FLIGHT SAFETY FOUNDATION

Safety Forum 2026

DATA AND AI FOR OPERATIONAL SAFETY: Opportunities and Responsibilities

Report and Discussion Paper

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SAFETY FORUM

DATA AND AI FOR OPERATIONAL SAFETY

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INTRODUCTION

Artificial intelligence (AI) and data-driven technologies are rapidly transforming many aspects of aviation. Increasing volumes of operational, technical, and safety data, combined with advances in machine learning, natural language processing and generative AI, are creating new opportunities to strengthen safety management, enhance operational understanding, improve predictive capabilities, and support more effective safety decision-making. At the same time, these opportunities bring important responsibilities. The safe introduction of AI into aviation requires robust governance, high-quality data, appropriate human oversight, operational validation, and continued confidence that these technologies support, rather than compromise, aviation's exceptionally high safety standards. These opportunities and responsibilities formed the central theme of Flight Safety Foundation's 13th annual Safety Forum, which was titled "Data and AI for Operational Safety: Opportunities and Responsibilities."

The two-day event was held 30 June–1 July 2026, in Brussels. Organised by Flight Safety Foundation in partnership with EUROCONTROL and the European Regions Airline Association (ERA), the Forum brought together approximately 240 aviation professionals from across the world representing regulators, airlines, aircraft manufacturers, air navigation service providers, airports, industry associations, research organisations, and technology providers. More than a conference, the Safety Forum was designed as a collaborative think tank where operational experience, practical implementation lessons, and open discussion were used to develop a shared understanding of the opportunities and challenges associated with the use of AI for operational safety.

The programme reflected this objective by bringing together speakers from a wide range of aviation domains and geographical regions. Presentations focused on practical operational experience rather than theoretical concepts or product promotion, sharing lessons learned from early implementation of AI-supported safety applications, operational deployment, organisational change, governance, and regulatory oversight. Discussions throughout the Forum were deliberately interactive, enabling participants to challenge ideas, compare experiences, and collectively identify both opportunities and implementation challenges that are broadly transferable across the aviation industry.

The AI genie is out of the bottle. While a genie may grant wishes, if the wish isn't carefully considered and stated, the wish may not be granted in a desired way.

This report captures the principal insights emerging from both the presentations and the extensive discussions held during the Safety Forum. It also incorporates the outcomes of a webinar, held on 15 April 2026, which attracted more than 700 participants from across the global aviation community and provided an early opportunity to explore the Forum's theme and identify many of the questions that were subsequently examined in greater depth during the event. Taken together, these activities enabled broad stakeholder participation and ensured that this report reflects a wide range of operational perspectives and implementation experience.

This report is intentionally presented as a discussion paper rather than as formal guidance or policy. Its purpose is to stimulate further dialogue, support organisations exploring the safe implementation of AI, and identify practical considerations that can inform future operational practice, research, and regulatory development. The report presents the collective insights in a structured and thematic manner, distinguishing between operational opportunities, implementation challenges, and practical safeguards identified by the participants. It also provides a common reference for key concepts and terminology intended to support a shared understanding of AI within the operational safety community.

To maximise the value of the discussions beyond the event itself, the presentations and video recordings for those sessions where speakers agreed to publication have been made available through SKYbrary. Together with this report, these resources form part of Flight Safety Foundation's continuing effort to capture, preserve, and share practical operational safety knowledge for the benefit of the global aviation community.

2 DISCUSSION

AI is becoming an enabler of operational safety, not an objective in itself

AI should not be viewed as a separate safety discipline or a parallel "AI safety system". Rather, it is a capability that should strengthen operational safety across the organisation, supporting safety management systems (SMS), operational decision-making, training, procedure design, investigations, and other activities that contribute to safety. Its value depends on being integrated with the same disciplined governance, risk management, assurance, learning, and safety culture that underpin the effective management of operational safety.

The discussions throughout the Safety Forum demonstrated that the aviation community has moved beyond asking whether artificial intelligence has a role in operational safety. Across organisations, AI is already supporting safety reporting, occurrence analysis, operational monitoring, predictive analytics, training, and decision support. Rather than debating the technology itself, participants focused primarily on the practical conditions required to introduce AI safely, responsibly, and effectively within aviation's established safety management framework.

