

# Indra Surveillance Evolution for ASBU



Automatic Dependent Surveillance – Broadcast OUT Implementation Meeting for  
the NAM/CAR Regions (ADS-B/OUT/M)  
Ottawa, Canada, 21-23 August 2019

**Agenda Item 3.4: Implementation of new surveillance Systems**

August 2019

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- 1. SURVEILLANCE VISION & ROADMAP**
- 2. SOLUTIONS**

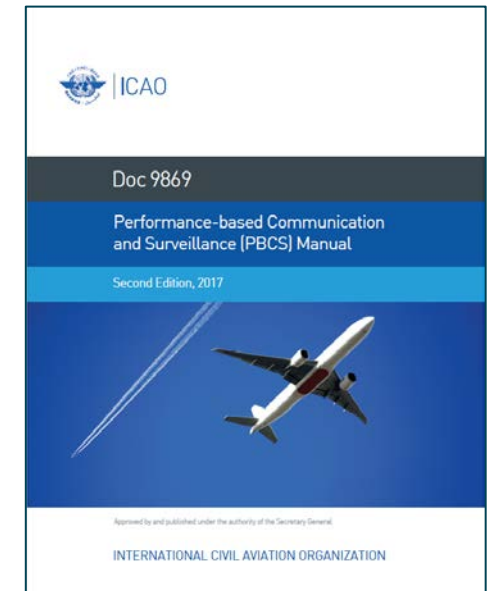
# ICAO VISION

## Performance-based approach (ICAO)

To prioritize future investment and to improve system efficiency, adoption of a performance-based approach in the spirit of ICAO document 9883 is required, in which a carefully chosen **set of performance indicators is used that also allows for monitoring of current operations.**

A performance-based approach is results-oriented, helping decision makers set priorities and determine appropriate trade-offs that support optimum resource allocation while maintaining an acceptable level of safety performance and promoting transparency and accountability among stakeholders.

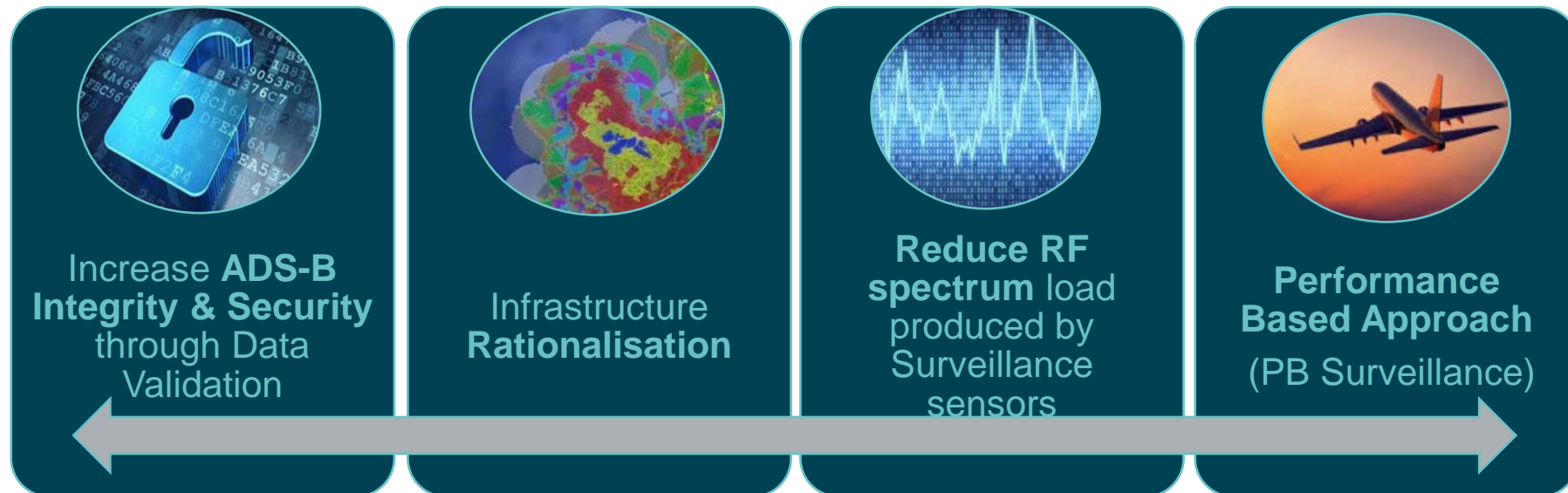
Currently ICAO is developing **PBCS concept** also (**Doc 9869 Performance-based Communication and Surveillance (PBCS) Manual**), which will be deployed in parallel with PBN in order to achieve **Performance Based Operations.**



