



Airservices
Australia

Surveillance
Program
Update



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AMSTAR Mode S RADAR

- First full Mode S radar commissioned
 - Has Downlink of Aircraft Parameters (DAPS) capability
- Gellibrand Hill (ML) & Coolangatta operating in Mode S
- Sydney & Adelaide transportable radars are transmitting
 - Getting ready for new TARs

Why Mode S?

- All Mode A transponders reply at same time
- Mode S Interrogates individual Mode S transponders
 - No garble
- Each Mode S reply has “parity” error detection/correction
- Less errors for ATC
- Multilateration much better with Mode S
 - Interrogates all directions at same time
- TCAS

Replies mix and garble



←
**INTERROGATE ALL
MODE A/C
TRANSPONDERS**

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**INTERROGATE
TRANSPONDER
WITH PARTICULAR
24 BIT ICAO CODE**

Enroute radar replacement

- Tenders being assessed
- Mode S capable
 - » including DAPS downlink capability
 - » Interrogates for FlightID
- Deploy all by end 2015



ASMGCS

- Advanced Surface movement and Guidance
 - Primary radar
 - Multilateration
 - ADS-B
- Commissioned at Sydney & Melbourne
- Perth & Brisbane being installed
- Uses Mode S & FlightID

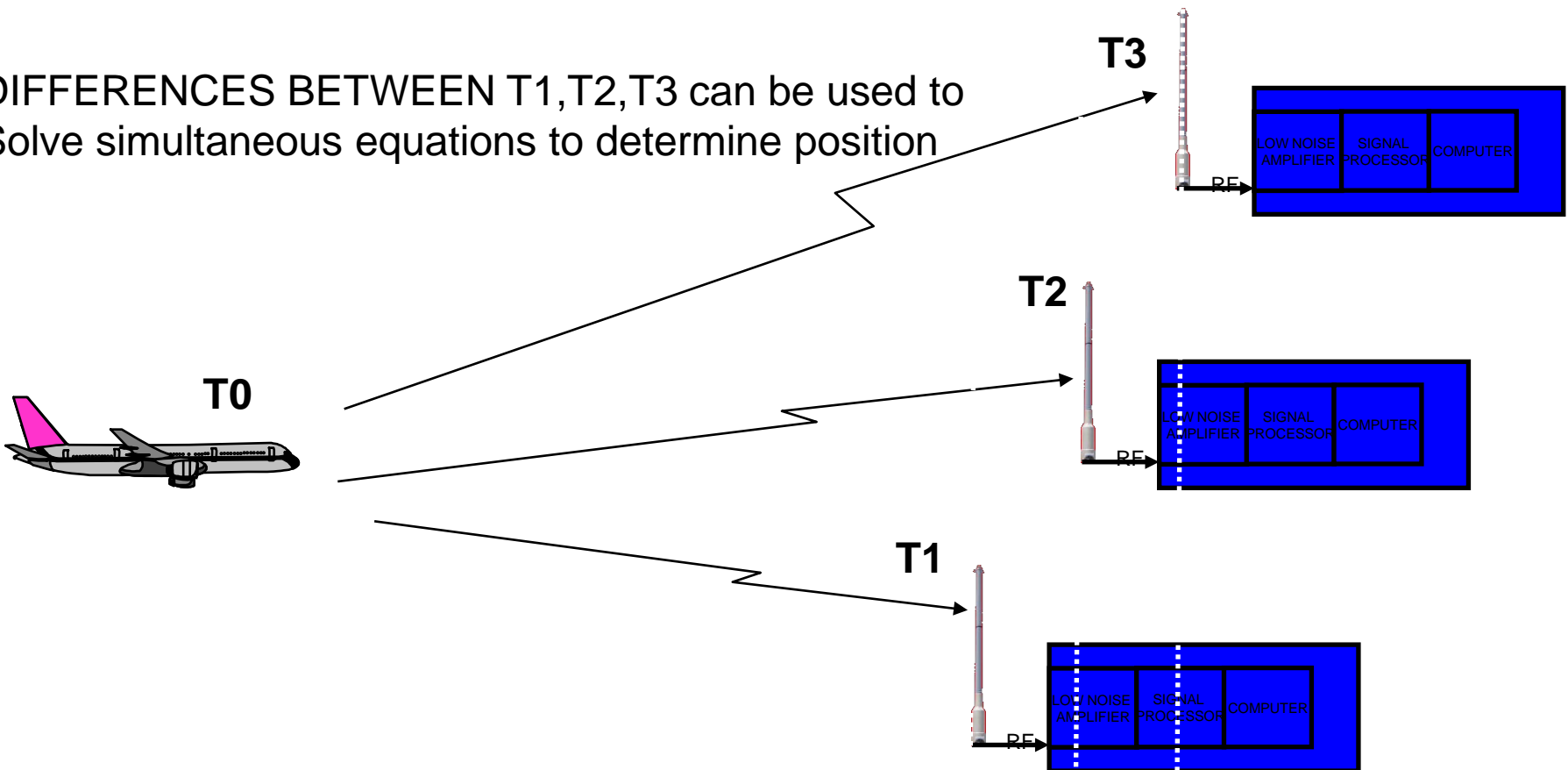


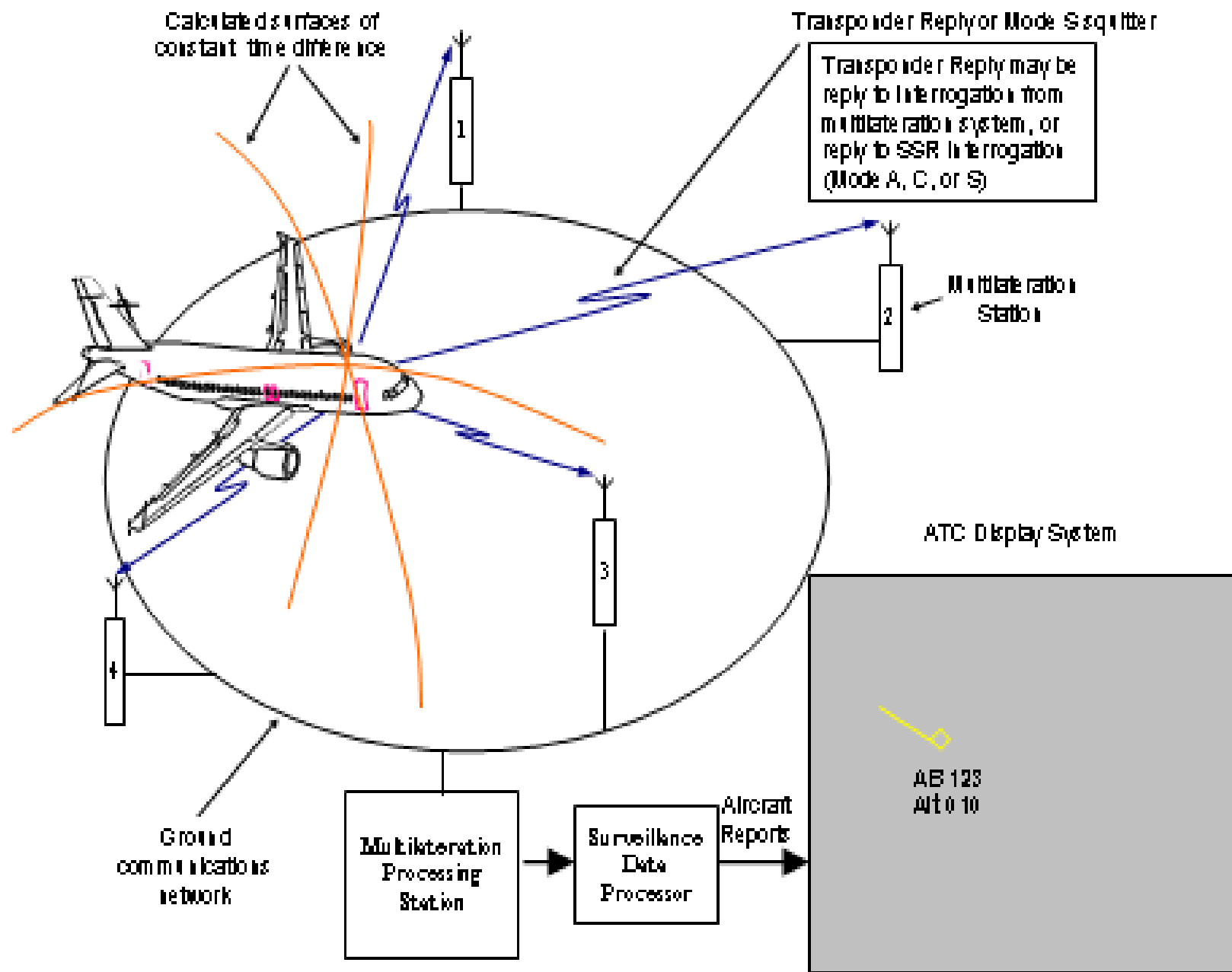
AIRPORT SURFACE SURVEILLANCE

Principle :
Difference in Time of arrival
at multiple sites

Multilateration signals

DIFFERENCES BETWEEN T_1, T_2, T_3 can be used to
Solve simultaneous equations to determine position





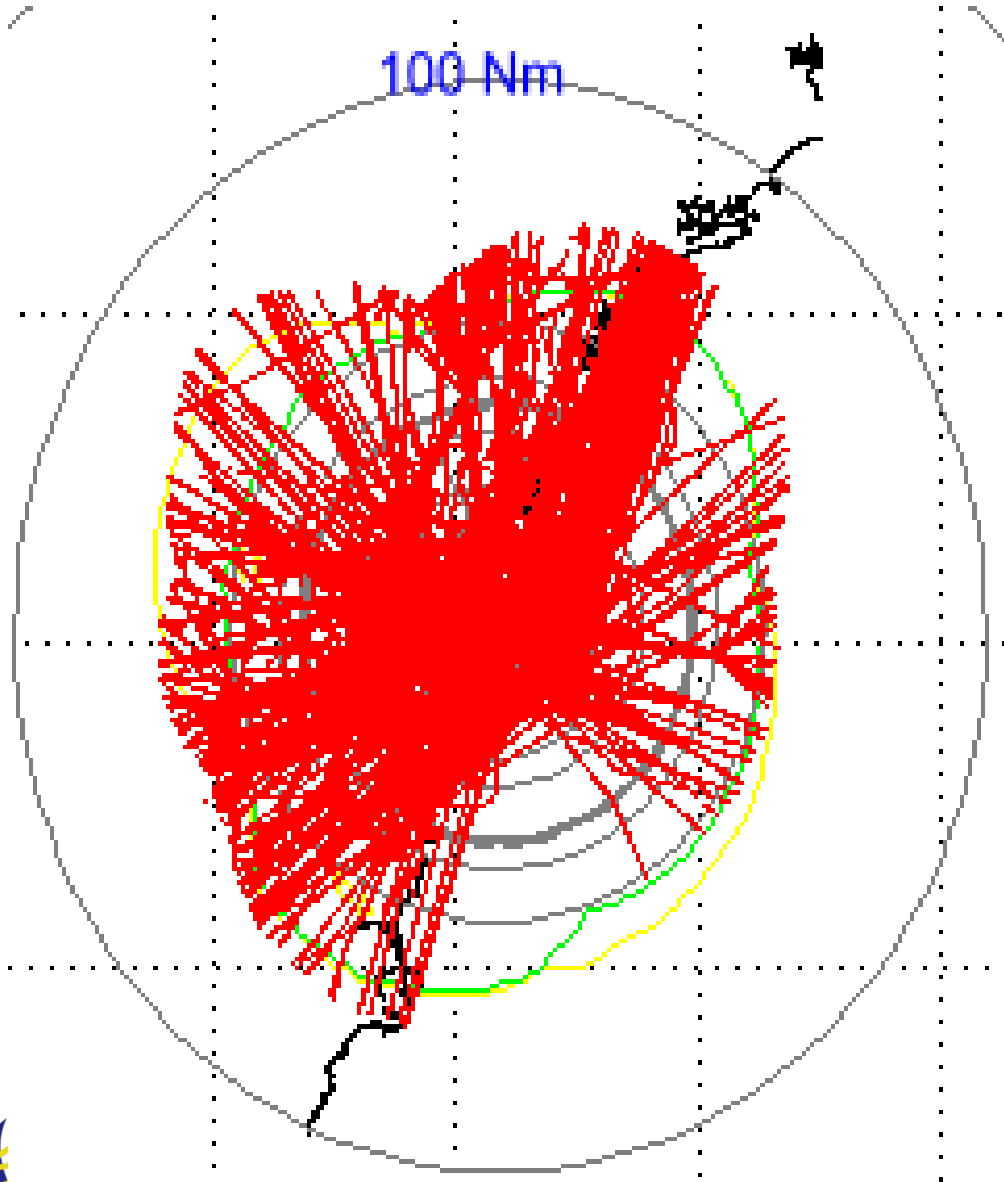


TAS WAM

- TAS WAM
Commissioned
- Operates as Mode S
radar
 - » FlightID used by ATC
- Operates as a 14 site
ADS-B receiver
- Launceston radar
 - » Redeployed to Adelaide
for AMSTAR radar
transition

