Presented by

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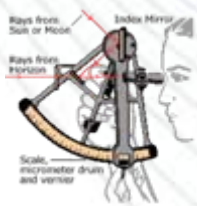
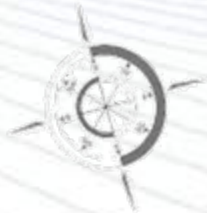
Technical Support to Sales and Programs

ADS-B IN
-
ATSAW
(Airborne Traffic Situational Awareness)





CONTENTS

AIRBUS

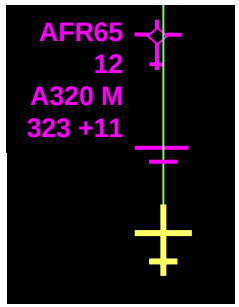
ADS-B Airbus roadmap

ADS-B IN

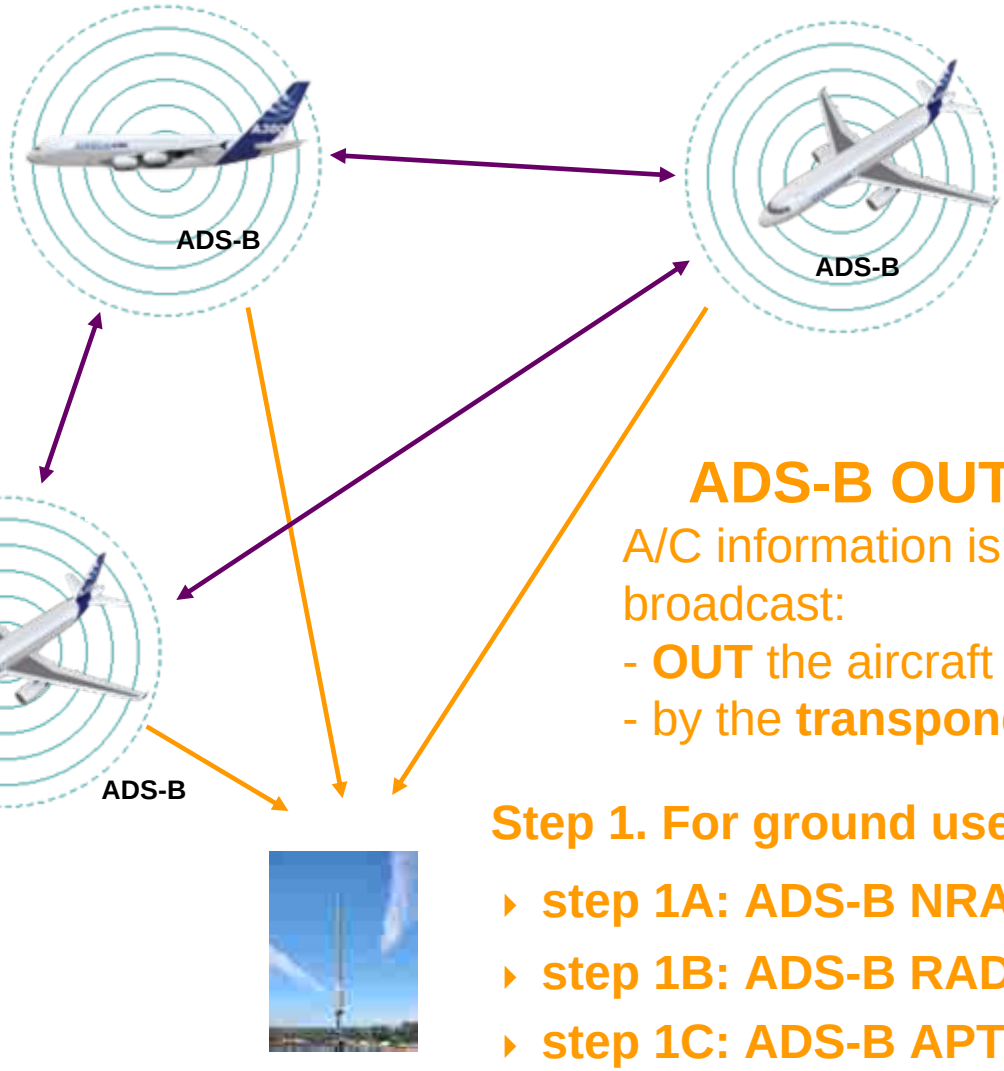
A/C information is received
- **IN** the airborne
- into the **TCAS**

Step 2. ATSAW
Display of other a/c information in the cockpit

Step 3. SPACING
A/C instructed to maintain spacing with target aircraft



Step 4. ASAS SEPARATION
A/C instructed to maintain Separation with other aircraft