# INDRA- SESAR PJ14 Technical goal

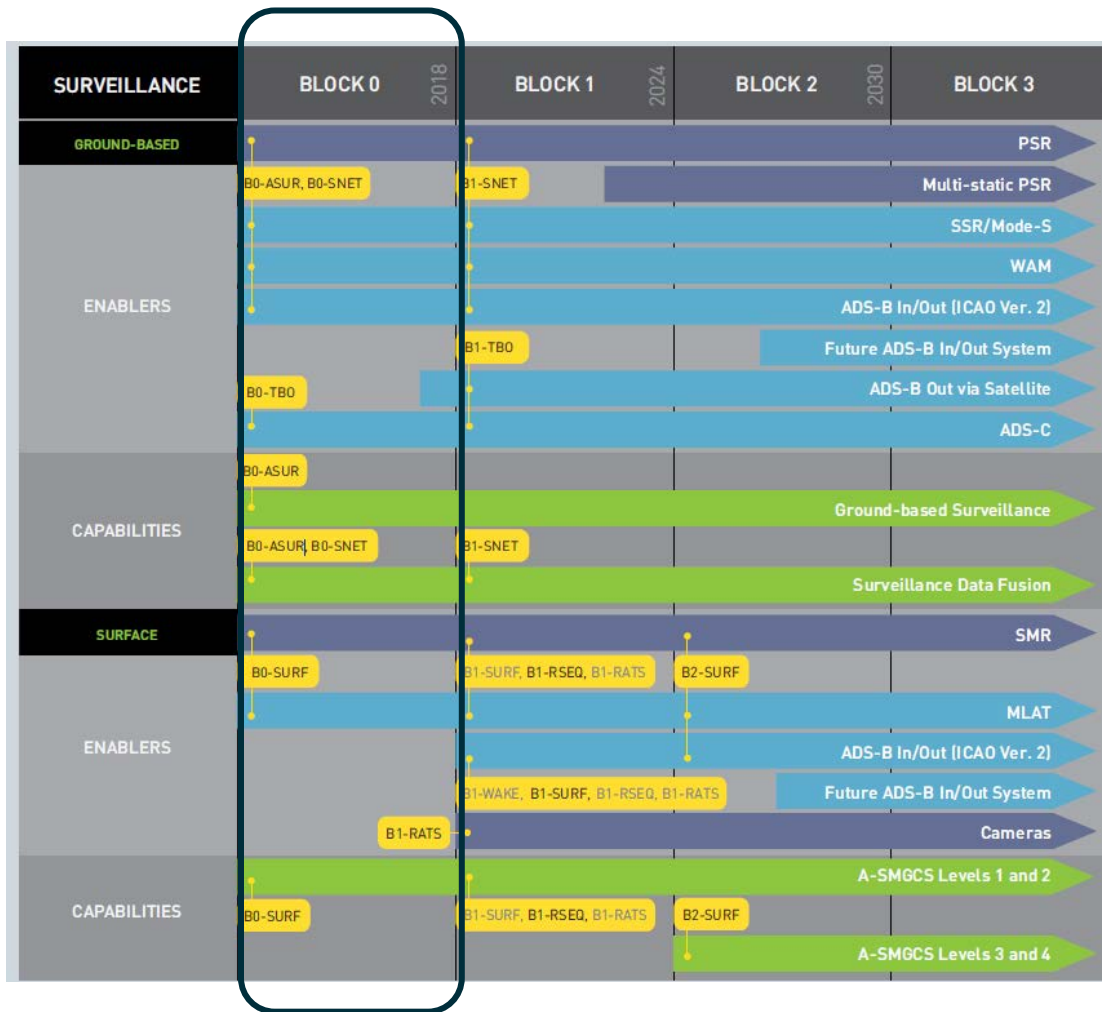
Surveillance goals is moving towards a **PBS concept** based on **ADS-B** and supplemented by a **MON** (Minimum Operating Network) including **Mode S Radar, MLAT** and **primary** surveillance.

In this sense, Indra in **PJ14** works to achieve:



