ADS-B in Context

APANPIRG ADS-B Study & Implementation Task Force

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Surveillance Program Lead

ADS-B - What is it ?

- Aircraft determines position using GPS
- Broadcasts position, identity, altitude and velocity **(ADS-B out)**
- Ground stations receive broadcasts and relay information to ATC
- Other aircraft receive broadcasts & display to pilot **(ADS-B in)**

ADS-B : Its an old idea !

International Standards
and Recommended Practices

Annex 10
to the Convention on
International Civil Aviation

Note 2.— The Mode S extended squitter system is subject to patent rights from the Massachusetts Institute of Technology (MIT) Lincoln Laboratory. On 22 August 1996, MIT Lincoln Laboratory issued a notice in the Commerce Business Daily *(CBD), a United States Government publication, of its intent not to assert its rights as patent owner against any and all persons in the commercial or non-commercial practice of the patent, in order to promote the widest possible use of the Mode S extended squitter technology. Further, by letter to ICAO dated 27 August 1998, MIT Lincoln Laboratory confirmed that the CBD notice has been provided to satisfy ICAO requirements for a statement of patent rights for techniques that are included in SARPs, and that the patent holders offer this technique free of charge for any use.*

*On 22 August 1996, MIT Lincoln Laboratory issued a notice of its intent **not** to assert its rights as patent owner – offered to all Free of Charge*

16 years ago

In 1994

ADS-B was flying in Gulf of Mexico in 1994

18 years ago

In 2001 : FAA Capstone program

FAA Alaska Region Capstone Investment in Safety

"Radar-Like" ADS-B Services

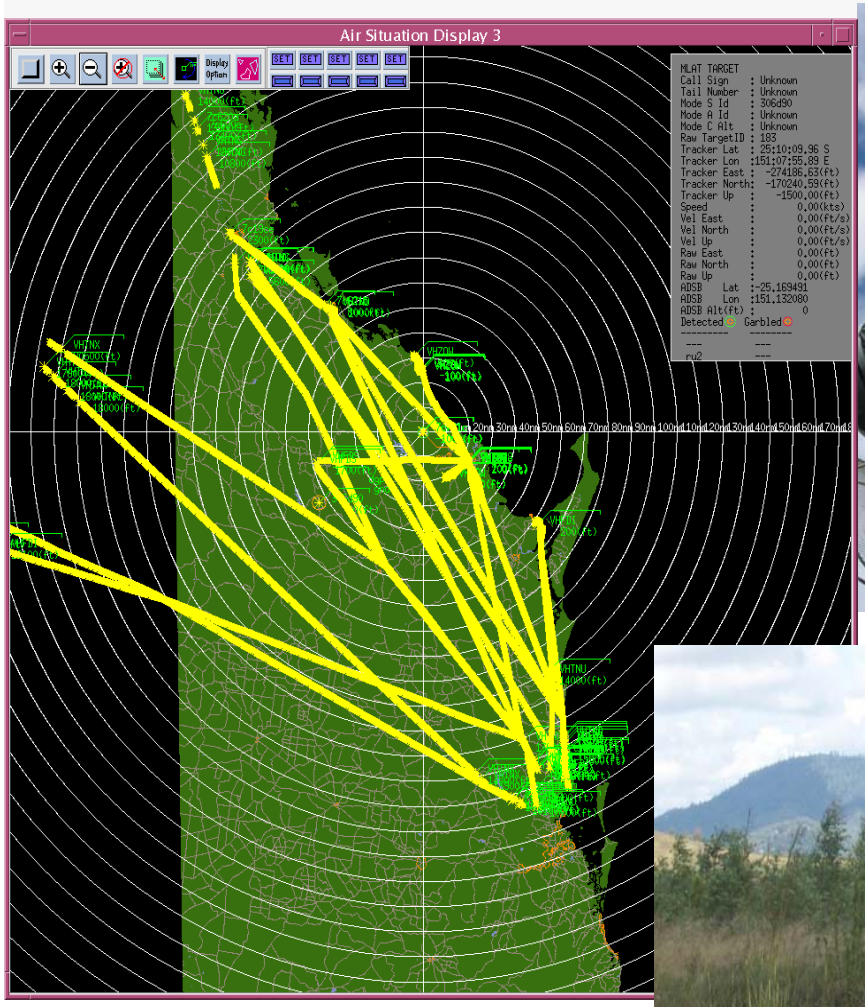
- 1st "Radar-Like" ADS-B services - 00:31GMT on 01/01/01

Lesson Learned:
Procedures must carefully "bridge" between legacy systems and the new or emerging.