ADS-B OUT

A/C information is broadcast:
- **OUT** the aircraft
- by the **transponder**

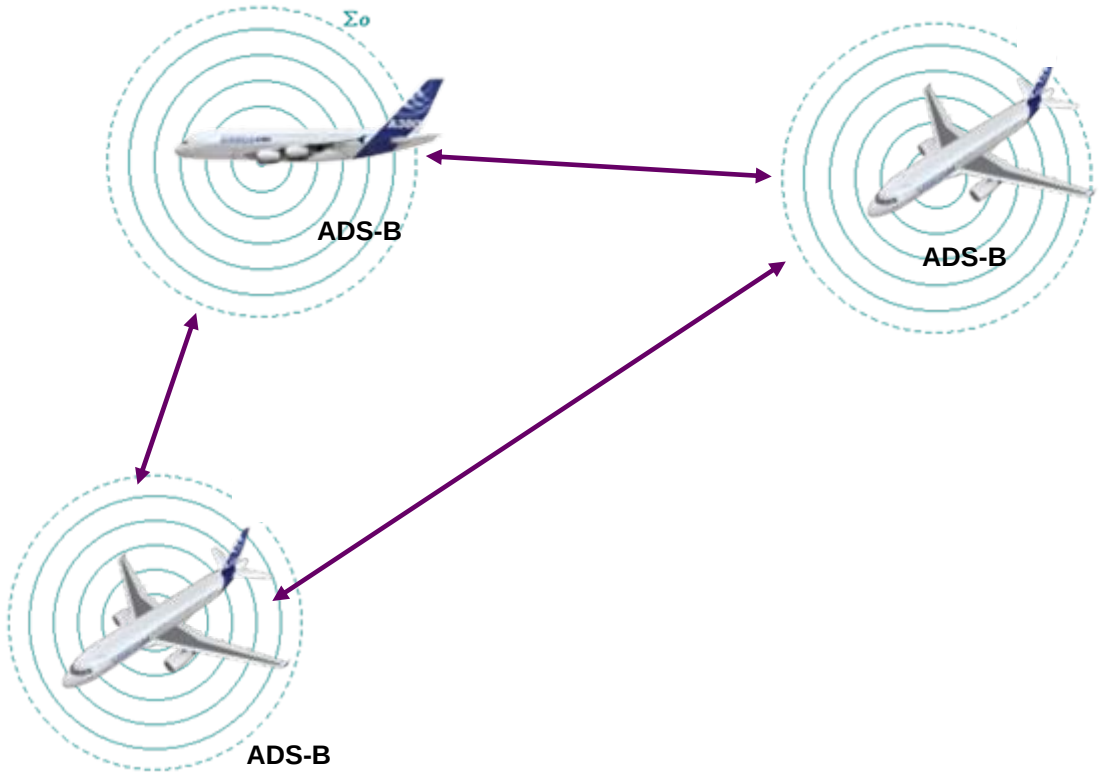
Step 1. For ground use
- **step 1A: ADS-B NRA**
- **step 1B: ADS-B RAD**
- **step 1C: ADS-B APT**

ADS-B Receiver for Air Traffic Control

ADS-B IN (ATSAW)

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

- **Step 2A (ATSAW applications in air)**
  - **ATSA-AIRB:** Enhanced awareness in all environment
  - **ATSA-ITP:** Flight Level Changes using “In Trail Procedure” in oceanic airspace
  - **ATSA-VSA:** Visual Separation Approach
- **Step 2B (ATSAW applications on ground)**
  - **ATSA-SURF:** Enhanced Traffic Situational Awareness on the Airport Surface

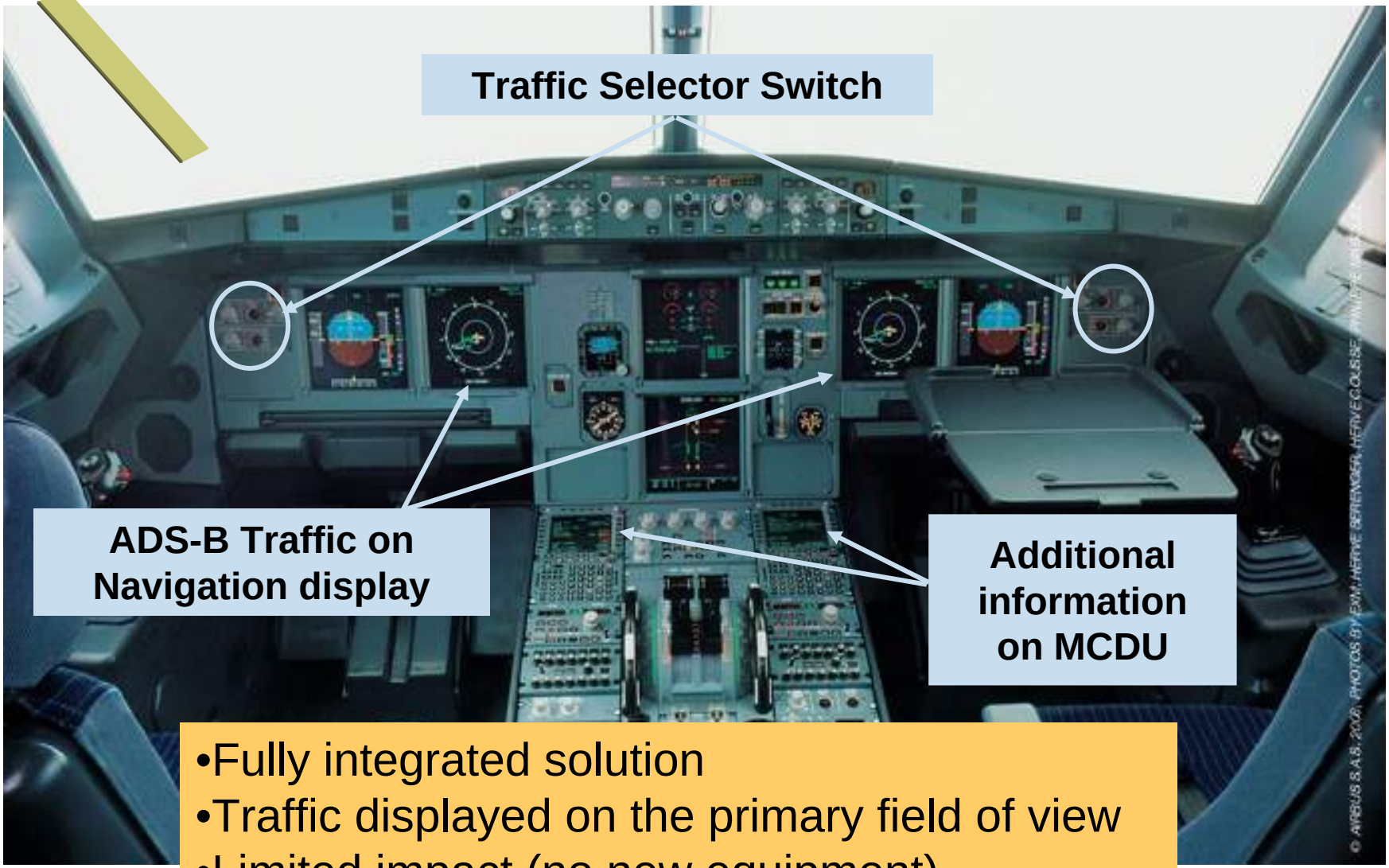
CONTENTS

AIRBUS

ATSAW DEFINITION

- **ATSAW definition**:
  - Enhancement of the flight crews' knowledge of the surrounding traffic situation
- **Goal:**
  - Safety and Efficiency improvement
  - Both in air and on airport surface.
- **Means:**
  - ADS-B information transmitted from each aircraft transponder
  - ADS-B information received and treated by the TCAS (ATSAW & TCAS software are partitioned within TCAS equipment)
  - A **CDTI** (Cockpit Display of Traffic Information) provides permanently updated traffic information (aircraft identification, position, direction…).