# INDRA-PJ14 Work In alignment with ICAO GANP

## Ground and surface – Surveillance Roadmap



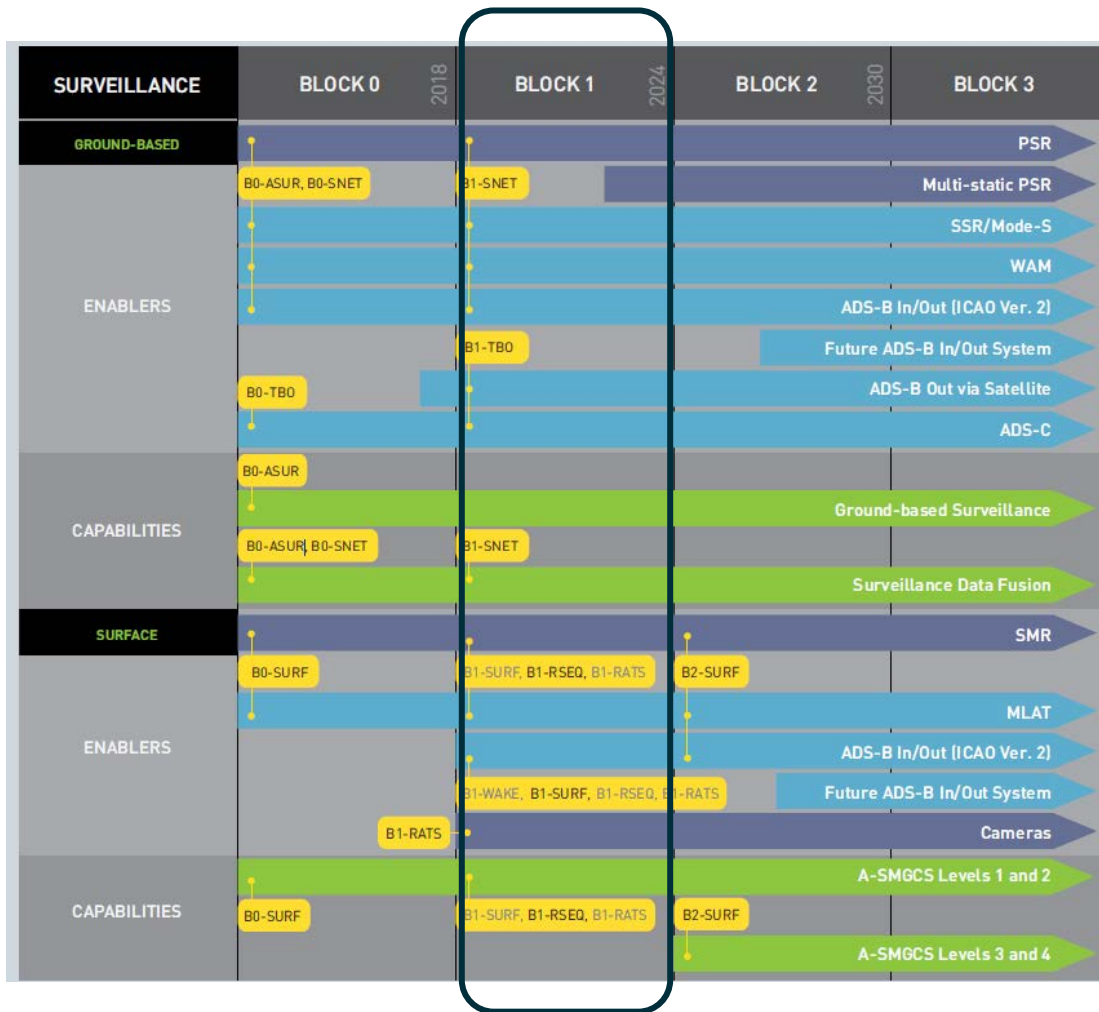
### Block 0 time frame

- Significant deployment of cooperative surveillance systems: ADS-B (ground- and space-based), MLAT, WAM.
  - Composite surveillance,
  - ADSB processing,
  - Secured surveillance,
  - Phase modulation.
- Ground processing systems will become increasingly sophisticated as they will need to fuse data from various sources and make increasing use of the data available from aircraft.
  - Full ADS-B integration.
- Surveillance data from various sources along with aircraft data will be used to provide basic safety net functions.
  - Full ADS-B integration.

# INDRA-PJ14 Work In alignment with ICAO

## GANP

### Ground and surface – Surveillance Roadmap

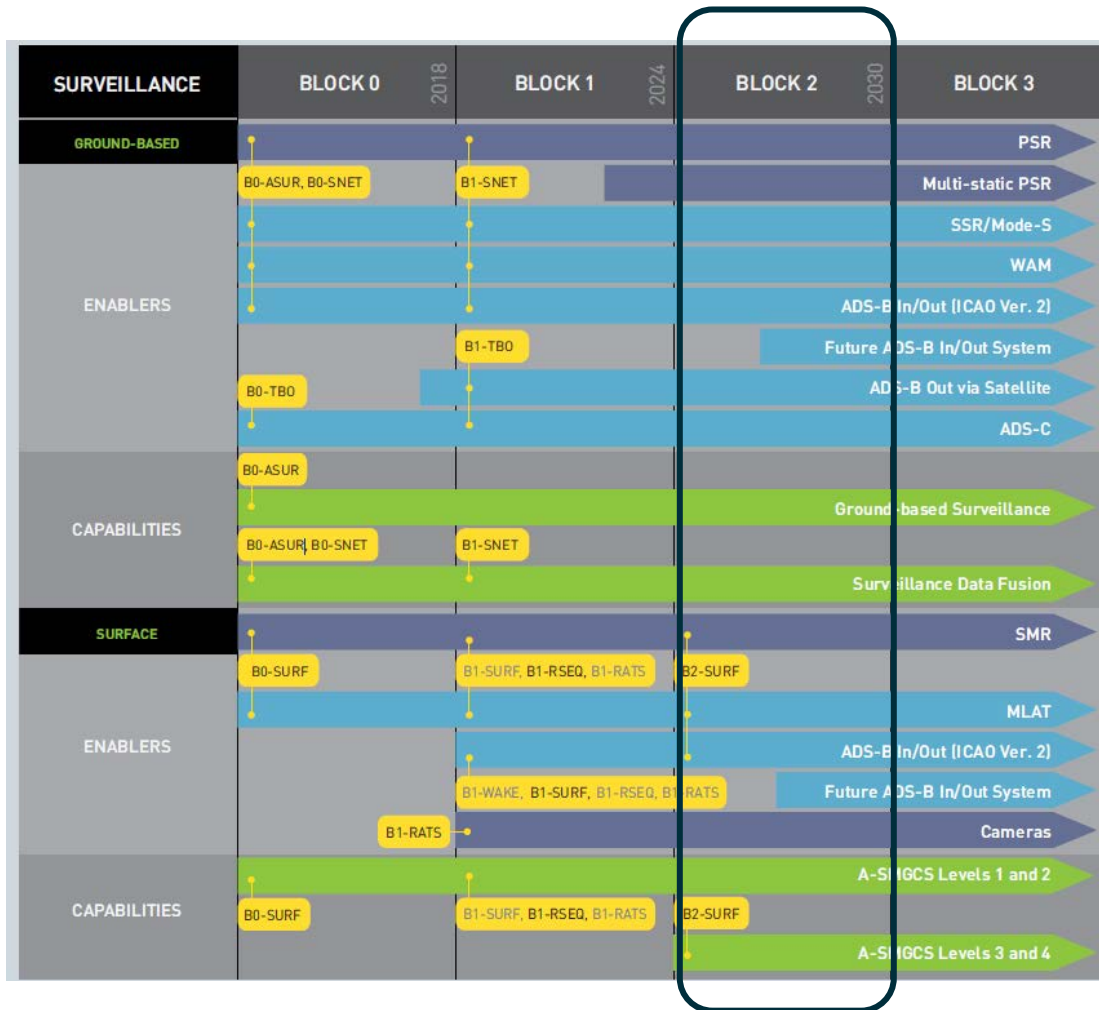


## Block 1 time frame

- Deployment of cooperative surveillance systems will expand.
  - Composite surveillance,
  - Full ADSB integration,
  - Secured surveillance,
  - Phase modulation.
- Cooperative surveillance techniques will enhance surface operations.
  - Performance Monitoring tools
- Remote operation of aerodromes and control towers will require remote visual surveillance techniques, e.g. cameras, to provide visual situational awareness.
  - Full ADS-B integration.,
  - Video Surveillance.

