



**Honeywell**

# **ADS-B Seminar**

**National Institutes of Aviation Management and Research  
(NIAMAR)**

**Rangpuri, Maharuli, New Delhi**

**Mike Grove**  
**January 28, 2010**

**Honeywell**



- **ADS-B Aircraft Equipment & Architecture Summary**
- **Honeywell ADS-B Planning**
- **ADS-B In – Honeywell Implementation on Airbus**
- **FAA/Honeywell ADS-B Programs**
- **Honeywell Participation in SESAR**
- **Wrap Up**



# ADS-B Aircraft Equipment & Architecture Summary

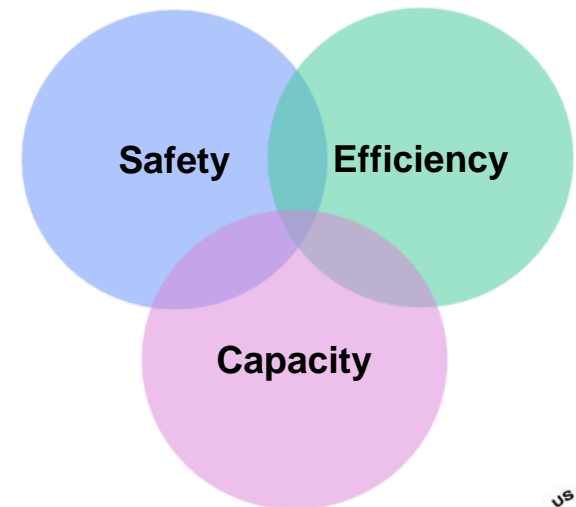
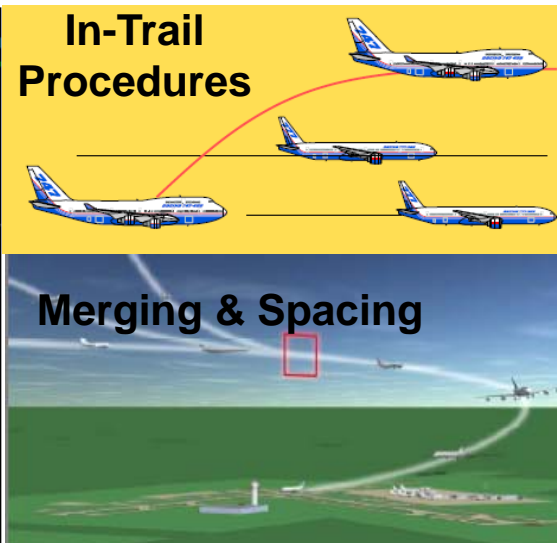
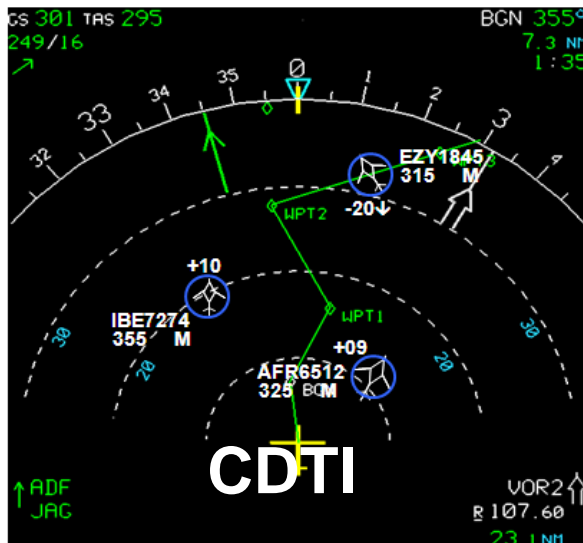
**Honeywell**



# ADS-B Summary - Aircraft Equipment Perspective

Honeywell

- **ADS-B Out**
  - Hosted in the Mode-S Transponder (or Universal Access Transceiver – USA General Aviation)
  - Augments Mode-S transmissions to include more detail and accuracy about aircraft position/velocity, based on GPS
- **ADS-B In**
  - Receive Capability Typically hosted within the TCAS
  - Traffic Display Requirements (Nav Display, MCDU, EFB, etc)
  - ADS-B traffic information is used by aircraft and ground stations to improve safety, efficiency, and capacity