ATSAW in A320/A340 cockpit

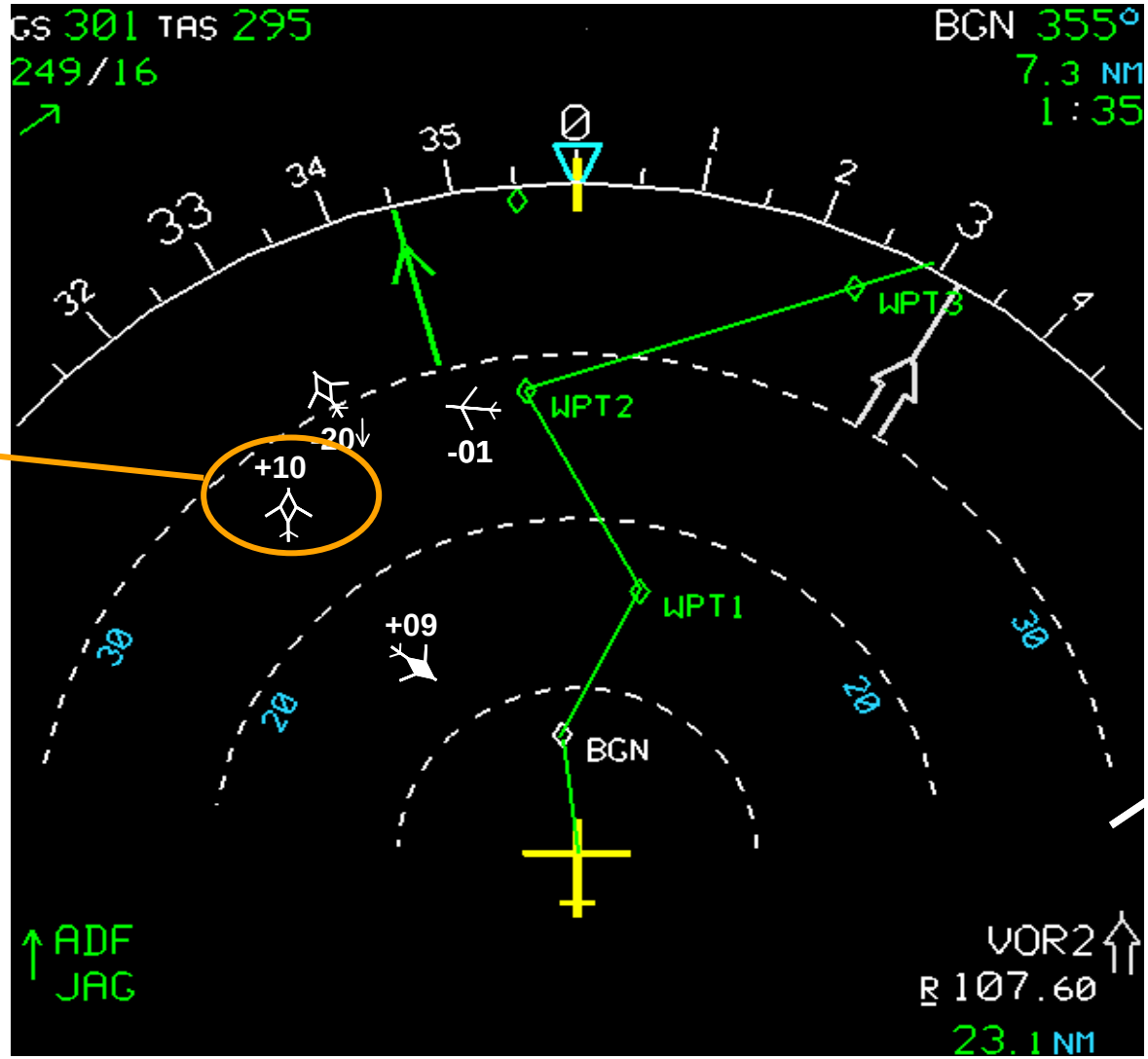


- Fully integrated solution
- Traffic displayed on the primary field of view
- Limited impact (no new equipment)

