THE EVOLUTION OF NEXT SURVEILLANCE TECHNOLOGY

According to ICAO's Aviation System Block Upgrades program and other institutional plans, the basis of this evolution is ADS-B supplemented by other systems.

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ATM surveillance is evolving. New challenges such as radio spectrum use, separation reduction that leads into increase of system performances and cost reduction are factors that are driving developments in surveillance systems. The use of ADS-B supplemented and integrated with other surveillance sensors will be the basis of future surveillance, and INDRA is working in SESAR for the development of this new kind of technologies.

Composite surveillance & Phase modulation

The evolution of ADS-B datalink and the exchange of data between sensors and composite surveillance improve sensor performance. In particular, the use of composite exploiting benefits of ADS-B Mode-S information enhances the capacity, integrity and security of both systems.

The composite systems provide additional features that are not required for meeting the minimum performance by each surveillance data channel. Rather, the composite provisions constitute supplemental system capabilities that aim to provide benefit that could be achieved by a system comprising of both ADS-B and independent channels within a single physical SUR Sensor system.

The objective of composite surveillance is not to extend the coverage of independent sensors i.e. by allowing ADS-B data to be used as an in-fill to a missing WAM sensor or to improve the continuity of a WAM horizontal position track information by filling in with ADS-B horizontal position data. The benefits of a "composite" system include: monitoring of ADS-B performance; identifying "rogue" Version 0 / 1 ADS-B Out installations; supporting the detection of ADS-B avionics anomalies – spoofing, and decreasing RF load.

INDRA validates the integrity of this ADS-B information in what is called SMART integration. Different kind of sensors, such as multilateration and Mode S radars use the validated ASD-B information in the track management process, to enhance the quantity and quality of data, and to reduce RF pollution, while maintaining the independency of the position determination of this multilateration and Mode S sensors.

Above: The IRTOS 4K video camera system, which produces data that can enhance ATC system performance

In the future, 2030 and Block 2 according to ICAO ASBUs, old PPM modulation will be replaced by Phase modulated signals that will enable be the future ADS-B link. This will multiply the capacity of the datalink several times, allowing new content for messages to be created and allowing new functions that will increase performance and security in the communications. INDRA is anticipating already working in SESAR to analyse the benefits of integrating these kind of signals on its products.

ADS-B security

ADS-B is a cooperative and dependent system. The system's RF-interface and modulation scheme is as vulnerable as any other RF-based system. In addition to this, target reports may be modified, created or even suppressed in a relatively easy way. Working together with a multilateration system (composite surveillance) or implementing new security functionalities, the detection and report of different threats, at sensor and at ground station level can be achieved.

For its part, multilateration and Mode S systems are more resilient than ADS-B, due to the fact they use independent surveillance, but they can be also candidates for threat or spoofing. The passive multilateration mode can be also be affected, because broadcasted data can be sometimes different as the downlinked. This information has to be periodically validated, using composite surveillance.

Indra is integrating these security functionalities for ground surveillance sensors: ADS-B, WAM and Mode S. The aim is to detect at sensor level the potential threats, and when possible report the existence of them to system users.

Composite systems improve the security level of isolate systems as well as create a new composite data flow. ADS-B data – such as position, identification or altitude information – is validated using multilateration, proving the resilience of the composite surveillance.

Top: An augmented reality video feed with integrated ADS-B data

Middle: INDRA's portfolio of surveillance products is in line with ICAO ASBU's

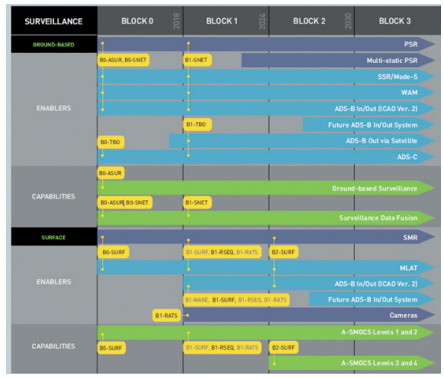
Below: Phase modulated signals will enhance capacity and security of ADS-B

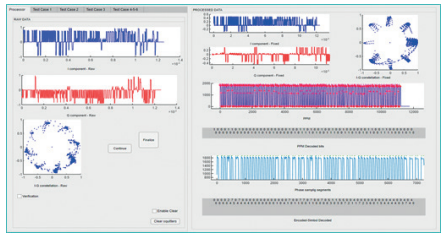
Bottom: INDRA have developed a suite of technologies for surveillance

The availability of additional data within the composite systems can also be used to support optional means to provide additional security mitigation techniques in a cost-effective manner. The threats are analyzed at signal level, at message content level (for ADS-B and for WAM content level) and also at GPS signal level.

Performance based surveillance

This is applied to the provision of air traffic services and determines the minimum operational, safety and performance requirements for a Generic Surveillance System supporting ATC services. Surveillance performance depends on the performance of independent systems including aircraft sub-systems and ground sub-systems. The definition of an end-to-end surveillance performance standard is therefore necessary. The design of surveillance systems that account for ground and airborne sub-system requirements is different from a performance based navigation approach, which considers airborne-based systems only. The Required Surveillance Performance (RSP) specification links ATC surveillance services, airspace types and separation minima with the respective ATC surveillance data provision requirements as applicable to a range of





typical ATC sector types within the airspace.

It is essential that the surveillance data output from new and emerging surveillance techniques and technologies can be seamlessly integrated into the ATM infrastructure. This implies among other things a trustworthy and accurate performance monitoring.

In this context, INDRA developed in SESAR2020, Surveillance Performance Monitoring (SPM) tools to enable the harmonised performance monitoring of surveillance systems. SPM tools seek to identify degradation trends early, by using both off-line and in continuous quasi real-time processes, demonstrating the correct functioning of the ATM surveillance function at the individual sensor level or at ATC end-to-end level.

Integrated video surveillance

Video surveillance is an enabler for both air and ground detection of targets. With the use of UHD/4K cameras for ultra-low sensitivity and colour night-vision, video augmentation provides a flexible and redundant architecture for surveillance. These kind of sensors can be easily integrated with other complete solutions such as ADS-B and multilateration or can be used with partial measurements of other sensors to enhance system performances, opening the field to new ATM applications. Examples of this are remote towers for both single and multi-remote tower operation, contingency towers and as a global ATM contingency strategy for Route, Approach and tower systems.

In airport upgrades, they can complement the existing tower without the need of auxiliary towers. Temporary mobile towers, the evolution of the conventional tower to the digital tower, introducing new functions and concepts such as intelligent binoculars, augmented reality, track object detection", "head-up display of integrated ATM / A-SMGCS data and intelligent gap-filling, replacing current CCTV systems used in complex airports are other application fields for this technology.

INDRA's spirit is based on innovation and the company continuously works to development new ideas and concepts for a range of ATM solutions in which the company is an industry leader. These ideas are at the service of the customers and evolve the ATM world. Customers and INDRA are creating skies together. ❖

INDRA SOLUTIONS FOR ATM SURVEILLANCE