# INDRA-PJ14 Work In alignment with ICAO GANP

## Ground and surface – Surveillance Roadmap

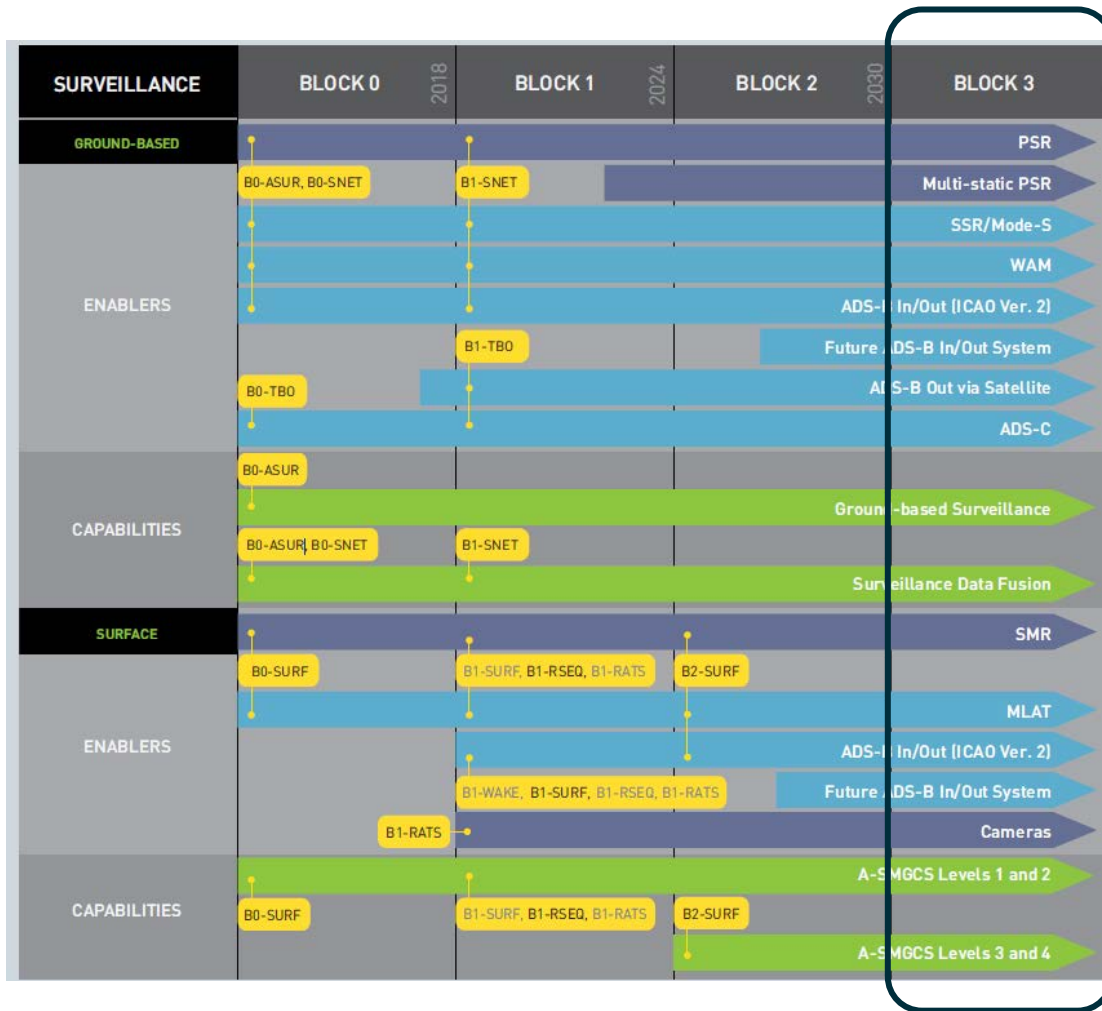


### Block 2 time frame

- The twin demands of increased traffic levels and reduced separation will require an improved form of ADS-B.
  - **Secured surveillance,**
  - **Phase modulation.**
- Primary surveillance radar will be used less and less as it is replaced by cooperative surveillance techniques.
  - **Composite surveillance,**
  - **Full ADS-B integration.**
- Space-based ADS-B is likely to be fully available.
  - **Full ADS-B integration.**

# INDRA-PJ14 Work In alignment with ICAO GANP

## Ground and surface – Surveillance Roadmap



### Block 3 time frame

- Cooperative surveillance techniques will be dominant as primary surveillance radar (PSR) use will be limited to demanding or specialized applications.  
 → **Composite surveillance.**



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1. SURVEILLANCE VISION & ROADMAP
2. **SOLUTIONS**