ATSAW: NAVIGATION DISPLAY

By default

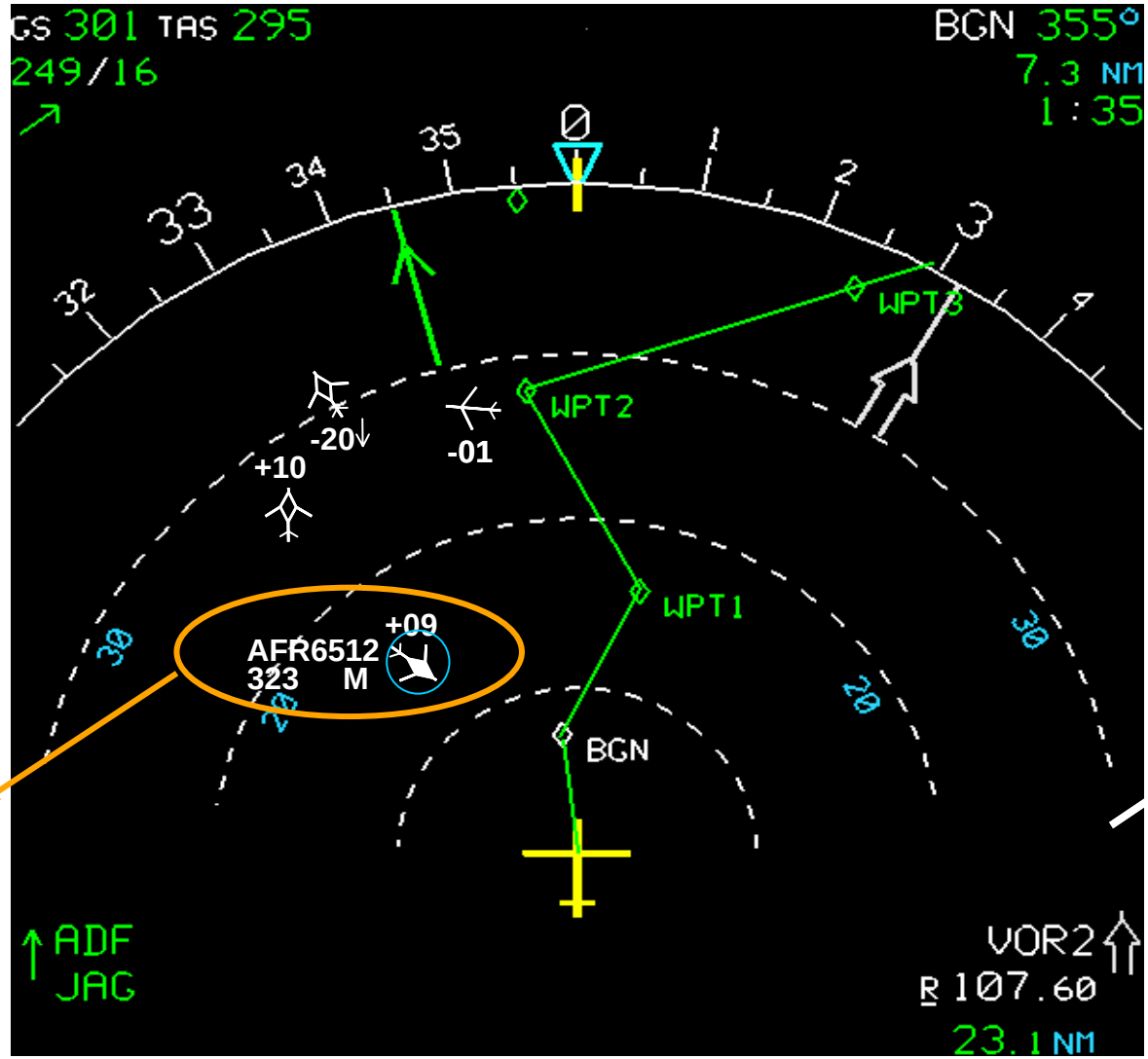
- ***Position***
- ***Orientation***
- ***Relative Altitude***
- ***Vertical Tendency***



Correlation with
TCAS information

ATSAW: NAVIGATION DISPLAY

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



- ***Default information***

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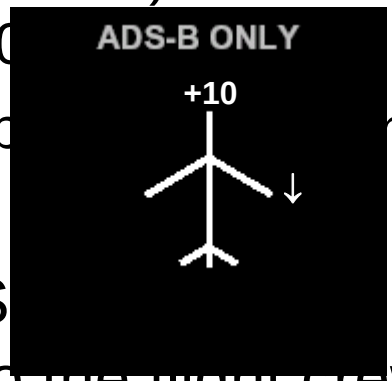
- ***A/C ident***
- ***Ground Speed***
- ***Wake Vortex category***

ATSAW: MCDU

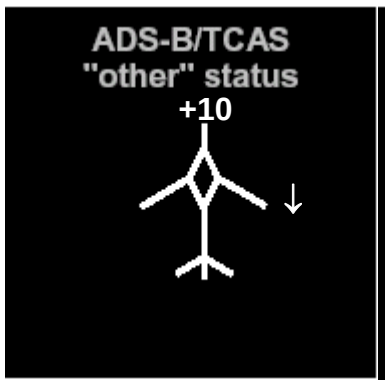
- **Traffic pages on MCDU**
- **Additional information for use during Cruise**

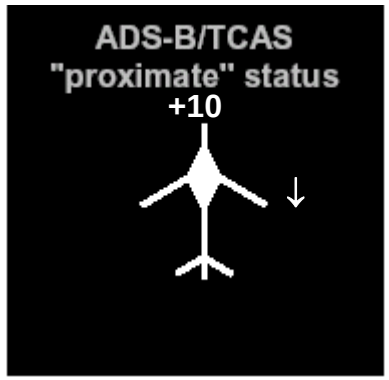
ATSAW: Comparison with TCAS

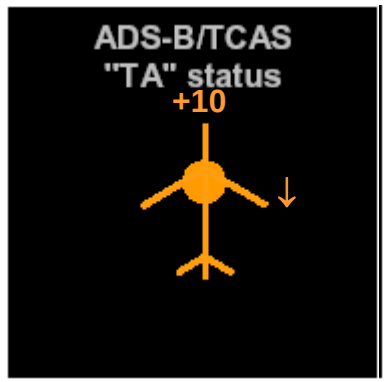
- ADS-B can provide
  - more information
  - wider range (up to 250 NM) than current TCAS is currently capable to provide (40
  - intruders direction rep n oriented symbol

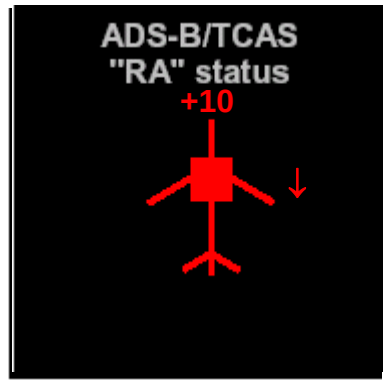


- Merge TCAS and ADS available to provide a unique traffic symbol to the flight crew









CONTENTS

AIRBUS

General ADS-B architecture

NAVIGATION

ADIRS | MMR | RA | FMS

SURVEILLANCE

Mode S Transponder
(Capable ADS-B OUT)