Speed is important because it allows us to identify challenges before they become problems. Speed enables efficiency. AI enables speed.

A recurring message throughout the Forum was that AI should not be viewed as an objective in itself, but as an enabler of operational safety. The value of AI lies not in deploying increasingly sophisticated technology, but in improving the industry's ability to identify hazards, understand operational risk, support better safety decisions, and ultimately improve safety performance. The discussions consistently demonstrated that successful implementation should therefore be measured by demonstrable safety outcomes rather than technological sophistication.

This evolution reflects a broader progression in aviation safety. During the early development of occurrence reporting systems, the principal challenge was obtaining sufficient safety information. As digital technologies, onboard sensors, flight data monitoring, surveillance systems, and other operational data sources became increasingly available, aviation evolved into a data-rich industry. The challenge subsequently shifted from collecting information to transforming it into operational safety knowledge. Despite unprecedented volumes of operational data, organisations frequently struggle to integrate information from multiple sources, identify meaningful patterns, and convert analysis into timely safety action, being "data rich and insight poor." The Forum demonstrated that AI offers a unique opportunity to strengthen the safety learning process by helping organisations transform increasingly abundant operational data into meaningful operational insight and more effective safety improvement.

Data, governance, and trust emerged as the principal implementation challenges

Participants consistently recognised that successful AI deployment depends on much more than selecting an appropriate model. Reliable safety outcomes require trustworthy governance, reliable and integrated safety information, effective organisational processes, and continued human oversight.

One of the strongest messages emerging from the discussions was that AI in safety needs to be governed well, built on reliable and integrated safety information, capable of generating meaningful operational safety insight, focused on improving safety performance, and trusted and understood by the people who use it. These characteristics should not be viewed as separate implementation topics, but as interdependent conditions for successful AI adoption. Weakness in any one of them has the potential to undermine the effectiveness of AI-supported safety activities.

Trust, the availability and quality of safety data, and organisational capability repeatedly emerged as the principal implementation challenges identified by participants. Discussions reinforced that AI cannot compensate for fragmented operational data, inconsistent terminology, poor data quality, or insufficient operational expertise. Particular attention was therefore devoted to establishing common safety concepts and taxonomies, improving interoperability between safety information sources, strengthening data governance and data lifecycle management, and ensuring appropriate validation, cybersecurity, accountability, and assurance. These were consistently viewed not as technical considerations but as fundamental elements of operational safety.

The pace of AI adoption should not outpace an organisiation's AI governance arrangements .

Both humans and AI need high-quality data coming in.

Trust itself was recognised as extending beyond technical performance. Confidence in AI depends equally upon transparency, operational validation, and the ability of users to understand both the capabilities and limitations of AI-supported outputs. Participants repeatedly highlighted the importance of communicating uncertainty appropriately, including the use of confidence levels that enable operational users to calibrate their trust, prioritise verification efforts, and recognise when additional human judgement is required. Trust also develops over time as users are able to understand, critically review, and, where appropriate, challenge AI-supported outputs before they are incorporated into safety decision-making.

The discussions also suggested that AI should not be viewed as a silver bullet for operational safety. AI does not compensate for weaknesses in existing operational safety processes. Organisations with fragmented data, weak reporting culture, unclear accountability, or limited ability to implement safety actions are unlikely to realise the full safety benefits of AI. Rather than replacing good operational safety management, AI tends to make both organisational strengths and underlying weaknesses more visible.

AI will likely accelerate whatever processes for which we use it. When used appropriately, it accelerates us toward achieving desired outcomes, but when misapplied, it can accelerate us toward undesired outcomes.

Human expertise becomes more important, not less

Perhaps the clearest consensus emerging from the Forum concerned the continuing role of people in AI-supported safety. Rather than replacing operational expertise, AI was consistently viewed as a capability that enables safety professionals to work more effectively by reducing repetitive analytical tasks, identifying patterns that may otherwise remain undetected, and allowing greater focus on higher-value safety activities.

The discussions consistently rejected the notion that AI should become a decision-maker within safety management. Human responsibility and accountability for safety decisions remain unchanged, while the role of subject matter experts becomes even more important. Operational experts are essential for validating AI outputs, interpreting operational context, challenging recommendations, maintaining organisational knowledge, and ensuring that analytical conclusions remain operationally meaningful. In this respect, AI was repeatedly described as an additional layer supporting SMS rather than a replacement for existing safety barriers or professional judgement.

