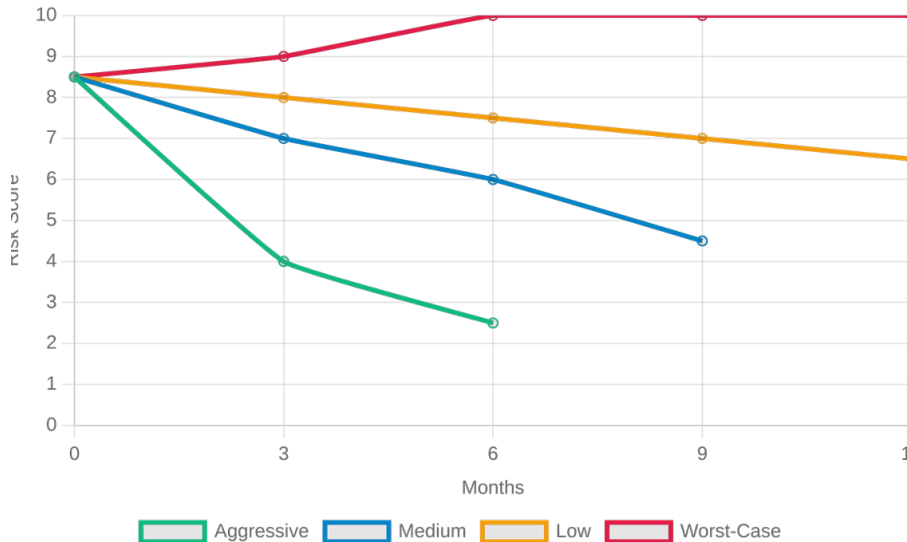
Organizational / Documentation, Processes & Procedures



PREDICTIVE TRENDS & FINANCIAL PLANNING

Forecasting Risk Mitigation and Investment Requirements

TREND PROJECTION (RISK SCORE)



*Projections based on Aggressive, Medium, Low, and Worst-Case mitigation scenarios.

IMPROVEMENT PLAN

EST. TIMELINE

6 Mo.

EST. COST

Rp 45M

PROJECTED MONTHLY SPEND

Month 1: Admin Overtime
Rp 5M

Month 2: IT Staff Incentive
Rp 10M

Month 2: Database Architecture
Rp 15M

Month 3: System Integration
Rp 15M



STRATEGIC OPTIMIZATION: ALARP & COMPLIANCE

Balancing Safety Investment with Regulatory Adherence

DOCUMENT CONTROL (CASR 135.429)

Overhaul Document Control System to ensure accurate, up-to-date manuals and training syllabi. Implement a centralized DMS.

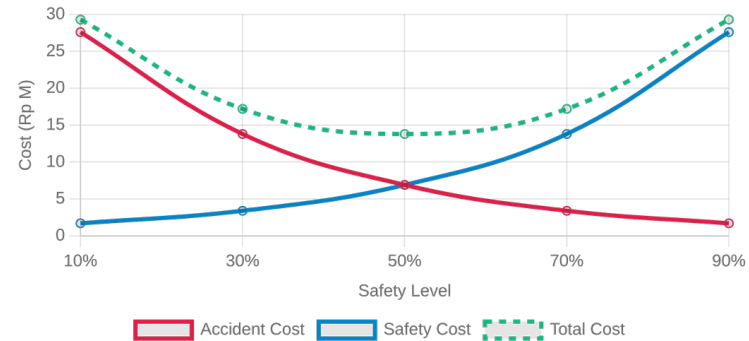
PERSONNEL TRACKING (CASR 135.323)

Implement automated personnel & training tracking. Transition from manual spreadsheets to an aviation ERP system.

QUALITY ASSURANCE (CASR 135.423)

Establish robust QA & supplier assessment. Create a dedicated QA audit schedule for long-term performance monitoring.

SAFETY COST OPTIMIZATION (ALARP)



OPTIMAL SAFETY LEVEL

60%

MIN. TOTAL COST

Rp 5 M

*Safety Investment (Rp 2.5B) + Potential Loss (Rp 2.5B) at optimal level.

SHIFTING FROM REACTIVE TO PREDICTIVE OVERSIGHT



RISK-BASED SURVEILLANCE PLANNING

Targeted Resource Allocation for Maximum Safety Impact



HIGH RISK TIERS

- Increased frequency of audits and inspections.
- In-depth focus on identified risk areas.
- Mandatory follow-up and monitoring of corrective actions.



MEDIUM RISK TIERS

- Standard surveillance schedule maintained.
- Focus on trend analysis and performance stability.
- Periodic review of safety management effectiveness.



LOW RISK TIERS

- Optimized oversight with reduced frequency.
- Focus on continuous improvement and safety culture.
- Resource reallocation to higher-risk operators.