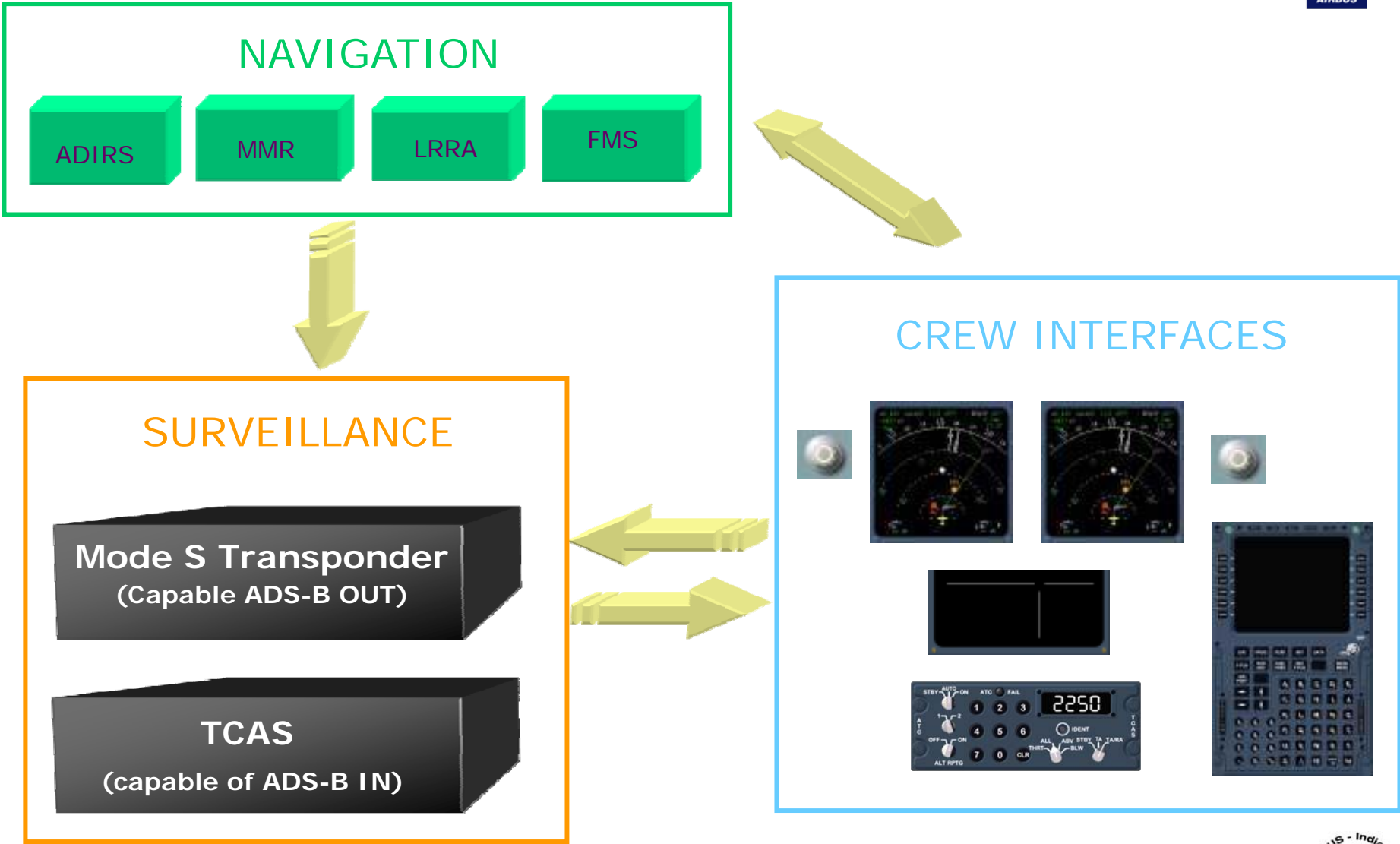




# General ADS-B Architecture – Airbus Example

Honeywell

Courtesy of 





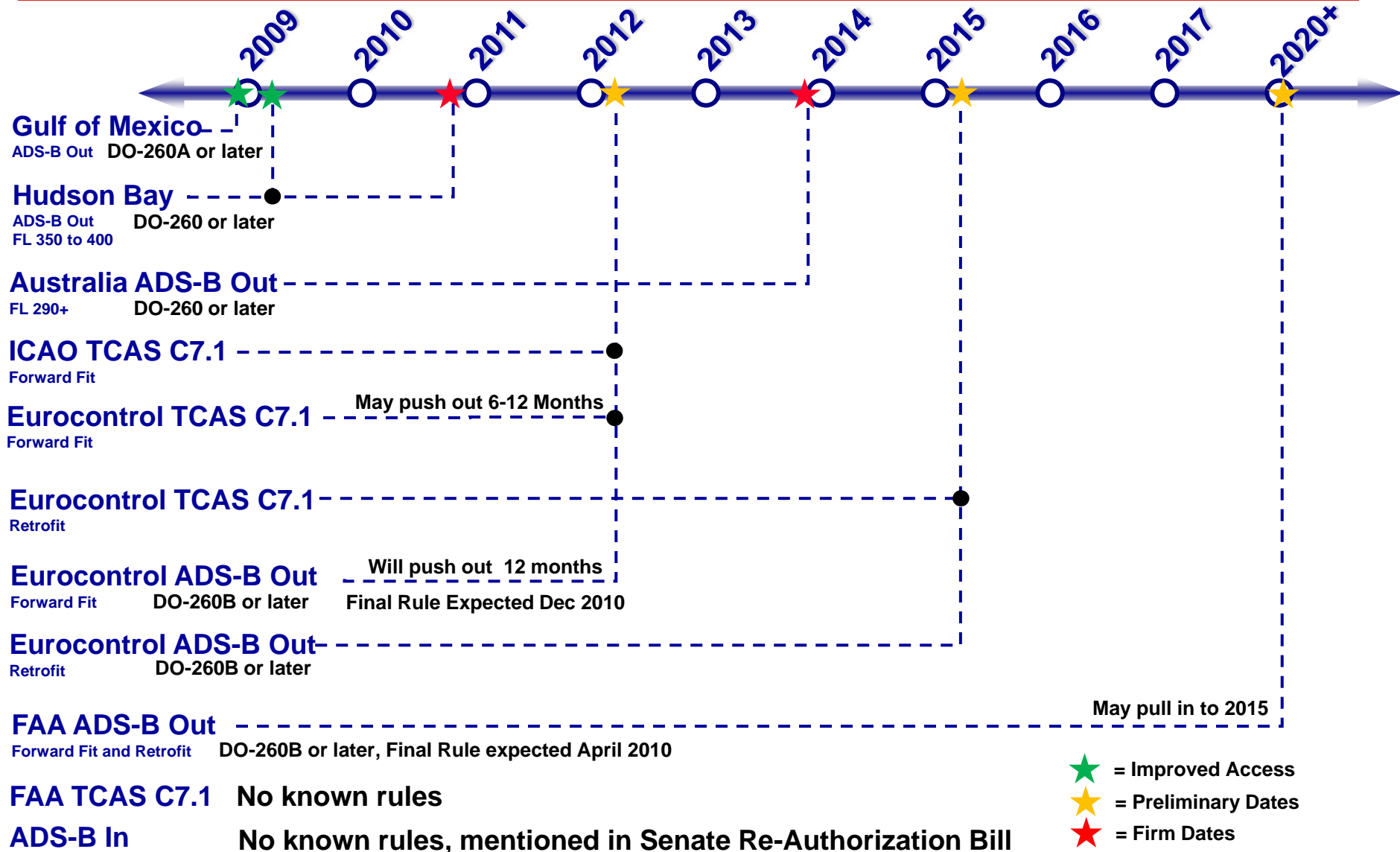
# Honeywell ADS-B Product Update Planning