Participants also recognised that successful implementation depends upon designing AI around operational users rather than expecting operational users to adapt to AI. Explainable outputs, predictable system behaviour, confidence indicators, intuitive interfaces, and co-design with operational personnel were all identified as important contributors to trust and adoption.

Change goes better when it's done WITH people rather than TO them.

Several organisations also demonstrated that implementation success depends as much on organisational acceptance and continuous user engagement as on model performance itself.

Participants also strongly recognised the importance of attracting and retaining the talent and expertise needed to support successful AI implementation.

AI implementation should be incremental, operational, and safety-driven

The discussions demonstrated considerable maturity in the aviation community's approach to AI implementation. Rather than advocating rapid or large-scale deployment, participants consistently supported incremental implementation focused on clearly defined operational safety problems capable of delivering measurable safety benefits. This enables organisations to progressively build confidence, validate operational performance, and strengthen governance before expanding AI into increasingly complex operational domains.

Although many presentations originated from organisations with substantial AI capability and implementation experience, participants also recognised that widespread adoption will increasingly involve organisations with significantly more limited resources. For many small and medium-sized organisations, successful implementation is unlikely to depend upon developing sophisticated AI capabilities internally, but rather upon applying a consistent set of implementation principles. These include establishing governance before deployment, defining clear ownership and accountability, ensuring transparency regarding where and how AI is used, developing reliable and well-governed safety data supported by common safety concepts and terminology, maintaining meaningful human validation, and introducing AI progressively through operational use cases that demonstrate measurable safety value before broader implementation.

The introduction of AI requires pairing the most complex machine systems ever created with the most complex natural systems (humans) to perform some of the most complex tasks ever conceived.

Collectively, the discussions suggested that the principal challenge facing aviation is no longer understanding what artificial intelligence is but understanding how it can be introduced safely, responsibly, and in a manner that demonstrably strengthens operational safety.

The insights presented in the following section capture this collective perspective. Rather than providing prescriptive guidance, they present a structured discussion of the principal operational opportunities, implementation challenges, and practical implementation considerations identified during the Safety Forum, providing a foundation for continued dialogue and the safe evolution of AI within aviation safety.

3 SAFETY FORUM INSIGHTS

The discussions presented in this report have been synthesised into a structured set of Safety Forum Insights that capture the principal themes emerging from the presentations, panel discussions, and audience contributions. The insights do not represent formal recommendations, regulatory guidance, or consensus positions of the participating organisations. Rather, they are intended as a discussion framework that summarises the collective observations, practical experiences, and implementation considerations shared throughout the Safety Forum and the preceding webinar.

To improve readability and facilitate practical use, the insights have been organised into seven thematic areas:

A. **Responsible AI governance and implementation**
B. **AI-ready safety data**
C. **AI for safety data capture and information generation**
D. **AI for safety analysis and risk understanding**
E. **AI for predictive safety and safety improvement**
F. **Human-centred AI for safety**
G. **AI for safety learning and competency development**

Viewed through a safety management lens, these themes broadly relate to familiar safety management functions, including governance and accountability, safety risk management, safety assurance, and safety promotion and learning. This reinforces that AI should be integrated into existing operational safety processes rather than treated as a separate technical initiative.

Within each theme, the insights are presented using a common structure comprising (1) opportunities and implementation challenges, describing either operational opportunities where AI may enhance safety performance or practical challenges associated with its implementation; and (2) practical safeguards and implementation considerations, outlining the governance measures, human factors, validation activities, and implementation approaches that participants considered important for achieving safe, trusted, and effective use of AI in operational safety.

The insights should not be interpreted individually or in isolation. Many are closely interconnected and collectively describe the organisational, technical, and human factors necessary for successful AI adoption. Together, they provide a structured foundation for further discussion, organisational reflection, and future development of AI-supported operational safety practices

OPPORTUNITIES AND IMPLEMENTATION CHALLENGES	PRACTICAL SAFEGUARDS AND IMPLEMENTATION CONSIDERATIONS
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A RESPONSIBLE AI GOVERNANCE AND IMPLEMENTATION

Challenges to establish the foundations for safe, trustworthy, and sustainable AI implementation.