Sydney WAM data

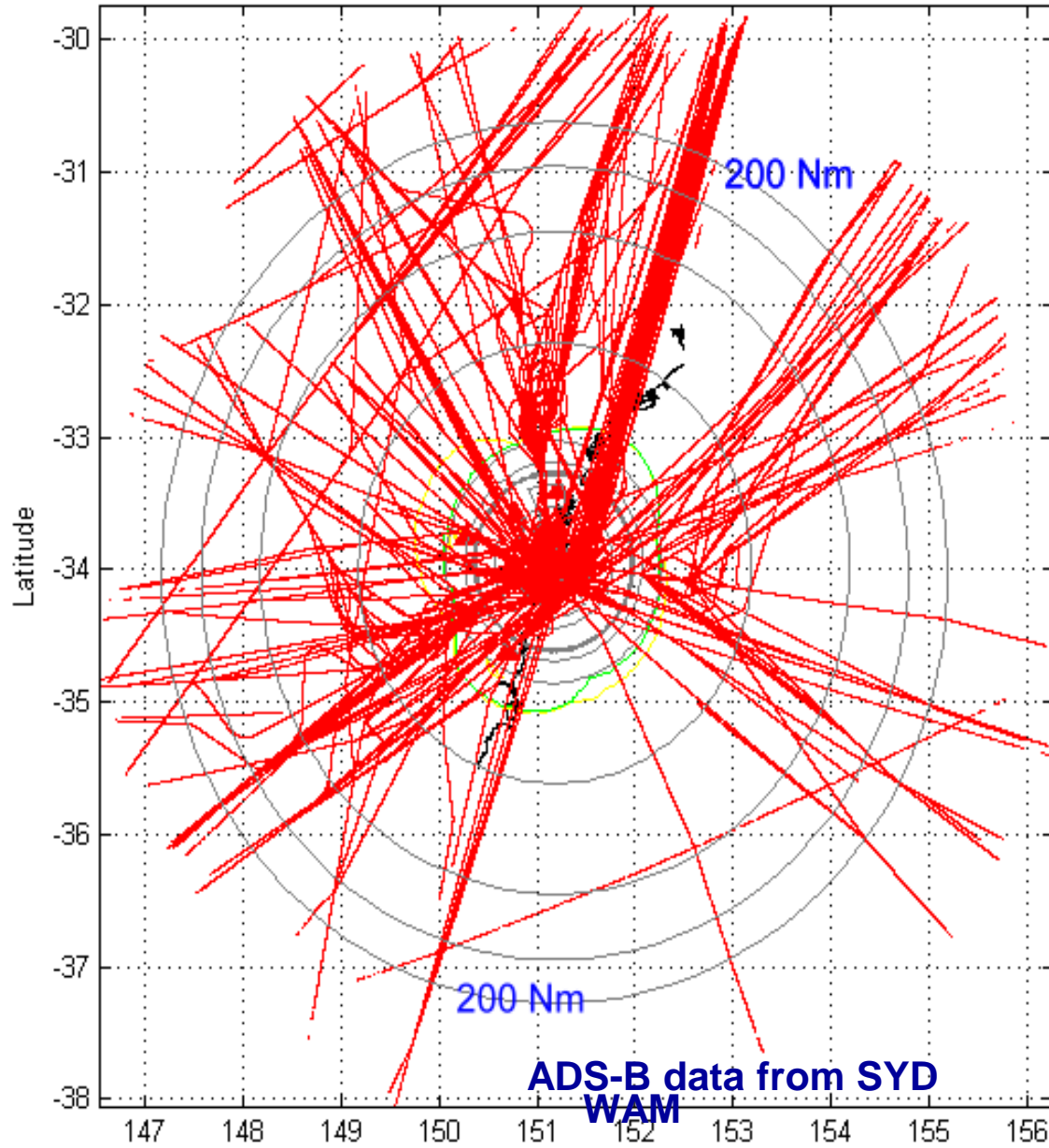
- SYD WAM testing has commenced
- Support to Terminal area
- Replace E-Scan radar for “PRM” function
 - High update
 - High Accuracy



SYD WAM data



SYDWAM CAT21 (ADSB) Coverage Plot - 24/07/2010



SY WAM

TELEPHONE:
1300-306-630
(local call - Aust wide,
except from mobile
phone)
FAX: 02 6268 5111

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MODE S TRANSPONDER REQUIREMENTS FOR AIRCRAFT IDENTIFICATION TRANSMISSION

1. INTRODUCTION

1.1 This AIP SUP describes requirements for correct transmission of Mode S Aircraft Identification.

2. BACKGROUND

2.1 Mode S transponders (either stand alone or associated with ADS-B transmitters) may include the capability for transmitting a preset, or pilot input Aircraft Identification.

2.2 Aircraft approved for ADS-B operations currently ensure the transmitted Aircraft Identification matches the aircraft identification as specified in Item 7 of the flight notification, or the aircraft registration (AIP 1.1 Para 57 refers).

2.3 Airservices Australia is progressively deploying Mode S capable radars, which interrogate the aircraft identification stored in the transponder, consequently aircraft transponder procedures must be updated to ensure valid data is provided by Mode S transponders to ATC.

FLIGHT ID USE

- FLightID used by radar, WAM, ASMGCS & ADS-B
- Issues of “spaces” and “null”
- Non ADS-B pilots unaware

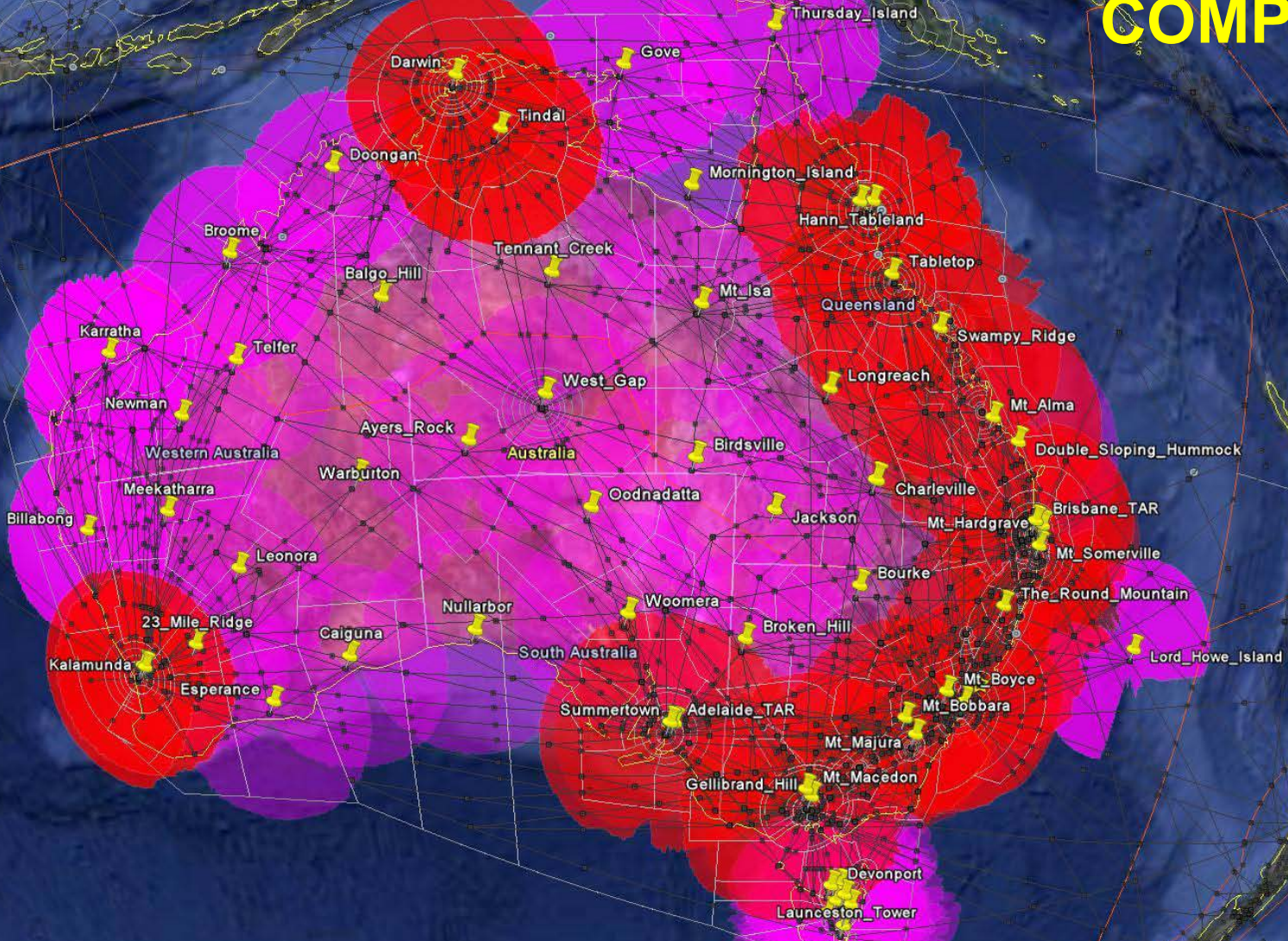
- Squat switch issue
- Mode S transponders must :
 - Be programmed with airframe unique correct 24 bit code
 - Reply to Mode S interrogations when on-ground
 - Not reply to Mode A/C interrogations when on-ground
- Mode A/C transponders
 - A problem at ASMGCS airports