**Honeywell**

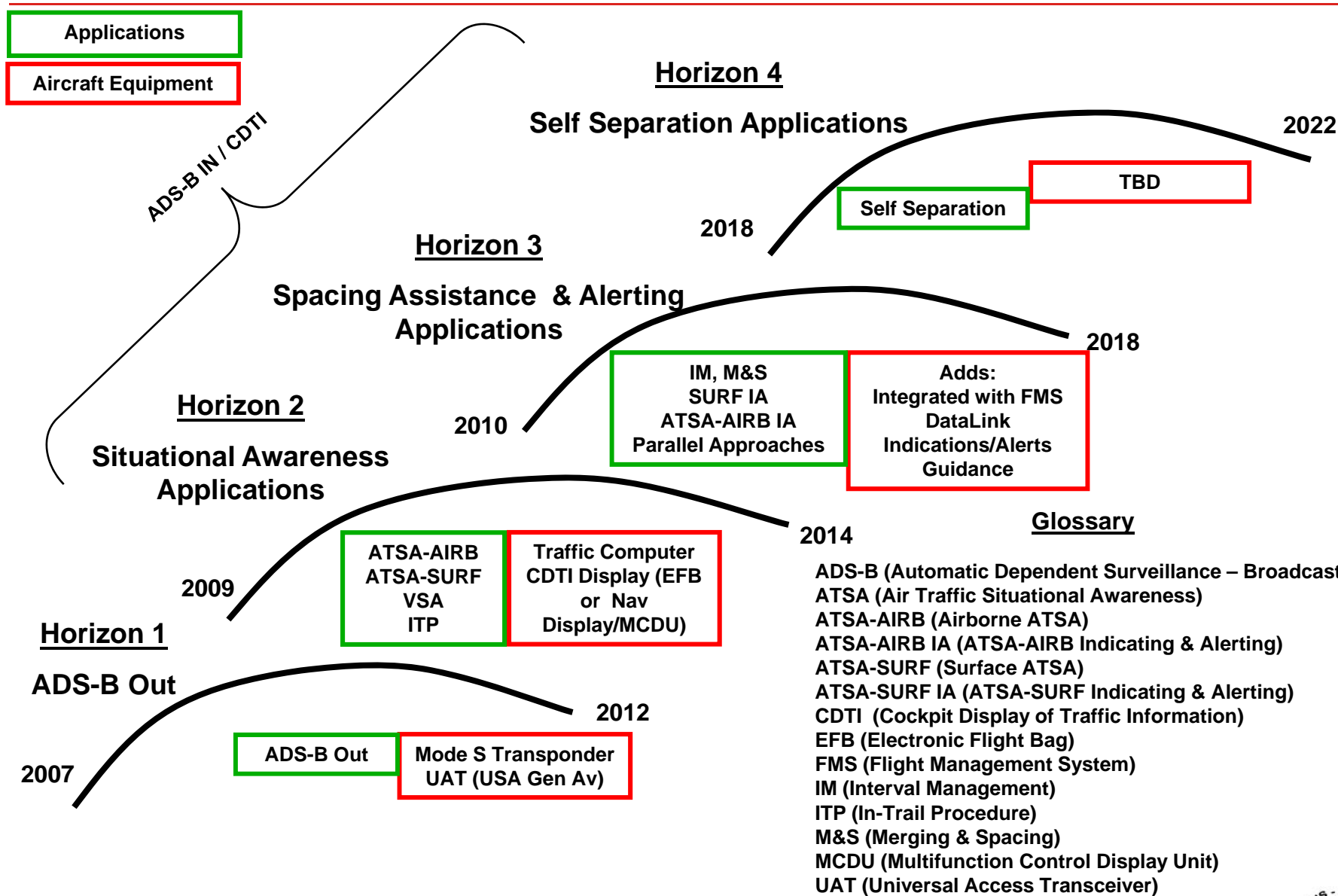


# ADS-B and TCAS Change 7.1 Timeline

Honeywell



# Honeywell ADS-B High Level Plan





# ADS-B Out Progression Summary

## **DO-260 (TSO-C166):**

- Initial ADS-B Out specification
- Transmits Surface / Airborne position and velocity twice per second with NUC which represents position integrity or position accuracy.
- Transmits Flight ID once every 5 seconds

## **DO-260A (TSO-C166a):**

- Removes ambiguity in navigational uncertainty transmission – improves accuracy of aircraft location
- Recommends an ADS-B On/Off flight deck switch

## **DO-260B (TSO-C166b): Available 1Q2010**

- Improves integrity/accuracy quality information (reporting)
- Adds TCAS Resolution Advisories in progress
- Adds Barometric Pressure Setting
- Expands Mode A code squitter transmission from only North America to global
- Adds support for future Radar Airspace and Surface applications
- Adds a new single antenna class of transmitter/receiver to support General Aviation applications without requiring diversity
- Recommends an In-Air determination for all aircraft (GA was previously excluded)
- Recommends an independent ADS-B fail flight deck indication
- Discourages an ADS-B On/Off flight deck switch

# Honeywell Product Planning – ADS-B Out

**Honeywell**

Product	Application	DO-260	DO-260A	DO-260B
Integrated Surveillance	Air Transport	--	Available	In Work
TRA-67	Air Transport	Available	--	In Work
Epic	Regional, Helicopter Business Aviation	--	Available	Planned
Primus II	Regional Business Aviation	--	--	In Work
MST-67	Regional Business Aviation	--	--	Planned
APEX	Business Aviation General Aviation	--	--	Planned
KT-73	General Aviation	Available (non-diversity)	--	Planned
MILACAS	Military Transport	Available - Military unique solution (planned DO-260 compliance)		

*Broad Range of Products and Applications,  
all with ADS-B Out Available and/or Planned*

# Honeywell Product Planning – ADS-B In

Product	Application	ADS-B In	Comments
TPA-100	Air Transport Business Aviation	4Q09	Airborne Situational Awareness Visual Separation on Approach In Trail Procedure (ITP)
AESS	Air Transport	In Work	Airborne Situational Awareness Visual Separation on Approach In Trail Procedure (ITP)
TPU-66/67	Regional Business Aviation	Planned	Airborne Situational Awareness Visual Separation on Approach
KX/KTA / KMH	Business Aviation Gen Aviation Helicopter	Planned	Specific Plans and Functionality being Developed based on Customer Input

