SMART SKIES

Picture credit: US Dept of Defense

Matthew Borie *investigates the growing Importance of AI in Aviation Security*

The use of Artificial Intelligence (AI), principally machine-learning techniques, has grown exponentially over the last decade and it now touches almost every part of our lives. In every sector of every industry, businesses are constantly searching for new ways to improve efficiency and scalability and are turning to AI to achieve that. Within the aviation community there are many ways in which it has already been applied, from airport traffic analysis to ticket pricing, airport passenger movement analysis and many more besides. However, security has, to a certain extent, lagged behind more commercial uses of these capabilities, despite the clear benefits that they would bring. We have seen the emergence of the use of AI in areas such as baggage scanning and facial recognition, bringing dramatic improvements in efficiency and effectiveness, however, more fundamental functions – specifically the identification of risks in the first place and risk management more broadly – have not benefitted from the same developments and use of technology.

Within the aviation security community, where risk management exists, it still relies to a greater extent on a human-based process. The fundamental flaw with this is humans are inherently subjective in their understanding of a situation. This undermines the accuracy of the three most important pieces of the risk assessment puzzle: threat identification, likelihood and impact quantification. The problem is that if you put two independent people in exactly the same situation, they will each have a different perspective. So, how can we expect our assessment to be consistent, objective or accurate when its core depends completely on who is conducting it?

We have also seen the reality that COVID-19 has brought into sharp focus – namely human based systems do not work when the humans required to manage and run those system are on furlough or laid off. How does an industry that is desperately trying to get planes back in the air do so with confidence that all the threats and risks have been identified and managed when the resources required to achieve that are no longer available?

The use of AI techniques can help to create a more resilient, objective, consistent, dynamic and comprehensive picture of the global aviation operating environment. In fact, arguably AI is the only way to achieve this. So the aviation security community needs to look to the future with wide eyes and embrace the use of AI techniques to better understand, and continuously improve that understanding of their environment, their risks and the measures that need to be taken to ensure that everyone is as safe and secure as possible when travelling by air. This will enable faster, more accurate assessments, resulting in faster and better decision making to mitigate a broad spectrum of risks in a timely and scalable fashion.

AI can help to create a more dynamic and comprehensive picture of the global aviation operating environment

THE BIGGER PICTURE

Risk assessment is fundamental, albeit usually sub-consciously, to every decision we make as human beings. We balance the potential gain with the potential likelihood and impact of a negative outcome to our business, to our families and to ourselves. And yet rarely do we take the time to understand the whole picture before we make that decision and therefore our analysis is based on incomplete and usually insufficient information. We learn to make decisions this way from a very early age and so it is no surprise that it is the norm that most organisations pay lip service to a proper risk management process. This is exacerbated by the fact that developing a comprehensive and objective understanding of an environment, particularly in an ever increasingly complex world is hard. In fact, it is more than hard. It is impossible for a human, with all the bias and subjectivity inherent in each different education, culture and experience to make that objective, consistent assessment. Within the aviation industry, this is compounded by the sheer operational tempo – when you cannot conduct an objective assessment for one flight, what do you do when faced with over 100,000 a day? The answer is that many organisations do not even try, and, those that do, consistently struggle to conduct a process that adds real value to their operation. And that should be the aim. Proper and effective risk management should and does add huge value. It is an essential component of operational and, in fact, commercial success.

Time constraints, bias and the focus on current intelligence production all play a major factor in the current analytical culture within the aviation industry. Time constraints on intelligence reporting can lead to a lack of necessary data required for complete threat identification and security risk analysis. The lack of data leads to assumptions that are skewed by the bias of the individual analyst. Also, there is a trend within the community to focus on current intelligence reporting – writing reports and producing PowerPoint slides – rather than multi-source threat identification and security risk analysis. In short, the community focuses its time and efforts on a 'whack-a-mole' posture of securing day-to-day operations rather than developing data-led risk management systems that can continuously improve over time.

In the post-COVID-19 world there must be a shift in the analytical culture. It is essential that we move from an individualistic and purely human-based approach to threat identification and security risk analysis to a more streamlined, data-led analytical methodology for risk assessment.

Only through the use of AI-enabled data collection and analysis can we achieve this. These capabilities offer huge opportunities to the aviation security community. Automated categorisation, multi-source corroboration, geolocation and date/time stamping are the fundamental components of a data-led risk management system and these all require AI capabilities to be effective and accurate. The continuous and automated improvement that machine learning enables ensures that these systems, assessment processes and analytical methodologies can, extremely quickly, become many orders of magnitude more capable and more accurate, with little or no drain on resources.