AVIONICS CONSEQUENCE

S

- Mode S transponders must work properly
 - Operational use
 - Flight ID
 - Squawt switch wiring
- Mode A/C transponders must work to specification
 - Frequency
 - Pulse power levels
- Wise to install ADS-B capable Mode S transponders instead of Mode A/C

ADS-B UAP COMPLETED



UAP Stage 3 became Operational on 18/12/2009

- Now 29 Ground stations operational on ATC displays
- Authorised for 5 Nm separation using all Ground stations
- Controller training completed
- Operational approval granted
- Notam issued

C8395/09 NOTAMN

Q) YUXX/QXXXX/IV/BO/E/000/999/

A) YMMM/YBBB

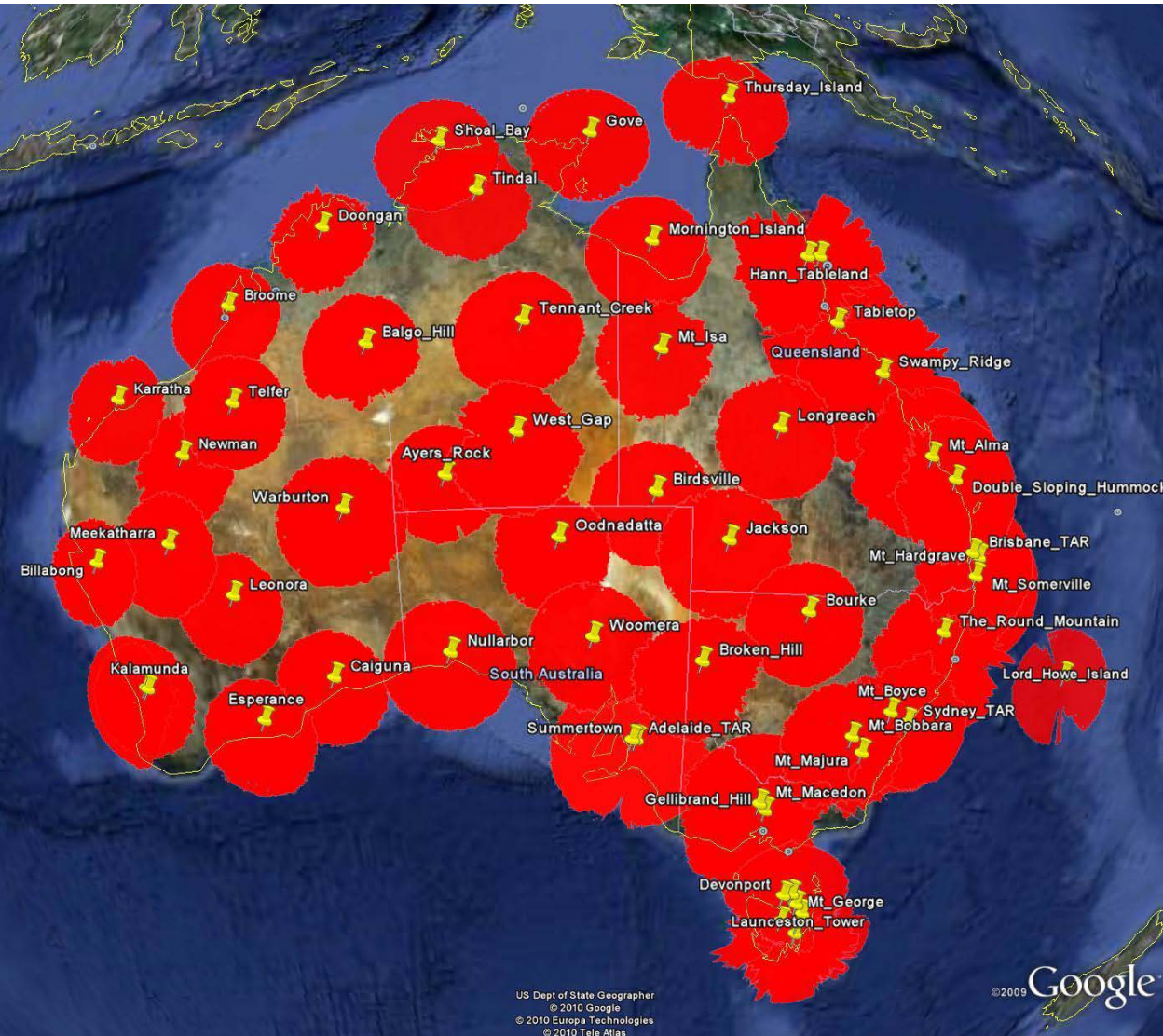
B) 0912181400 C) 1001310600 EST

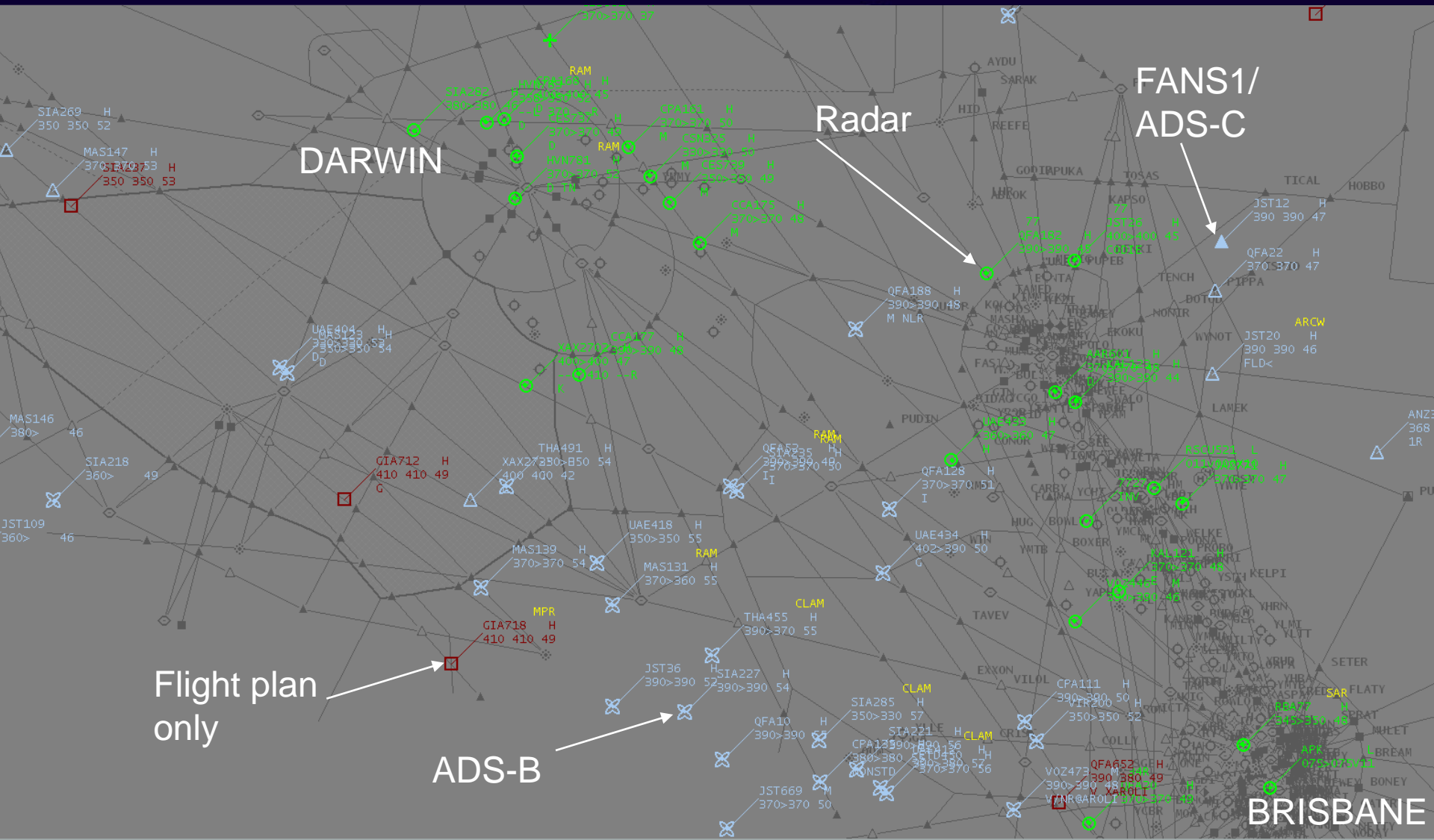
E) SURVEILLANCE SEPARATION AVBL OUTSIDE RADAR COVERAGE IN BRISBANE AND MELBOURNE FIR DUE ADS-B UPPER AIRSPACE PROGRAM STAGE 3