*ADS-B In Operator Adoption is Driven by Business Case*



# Honeywell ADS-B for Airbus Airborne Traffic Situational Awareness ATSAW

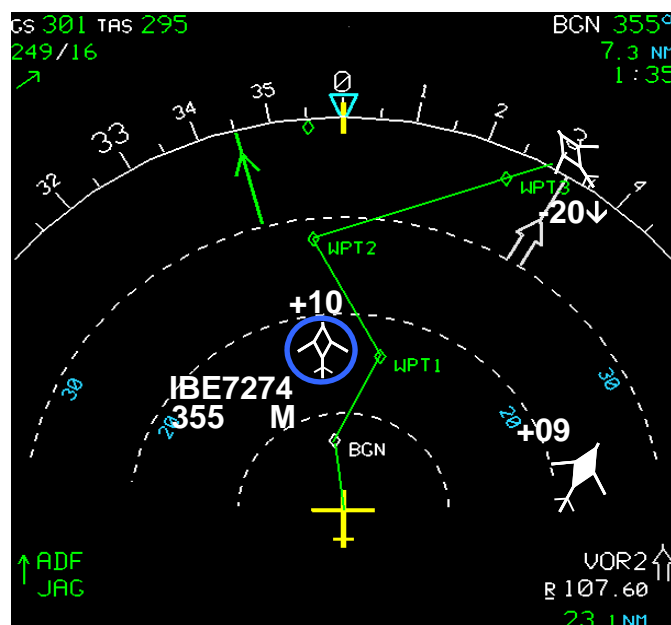
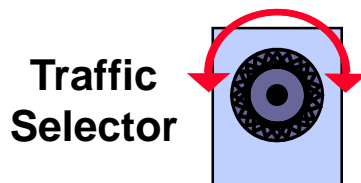
**Honeywell**





# ATSAW: ADS-B In for Airbus Aircraft

Honeywell



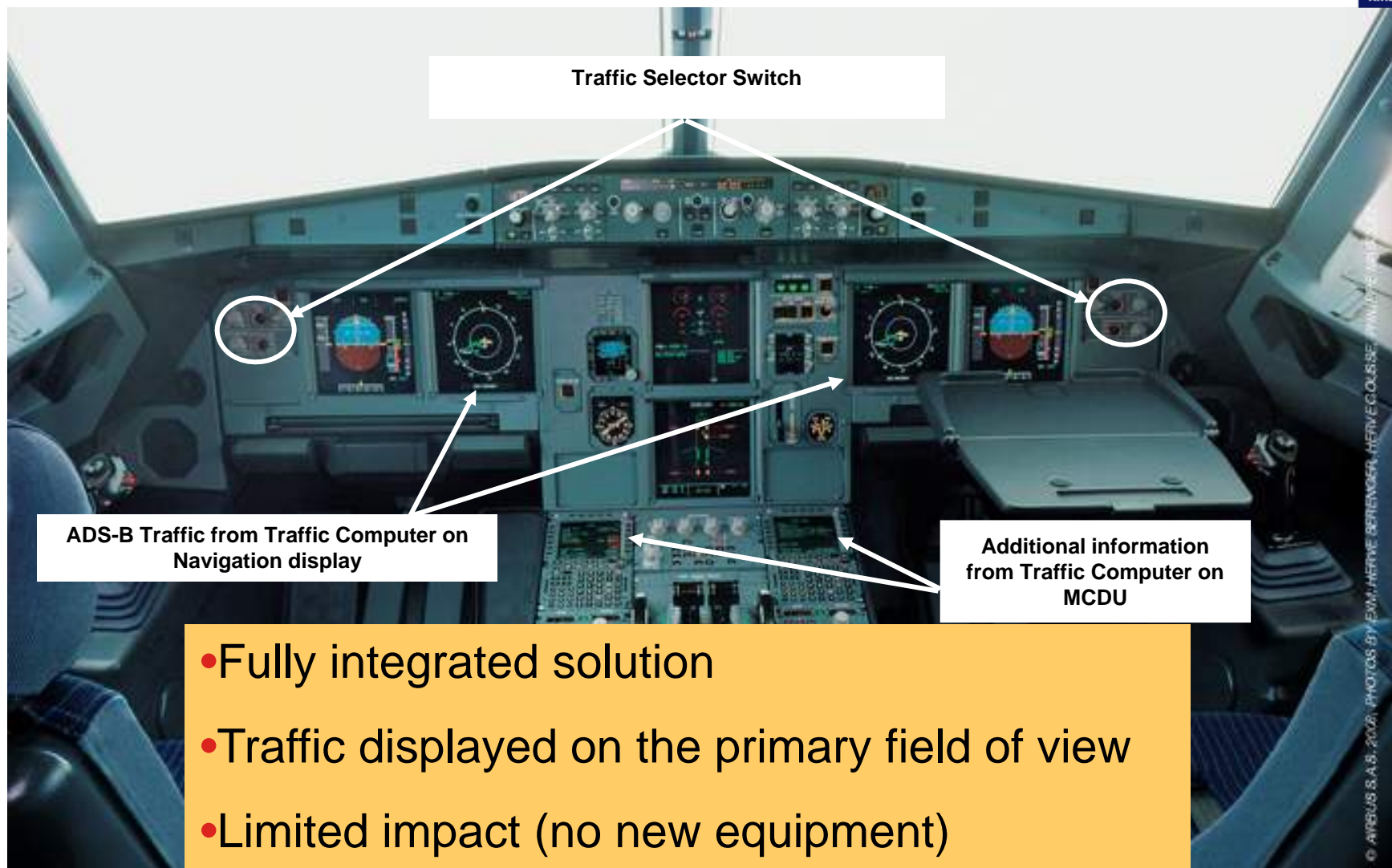
- Airborne Traffic Situational Awareness (ATSAW)
- Joint Program with Airbus since 2004
- Cockpit Display of Traffic Information (CDTI):
  - Aircraft ID, Ground Speed, Wake Vortex Data (AC Wt Category) – When Traffic is Selected
- ATSAW Applications:
  - Step 2A:
    - ATSA-AIRB: Airborne Traffic Situational Awareness
    - ATSA-VSA: Visual Separation on Approach
    - ATSA-ITP: In-Trail Procedure
  - Step 2B:
    - ATSA-SURF: Surface Situational Awareness
- Selectable Option Forward Fit + Service Bulletin
  - Wiring Provisions since 2009
  - Traffic Selector, Traffic Computer Update, Display Updates