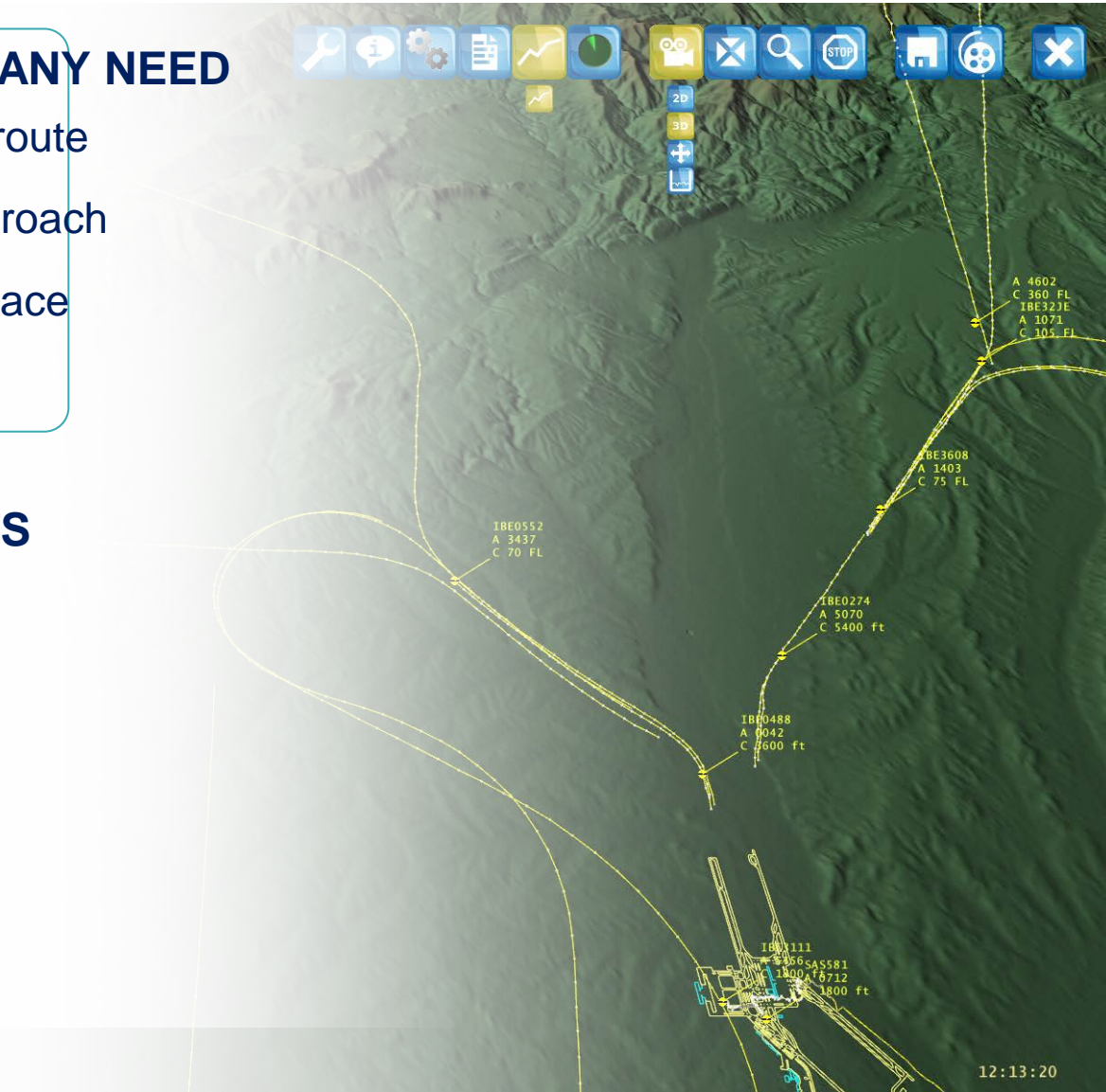
# INDRA SOLUTIONS FOR ATM SURVEILLANCE

## MULTIPLE CONFIGURATIONS AVAILABLE COVERING ANY NEED

- Cooperative and non-cooperative surveillance for en-route
- Cooperative and non-cooperative surveillance for approach
- Cooperative and non-cooperative surveillance for surface
- Fixed and transportable systems

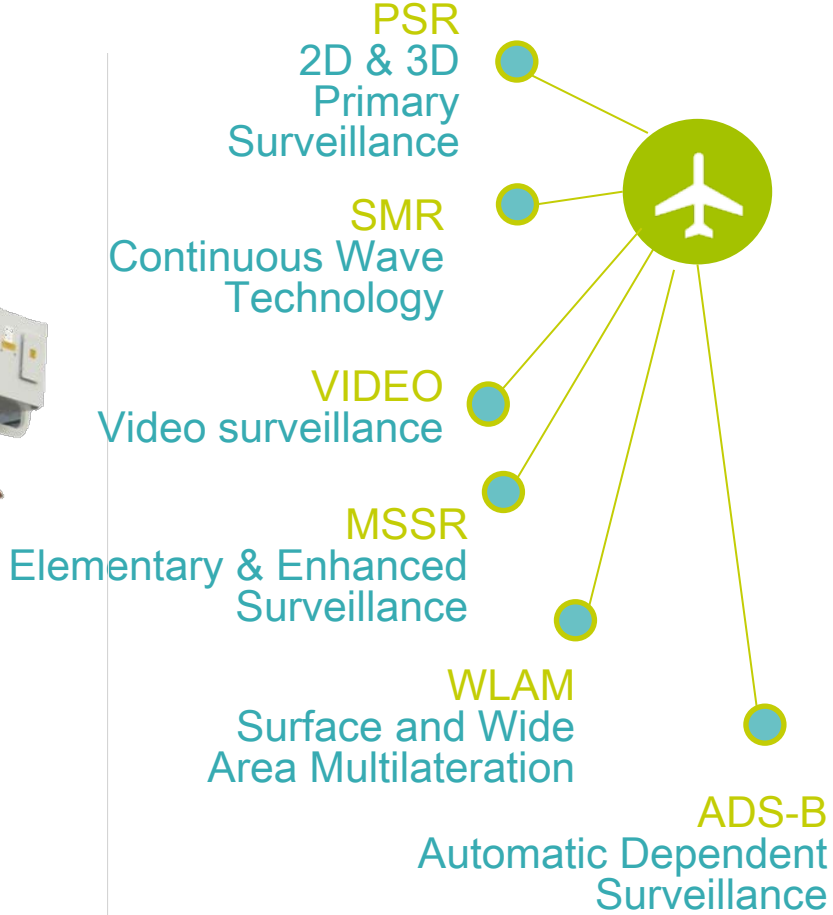
## COMPLETE AND UPDATED PORTFOLIO OF PRODUCTS

- PSR (L-Band and S-Band)
- MSSR mode S - Composite
- WAM //MLAT //ADS-B - Composite
- SMR
- Drone detection
- Video Surveillance



12:13:20

# INDRA SOLUTIONS FOR ATM SURVEILLANCE



# INDRA SURVEILLANCE ENHANCEMENTS

## A) Composite Surveillance (ADS-B + ICS)

In line with roadmaps, Indra is leading developments in **SESAR & EUROCAE for Composite surveillance**. System **validates correct ADS-B data** information in both **ICS (WLAM / Mode S) & ADS-B channels**.