#	Opportunities and Implementation Challenges	Practical Safeguards and Implementation Considerations
1	**Accountability and ownership** AI-supported safety analysis may create ambiguity around who is accountable for outputs, recommendations, and resulting safety actions.	Define clear ownership for AI use cases before operational deployment. Define ownership for model performance, data quality, human review, escalation, decision-making, and corrective action follow-through, while maintaining clear accountability and human responsibility for safety decisions and outcomes.
2	**Certification and assurance pathways** AI-supported safety tools currently lack clearly defined certification, assurance, and standardised approval pathways, making it difficult to determine acceptable levels of safety assurance before operational use.	Develop structured assurance cases, align with emerging regulatory guidance (e.g., European Union Aviation Safety Agency AI trustworthiness frameworks), and define acceptable risk thresholds. Implement staged deployment with increasing operational exposure only after demonstrated safety performance rather than waiting for fully developed certification pathways, while drawing on relevant assurance practices from other industries where appropriate. Monitor and align implementation with evolving regulatory roadmaps, standards, and cross-authority initiatives as they mature.
3	**Reliability and limitations of AI outputs** Large language models and automated analysis tools may generate incorrect, misleading, or non-contextual safety outputs or present correlations without sufficient causal or operational context.	Use AI as decision-support rather than decision-maker, require competent human validation for safety-critical outputs, and define operational limitations clearly. Initially deploy AI alongside existing processes to compare AI outputs with established methods before increasing operational reliance.

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4	**Communicating uncertainty** AI systems may not always be able to provide a reliable answer or recommendation. In some safety applications, recognising uncertainty and explicitly indicating when confidence is insufficient may be safer than providing an incorrect or potentially misleading output.	Design AI systems to communicate uncertainty transparently through intuitive user interfaces, define confidence thresholds for safety-related outputs, and ensure that cases with insufficient confidence are clearly identified (e.g., "I don't know" or "confidence is low") and referred for human assessment and decision-making. Where AI provides recommendations, ensure users can review, accept, modify, or reject them.
5	**Model validation across operational environments** AI models developed for a specific operational environment or airport may not automatically remain effective when transferred to different operational contexts or topographies.	Continuously validate and adapt models to local operational environments, procedures, and infrastructure before broader deployment. Expand deployment progressively, validating each model in the operational environments where it will be used before wider rollout.
6	**Model lifecycle management** AI models may degrade over time as operations, procedures, aircraft, infrastructure, reporting behaviours, or data sources change.	Establish model lifecycle management. This includes version control, performance monitoring, monitoring for model drift, periodic validation following significant operational or data changes, scheduled post-deployment reviews, retraining triggers, retirement criteria, and documentation of changes.
7	**Cybersecurity** AI safety tools may introduce cybersecurity risks if models, prompts, data pipelines, or user access controls are not adequately protected.	Include cybersecurity review in AI safety deployment governance, define access controls, maintain audit logs, protect training and operational data from unauthorised use, and monitor for prompt manipulation, data poisoning, or model misuse.

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8	**Privacy, employee trust, and acceptable use** AI-supported safety insights may create privacy, employee trust, or labour concerns if operational data is perceived as surveillance or used outside its intended safety purpose	Define acceptable use boundaries, including for AI tools already adopted. Apply privacy and labour review where appropriate; communicate purpose, acceptable use, and limitations clearly before deployment; and prevent use of safety AI outputs for inappropriate individual performance management or discipline.
9	**Third-party vendors and dependencies** Use of third-party AI platforms or vendors may introduce risks related to transparency, data access, supportability, ownership, and long-term dependency.	Conduct vendor due diligence, define contractual safeguards, clarify data rights and model transparency expectations, assess exit strategies, and require ongoing performance and security monitoring
10	**Operational resilience and fallback procedures** AI-supported processes may become operationally brittle and create a single point of failure if users do not know what to do when the tool is unavailable, degraded or produces conflicting results	Define fallback procedures, escalation paths, and manual review processes for system outages, low-confidence outputs, contradictory findings, or suspected model failure. Validate AI behaviour under degraded and emergency scenarios before operational deployment, and ensure personnel are trained to apply fallback procedures effectively.
11	**Traceability and explainability of analytical outputs** AI outputs may be difficult to defend in audits, investigations, or regulatory discussions if data lineage and model logic are not traceable.	Include cybersecurity review in AI safety deployment governance, define access controls, maintain audit logs, protect training and operational data from unauthorised use, and monitor for prompt manipulation, data poisoning, or model misuse.