*First Certification March 2010*

# ATSAW in A320/A340 cockpit

Honeywell

Courtesy of



# ATSAW: NAVIGATION DISPLAY

Honeywell

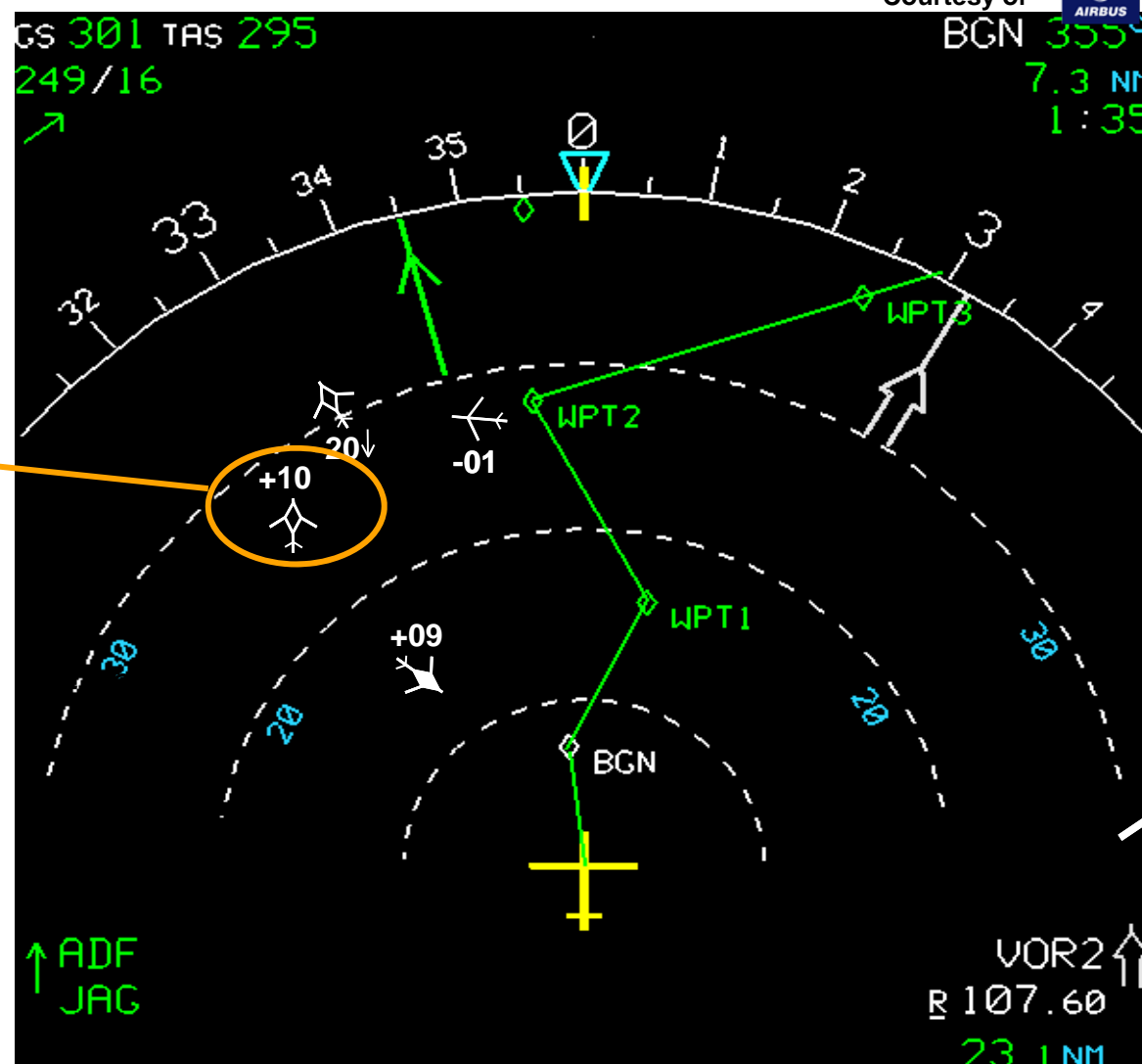
Courtesy of



## By default

- Position
- Orientation
- Relative Altitude
- Vertical Tendency

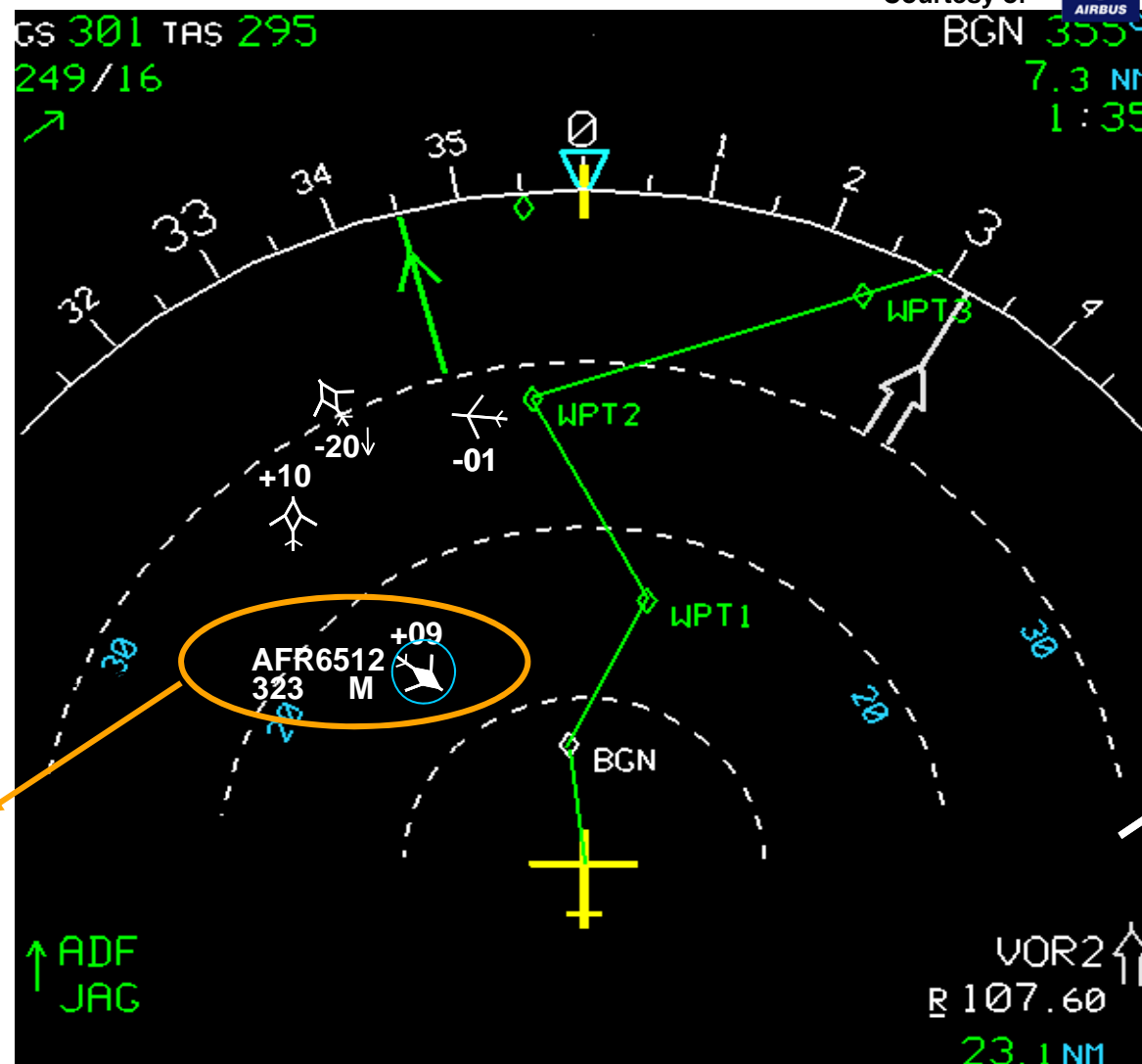
Correlation with  
TCAS information



# ATSAW: NAVIGATION DISPLAY

Honeywell

Courtesy of



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

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

+



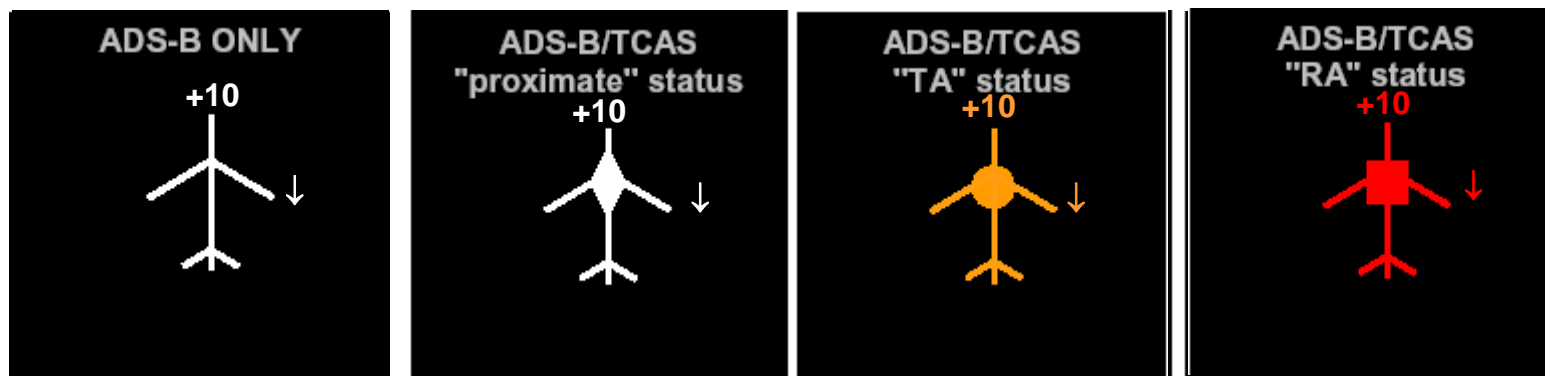
# ATSAW: Comparison with TCAS

Honeywell

Courtesy of



- ADS-B can provide
  - more information
  - wider range (up to 250 NM) than current TCAS is currently capable to provide (40 to 80 NM).
  - intruders direction represented by an oriented symbol
- Merge TCAS and ADS-B when both available to provide a unique traffic symbol to the flight crew



Page 17

# ATSAW: Multifunction Cockpit Display Unit (MCDU)

Honeywell

Courtesy of



- Traffic pages on MCDU
- Additional information for use during Cruise
- Special Pages for In-Trail Procedures



© AIRBUS FRANCE 2007



## FAA Sponsored Honeywell ADS-B Industry Programs

**Honeywell**



## The Aviation Rulemaking Committee (ARC)

- ➔ Directed SBS program to examine operational benefits of ADS-B being realized before compliance with nationwide ADS-B mandate

## Objective

- ➔ Develop globally accepted, airborne ADS-B applications providing operational benefits prior to required compliance with the ADS-B mandate
- ➔ Accelerate understanding and acceptance of airborne ADS-B
