

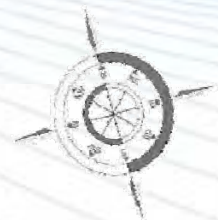
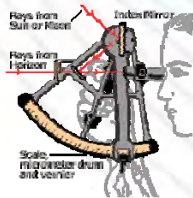
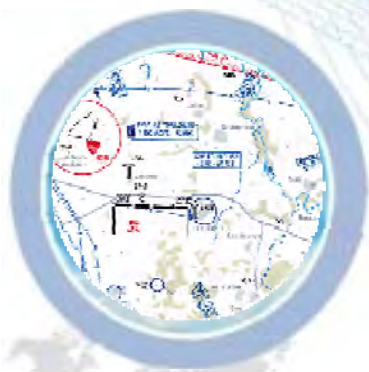
Presented by

Laurent VIDAL

Surveillance Systems Manager

Engineering - Support to Sales, Programs and Marketing

ADS-B IN



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INTRODUCTION - ADS-B Airbus roadmap

ADS-B IN

- A/C information is received
- IN the airborne
- into the TCAS

Step 2. ATSAW

Display of other a/c information in the cockpit



Next Steps (part of SESAR)

- SPACING applications:

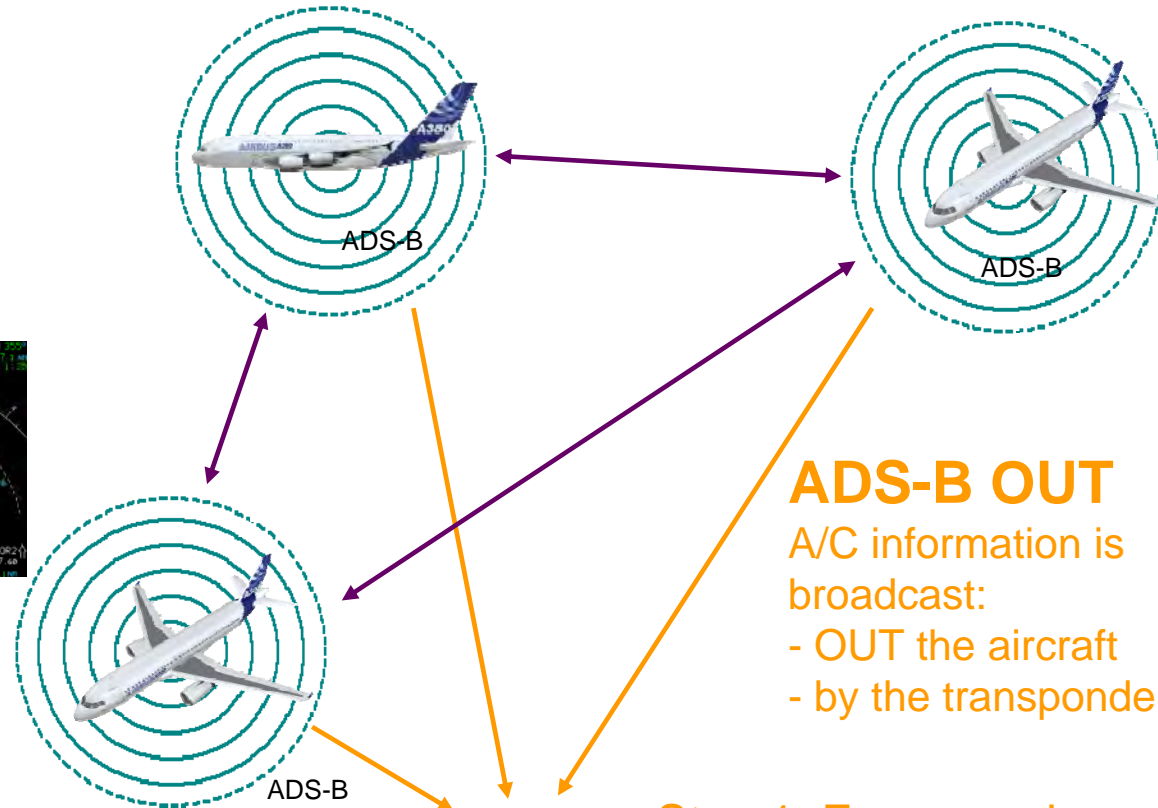
A/C instructed to maintain spacing with target aircraft

- Taxi Clearance:

Display of ground trajectory from the gate to the runway

- ATSA-SURF IA:

Indicating & Alerting on airport Surface



ADS-B OUT

A/C information is broadcast:

- OUT the aircraft
- by the transponder

Step 1. For ground use

- ▶ step 1A: ADS-B NRA
- ▶ step 1B: ADS-B RAD
- ▶ step 1C: ADS-B APT



ADS-B Receiver for Air Traffic Control

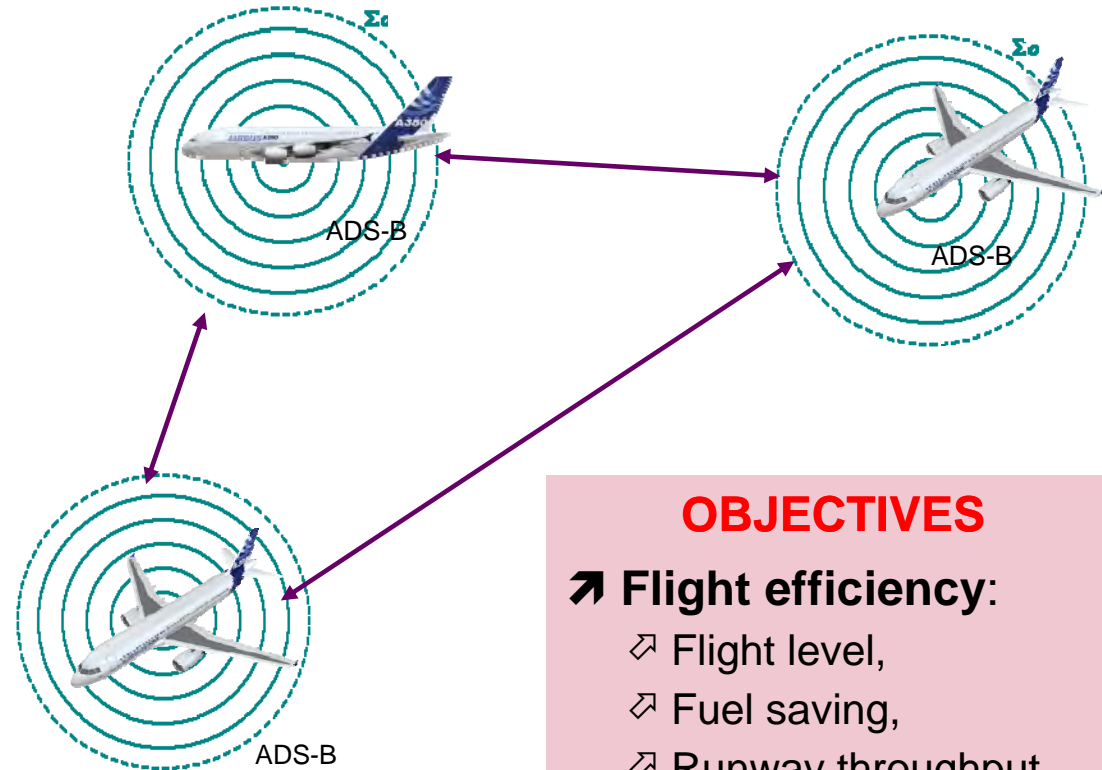
INTRODUCTION - ADS-B Airbus roadmap

ADS-B IN

- A/C information is received
- IN the airborne
- into the TCAS

Step 2. ATSAW

Display of other a/c information in the cockpit



OBJECTIVES

➤ Flight efficiency:

- ✦ Flight level,
- ✦ Fuel saving,
- ✦ Runway throughput

➤ Safety

- ✦ Traffic situational awareness,
- ✦ Aircraft identification

- **Step 2A (ATSAW applications in air)**

- ATSA-AIRB: Enhanced traffic awareness in all environment
- ATSA-ITP: In Trail Procedure for flight level change
- ATSA-VSA: Visual Separation Approach