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12	**Keeping safety decision-making and governance aligned with AI-enabled insight** Faster AI-supported insight generation may create pressure on organisations to ensure safety decision-making, governance, and mitigation processes can keep pace with the speed of analysis and translate insight into timely safety action.	Adapt governance, decision-making and operational response processes to ensure timely evaluation and implementation of safety actions generated through AI-supported analytics. Ensure organisations maintain sufficient leadership, governance capability, and AI competence to act on AI-generated insights.
13	**Safety-driven implementation objectives** AI initiatives may become technology-driven rather than safety-driven if the safety problem being addressed and success measures are not defined up front.	Establish safety value metrics such as faster hazard identification, improved mitigation tracking, better reporting quality, reduced repeat events, improved closure effectiveness, and measurable improvement in safety risk management. Demonstrate value using operational performance indicators before scaling deployment.
14	**Prioritisation of AI opportunities** Broad AI opportunity areas may compete for resources without a clear prioritisation approach.	Prioritise use cases based on safety impact, operational feasibility, data readiness, regulatory sensitivity, implementation complexity, user readiness and ability to measure value. Start with clearly bounded safety problems that deliver measurable operational value before broader implementation.

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B	**AI-READY SAFETY DATA** ***Challenges to establish the data foundations required for reliable AI-supported safety.***	
15	**Fragmented operational data ecosystems** Fragmented operational data ecosystems limit the ability to develop scalable AI-supported safety analysis and shared safety intelligence, and may reduce AI reliability or create false confidence	Develop common definitions of key safety concepts, common taxonomies, consistent safety data recording, governance frameworks, and interoperable data architectures across organisations and operational domains. Integrate complementary operational data sources to provide AI models with a richer representation of operational events.
16	**Data completeness and representativeness** AI-supported safety intelligence may mislead users if the underlying data is incomplete, unevenly distributed or not representative of the operation being assessed.	Make data coverage, distribution and representativeness, including significant gaps or imbalances, visible to users before safety conclusions or decisions are made.
17	**Data pipeline integrity** AI safety outputs are highly dependent on the quality, completeness and timeliness of upstream data pipelines, which may introduce hidden risks if data is delayed, corrupted, incomplete, or inconsistent across sources.	Implement data validation layers, monitoring of data freshness and completeness, clear data lineage tracking, and automated alerts for data integrity issues before AI outputs are used operationally. Monitor data pipeline health as part of ongoing safety assurance.

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18	**Bias arising from source data** AI tools may unintentionally reinforce bias if source data reflects uneven reporting patterns, operational exposure differences, or historical decision-making practices. As a result, AI may reflect the operation as it is, rather than as it should be.	Assess data and outputs for bias, and compare results across operational contexts carefully, for example, considering differences in reporting culture, fleet mix, airport complexity or operational exposure. Involve subject matter experts, and avoid drawing performance conclusions without exposure, context and representativeness checks.
C	**AI FOR SAFETY DATA CAPTURE AND INFORMATION GENERATION** **Opportunities to use AI to capture, structure, and enrich operational safety information.**	
19	**NLP and speech-to-text technologies** Natural language processing (NLP) and speech-to-text technologies may enable analysis of narratives that are currently difficult to exploit systematically.	Protect confidentiality and just culture principles, define acceptable use boundaries, including limits on secondary use of safety data, and ensure appropriate governance for sensitive operational data. Maintain original safety reports alongside AI-generated summaries or classifications to preserve operational context.
20	**AI-supported reporting interfaces** AI-supported reporting interfaces may improve reporting usability, data consistency, and reporting participation, especially where safety reporting is under-used or difficult for frontline users, by helping reporters generate structured safety information closer to the event, including by AI prompting for relevant information where appropriate.	Preserve reporter control and transparency, allow users to review, modify, and challenge automated notifications or suggestions, and ensure easier reporting does not reduce narrative quality or operational context. Co-design reporting interfaces with end users to ensure they are operationally relevant, understandable, and trusted.