AI-enabled information collection tools – which are publicly available in the aviation security marketplace – can gather data from a very broad spectrum of sources. Such sources include social media platforms, major international media outlets, local news publications, national-level authorities, law enforcement, government departments, industry organisations, special interest groups with a focus on aviation, think tanks and third-party intelligence providers. Some of these publicly available tools can accept any form of information feed, manual or automated, making them all-source intelligence integration tools.

THERE IS A TREND TO FOCUS ON INTELLIGENCE REPORTING RATHER THAN SECURITY RISK ANALYSIS

Using advanced computing techniques, such tools can every few minutes gather data from hundreds of thousands of open sources in dozens of different languages. The aviation-centric datasets that are generated can then enable automated quantified and objective assessments of impact and probability of any incident type, thus producing a highly accurate, dynamic and instantaneous risk assessment. When combined with a specialised team of analysts, it can ensure that at any one time there is an objective and consistent picture of the global aviation security environment.

AI techniques – when implemented within the IT systems and programs used by aviation security practitioners – can significantly enhance capacity within three key areas: Analytical Methodology Automation, Incident Database Development and Collection Management. All three are crucial areas of the future of aviation security in a post-COVID-19 world. Now more than ever practitioners have a core focus of timely and accurate qualitative reporting of aviation security incidents that must be supplemented by robust risk assessments, long-term trend analysis and tailored data-collection models. Below are several key outputs of the integration of AI and machine-learning techniques within the IT systems and programs used by aviation security practitioners:

Analytical Methodology Automation
- Cutting-edge, instantaneous operational aviation security risk assessment methodology
- Near real-time risk scoring updates via automated criteria benchmarking and machine learning
- Direct, instantaneous access to operational aviation security risk assessments and data analytics

Incident Database Development
- Reporting combines human expertise supplemented by machine learning analytical techniques
- Geospatial and quantitative aviation security incident structuring to facilitate predictive analysis

- Automated web scraping of multi-source verified and coded aviation security incident data

Collection Management
- Exploitation of aviation security keyword trends on social media and internet search platforms
- Geospatial mapping and modelling of incident data intensity levels for historical trend analysis
- Analytics and mapping of aviation security keywords in traditional media via big data querying

On 14 February 2019, a suicide car bombing targeted an Indian Central Reserve Police Force convoy in Jammu and Kashmir state. The bombing resulted in at least 40 deaths, with the Pakistan-based Jaish-e-Mohammed (JeM) extremist group claiming responsibility. This was not, on the face of it, an incident that was particularly relevant to aviation, but having been monitoring the escalation in the environment prior to this through trend analysis of conflict type activity in the region, we knew that it was significant.

Osprey Flight Solutions issued a Critical Alert the following day stating that: "short-notice airspace restrictions for FIR Lahore (OPLR) covering northern Pakistan and/or FIR Delhi (VIDF) covering north-west India may be enacted should armed clashes between the two countries significantly escalate along the Line of Control (LoC)".

Based on the clear escalation, which had been occurring for several months prior, in the conflict type activity that Osprey's system was monitoring in the border area between India and Pakistan, combined with the significance of the car-bombing, Osprey's analysis team anticipated that the bombing represented a clear indication that airspace access over Pakistan could be severely disrupted within the 30 days following the attack, and resulting military action by both countries meant that Pakistan did indeed close the near entirety of its airspace to overflight from 27 February to 15 July 2019.

An analyst's strength is filling gaps with knowledge and experience. When there is limited information about a situation, a human can make an assessment. But that assessment is fundamentally flawed and inherently biased by all the attributes that make that analyst human. With the AI technology and data capabilities that are readily available today, proper, effective and truly systematic aviation risk management that adds real value to an organisation is no longer a pipe dream.

IT'S IMPOSSIBLE FOR A HUMAN TO CONSISTENTLY MAKE BIAS-FREE AND OBJECTIVE ASSESSMENTS

AI techniques enabling true data-led risk management must be seen as a legitimate starting point for aviation risk management processes, the base level from which an effective process can then be built. They ensure resilience, consistency, objectivity, accuracy and speed, making them the only option for truly systematic aviation risk management.

The question is: is it really acceptable to rely on the inherently subjective view of the world that a human analyst provides? And considering that technology makes risk assessment as easy as the click of a button, how is it possible that there continue to be tragic examples of failures in risk management? Let's work together as an industry to utilise every tool, every technique and every technology to ensure that everyone is as safe and secure as possible when travelling by air ●

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Proper and effective risk management adds huge value

Picture credit: US Dept of Defense