- **Step 2B (ATSAW applications on ground)**

- ATSA-SURF: Enhanced Traffic Situational Awareness on the Airport Surface

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ATSAW - DEFINITION

- **ATSAW definition:**

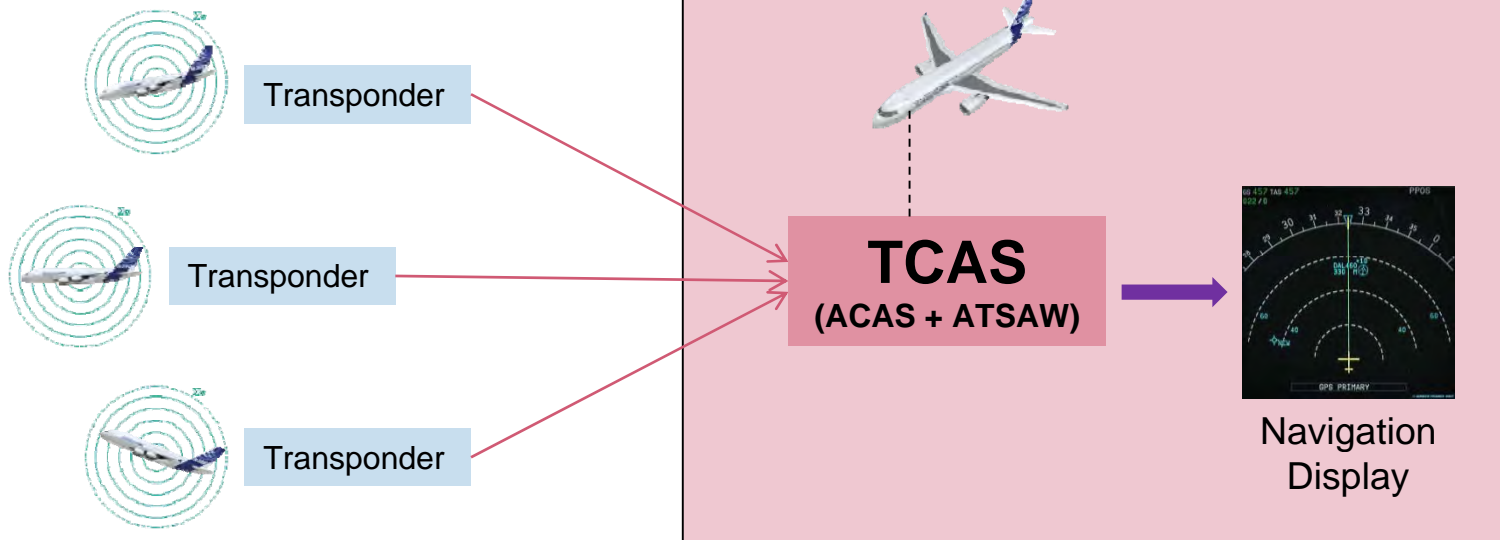
- ▶ Enhancement for the flight crews of the knowledge of the surrounding traffic situation

- **Goal:**

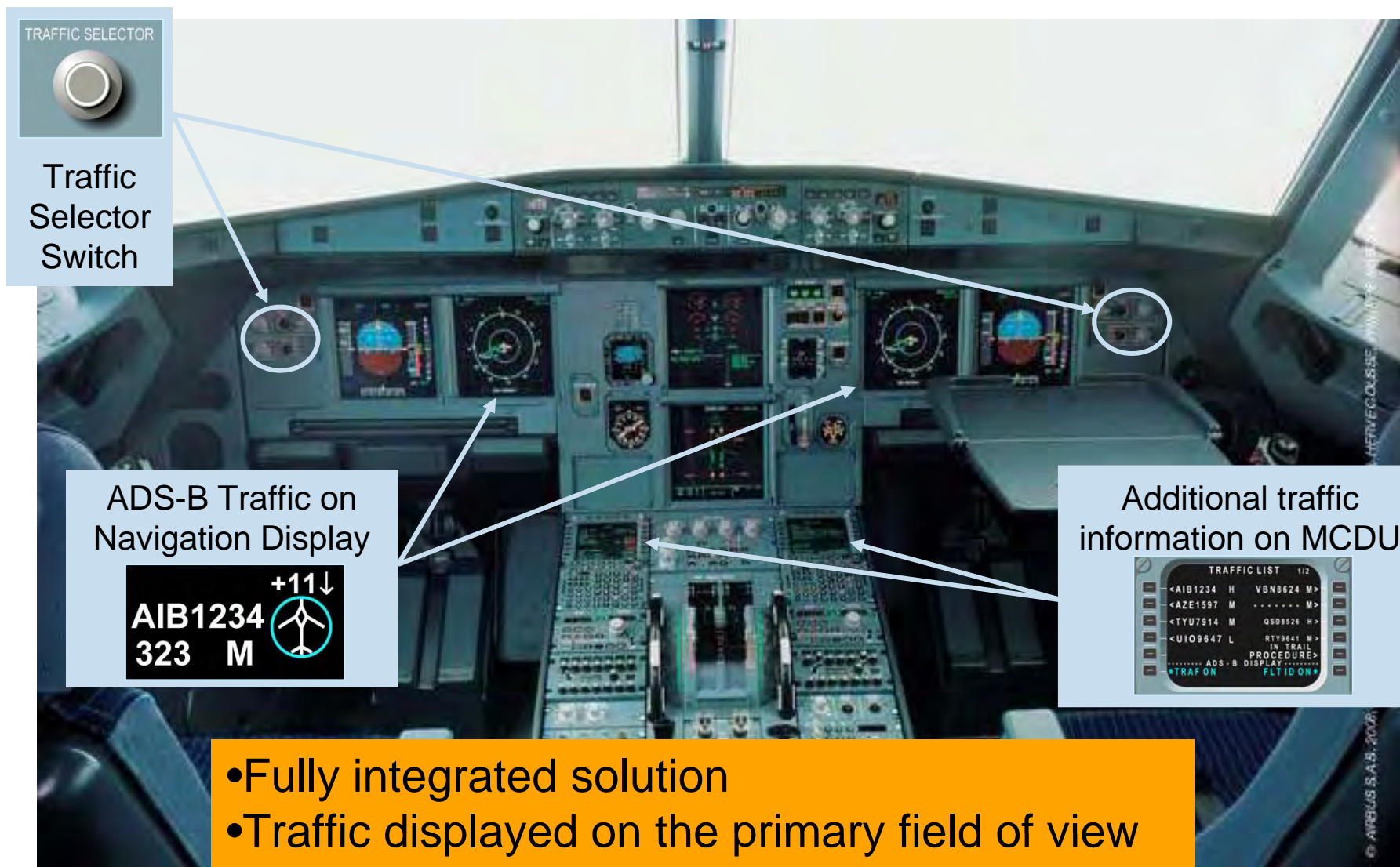
- ▶ Safety and Efficiency improvement
- ▶ Both in air and on airport surface.