IMPLEMENTATION COVERAGE DETAILS AVAILABLE AT
WWW.AIRSERVICESAUSTRALIA.COM/PROJECTSSERVICES/PROJECTS/ADSB/UAP.ASP

10,000 feet

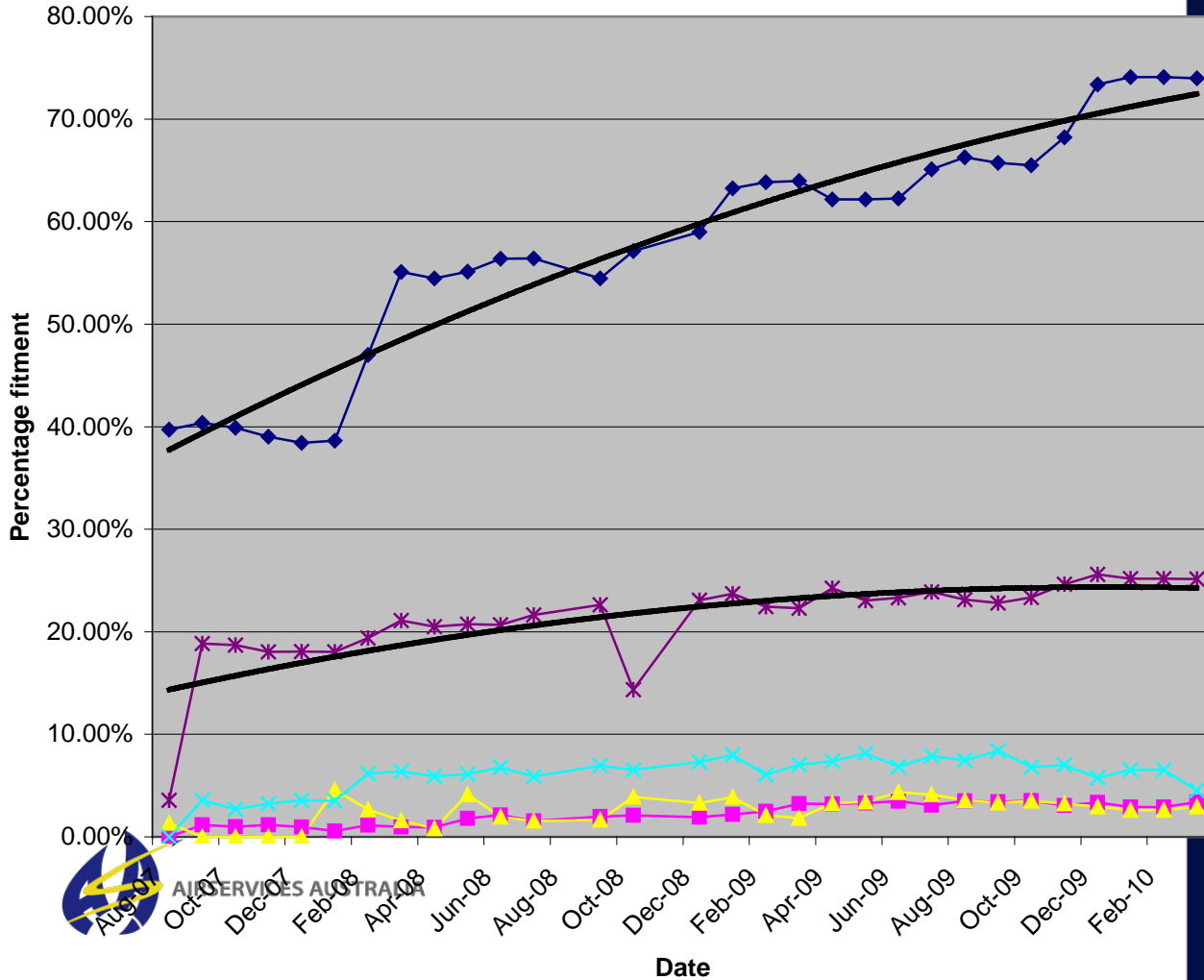
ADS-B already provides significant coverage in lower level airspace





ADS-B FITMENT RATES BY FLIGHT

ADS-B FITMENT RATES OVER TIME



- ◆ ALL SCHEDULED INTERNATIONALS
- DOMESTIC GENERAL AVIATION
- ▲ DOMESTIC MILITARY
- ✕ DOMESTIC NON-SCHEDULED
- ✱ DOMESTIC SCHEDULED
- Poly. (ALL SCHEDULED INTERNATIONALS)
- Poly. (DOMESTIC SCHEDULED)