TCAS
(capable of ADS-B IN)

CREW INTERFACES

ATSAW Architecture

Systems connected:
- ADIRU
- RA
- CFDIU/CMC
- ATC transponder & control panel

OANS with traffic

TCAS

(ACAS + ATSAW)

ATSAW & TCAS software are partitioned within TCAS equipment

Antennas

FWC

TA/RA DISPLAY BUS

EIS (ND)

DISPLAY CONTROL BUS

MCDU

Traffic Selector

Legend

EXISTING A429 BUS

NEW A429 BUS

NEW DISCRETE

Unchanged equipment

Slight update

Significant Change

CONTENTS

AIRBUS

ATSAW APPLICATIONS

Remind - ATSAW applications will be implemented in two steps:

- **Step 2A (ATSAW applications in air)**
  - **ATSA-AIRB** Enhanced awareness in all environment
  - **ATSA-ITP** Flight Level Changes using “In Trail Procedure” in oceanic airspace
  - **ATSA-VSA** Visual Separation Approach

  (ATSA-ITP and ATSA-VSA are used in a context of specific ATC procedures)

- **Step 2B (ATSAW applications on ground)**
  - **ATSA-SURF:** Enhanced Traffic Situational Awareness on the Airport Surface

ATSAW Applications in air - Step 2A

ATSAW for Flight Level change

ATSA-ITP

STEP 2A – ATSAW for flight level changes

- 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

STEP 2A – ATSAW for flight level changes

1. ATSAW : Detect Climb Opportunity

2. CPDLC Clearance exchange

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ATSAW combined with CPDLC allows to obtain better Flight Level changes

STEP 2A – ATSAW for flight level changes using ITP (In Trail Procedure in Oceanic Airspace)

Standard Longitudinal Separation Requirement = 10mn (80 NM)

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

With ITP a longitudinal separation of 20 NM will be sufficient to a flight level change (compared to 80 NM today)

Step 2A: ATSA-ITP - BENEFITS

BENEFITS

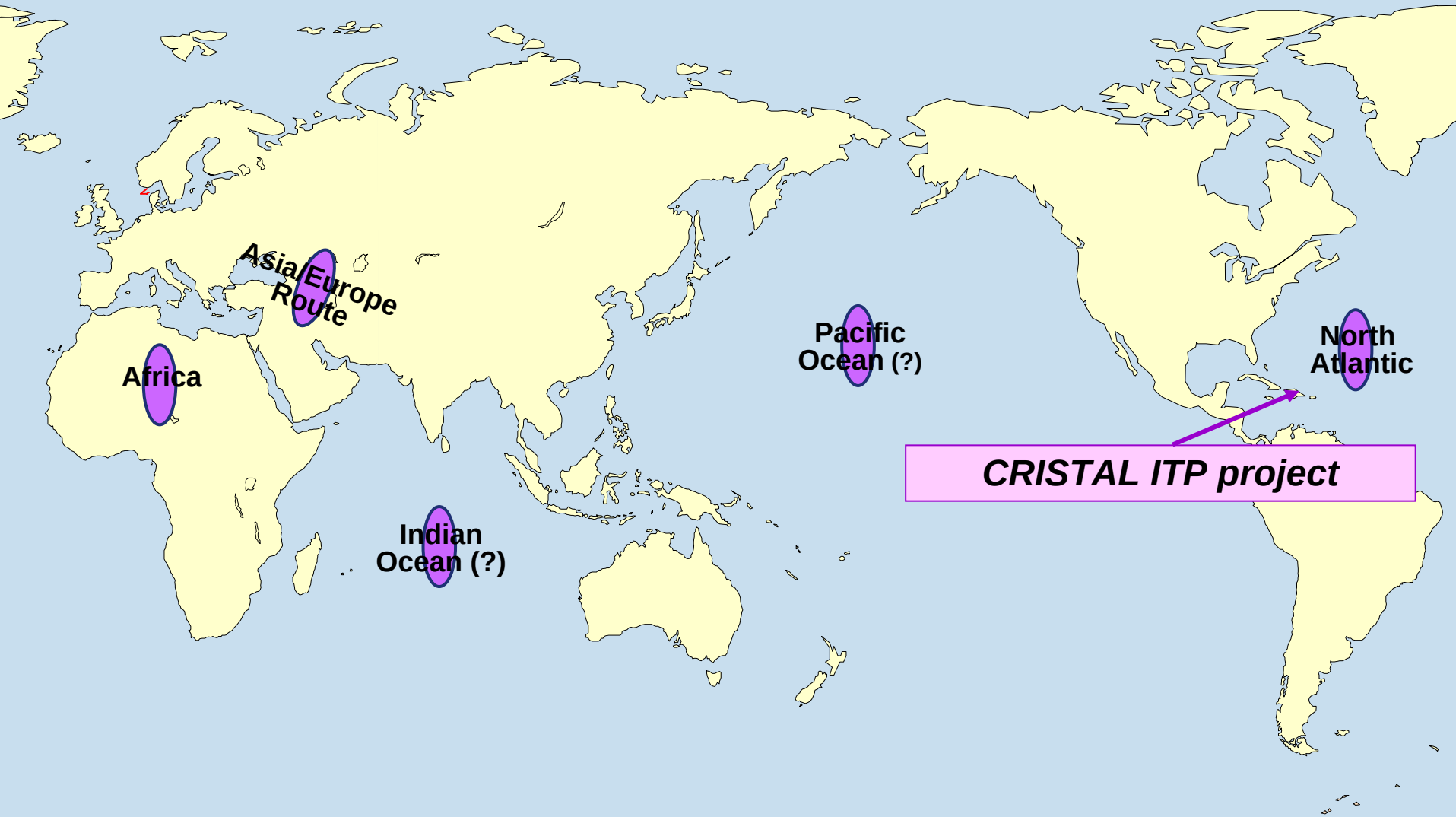
- In North Atlantic Ocean
  - 30% of aircraft below their requested FL at ocean entry
  - 50% of these aircraft may request and obtain a climb
- ATSAW provides significant fuel saving due to flight at the optimum flight level
  - With current separation standards
  - With temporary reduced separations (ATSA-ITP)
  - Yearly savings: from several 10 000 $ to over a 100 000 $ depending on:
    - Flight frequency,
    - Aircraft fuel burn,
    - Flight duration…