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21	**Analysis of operational communications** AI-supported analysis of operational communications (e.g., air-ground communication) may enable identification of operational patterns, weak signals, precursors, and safety-relevant events that are currently unreported or difficult to capture systematically, while supporting continuous safety monitoring of normal operations beyond post-event investigation and reported occurrences.	Ensure appropriate governance, confidentiality protections, trust-building measures, and operational validation when analysing operational communications and sensitive operational data. Clearly communicate the purpose, safeguards and acceptable use to personnel to build trust and avoid perceptions of individual surveillance. Use insights derived from operational voice communications to complement traditional occurrence-based safety monitoring, and validate outputs against operational context, radio quality, and phraseology variation.
D	**AI FOR SAFETY ANALYSIS AND RISK UNDERSTANDING** Opportunities to transform safety information into operational understanding.	
22	**Weak signals and emerging risks** AI-assisted analysis of large safety datasets may help identify weak signals and emerging operational risks earlier, particularly where signals are too small, scattered, or infrequent to detect manually. AI enables looking at everyday data, so we are no longer limited by analyst bandwidth to just looking at exceedances and failures.	Maintain expert operational review, allocate sufficient expert resources to continuously validate AI outputs, validate outputs against operational realities, and ensure models are continuously monitored and refined. The Foundation offers resources and strategies for learning from everyday work: https://flightsafety.org/toolkits-resources/learning-from-all-operations/.
23	**Complex chains of threats and contributing factors** Understanding operational safety risk and performance degradation may require analysis of complex chains of threats, errors, and contributing factors that are difficult to identify manually.	Combine operational expertise, threat-and-error management frameworks, and AI-supported analytics to identify precursor patterns and contributing factors while recognising that not all causal factors may be visible in the available data, and that correlation should not be treated as causation.

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24	**Analysis of operational deviations** AI-supported analysis of operational deviations from published procedures may help identify operational drift, inefficiencies, and areas requiring safety attention.	Ensure deviations are interpreted within operational context and assessed with operational expertise before defining safety actions or performance conclusions. Distinguish between deviations indicating increased safety risk and those representing appropriate operational adaptations to operational constraints.
25	**Anomaly detection** AI-supported anomaly detection may help distinguish important signals from benign environmental or operational variability, reducing false alarms and unnecessary manual screening so that expert attention is focused on higher-priority safety cases rather than contributing to alert fatigue.	Ensure models are trained and validated using operational expertise and local operational context to avoid filtering out operationally relevant deviations and to ensure alerts and outputs are prioritised so that expert attention remains focused on the most safety-relevant cases.
26	**Benchmarking and operational drift** AI-supported benchmarking may help identify operational drift and emerging safety risks across operationally comparable peers or environments.	Ensure operational context, comparability, and expert oversight when interpreting AI-generated benchmarking outputs. Consider differences in fleet/traffic, route structure, airport environment, operational pressure, and operational exposure before drawing performance conclusions.
27	**Consistency and expert knowledge in analysis** AI-supported analysis may help reduce variability, juniority effects (variation in analysis quality caused by differences in analyst experience), and subjectivity in safety analysis and root cause identification, and may help capture, structure, and preserve expert or "tribal" knowledge.	Ensure AI outputs remain transparent, reviewable, and continuously challenged by operational experts to avoid introducing systematic analytical bias or over-standardisation, and to ensure structured knowledge remains operationally valid and up to date.

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28	**Analysis of regulations and procedures** AI-assisted analysis of regulations and internal procedures may help identify gaps, inconsistencies, and areas requiring compliance or safety attention more rapidly, supporting compliance monitoring and change management.	Ensure regulatory interpretations and identified gaps are reviewed by operational and regulatory subject matter experts before implementation or safety action.
E	**AI FOR PREDICTIVE SAFETY AND SAFETY IMPROVEMENT** Opportunities to turn operational understanding into proactive safety action.	
29	**Predictive analytics** Predictive analytics may support earlier identification of precursors and operational trends before incidents occur, enabling earlier questions and discussions about emerging safety risks before the operation reaches the incident stage.	Validate predictive models against operational outcomes, monitor false positives/negatives, and ensure outputs remain interpretable for operational users. Conduct scheduled post-implementation reviews using meaningful operational performance metrics and continuously refine models using newly identified weak signals and operational experience.
30	**Forecasting demand, complexity and workload** AI-supported forecasting may help identify periods where operational demand, complexity, or workload are approaching levels associated with degraded safety performance, enabling earlier staffing, planning, and mitigation actions before safety margins are reduced.	Validate forecasting models against operational experience, ensure outputs are interpretable by operational managers, and use forecasts to support rather than replace operational judgement when planning resources and mitigations.