FAA equipped 140 aircraft in Alaska.

Radar like services in 2001

2001- 4 : Australian operational trial



- Operationally commissioned
- 9 aircraft
  - Dh8, Shorts, B200, Jabiru

Objective : Learn operational lessons

Separation standards approved

TESTING : Radar compared to ADS-B

In March 2003 :

airservices

ADS-B Study & Implementation
Task Force Meeting 1 : Brisbane

Adopted :

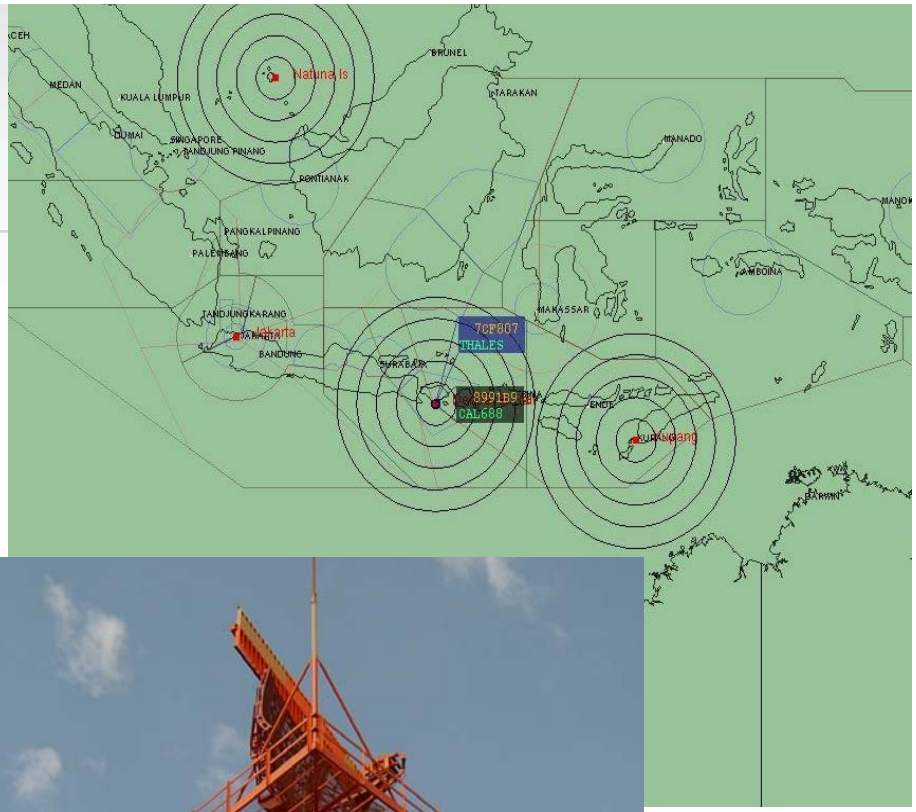
- We need SARPS and Separation standards

- Asia Pacific will use 1090ES in near term

- States be encouraged to implement ATC use by 2006

In 2006 :

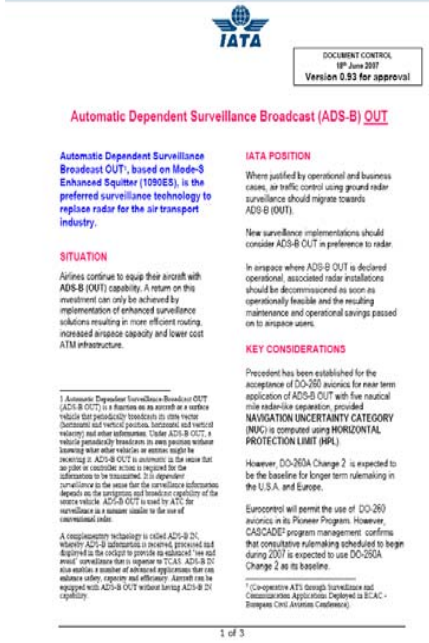
ADS-B trial in Indonesia



In 2007 :

ADS-B Task Force Meeting
Seoul Korea

IATA is convinced (2007)


IATA

DOCUMENT CONTROL
18th June 2007
Version 0.93 for approval

Automatic Dependent Surveillance Broadcast (ADS-B) OUT

Automatic Dependent Surveillance Broadcast OUT[1], based on Mode-S Enhanced Squitter (1090ES), is the preferred surveillance technology to replace radar for the air transport industry.