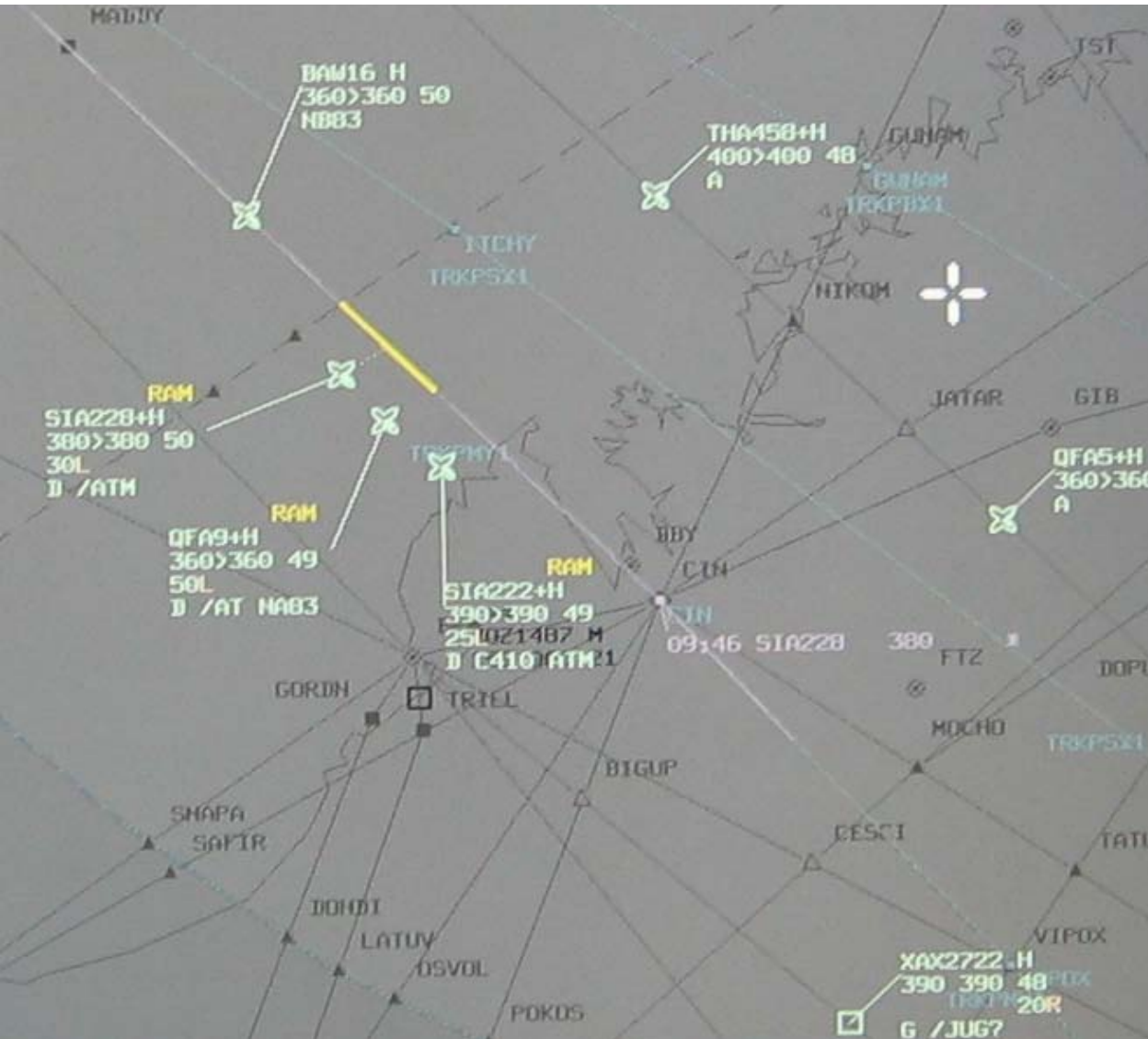


	Qantas			Jetstar		
	Aircraft	ADS-B Fitted		Aircraft	ADS-B Fitted	
A380	6	6	100%			
A330	17	17	100%	7	7	100%
A320/321				46	46	100%
B747	27	27	100%			
B767	26	0	0%			
B737	62	24	39%			
B717	11	0	0%			
DSH8	35	2	6%			
	184	76	41%	53	53	100%

In September 2010 Qantas have announced an equipage program for B767

Feedback

- ATC feedback very positive
 - » Less ATC intervention
 - » Higher safety



ADS-B AVIONICS CONSEQUENCES

- Equipment must work properly
 - CASA CAO 20.18 and AC21.45
 - requires all transmissions to be compliant
 - In force since 2007
 - : Still a few aircraft transmitting non compliant data
 - : Eg TDR94 before -108
- GPS must be interfaced correctly
 - Position alone is not adequate
 - Position may not be from GPS
 - Check NIC, NAC, or NUC
 - : Is the value ok. Eg Type code 18 means NUC/NIC=0 (not acceptable)
- DISABLE ADS-B if not compliant



Example configuration

FLIGHT ID : CALLSIGN



TRANSPONDER
ALTITUDE



POSITION &
INTEGRITY

GPS/ MMR



AIRSERVICES AUSTRALIA

Key components

- Transponder
 - » ADS-B capable model
- GPS or MMR
 - » Provides integrity data
- Panel or system to provide CALLSIGN

Standards

GPS	
DO208 (TSO129)	Needs HPL output. Most assume SA ON
DO316 (TSO196)	SA aware
DO229 (TSO145/146)	WAAS GPS (SA aware)

TRANSPONDER	
DO260 (TSO166)	Accepted by Canada & Australia (AMC20-24 certification)
DO260A (TSO166A)	Adds NIC, NAC, SIL, Mode A code
DO260B (TSO166B)	Adds additional parameters. FAA requirement