- ➔ Provide a growth path to future applications

## Approach

- ➔ Conduct operational evaluation of airborne ADS-B applications ability to enhance operations

*Establishing Requirements, Encouraging Development, Validating Performance, and Demonstrating Value*

*....Keys to Success*



# FAA/Honeywell ATSA SURF IA Demonstration Program

Honeywell



- **Aircraft Surface Conflict Detection and Cockpit Alerting**
- **Concept: Supplement current flight crew procedures for safe operation on and near the runway by providing an on-board system that includes:**
  - Electronic map of the airport surface
  - Relevant surface and airborne traffic
  - Indications of runway occupancy during normal operations
  - Cautions and warnings for predicted collisions with aircraft or vehicles on the runway surface



# Surface (SURF IA) Operational Evaluation

Honeywell

- **Sixteen-month program started 11/2008**
  - Accelerate RTCA SURF IA standards development by producing an Operational Performance Assessment and Operational Safety Assessment
  - Develop display concepts and indication and alerting algorithms
    - Honeywell human factors evaluation will include JetBlue Airways and Alaska Airlines pilots
    - Honeywell is keeping Boeing apprised as we go
  - Prototype display, surveillance and alerting functionality
    - Honeywell will use King Air and Sovereign test aircraft
  - Demonstrate the system
    - Honeywell will demonstrate at Seattle-Tacoma International airport (SEA) and Snohomish County Paine Field airport (PAE)