SITUATION

Airlines continue to equip their aircraft with ADS-B (OUT) capability. A return on this investment can only be achieved by implementation of enhanced surveillance solutions resulting in more efficient routing, increased airspace capacity and lower cost ATM infrastructure.

IATA POSITION

Where justified by operational and business cases, air traffic control using ground radar surveillance should migrate towards ADS-B (OUT).

New surveillance implementations should consider ADS-B OUT in preference to radar.

In airspace where ADS-B OUT is declared operational, associated radar installations should be decommissioned as soon as operationally feasible and the resulting maintenance and operational savings passed on to airspace users.

KEY CONSIDERATIONS

Precedent has been established for the acceptance of DO-260 avionics for near term application of ADS-B OUT with five nautical mile radar-like separation, provided **NAVIGATION UNCERTAINTY CATEGORY (NUC)** is computed using **HORIZONTAL PROTECTION LIMIT (HPL)**.

However, DO-260A Change 2 is expected to be the baseline for longer term rulemaking in the U.S.A. and Europe.

Eurocontrol will permit the use of DO-260 avionics in its Pioneer Program. However, CASCADE[2] program management confirms that consultative rulemaking scheduled to begin during 2007 is expected to use DO-260A Change 2 as its baseline.

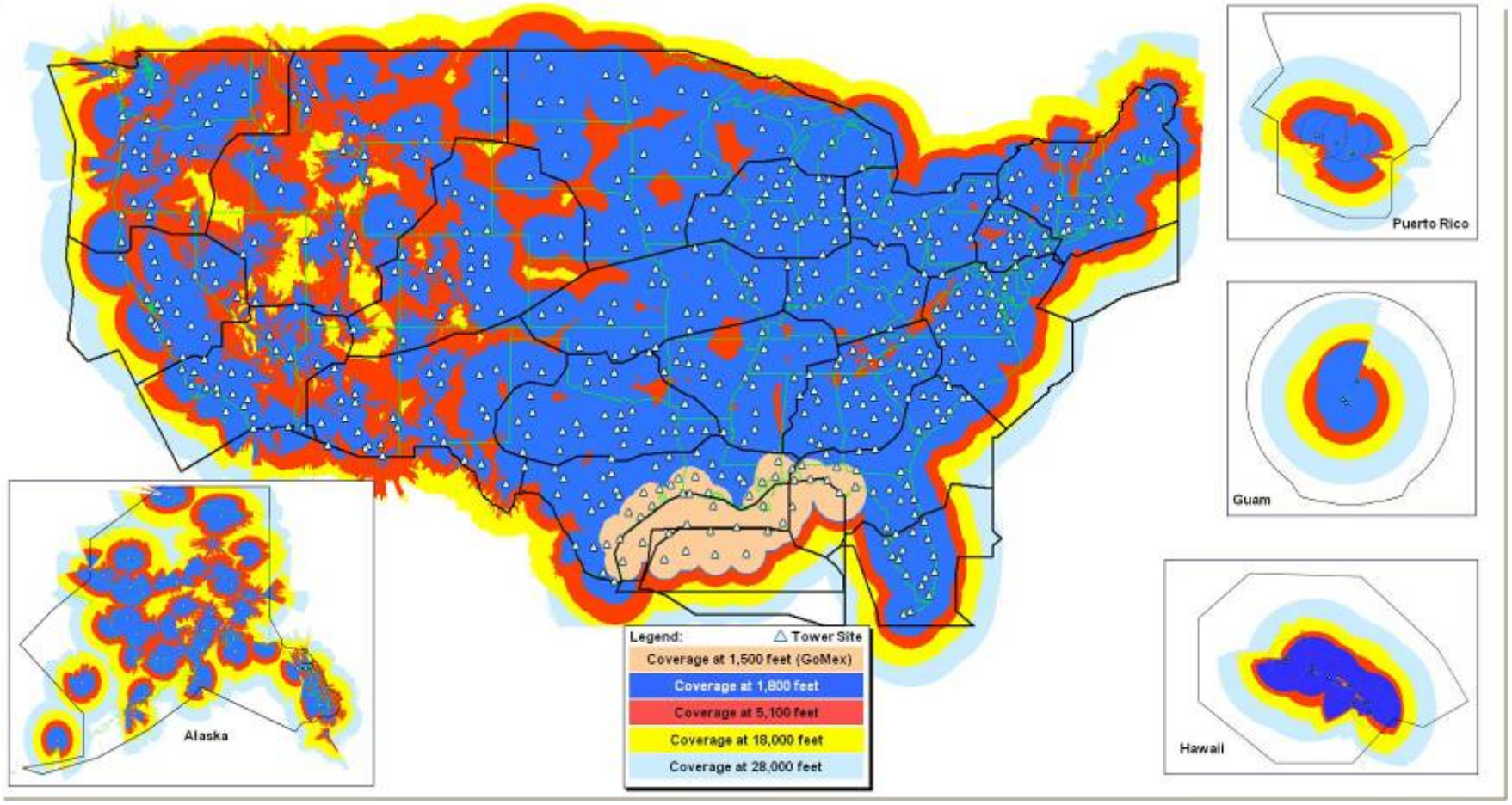
[1] Automatic Dependent Surveillance-Broadcast OUT (ADS-B OUT) is a function on an aircraft or a surface vehicle that periodically broadcasts its state vector (horizontal and vertical position, horizontal and vertical velocity) and other information. Under ADS-B OUT, a vehicle periodically broadcasts its own position without knowing what other vehicles or stations might be receiving it. ADS-B OUT is automatic in the sense that no pilot or controller action is required for the information to be transmitted. It is dependent surveillance in the sense that the surveillance information depends on the navigation and broadcast capability of the source vehicle. ADS-B OUT is used by ATC for surveillance in a manner similar to the use of conventional radar.