- **Means:**

ADS-B OUT



ATSAW – COCKPIT VIEW



- Fully integrated solution
- Traffic displayed on the primary field of view
- Limited impact (no new equipment)

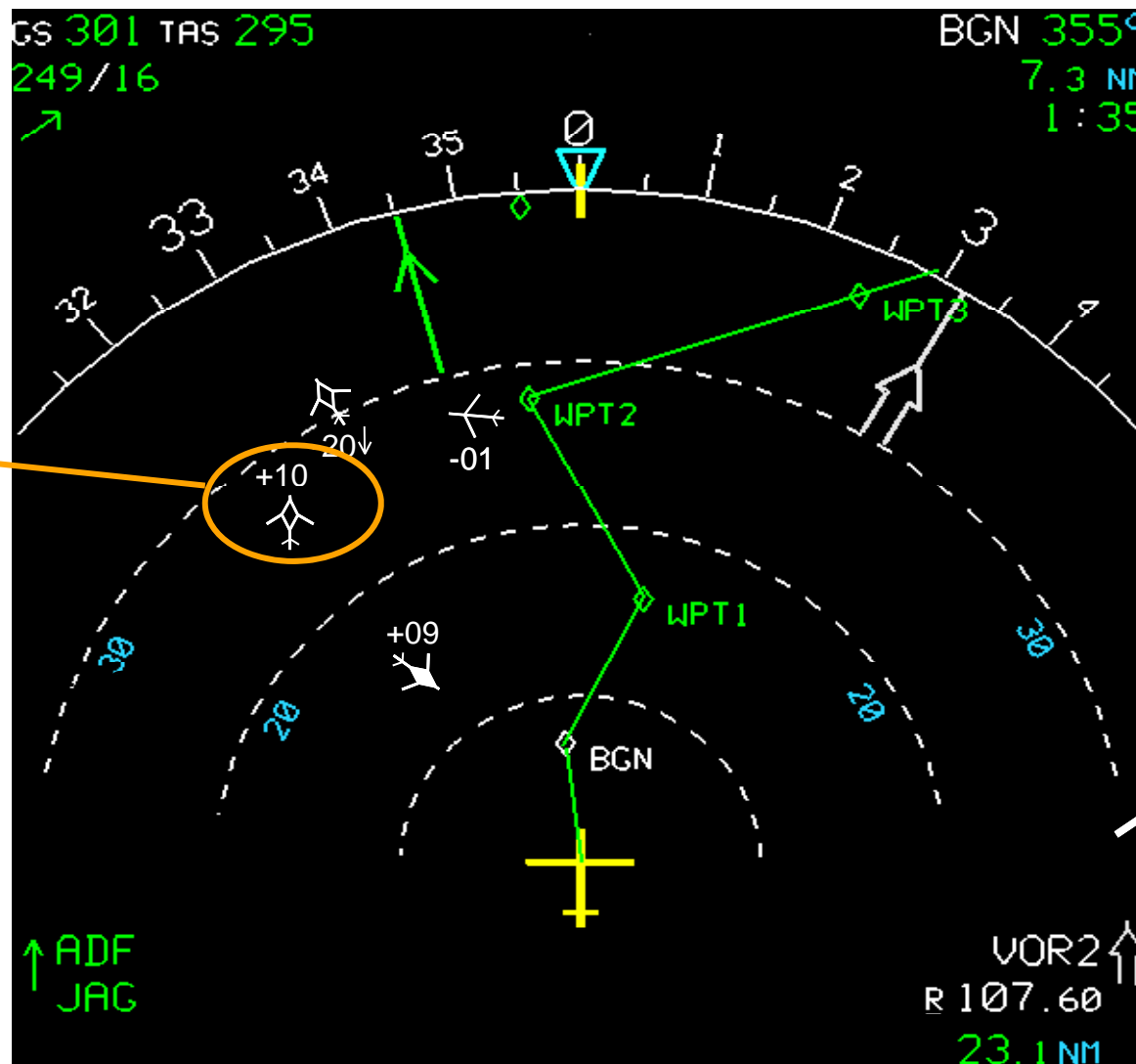
ATSAW - NAVIGATION DISPLAY

By default

- Position
- Orientation
- Relative Altitude
- Vertical Tendency

Up to 8 closest aircraft

Correlation with TCAS information

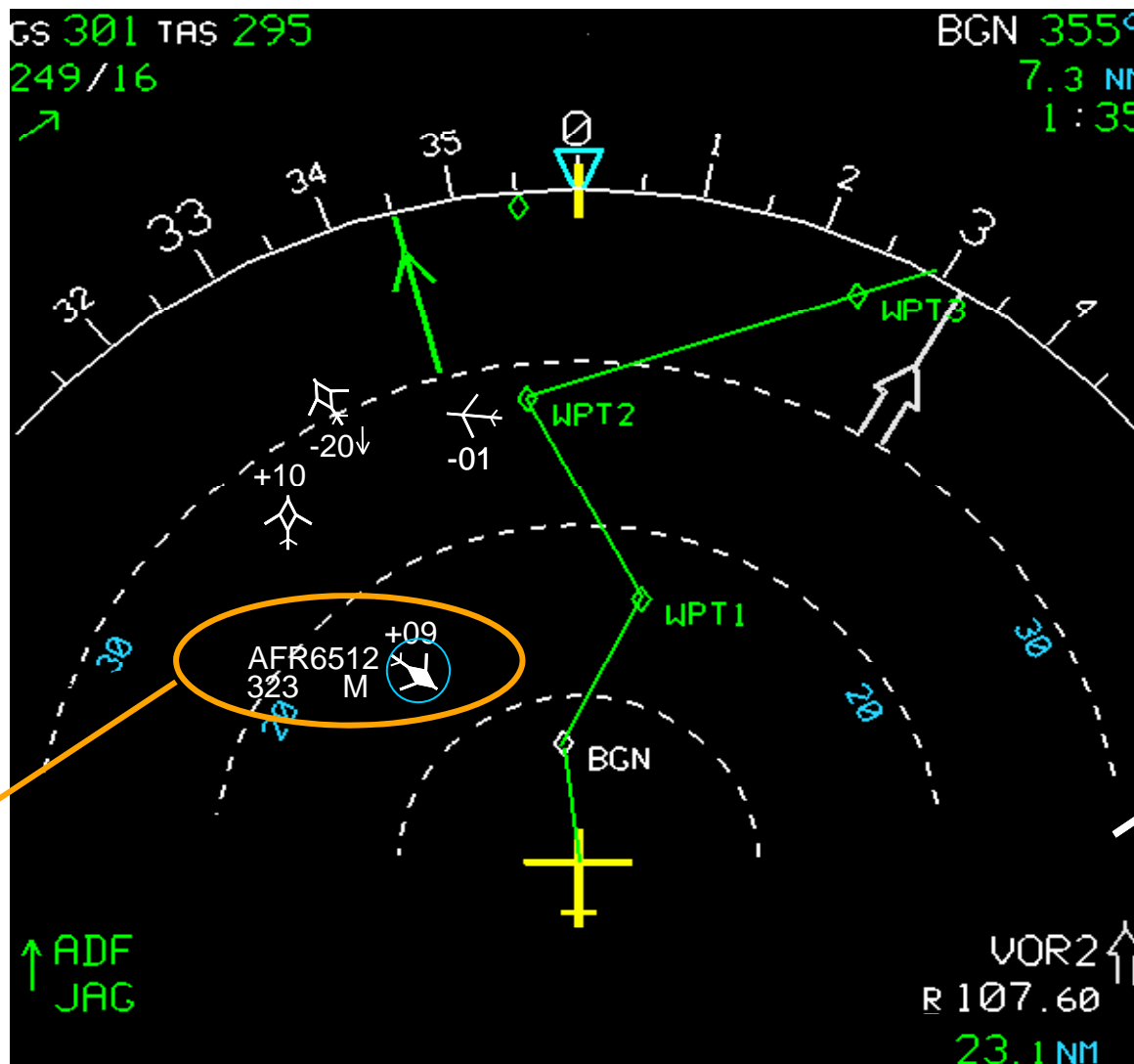


ATSAW - NAVIGATION DISPLAY

The aircraft is highlighted using the traffic selector switch located in the cockpit