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31	**Closed loop safety improvements** AI and large-scale operational data analytics may support closed-loop safety improvement by connecting hazard identification, root cause analysis, mitigation, training implementation, and operational performance monitoring into a continuous cycle, helping organisations assess whether implemented mitigations are effective.	Integrate analytics outputs directly into SMS processes, training programmes, and operational monitoring systems, and continuously assess whether implemented mitigations produce measurable operational safety improvements.
F	**HUMAN-CENTRED AI FOR SAFETY** **Challenges to ensure AI supports people, preserves human judgement, and earns operational trust**	
32	**Trust and explainability** Trust in AI-supported safety tools may be difficult to establish if outputs are not transparent, explainable, operationally credible, based on trusted safety information, or aligned with emerging aviation trustworthiness requirements. Insufficient trust may lead to non-use, while excessive trust may lead to over-reliance.	Ensure AI outputs are explainable, operationally interpretable, and validated against real operational environments. Maintain human oversight, communicate limitations clearly, progressively build confidence through small, operationally useful and demonstrated results, and align implementation with applicable AI trustworthiness, assurance, certification, and regulatory frameworks as they mature. Present AI confidence levels through intuitive user interfaces to help users calibrate trust and prioritise verification effort.
33	**Over-reliance and erosion of expertise** AI systems may create over-reliance and gradual erosion of expertise, critical thinking, and the ability to challenge AI outputs.	Maintain human responsibility and authority for decisions and ensure continuous competence development of personnel, including AI literacy, upskilling, and the ability to challenge AI outputs. Embed mandatory human review checkpoints before AI-generated insights trigger safety actions to preserve expertise and prevent automation bias.

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34	**User adoption** AI implementation may fail to deliver safety value if frontline users, analysts, and operational leaders do not understand, trust, or adopt the tools, or if the tools do not fit real operational workflows.	Use phased trials, user-centred design, role-based training, change management, feedback loops, and frontline engagement to ensure tools fit real operational workflows and decision needs. Identify and empower early adopters to support peer-to-peer learning and change management during deployment. Co-design tools with operational users from the outset rather than relying solely on post-development change management.
35	**Human-machine interface design** Poorly designed AI interfaces may increase automation bias, alert fatigue, or misunderstanding of safety outputs.	Conduct human factors and usability testing, co-design interfaces with operational users, design outputs to show confidence and limitations clearly, prioritise alerts, and ensure users can challenge, dismiss, or escalate AI-generated findings.
36	**Avoiding anthropomorphism** AI may be treated as a human decision-maker or team member, leading users to attribute judgement, intent, or authority that the system does not possess.	Clearly communicate that AI is a decision-support tool rather than a team member or decision-maker, maintain human responsibility and accountability for safety decisions, and train users to understand the capabilities and limitations of AI systems. These systems are tools, and when used appropriately, can be very useful tools. When we attribute "teammate" status to a model, we risk attributing capabilities to the model that it doesn't have and making erroneous predictions about its behavior. We may also miss opportunities to leverage its strengths by incorrectly framing the boundaries of its capabilities.
37	**Human factors beyond over-reliance** AI-supported tools may alter operator workload and create ambiguity between automated, advisory and human decision-making roles, potentially leading to confusion or inappropriate reliance.	Design human-machine interfaces that clearly communicate AI roles and limitations, validate tools in operational environments, and incorporate human factors testing, including workload, attention, decision-making impact, role clarity, and escalation behaviour.