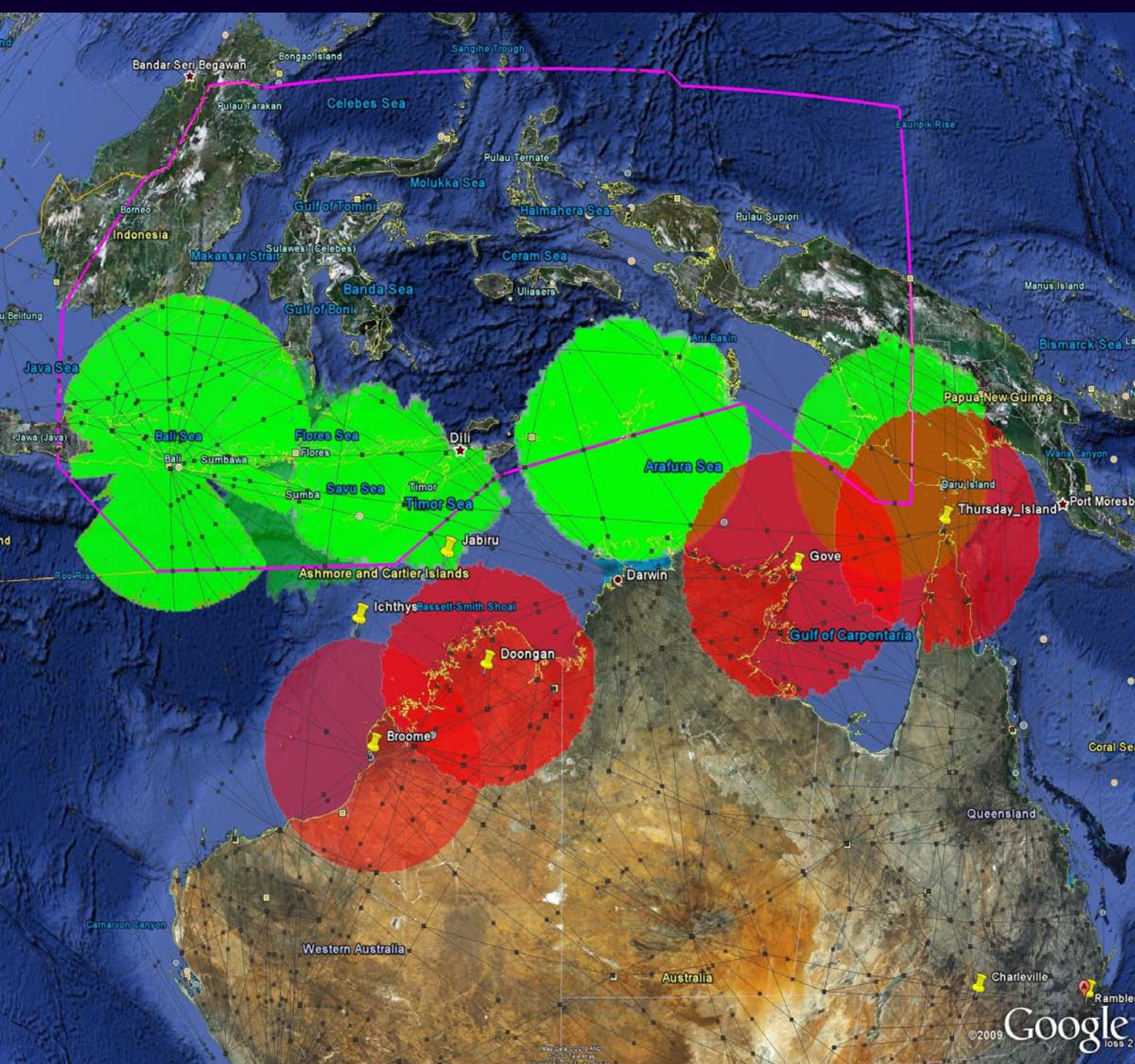
GPS/ MMR
CES AUSTRALIA

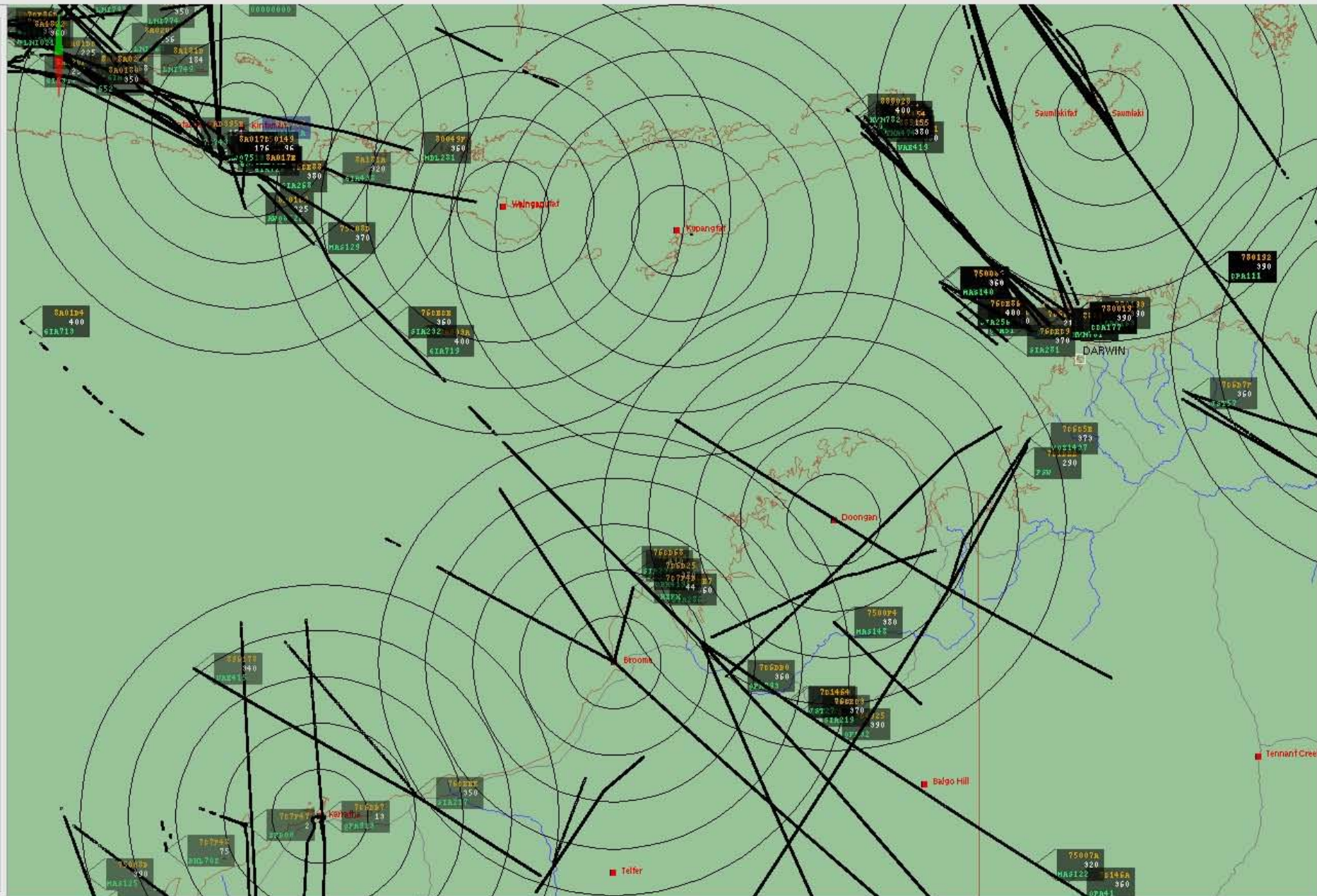


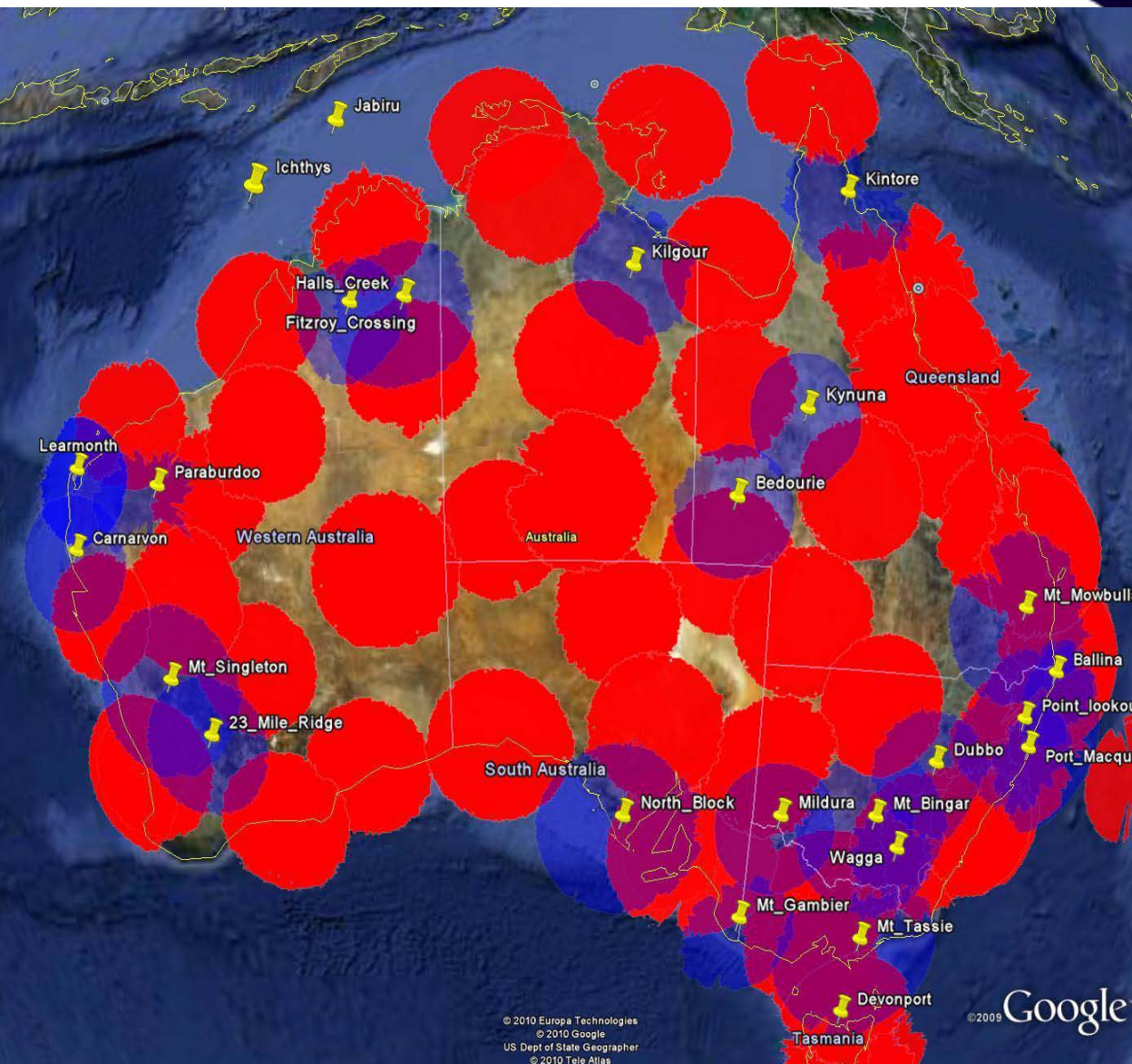
TRANSPONDER

ADS-B Sharing Phase 1

- Target now Nov 2010
- Now 4 + 4







UAP

Extension

- Enroute radar locations
 - Being re-considered
 - Extra ADS-B equipment can be purchased if Enroute radar program is running late

- Complete review

- Some uncertainties

- Do we need ALL enroute radars ?

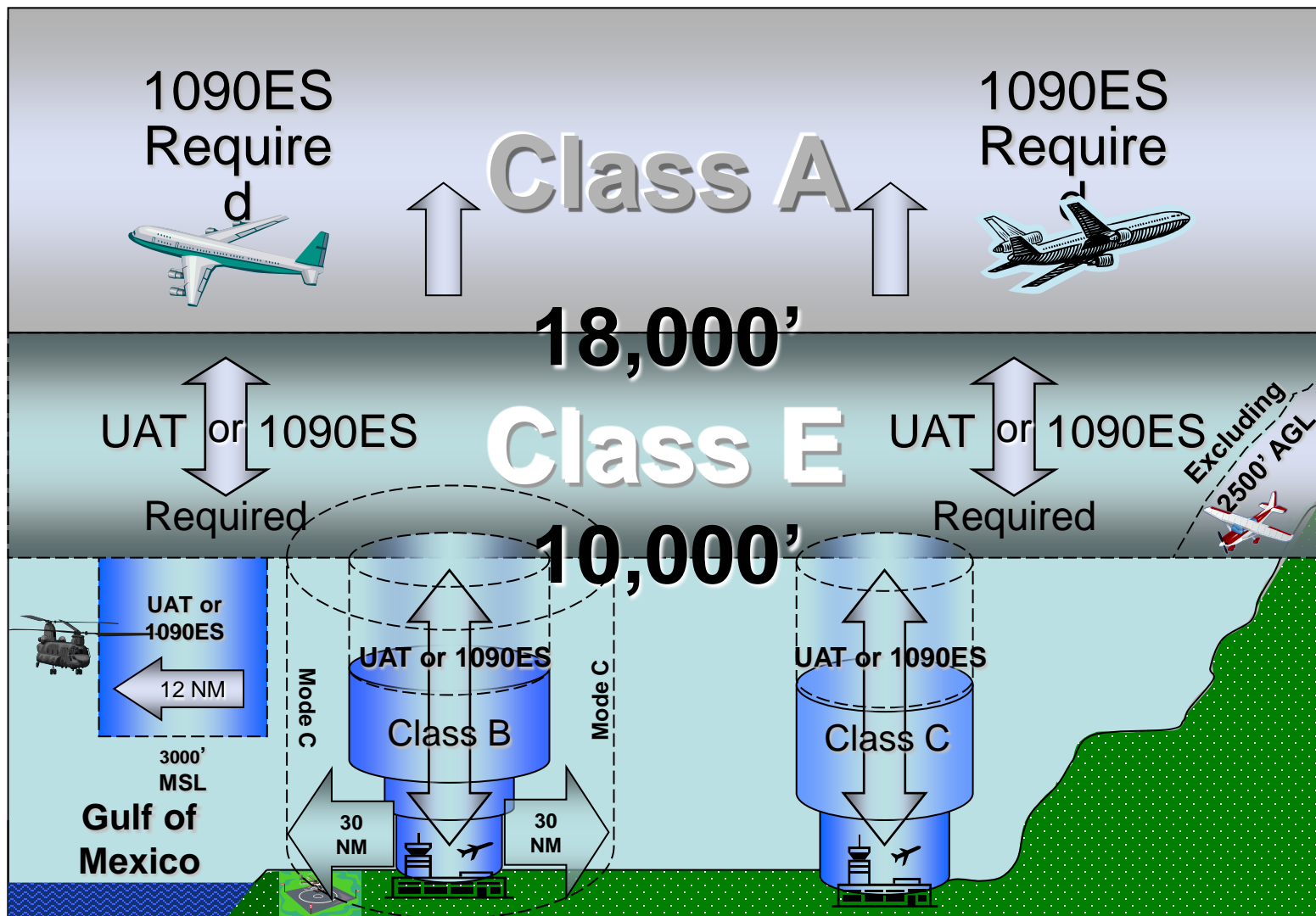
→ eg: Mt Bobbarra

ADS-B Task Force Meeting August 2010



- Items of Interest
 - ADS-B mandates
 - Singapore (2014..some routes)
 - Fiji (published...2013)
 - Hong Kong (end 2013....)
 - FAA mandate Issued May 28, 2010 (2020)
- Agreed template for Asia Pac mandates
 - Recognises CASA rules
 - Mandate that no misleading transmission occur in voluntary fitment airspace
- South China Sea Project progressing

ADS-B Airspace Rule § 91.225





TRIG

TRIG T21 ADS-B TRANSPONDER
ADS-B capable Mode S transponder
with altitude encoder. 130W Tx pulse
Reviews say draws 150mA in real use !



POWERFLARM

POWERFLARM
ADS-B IN and FLARM in one box
Runs on AA cells
Aural alert & display



TRX-1090 **ADS-B IN** receiver for
integration into original FLARM (R)
display – or Garmin display



Funkwerk:

Some Products

ADS-B Mode-S
GA transponders



TRIG, GARMIN, BECKER,
GARRECHT



Accord Technology