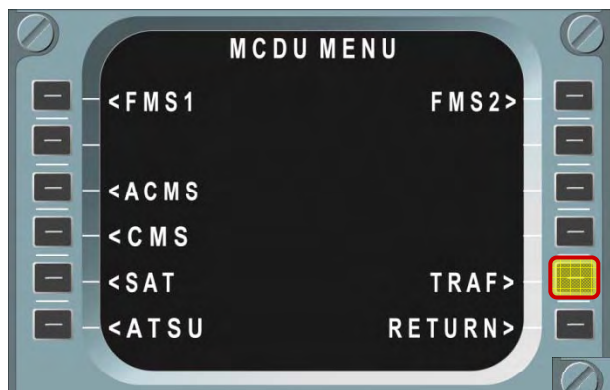


- Default information
- +
 - A/C ident
 - Ground Speed
 - Wake Vortex category



ATSAW - MCDU

- Specific Traffic pages on MCDU provides additional traffic information



Up to 90 aircraft

Synchronization between MCDU & ND



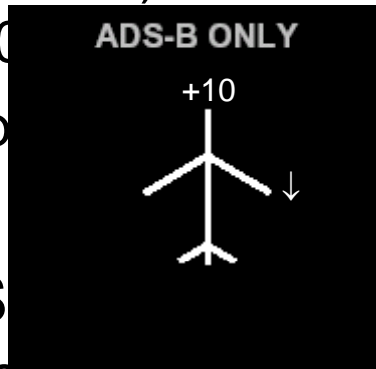
- **LARGE** font = aircraft also displayed on ND
- **small** font = aircraft not displayed on ND
- Traffic on ND at top of the MCDU traffic list

• **TRAF ON/OFF** switch:
OFF = ADS-B data not displayed

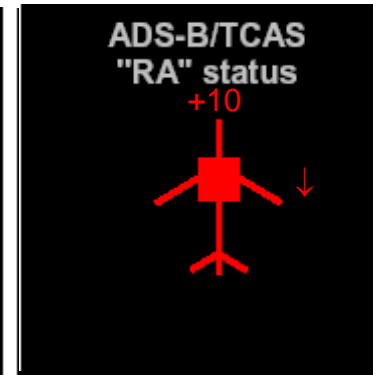
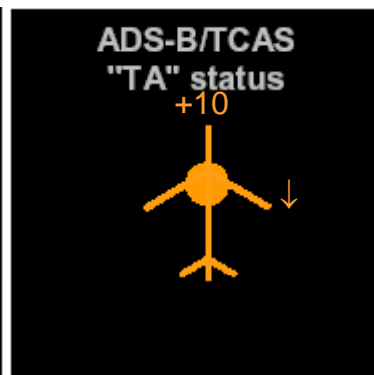
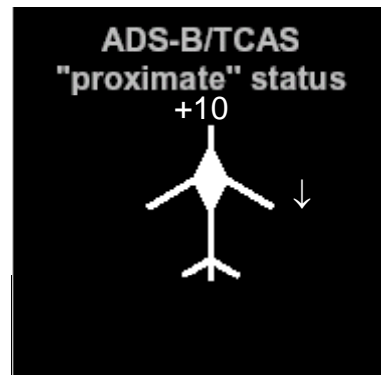
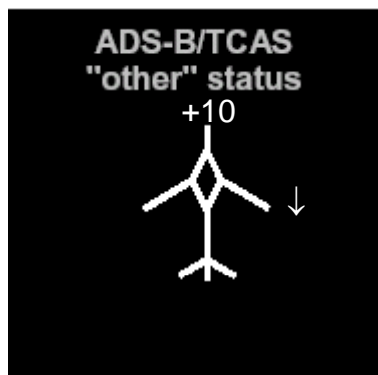
• **FLT ID ON/OFF** switch
ON = flight ID displayed for all ATSAW symbols

ATSAW – COMPARISON WITH TCAS

- ADS-B can provide
 - ▶ more information
 - ▶ wider range (up to 250 NM) than current TCAS is currently capable to provide (40 NM)
 - ▶ intruders direction represented by an oriented symbol



- Merge TCAS and ADS-B information available to provide a unique traffic symbol to the flight crew



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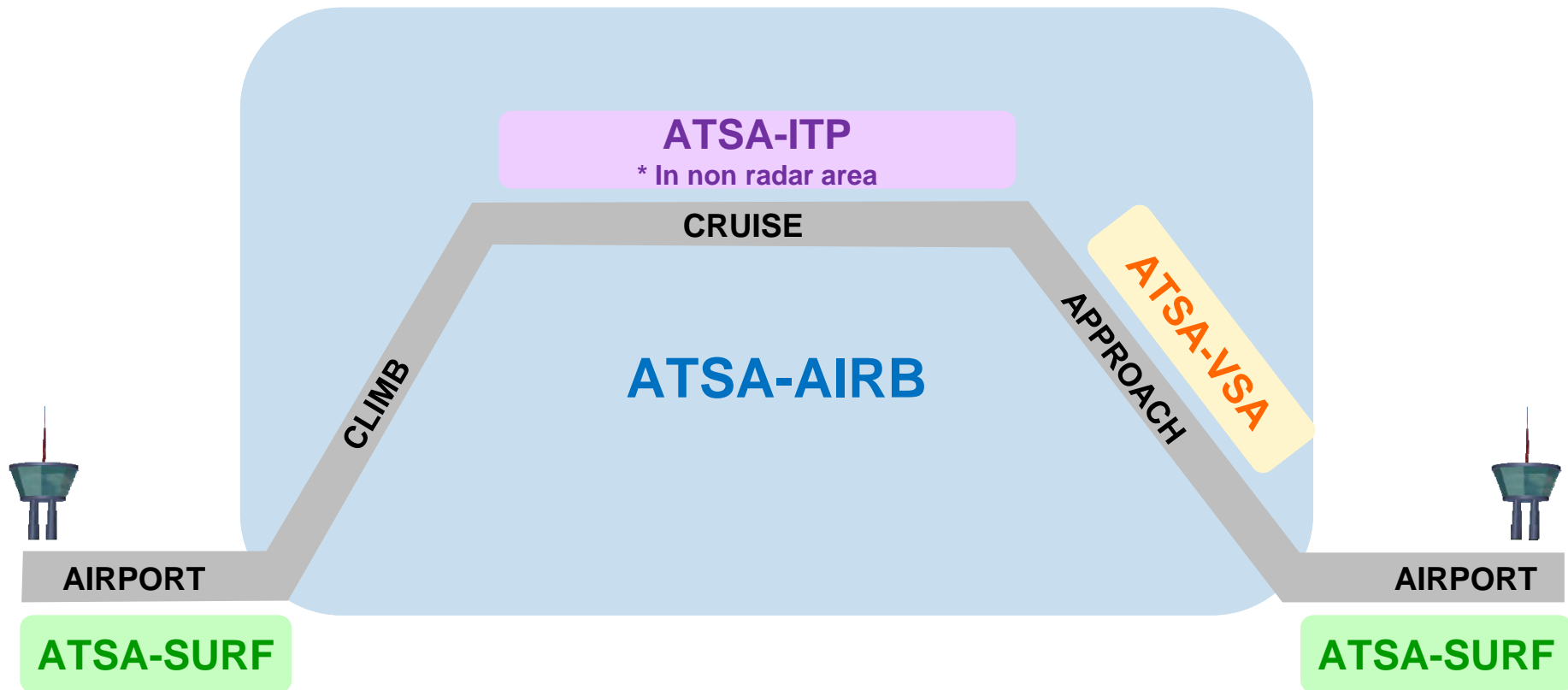
4

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ATSAW APPLICATIONS



- Step 2A (ATSAW applications in air): **ATSA-AIRB, ATSA-ITP, ATSA-VSA**
- Step 2B (ATSAW applications on ground): **ATSA-SURF**

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ATSAW Applications in Air (Step 2A) – ATSA-AIRB