Step 2A: ATSA-ITP - BENEFITS

- Benefits have been assessed within CRISTAL ITP project
  - ➢ See the official Benefits analysis document provided by Eurocontrol **(http://www.eurocontrol.int:80/cascade/gallery/content/public/documents/EN%20-%20ATSA-ITP%20Benefit%)**

Scenario	ITP enabled (%)	ADS-B OUT equiped (%)	Steep Climb Increase (%)	CO2 Reduction / Fleet / Year (k tonnes)	Fuel Burn Savings / ITP aircraft / Year (Tonnes)	Fuel Burn Savings / ITP aircraft / Year (k US Gallon)	Fuel Burn Savings / ITP aircraft / Year (k $)
2010	5	45	132	31	410	135	270
2015	20	80	211	71	202	67	133
2020	70	95	607	215	155	51	102
Max	100	100	1107	344	173	57	114

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)

ATSAW for Visual Separation Approach

ATSA-VSA

STEP 2A – ATSAW for Visual Separation Approach

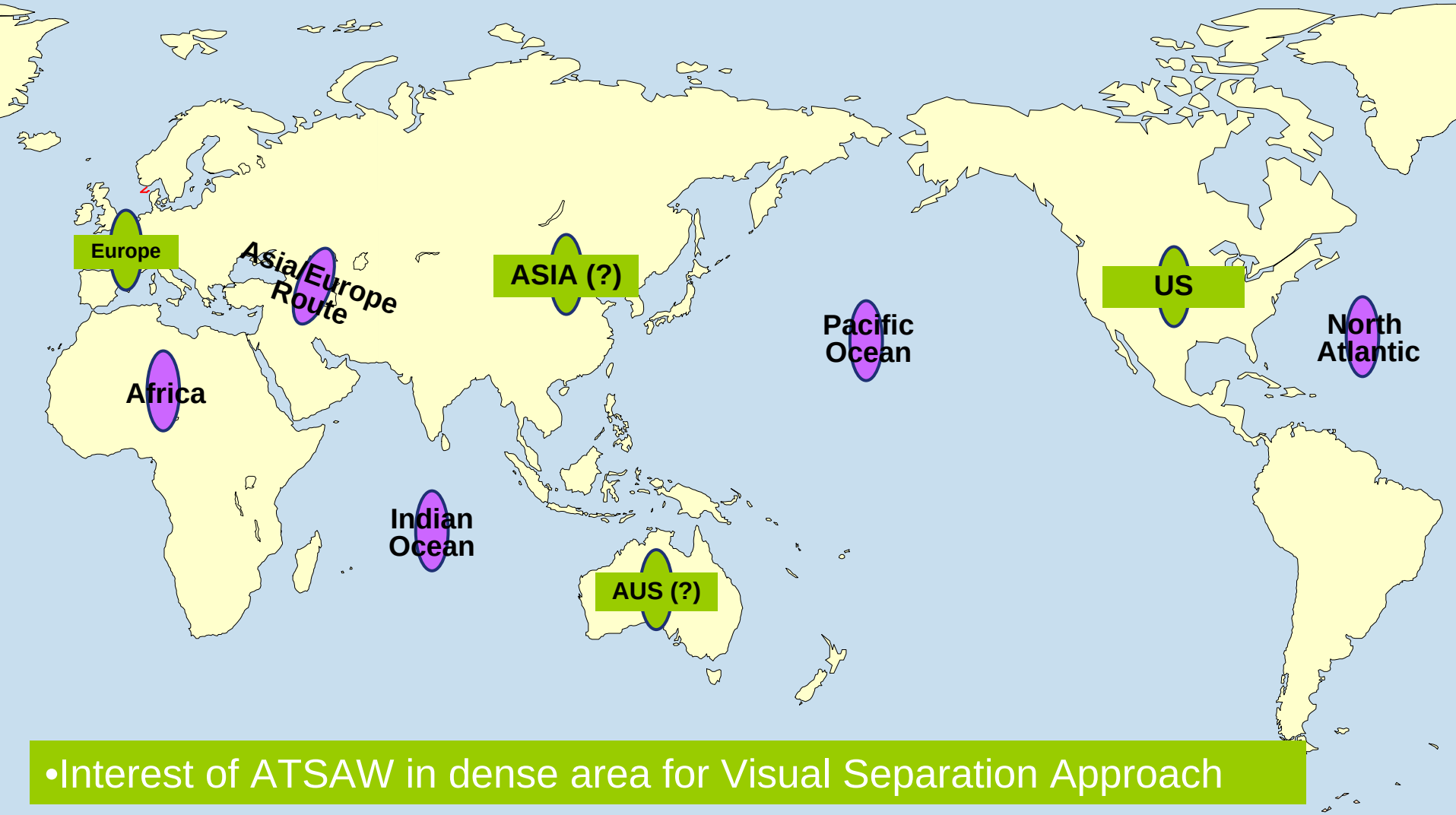
- Context:
  - Approach procedures with visual separation clearance increase runway capacity
- Objectives:
  - To **safely** perform approach procedures with **own visual separation** from the preceding aircraft on a **more regular basis**:
    - Procedure easier for flight crews to acquire and then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

STEP 2A – ATSAW for Visual Separation Approach

BENEFITS

- Benefits are specific for each airport (and indirectly for airlines) depending on airport configuration, approaches configuration, weather conditions…,
- Close parallel runways: without VSA → only a single runway is used
  - Capacity reduction of 40-50% without VSA at San Francisco (NASA source)
- Independent parallel runways: without VSA → similar as single runway
  - Capacity reduction of 16% without VSA at Dallas (NASA source)
- Operational benefits easier identified for airlines at dominated Hubs
  - Louisville for UPS
- Next steps:
  - More benefits combined with RNP (e.g. San Fransisco, Washington)
- **ATSA-VSA paves the way to future Spacing applications.**