General Benefits of COMPOSITE SURVEILLANCE are:

- Operation in **passive or quasi passive mode** by validation of ADS-B information.
- **ADS-B validation** marking correct and incorrect data.  
This info can be used downstream for different purposes (whitelist, blacklist, identification of jamming-spoofing, tracker settings, increase coverage limits.....)
- Provides a solution to **ICAO mandates to reduce transponder load**.
- **One system to provide different surveillance layers:** Inclusion of ADS-B ASTERIX CAT021 in addition to standard outputs (CAT020, CAT048)

# INDRA SURVEILLANCE ENHANCEMENTS

## A) Composite Surveillance Benefits for WLAM system

### RF spectrum:

- Decreasing RF load (target acquisition, RF downlink ) – ICAO mandate

### Security:

- Supporting the detection of ADS-B avionics anomalies – spoofing.
- Information about integrity validation is provide through CAT021 dataflow.
- Monitoring ADS-B performances

### Safety:

- identifying “rogue” Version 0 / 1 ADS-B Out installations

### Others:

- Duplicated ICAO address Resolution,
- Quality of validated ADS-B targets is normally better than WAM info in the borders of the coverage.



# INDRA SURVEILLANCE ENHANCEMENTS

## A) Composite Surveillance Benefits for Mode S system

### Passive Acquisition of targets:

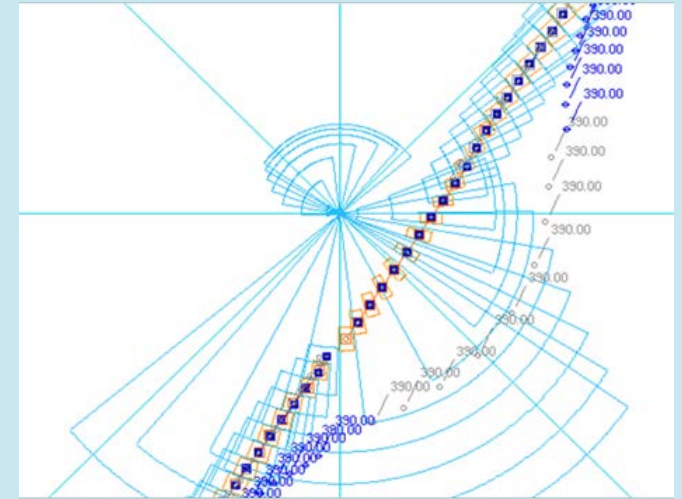
- With the ADS-B there is no need to have the All-Call interrogations
- Targets that are on the ground (i.e. in airport runways or taxi areas) are not replying to Mode S All-Call interrogations, improving surface detection.

### Cone of silence reduction:

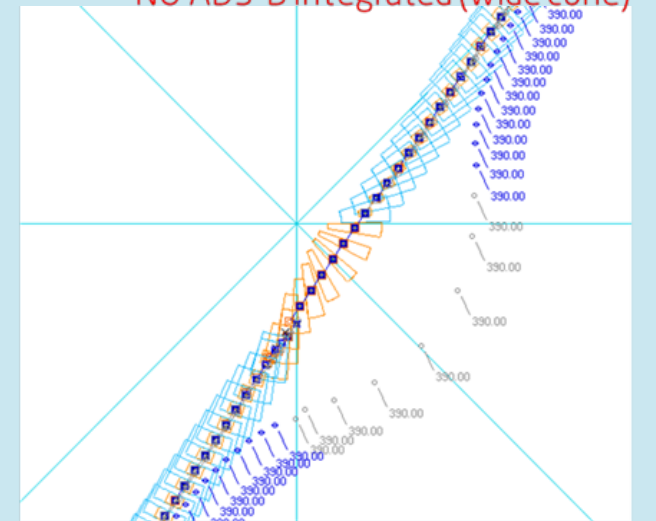
- The radar system continues having ADS-B info while the target is crossing the MSSR cone of silence.

### Performances enhancement:

- Using ADS-B information while in cone of silence, reflections, support during maintenance, Interrogation code conflict.



NO ADS-B integrated (wide cone)



ADS-B integrated (smaller cone)

# INDRA SURVEILLANCE ENHANCEMENTS

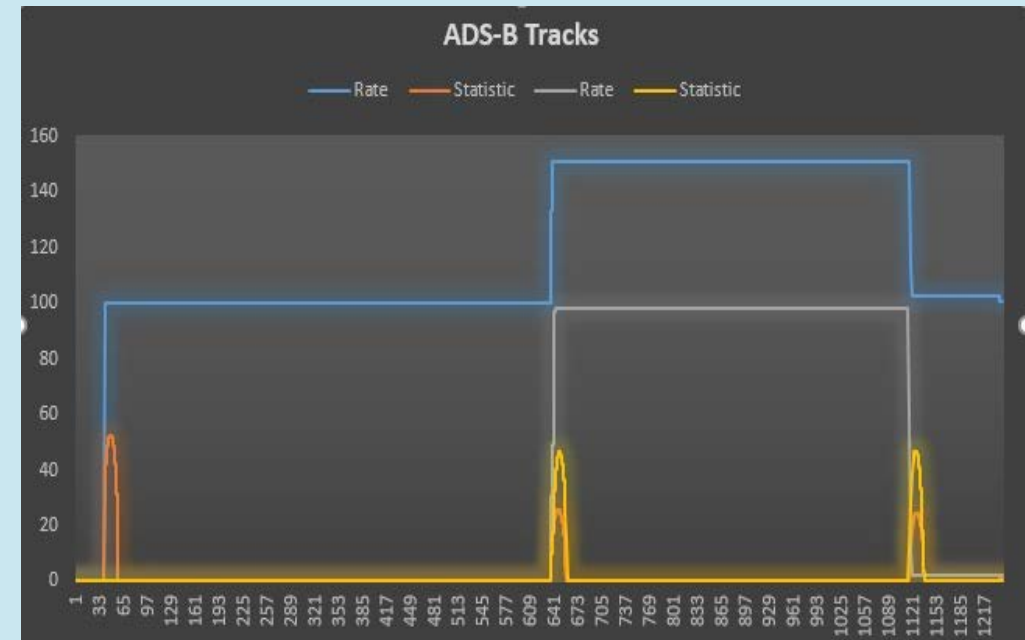
## B) Secured ADS-B Surveillance

INDRA is leading developments in **SESAR & EUROCAE** for Secured surveillance.