ATSA-AIRB

ATSAW for general in-flight operation



ATSAW Applications in Air (Step 2A) – ATSA-AIRB

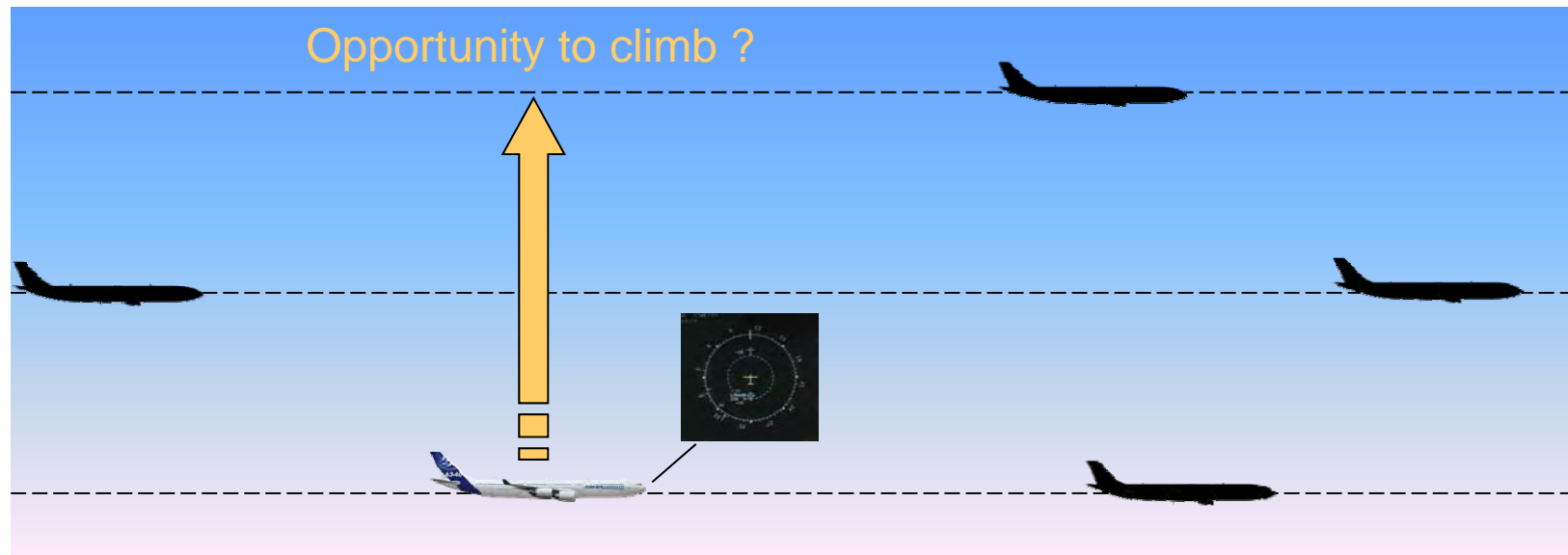
- ATSA-AIRB improves traffic situational awareness during general in-flight operations:

Reduced Workload

- ➔ Assistance to out-the-window scans
- ➔ Reduced mental effort for traffic awareness

Improved Efficiency

- ➔ Improved cooperation with ATC (better understanding of ATC instructions)
- ➔ Detection opportunity to Flight Level change in standard separation
 - **Fuel saving**



ATSAW Applications in Air (Step 2A) – ATSA-ITP

ATSA-ITP

Specific ATSAW procedure for Flight Level change

*ATSA-ITP application is defined in EUROCAE/RTCA document **ED-159/DO-312***



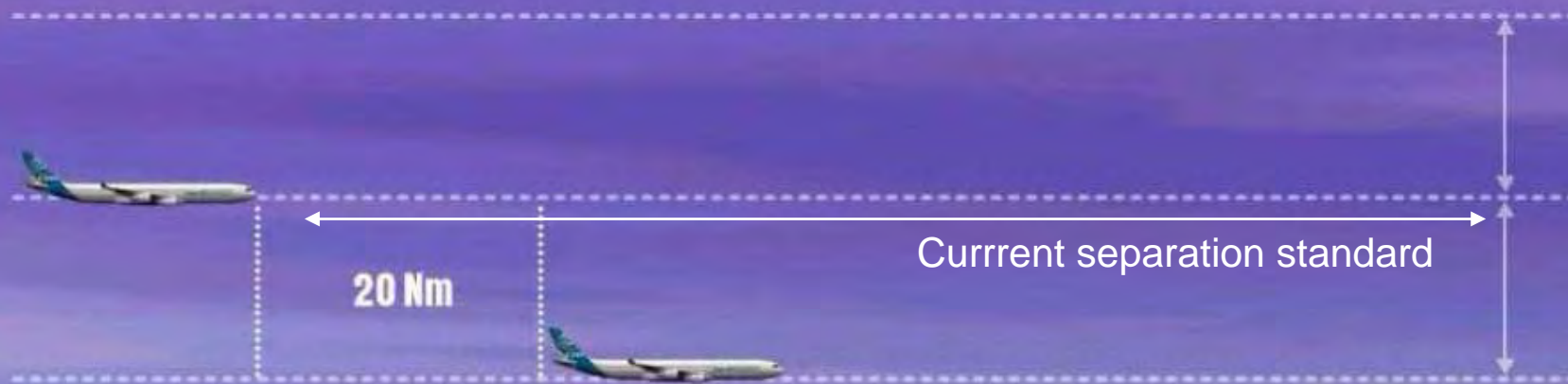
ATSAW Applications in Air (Step 2A) – ATSA-ITP

- Context:
 - ▶ Many aircraft are constrained to fly at the same flight level.
 - ▶ Many aircraft don't fly at an optimum flight level
- Objective:
 - ▶ Enable more frequent altitude changes **by flying at the optimum flight level**
- Enhanced efficiency:
 - ▶ **Significant fuel saving**
 - ▶ **Reduction of CO2 emission**
- Enhanced safety:
 - ▶ **Awareness of traffic situation**

ATSAW Applications in Air (Step 2A) – ATSA-ITP

Standard Longitudinal Separation Requirement = 10mn (80 NM)

As per ICAO PANS-ATM, Doc 4444, Chapter 5



ITP criteria (*) are defined to ensure a separation minimum of 10NM during the climb

(*) ITP criteria (itp distance; convergent track; min vertical speed >300 ft min)

ATSAW Applications in Air (Step 2A) – ATSA-ITP



ITP possible

Time opportunity

ITP distance /
position /
reference aircraft



ITP not possible

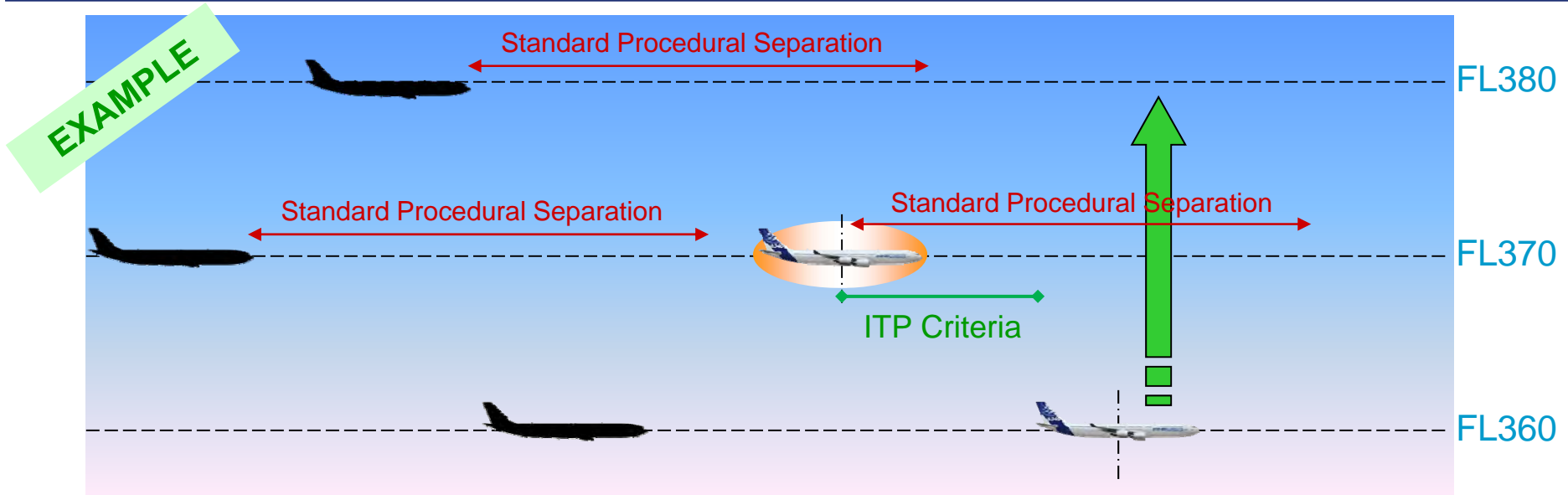
Blocking aircraft
with causes



ITP not applicable

Standard
procedure
possible

ATSAW Applications in Air (Step 2A) – ATSA-ITP



- Climb from FL360 to FL380 is desired.
- Standard procedural separation does not permit a standard climb at FL370.