A complementary technology is called ADS-B IN, whereby ADS-B information is received, processed and displayed in the cockpit to provide an enhanced "see and avoid" surveillance than is superior to TCAS. ADS-B IN also enables a number of advanced applications that can enhance safety, capacity and efficiency. Aircraft can be equipped with ADS-B OUT without having ADS-B IN capability.

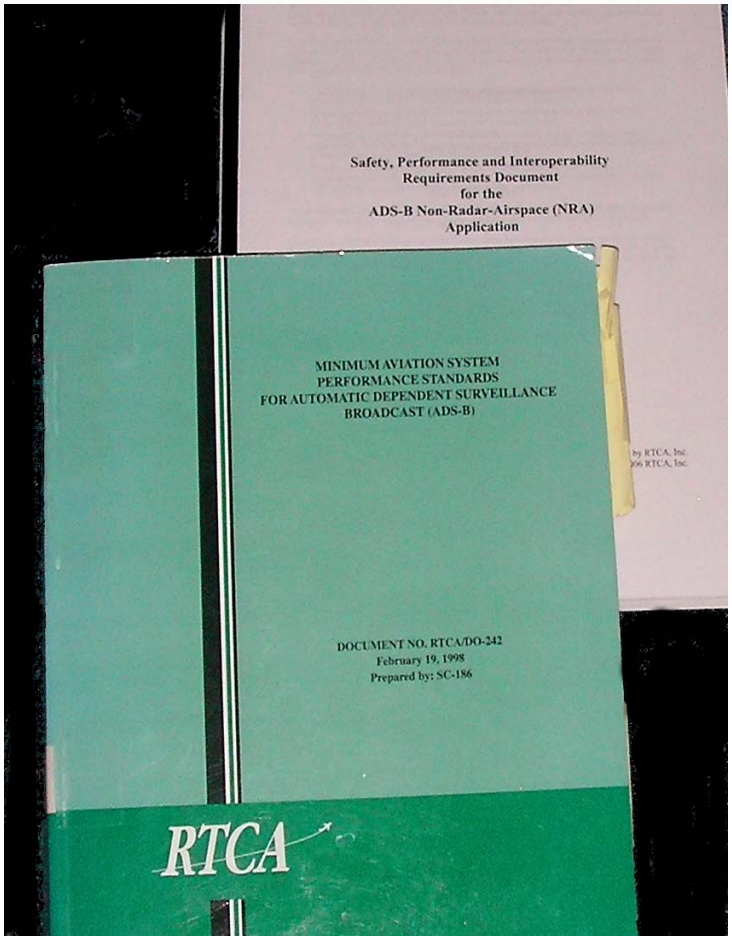
[2] (Co-operative ATS through Surveillance and Communications Applications Deployed in ECAC - European Civil Aviation Conference).