Making use of Composite surveillance and Other Features, system detects and reports different kind of threats at **target** and at **sensor level**.

Reporting is through ASTERIX CAT025 and/or CAT021.

- Identification of **jamming** signals at sensor level.
- Identification of **spoofing targets** (false or modified targets).
- Provides to the customer: methods for threat detection & reporting.



# INDRA SURVEILLANCE ENHANCEMENTS

## B) Secured ADS-B Surveillance

The main results of the new SESAR developments in the Secured Surveillance field are the **independently determination of the performance values for Secured Surveillance in relation with the parameters under assessment:**

- Continuity of Security Function,
- Integrity of security function,
- Time to alarm and
- Accuracy of security function.

Once the threat is determined, alarms are produced at **ASTERIX CAT 025 and CAT 021** level, as well as in **CMS** systems.

This parameters are **dependent of the operational service volume** and has to be calculated for each system independently.



# INDRA SURVEILLANCE ENHANCEMENTS

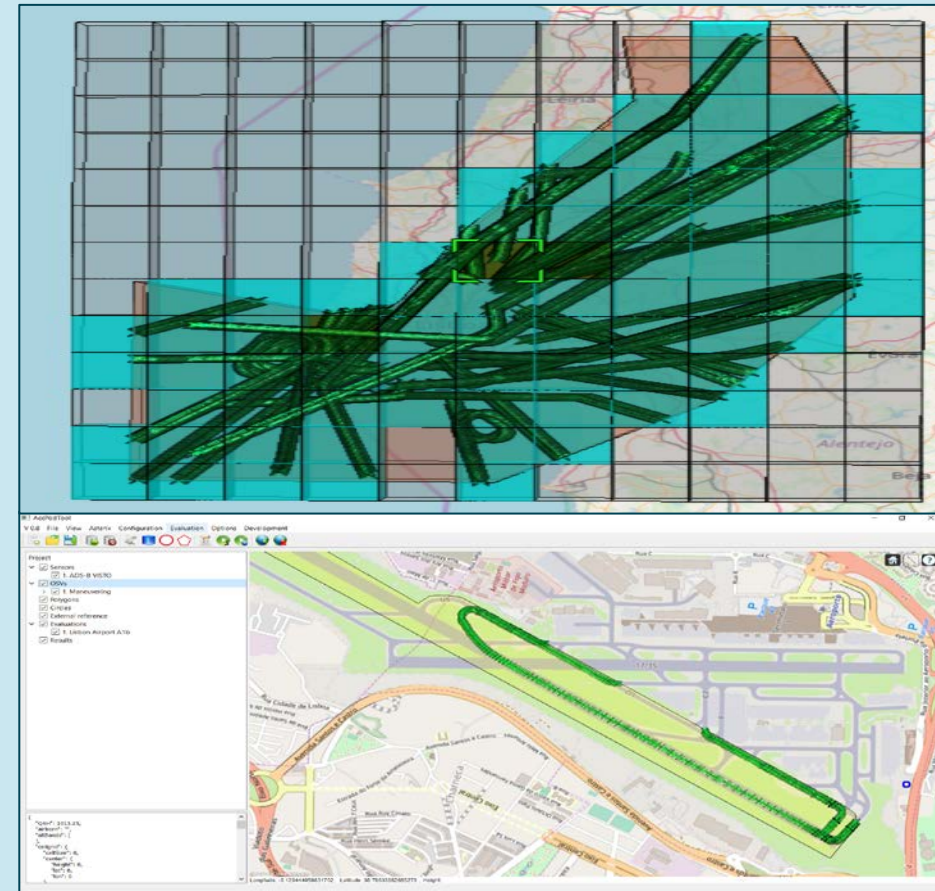
## C) Surveillance Performance Monitoring Tools

SPM Tools seek to identify degradation trends early using both off-line and quasi-real time evaluations.

INDRA has developed **AccPoDTool**, a SPM Tool designed following the PBS approach, determining the KPI of surveillance systems – paving the path to PB Operations.

The Tool analyses the Surveillance Sensors data (cooperative -**ADS-B** / **WAM**/ **MLAT**- and non-cooperative -**SMR**-) against a reference trajectory, calculating performance metrics such as PoD, PoU, PLG, RMS, PFT/PGT, etc.

It has a **3D and 2D representation** and the analysis can be Performed For different environments such as **ER**, **TMA** and **surface**. Graphical representation in **OSV**, **cells** and **individual tracks** is provided, as well as Reports containing all the results.