➤ Consider ITP climb using ATSAW

1. Flight crew checks that ITP criteria are met and requests ITP clearance.
2. ATC issues ITP climb clearance.
3. Flight crew checks that ITP criteria are still met and executes ITP clearance without delay.



= Other Aircraft



= ITP Aircraft



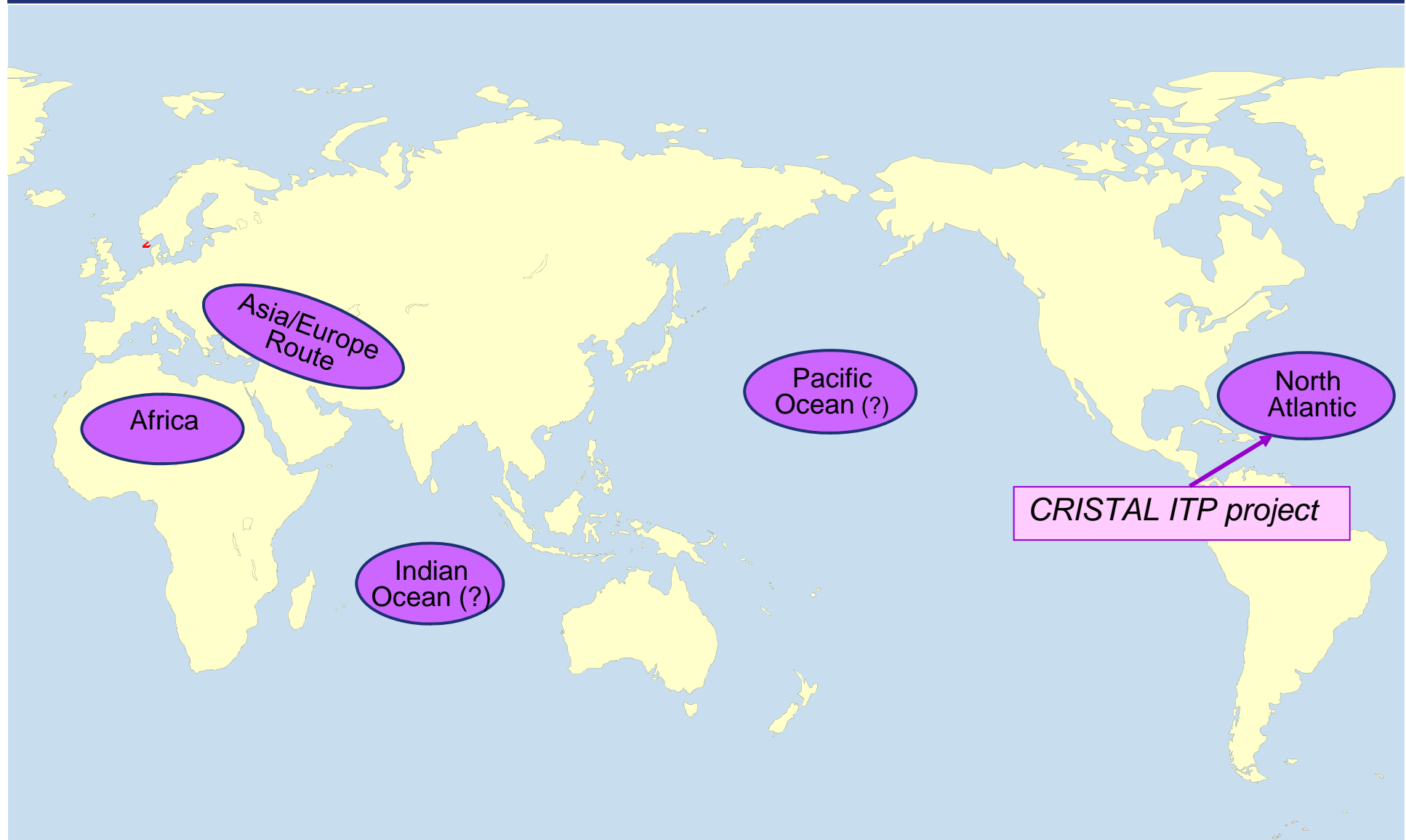
= Reference Aircraft

ATSAW Applications in Air (Step 2A) – ATSA-ITP

BENEFITS

- ATSAW provides significant **fuel saving** due to flight at the optimum flight level
 - ▶ With current separation standards
 - ▶ With temporary reduced separations (ATSA-ITP)
 - ▶ Yearly savings: from several 10 000 \$ to over a 100 000 \$ depending on:
 - Flight frequency,
 - Aircraft fuel burn,
 - Flight duration...
 - ▶ NASA study: 538 000\$ yearly
- In North Atlantic Ocean
 - ▶ 30% of aircraft below their requested FL at ocean entry
 - ▶ 50% of these aircraft may request and obtain a climb
 - ➔ CRISTAL ITP project was launched in 2008 by Eurocontrol

STEP 2A – ATSAW for flight level changes



- Interest of ATSAW in oceanic and remote area for flight level change

ATSAW Applications in Air (Step 2A) – ATSA-VSA

ATSA-VSA

ATSAW for Visual Separation Approach

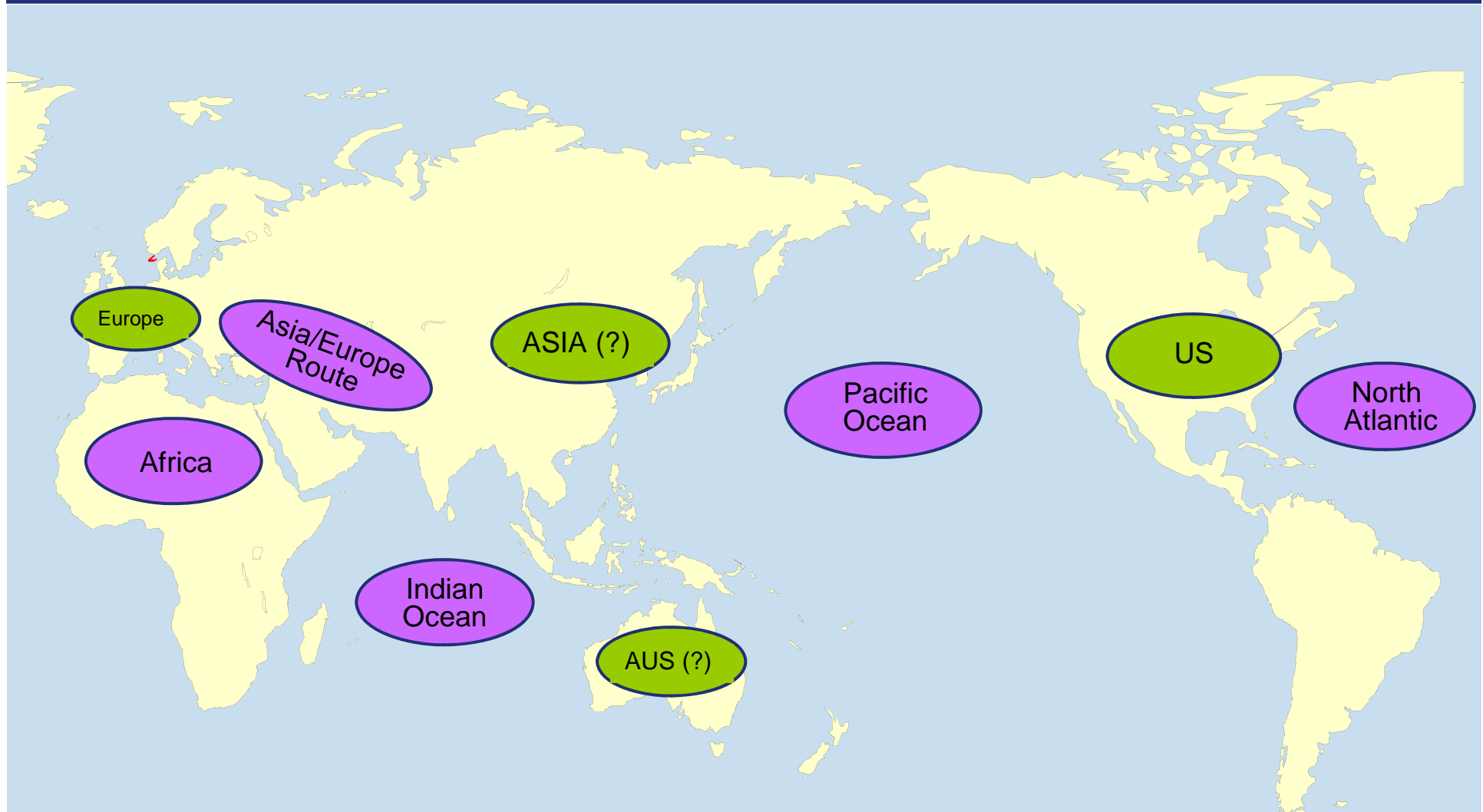
ATSA-VSA application is defined in EUROCAE/RTCA document ED-160/DO-314