STEP 2A – ATSAW for Visual Separation Approach



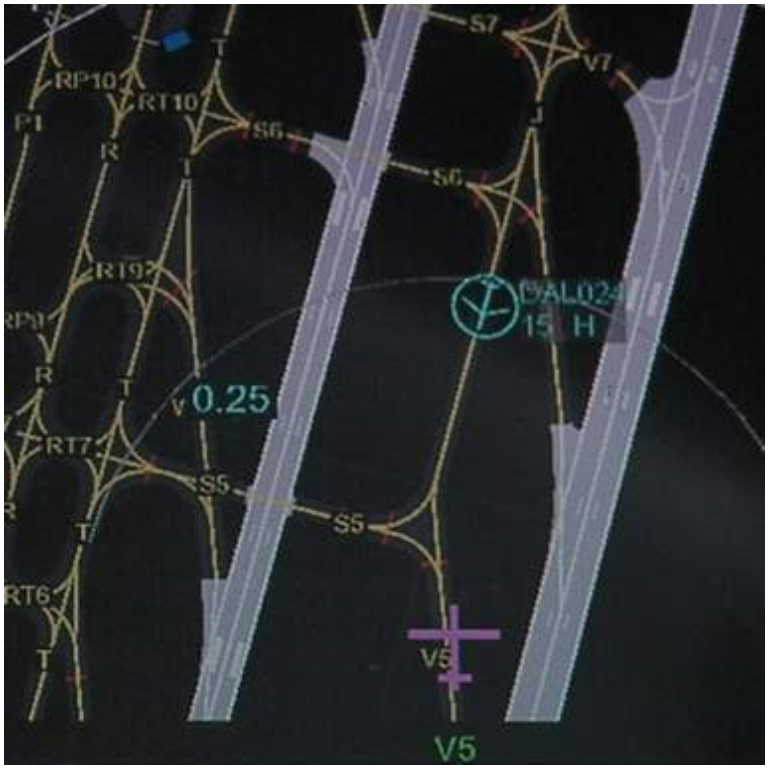
- Interest of ATSAW in dense area for Visual Separation Approach
- Interest of ATSAW in oceanic and remote area for flight level change

CONTENTS

ATSAW Applications On Ground (Step 2B)

ATSAW on Airport Surface (ATSA-SURF)