1 of 3

2007 FAA ITT Contract
Ground Infrastructure: 794 Ground Station Solution Provides National Coverage



2004-2009
RFG work on RTCA-EUROCAE GREEN BOOKS

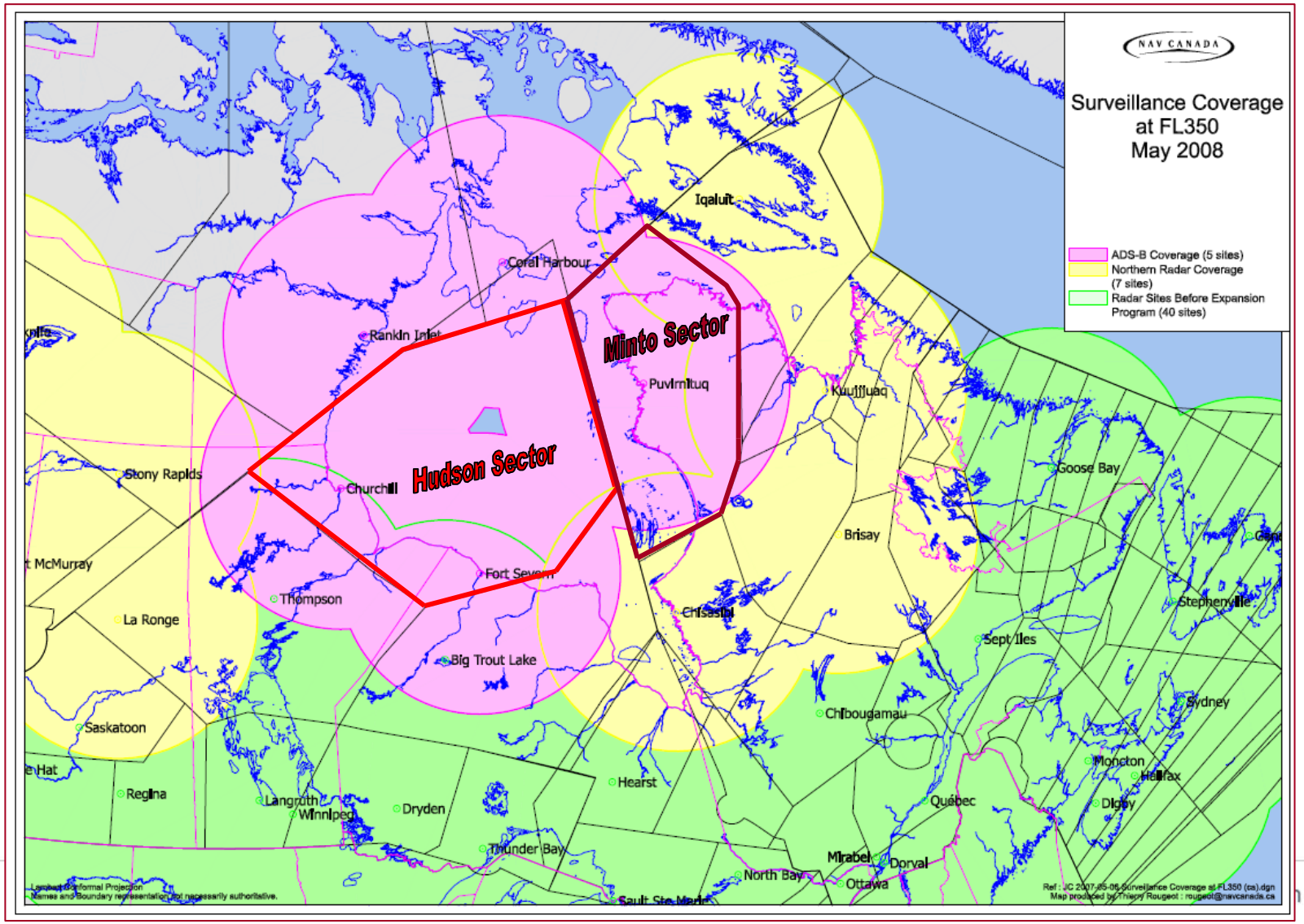


Eg: RTCA DO303
"ADS-B in
Non-Radar Airspace – NRA"