OPPORTUNITIES AND IMPLEMENTATION CHALLENGES	PRACTICAL SAFEGUARDS AND IMPLEMENTATION CONSIDERATIONS
Describes either: 1) an operational safety opportunity where AI may enhance safety processes performance, intelligence, or resilience, OR 2) a challenge, limitation, or risk associated with the implementation or use of AI for safety.	*Describes practical conditions, safeguards, governance measures, human factors, integration needs, training, validation methods, or implementation approaches needed for safe and effective use.*

G AI FOR SAFETY LEARNING AND COMPETENCY DEVELOPMENT

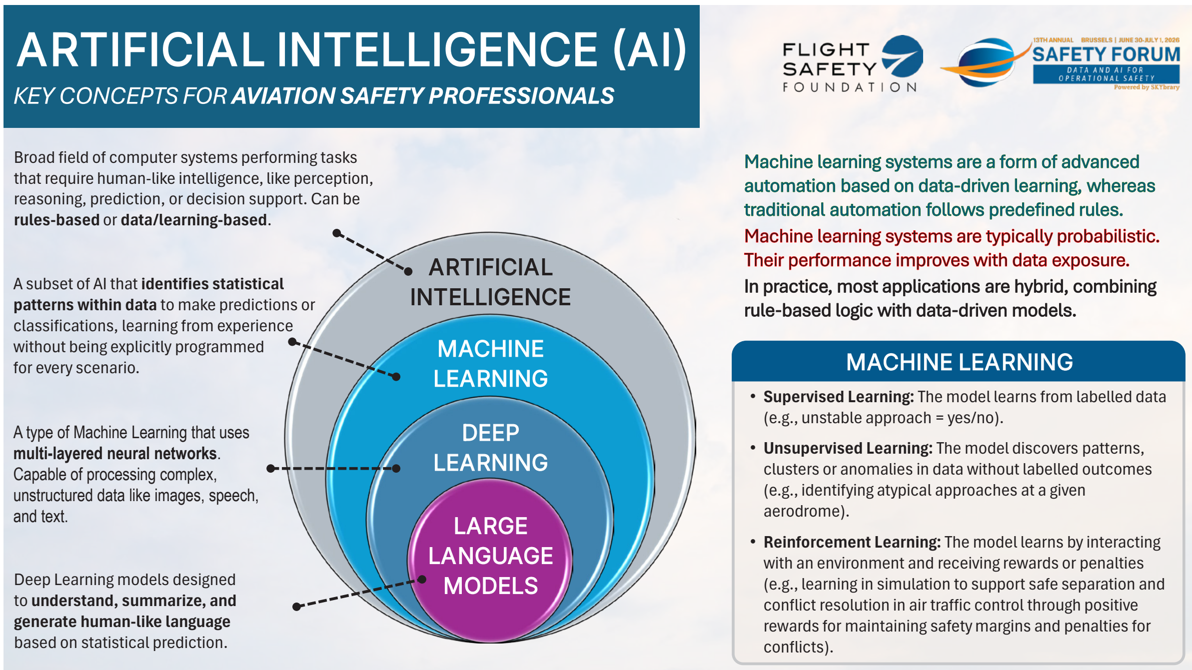
Opportunities to enhance safety learning, training, and performance through AI-supported analysis.

#	Opportunities and implementation challenges	Practical safeguards and implementation considerations
38	**Risk-based training** AI may enable more tailored and risk-based training by identifying where training is most needed through integration of operational and simulator telemetry data.	Ensure data-driven training complements instructor judgement and operational expertise rather than replacing them.
39	**Competency-based training** AI-supported analytics may enable scalable and tailored competency-based training by linking operational, behavioural, and simulator telemetry data with specific competencies and observable behaviours.	Ensure competency models, training objectives, and behavioural indicators remain operationally meaningful, validated, and adaptable to evolving operational environments and risks, and understandable to instructors and operational personnel.
40	**Behavioural performance assessment** AI-supported analysis of behavioural data may enable objective measurement of cognitive skills and performance indicators that have traditionally relied on subjective observation and assessment.	Ensure behavioural indicators are validated against operational performance, interpreted within operational context, and used to support development, learning, expert assessment, and coaching rather than replace them or become a simplistic measure of individual performance. Apply appropriate privacy and labour protections, and ensure behavioural data are used to support learning and development rather than inappropriate individual performance management or disciplinary action.

4 AI KEY CONCEPTS FOR SAFETY PROFESSIONALS

To support a common understanding throughout this report, this section provides a simplified overview of the principal AI concepts and terminology most relevant to operational safety.

The diagram is intended as a practical reference for aviation safety professionals and is not a comprehensive description of artificial intelligence technologies.



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