STEP 2B



STEP 2B – ATSAW on Airport Surface

- 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**

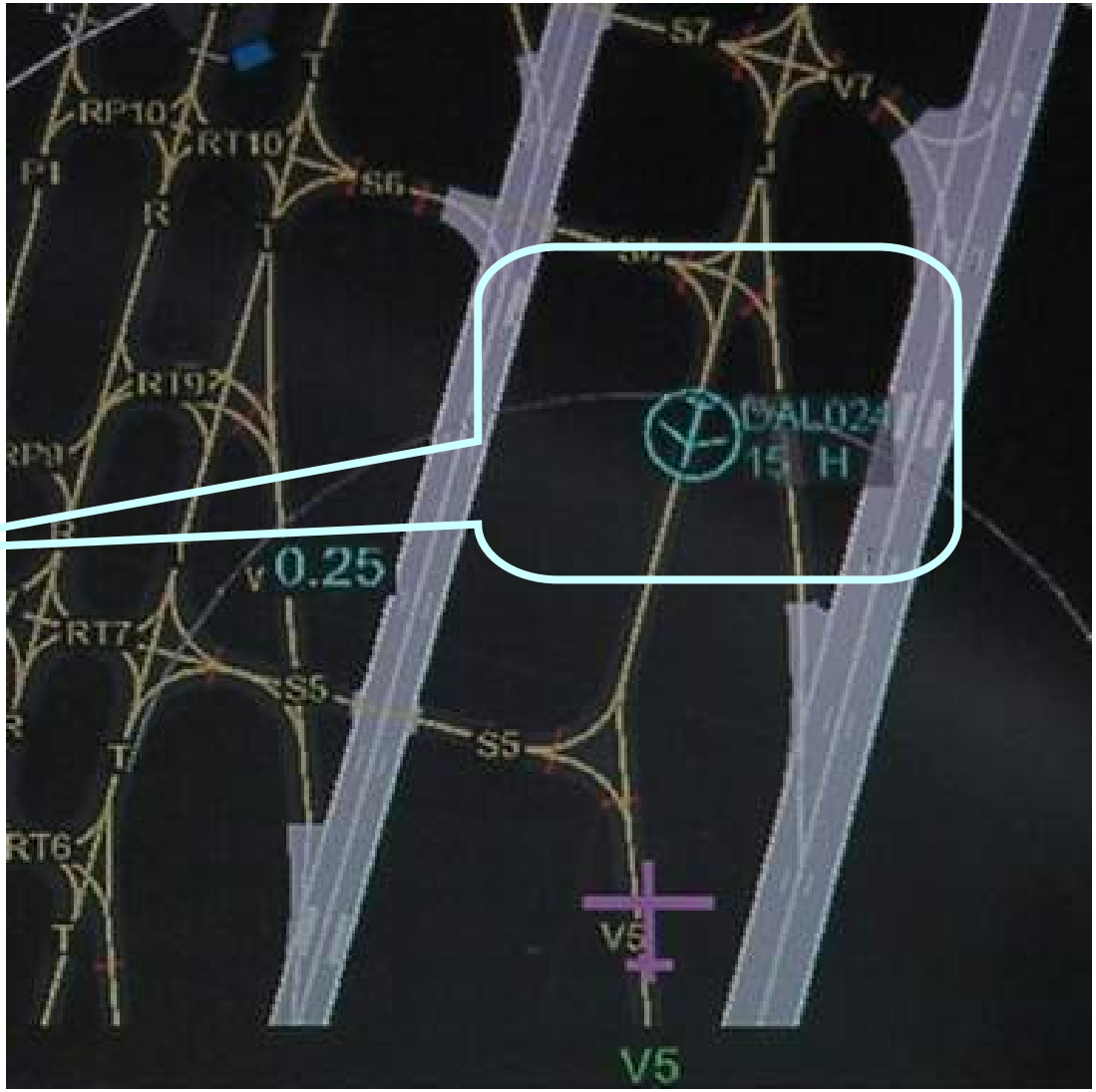
STEP 2B – ATSAW on Airport Surface

MOVING MAP

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

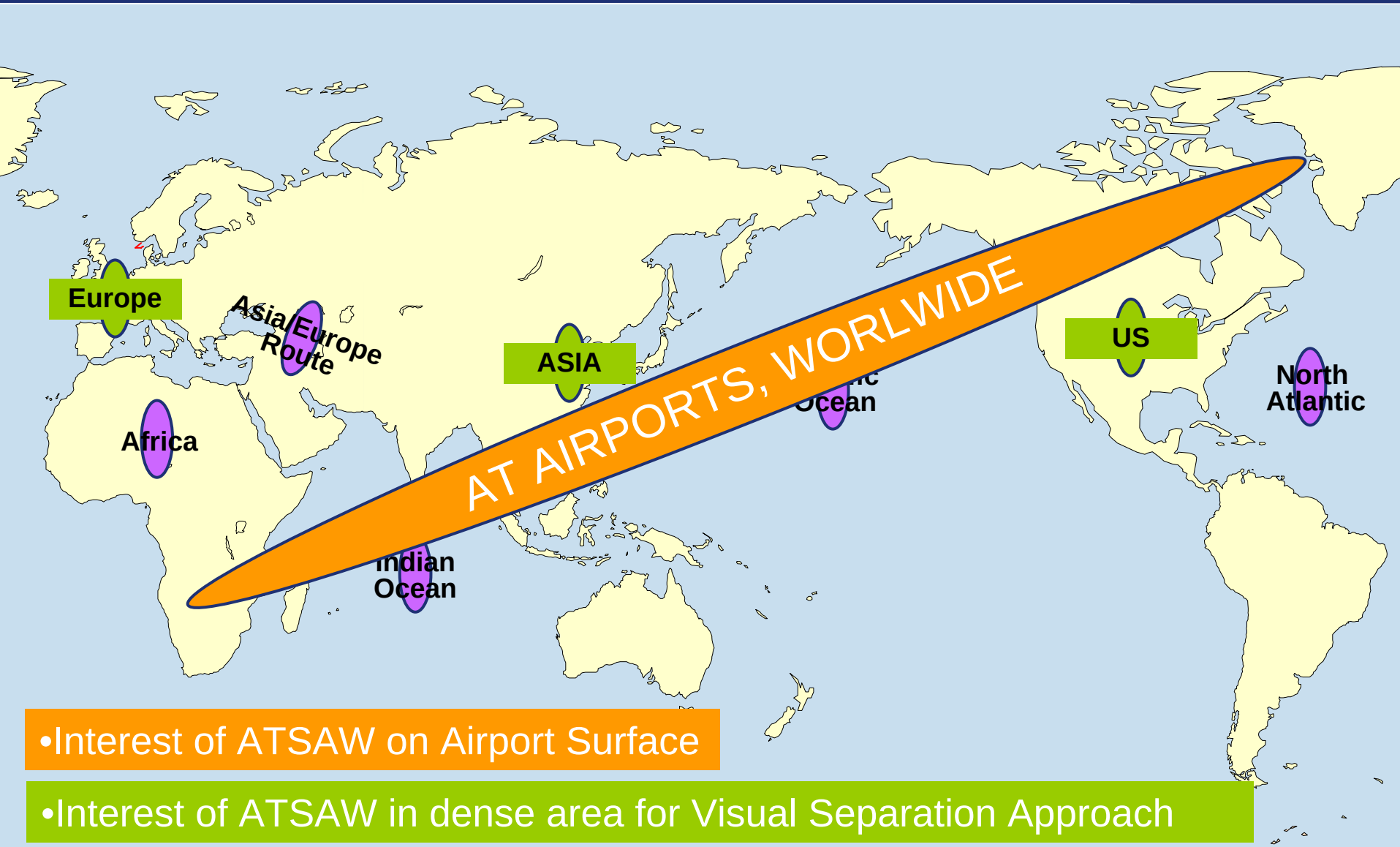
+ TRAFFIC

(ADS-B data)



- **OANS development on going**

STEP 2B – ATSAW on Airport Surface



- 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

CONTENTS

AIRBUS

AIRBUS ADS-B ROAD MAP

Step 0

ELS / EHS certification & ADS-B OUT capacity

Certified

Step 1

ADS-B OUT certification

Step 1A for NRA

Step 1B for RAD

Certified

2011 (TBC)

Step 2

ATSAW

Step 2A for air application

Step 2B on airport surface

A320: 2010
A330/340: 2010
A380: TBD
A350: EIS

2013 (TBC)

Step 3

Spacing

2015 (TBC)

Step 4

Separation

R &T

ATSAW: Program Offerability

- ATSAW will be available with:

T3CAS from ACSS/Thales
certification planned Q4 2010
on A320/A330/A340 aircraft familly

TPA-100B from Honeywell
certification planned Q4 2010
on A320/A330/A340 aircraft familly

- 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**
    - activated by pin-programming
    - includes the specific ITP page on MCDU
    - includes the aircraft documentation update
    - option chargeable

ATSAW BENEFITS - SUMMARY

	IN FLIGHT	ON AIRPORT SURFACE
	ATSA-AIRB (step 2A)	**ATSA-SURF (step 2B)**
EFFICIENCY	**Fuel saving** Flight time optimasation **Increase runway throughtput** 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 & taxiing occupancy awareness** **Colision risk anticipation**

THANKS FOR YOUR ATTENTION…

QUESTIONS?

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