*Demonstrations Began in December 2009*

ADS-B Seminar 28 Jan 2010

# In-Trail Procedures Operational Evaluation

Honeywell

Courtesy of FAA

## Goals

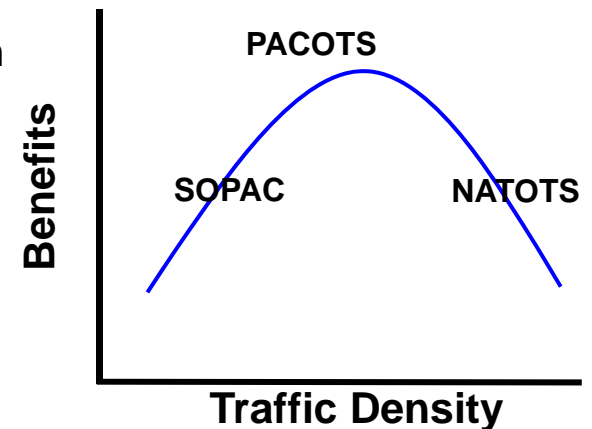
- Employ ADS-B ITP in limited, oceanic air carrier operations

## Objectives

- Validate operational performance of ADS-B ITP
- Validate economic benefits of ADS-B ITP
- Establish framework for global implementation of ADS-B ITP and follow-on airborne ADS-B applications

## Location

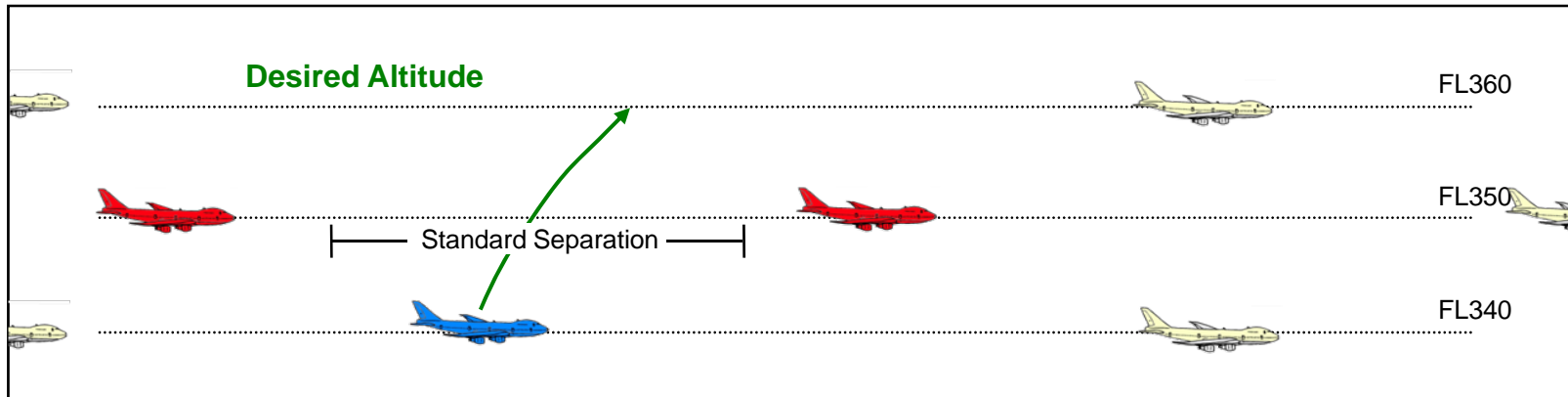
- Potential locations included SOPAC, PACOTS, NATOTS
- SOPAC appears to be a good initial implementation region
  - Favorable business case
  - Straight forward implementation
- Future migration to the PACOTS



# Motivation for ADS-B In-Trail Procedures (ITP)

Honeywell

Courtesy of FAA



**NEED**



**CHALLENGE**

**=**

**OPPORTUNITIES**

Altitude Changes  
required for better  
fuel economy,  
winds, and ride  
quality

The combination of  
locally dense traffic  
and large  
separation minima  
limits altitude  
changes

Use airborne ADS-B  
applications to enable  
altitude changes  
otherwise blocked by  
conventional  
operations