- **TSO145C GPS engine**
- **Low cost in quantity**
- **Expect inclusion inside low cost transponders**

STWG

Industry group advising government on Surveillance Technology at behest of ASTRA

- Airservices
- RAAA
- Airlines (Qantas, Virgin, Rex, Nat Jet)
- AOPA
- ABBA
- AFAP/AIPA
- ASAC
- Aeromedical (RFDS)
- CSIRO

Surveillance Technology Working Group (STWG) & ASTRA

- Like CASA is considering Government White Paper

Some expectations

- Staged introduction of new technology
- Avionics driven by Applications
- Expected avionics requirements till 2020
 - Gradual transition to Mode S transponders in some environments
 - Gradual transition to ADS-B
 - : With appropriate exemptions, where justified
 - : All Class A,C,D & E above 10,000 feet
 - : Class C below 10,000 feet outside radar coverage
 - : Some Class E below 10,000 feet in regional areas
 - WAM and possibly TIS-B to support transition as justified
 - Expectation of low cost ADS-B IN
 - : Major objective or benefit to non airline fleet
 - : Examine lower cost alternatives

Possible earlier benefits in some regions Australia





Coolangatta Mode S radar



Nullabor ADS-B site

CONCLUSION

- Increasing demands and use of transponders
 - Now and the future
- AEA members will be in the thick of the transition
 - An important role to play

Questions?

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