# INDRA SURVEILLANCE ENHANCEMENTS

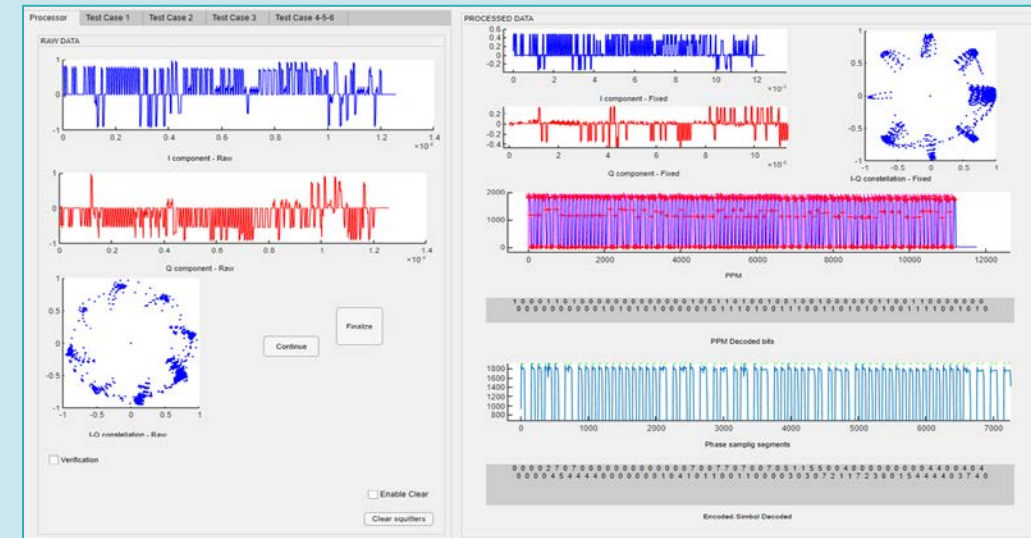
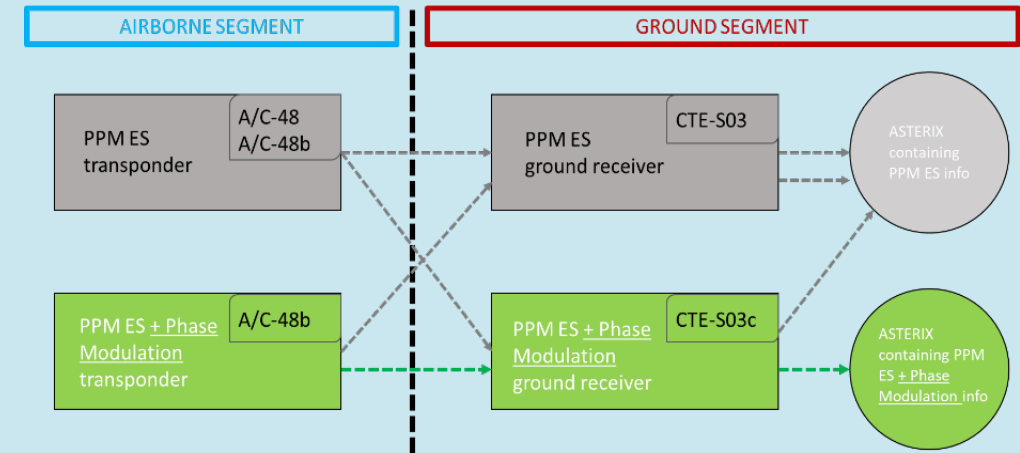
## D) Phase Modulation for ADS-B

Phase modulation is the result of the combination of Pulse Position Modulation (PPM) and Phase Shift Keying (PSK) Modulation, transmitting 3 new bits for each PPM pulse.

PM ADS-B (Phase modulated ADS-B) 1090ES carries separated information in amplitude (PPM) and phase (PSK), and therefore, no modification needs to be made in the structure of the current ADS-B (PPM only) message, as well as the assigned spectrum.

The main benefits of this technology are:

- **Payload:** 4 times the PPM current payload, many new message types can be defined.
- Possibility to include **signature to authenticate ADS-B** messages.
- RF spectrum pollution reduction.
- interoperable with existing receivers.



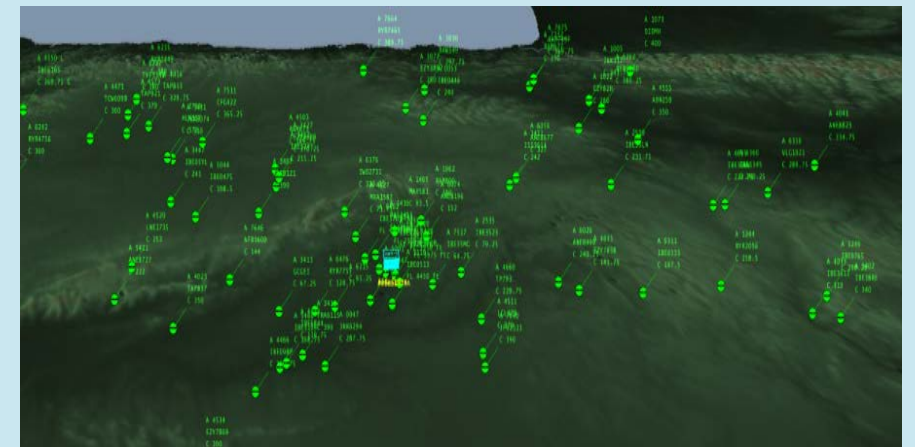
# INDRA SURVEILLANCE ENHANCEMENTS

## E) Full ADS-B integration - Improved multi-sensor data fusion for Space-based ADS-B and MSPSR

It is essential that the surveillance data output from new and emerging surveillance techniques and technologies can be **seamlessly integrated in to the ATM infrastructure**.

Effort has been made on ensuring the interfaces between the sensors and subsequent processing stages, including multi-sensor tracker, are correct and fit for purpose.

It included a **performance based data fusion** which underlying objective is to improve the SDPS resilience based on an advanced monitoring of the tracker coherence.



# INDRA SURVEILLANCE ENHANCEMENTS

## E) Video Surveillance - Multi Remote Tower Solutions

### IRTOS Indra Remote Tower Optical System

Its mission is to provide OTW images of a control tower to operators located in a Remote Tower Control Center (RTC), creating an additional independent surveillance source.

It offers:

- Interactive PTZ control, and automatic target tracking.
- Detection and tracking of moving objects within the interest areas.
- Fusion of visual and surveillance / FP tracks, to labelling the objects of interest for the ATCOs.





**Questions**

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**indra**  
At the core