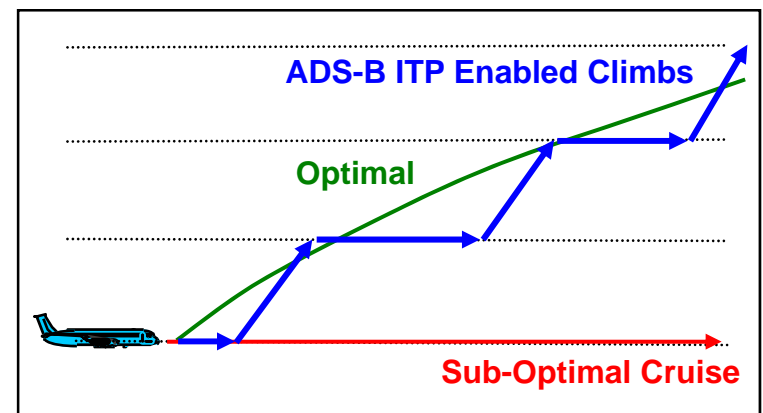




# FAA/UAL/Honeywell ITP Program

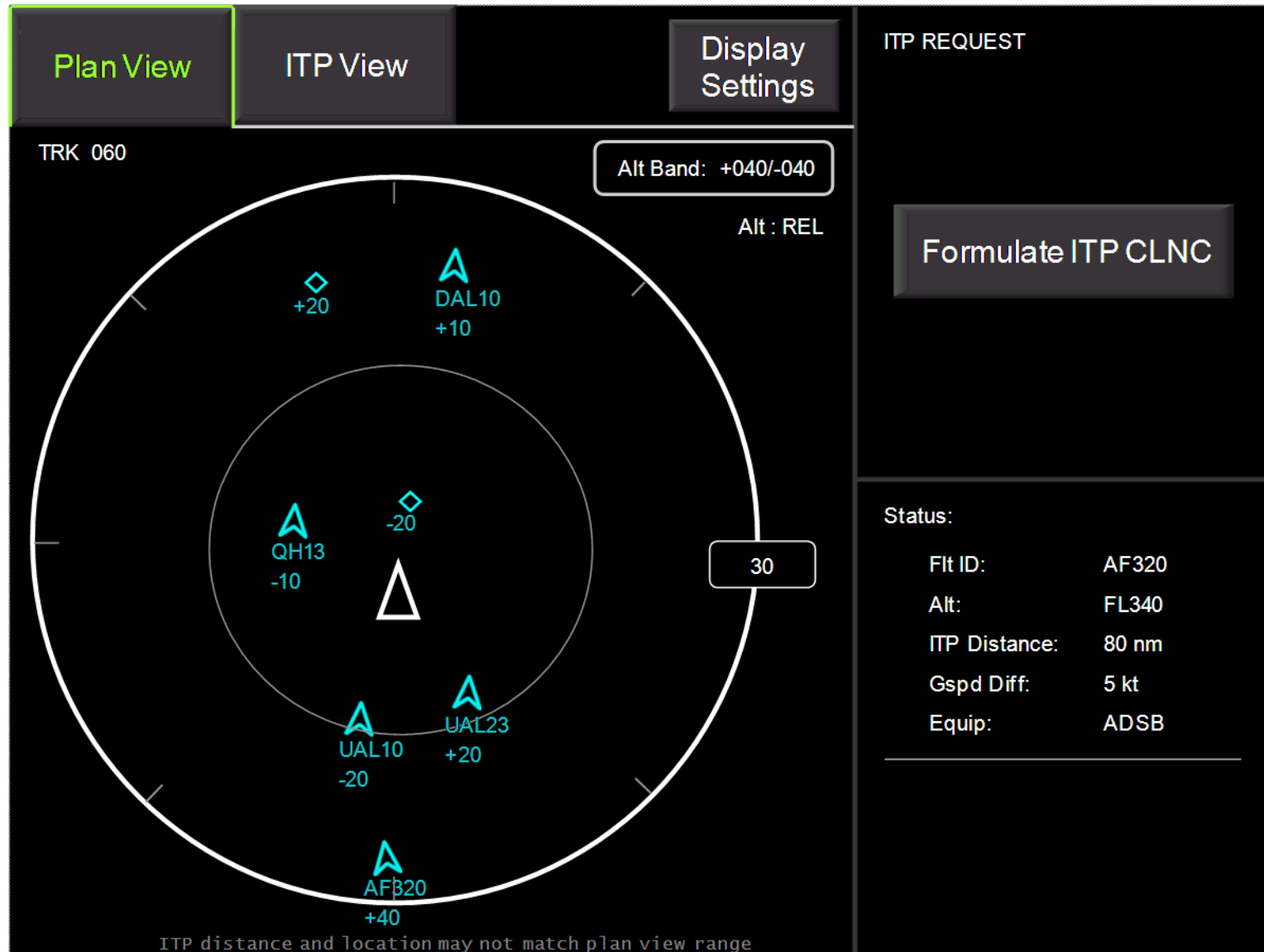
Honeywell

- **Joint FAA/UAL/Honeywell Program**
  - Demonstrate operational benefits enabled by the ADS-B In, In Trail Procedures
  - Honeywell is developing, integrating, and certifying complete ITP avionics capability to be installed on United Airlines 747-400
- **Avionics system consists of:**
  - Honeywell Traffic Computer, TPA-100B with ADS-B In and ITP capability
  - Honeywell Transponder, TRA-67B with ADS-B Out capability
  - Class 3 EFB running Honeywell ITP display software
- **United Airlines will operate approximately 12 Honeywell ITP avionics equipped 747-400 aircraft in the South Pacific (SOPAC) route for a 1 year Operational Evaluation**



# Example Plan View Traffic Display

Honeywell



# Example ITP Traffic Display

Honeywell





# Single European Sky ATM Research Program – Honeywell Participation

**Honeywell**



# Single European Sky ATM Research (SESAR)

Honeywell

## ➤ Honeywell Program Participation:

- **Surface Situational Awareness and Traffic Alerting**
  - Algorithms and simulator analysis
- **Merging and Spacing**
  - Traffic Computer prototype for lab and flight testing
- **1090 MHz Capacity and Future ADS-B Requirements**
- **Future TCAS Enhancements**



- **Leveraging Honeywell experience in flight safety, situational awareness, traffic surveillance, and human factors**
- **Program Extends from 2009 through 2020**

*Working Toward Harmonization of SESAR and NextGen*







## Wrap Up

# Honeywell



- **ADS-B Out**

- **Converge on Timing and Requirements**
- **Harmonization with US, Canada, Europe, Australia, etc**
- **Incentivize Equipage for Early Adoption (Preferred Routing?)**
- **Accelerate Ground Infrastructure**

- **ADS-B In**

- **Identifying Criteria and Procedural Changes that Enhance Value**
- **Incentives to Help Close the Business Case**
- **Accelerating Implementation and Availability of Ground Support Infrastructure**

*Thank You*

**ADIRS (Air Data Inertial Reference System)**  
**ADS-B (Automatic Dependent Surveillance – Broadcast)**  
**AESS (Aircraft Environment Surveillance System)**  
**ARC (Aviation Rulemaking Committee)**  
**ATM (Air Traffic Management)**  
**ATSA (Air Traffic Situational Awareness)**  
**ATSA-AIRB (Airborne ATSA)**  
**ATSA-AIRB IA (ATSA-AIRB Indicating & Alerting)**  
**ATSA-SURF (Surface ATSA)**  
**ATSA-SURF IA (ATSA-SURF Indicating & Alerting)**  
**CDTI (Cockpit Display of Traffic Information)**  
**EFB (Electronic Flight Bag)**  
**FMS (Flight Management System)**  
**IM (Interval Management)**  
**ITP (In-Trail Procedure)**  
**LRRA (Low Range Radio Altimeter)**  
**M&S (Merging & Spacing)**  
**MCDU (Multifunction Control Display Unit)**  
**MMR (Multi-Mode Receiver)**  
**NOPAC (North Pacific)**  
**NUC (Navigation Uncertainty Category)**  
**PACOTS (Pacific Organized Track System)**  
**RA (Resolution Advisory)**  
**SBS (Surveillance Broadcast Services)**  
**SESAR (Single European Sky ATM Research)**  
**SOPAC (South Pacific)**  
**TA (Traffic Advisory)**  
**TCAS (Traffic Alert & Collision Avoidance System)**  
**UAT (Universal Access Transceiver)**

# Honeywell

[www.honeywell.com](http://www.honeywell.com)