ATSAW Applications in Air (Step 2A) – ATSA-VSA

- Context:
 - ▶ Approach procedures with visual separation clearance increase runway capacity (compared to radar separation)
- Objectives:
 - ▶ To **safely** perform approach procedures with **own visual separation** from the preceding aircraft on a **more regular basis**:
 - Procedure easier for flight crews to acquire and then to maintain visual contact with the preceding aircraft,
 - May safely be used in extended meteorological conditions (limit VMC/IMC)
- Enhanced efficiency:
 - ▶ **Increased runway capacity**
- Enhanced safety:
 - ▶ **Awareness of traffic situation**
 - ▶ **Enhanced identification of target aircraft**

ATSAW Applications in Air (Step 2A) – ATSA-VSA



• Interest of ATSAW in dense area for Visual Separation Approach

• Interest of ATSAW in oceanic and remote area for flight level change

ATSAW Applications in Air (Step 2A) – OFFERABILITY

- ATSAW for air operations (step 2A) will be available with:



▶ T3CAS ACSS

Certification scheduled Q4 2010 on A320 & A330/A340 aircraft family



▶ TCAS TPA-100B Honeywell

Certification scheduled Q4 2010 on A320 & A330/A340 aircraft family

- ATSAW options are considered and embodied as follow:
 - ▶ **ATSAW wiring provision** (Basic on A330/A340 a/c family since Nov 2008)
 - ▶ **ATSA-AIRB / ATSA-VSA**
 - activated by pin-programming
 - includes implementation of the traffic selector switches
 - includes the aircraft documentation update
 - option chargeable
 - ▶ **ATSA-ITP** *note: separate option to not penalize SA because benefits are essentially for LR*
 - activated by pin-programming
 - includes the specific ITP page on MCDU
 - includes the aircraft documentation update
 - option chargeable

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ATSAW Applications on Ground (Step 2B) – ATSA-SURF

ATSA-SURF

ATSAW on Airport Surface (Step 2B)

ATSA-SURF application is defined in EUROCAE document ED-165



ATSAW Applications on Ground (Step 2B) – ATSA-SURF

- Objective:
 - ▶ To improve the safety on airport surface
- Method:
 - ▶ To display aircraft and vehicle positional information on runways and taxiways (using airport moving map)
- Applicability:
 - ▶ On runways, taxiways,
 - ▶ In all weather conditions, day and night.
- Safety benefits:
 - ▶ **Awareness of traffic situation (Runway occupancy)**
 - ▶ **Collision risk anticipation**

ATSAW Applications on Ground (Step 2B) – ATSA-SURF

MOVING MAP

(provided by On-board Airport Navigation System - OANS)

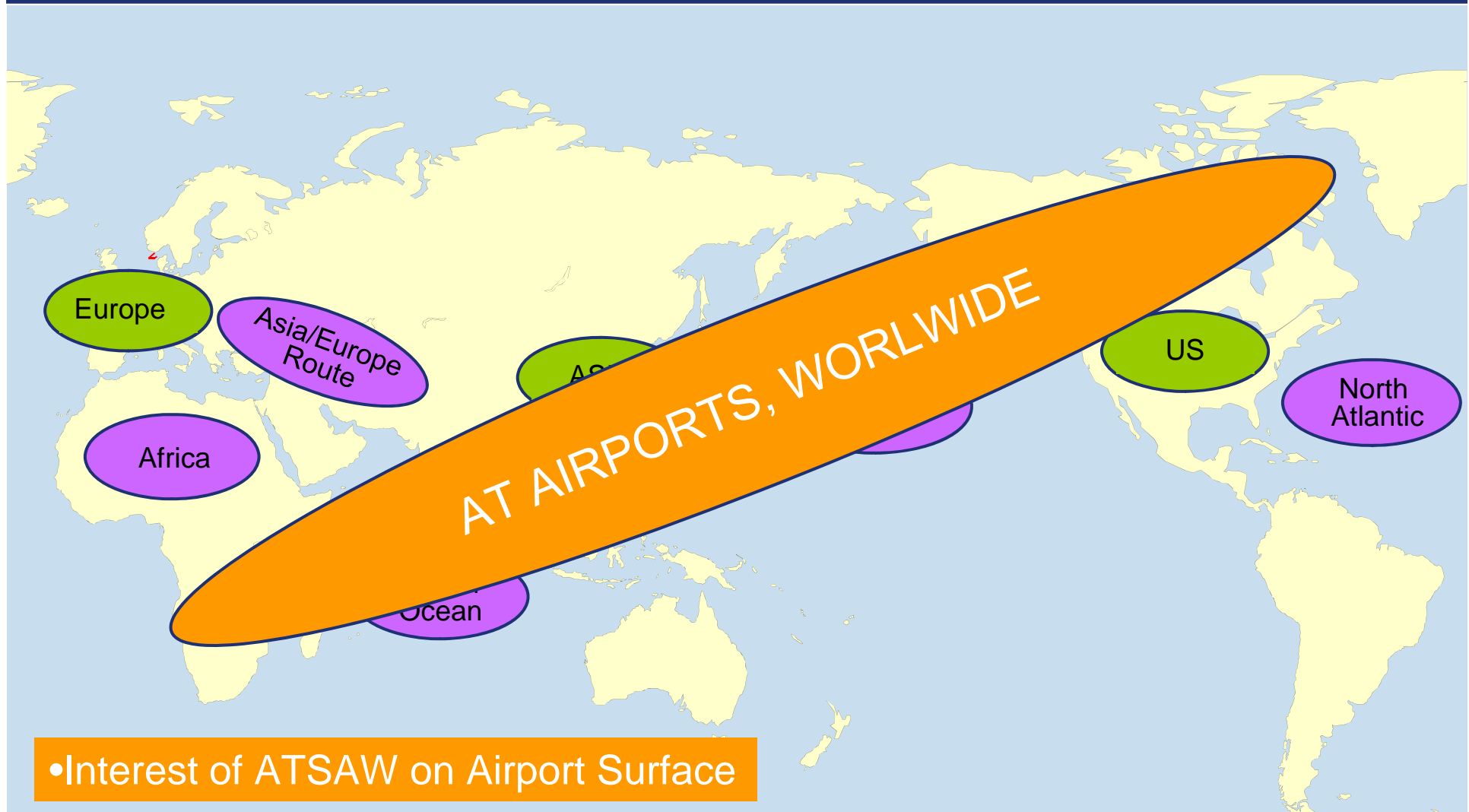
+ TRAFFIC

(ADS-B data)