STRATEGIC IMPACT: SMARTER RESOURCE USE

RESULT: ENHANCED NATIONAL AVIATION SAFETY



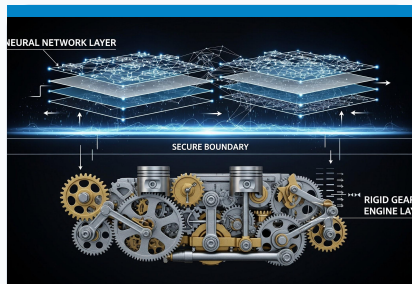
ELEVATING THE INSPECTOR'S ANALYTICAL PRECISION

Empowering Human Expertise with Advanced Predictive Intelligence



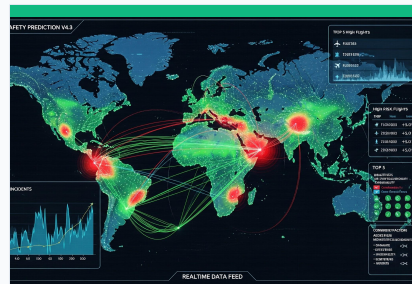
SUPERHUMAN DATA CRUNCHING

Processes a "Sea of Data" in seconds. Identifies hidden risk patterns in SMS reports that fatigued human eyes might overlook.



SECURE DUAL ARCHITECTURE

Strict boundary between AI context and Deterministic Regulatory Engine. No "hallucinations" in scoring; 100% CASR compliance.



PREDICTIVE SURVEILLANCE

Shift from reactive to real-time risk mapping. Strategic allocation of limited inspection budgets to high-priority areas.



OBJECTIVE CONSISTENCY

Standardizes the oversight baseline. Eliminates subjective bias between regions, ensuring fair treatment for all stakeholders.



CHALLENGES IN AI ADOPTION

Addressing Strategic Bottlenecks in the AI-Assisted RBO Initiative

01. DATA QUALITY

Garbage In, Garbage Out

Subjective narratives hinder objective scoring. Standardizing reports is critical for RAG accuracy.

02. REGULATORY RISK

Hallucination Potential

Risk of referencing outdated CASR. Requires a boundary between AI and Deterministic Engines.

03. PERFORMANCE

Latency & Operational Costs

High computational demands for large data volumes result in latency and increased infrastructure overheads.

04. INTUITION GAP

Missing "Gut Feeling"

AI lacks the professional intuition to grasp "safety culture" nuances invisible in formal docs.

CURRENT MITIGATION STRATEGIES

Human-in-the-Loop

AI acts as a Decision Support System (DSS) with human validation.

Fine-tuning

Specialized training on aviation datasets for higher accuracy.

Data Standardization

Implementing structured data protocols at source to improve overall efficiency.

SAFEGUARDING SYSTEM INTEGRITY THROUGH SECURE ON-PREMISE INFRASTRUCTURE



PILOT PROJECT INITIATIVE: ROADMAP

A Phased Approach to Regional AI-Assisted Oversight

1

TASKFORCE ESTABLISHMENT

Formation of a dedicated AI-Assisted RBO Pilot Project taskforce comprising regulatory, safety, and technical experts.

2

PROGRAMME DEVELOPMENT

Development of the pilot project framework, governance structure, detailed roadmap, and implementation timeline.

3

PILOT IMPLEMENTATION

Technical assistance, system configuration, training, and operational deployment within participating SEA Member States.

SHIFTING FROM REACTIVE TO PREDICTIVE OVERSIGHT



ACTION OF THE MEETING

Official Proposal for the 23rd COSCAP-SEA Steering Committee

STRATEGIC IMPACT



ICAO Compliance

Strengthening adherence to Annex 19 and Doc 9734 Critical Elements (CE-3 & CE-8).



USOAP Performance

Improving regional USOAP scores through data-driven safety intelligence.



Oversight Effectiveness

Enhancing transparency and consistency across SEA Member States.

THE COMMITTEE IS INVITED TO:

01

NOTE THE PROPOSED AI-ASSISTED RISK-BASED OVERSIGHT PILOT PROJECT.

02

INVITE SEA STATES TO PARTICIPATE IN AND SUPPORT THE PILOT IMPLEMENTATION.

03

AGREE FOR COSCAP-SEA TO COORDINATE AND PROVIDE TECHNICAL SUPPORT.

SHIFTING FROM REACTIVE TO PREDICTIVE OVERSIGHT

THANK YOU

AI-ASSISTED RBO
PILOT PROJECT INITIATIVE

Directorate General Civil Aviation
Indonesia

FORGING A SAFER FUTURE THROUGH DATA-DRIVEN INTELLIGENCE