- OANS development on going
- ATSA-SURF not available before 2013



ATSAW Applications on Ground (Step 2B) – ATSA-SURF



•Interest of ATSAW on Airport Surface

•Interest of ATSAW in dense area for Visual Separation Approach

•Interest of ATSAW in oceanic and remote area for flight level change

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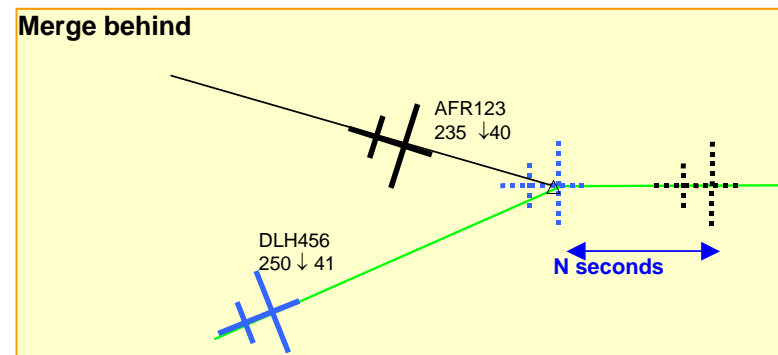
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NEXT STEPS (SESAR) – Spacing Applications

- Spacing applications is the next step after ATSAW
- Objectives:
 - ▶ Enable the flight crews to achieve and **maintain automatically a given spacing with designated aircraft**
- 3 maneuvers:
 - ▶ Remain Behind
 - ▶ Merge behind
 - ▶ Radar Vector then Merge behind
- **Operational benefit:**
 - ▶ **Enhance traffic regularity during the approach to dense airports for increasing airport capacity.**
- Procedural and ground system impacts:
 - ▶ To be addressed in parallel by ANSPs within SESAR

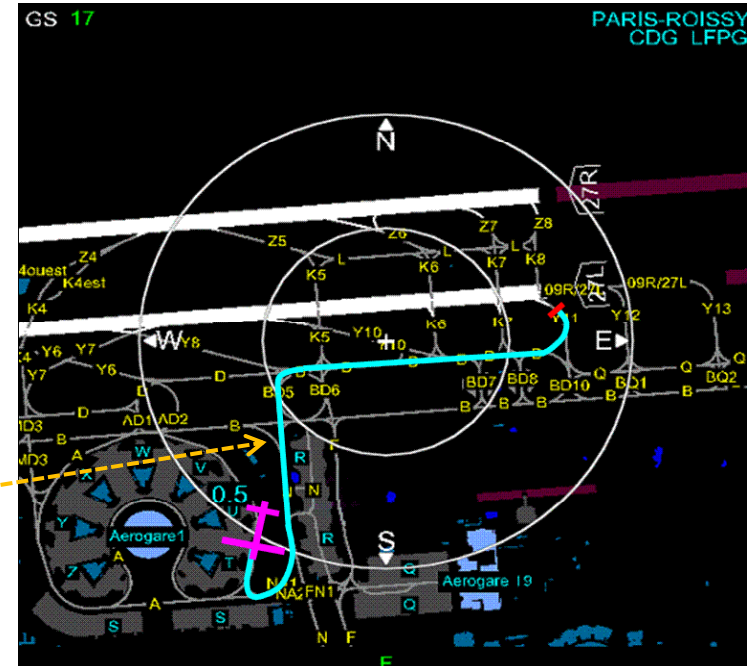


NEXT STEPS – Taxi Clearance & Surface Airport Alerts

- **Taxi clearance function:**

- ▶ Computes and displays Taxi Path from the gate to the runway.
- ▶ Needs taxi path information transmitted:
 - Automatically (by datalink)
 - or Manually (Flight crew interaction)

Taxi clearance



- **Surface Airport Alerts: ATSA-SURF IA (Indicating & Alerting)**

- ▶ Next step of ATSA-SURF
- ▶ Computes potential conflict with aircraft ADS-B OUT equipped
- ▶ Provides to the crew indicating and alerting in case of potential conflict

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CONCLUSION - ATSAW BENEFITS

ATSAW in flight (Step 2A)

ATSAW on ground (Step 2B)

ATSA-AIRB / ITP / VSA

ATSA-SURF

 **EFFICIENCY**

- **Fuel saving**
- Flight time optimisation
- **Increase runway throughput**
- Reduction of radio call
- Reduction of Nox
- Decrease of missed approaches

- Improve taxiing operations (time & fuel saving)
- Increase airport capacity
- Departure clearance at the right time
- Gate occupancy awareness

 **SAFETY**

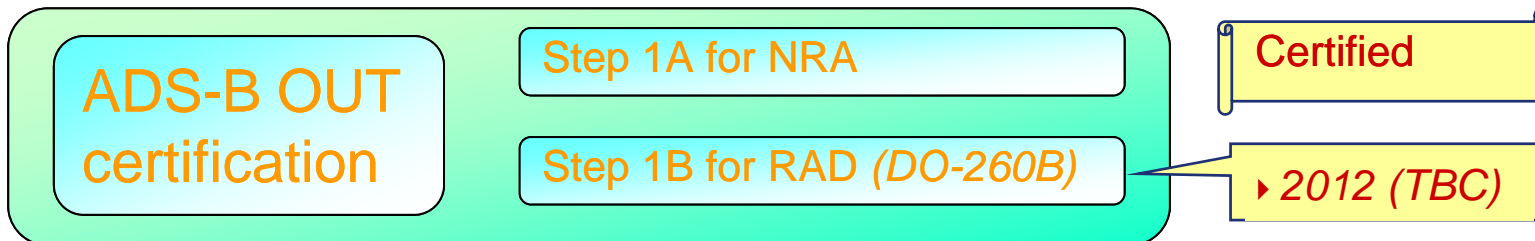
- **Awareness of traffic situation**
- **Enhanced identification of target aircraft**
- Readiness for avoidance actions
- Correlation of radio communication and traffic display

- **Runway & taxiway occupancy awareness**
- **Collision risk anticipation**

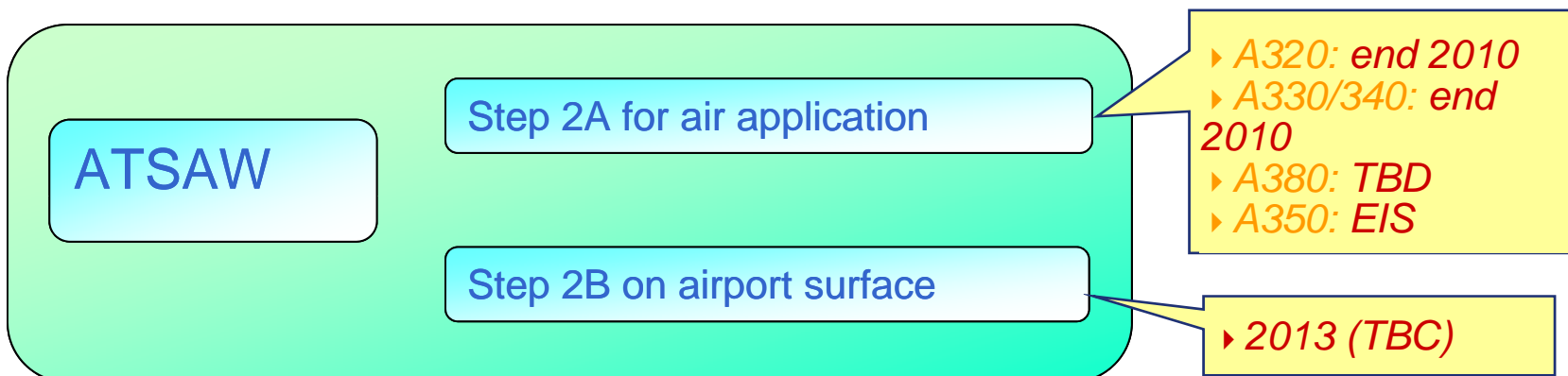
ATSAW helps gaining experience and confidence for future applications

CONCLUSION - AIRBUS ROAD MAP

Step 1



Step 2



Next steps



THANKS FOR YOUR ATTENTION...

QUESTIONS?

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laurent.vidal@airbus.com

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