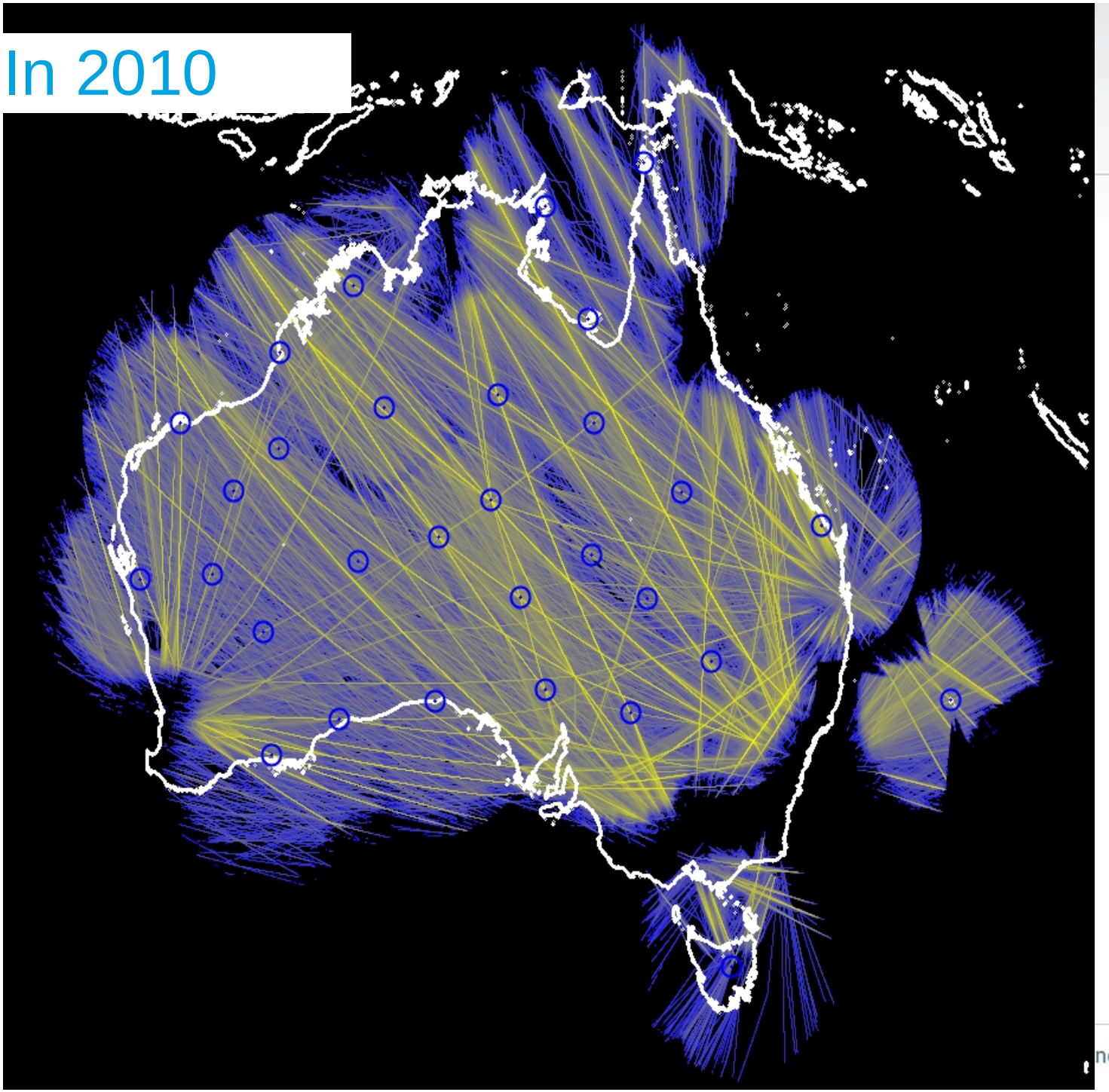
Standards for Global interoperability

Led to AMC20-24 certification

In 2008 – Hudson Bay



In 2010



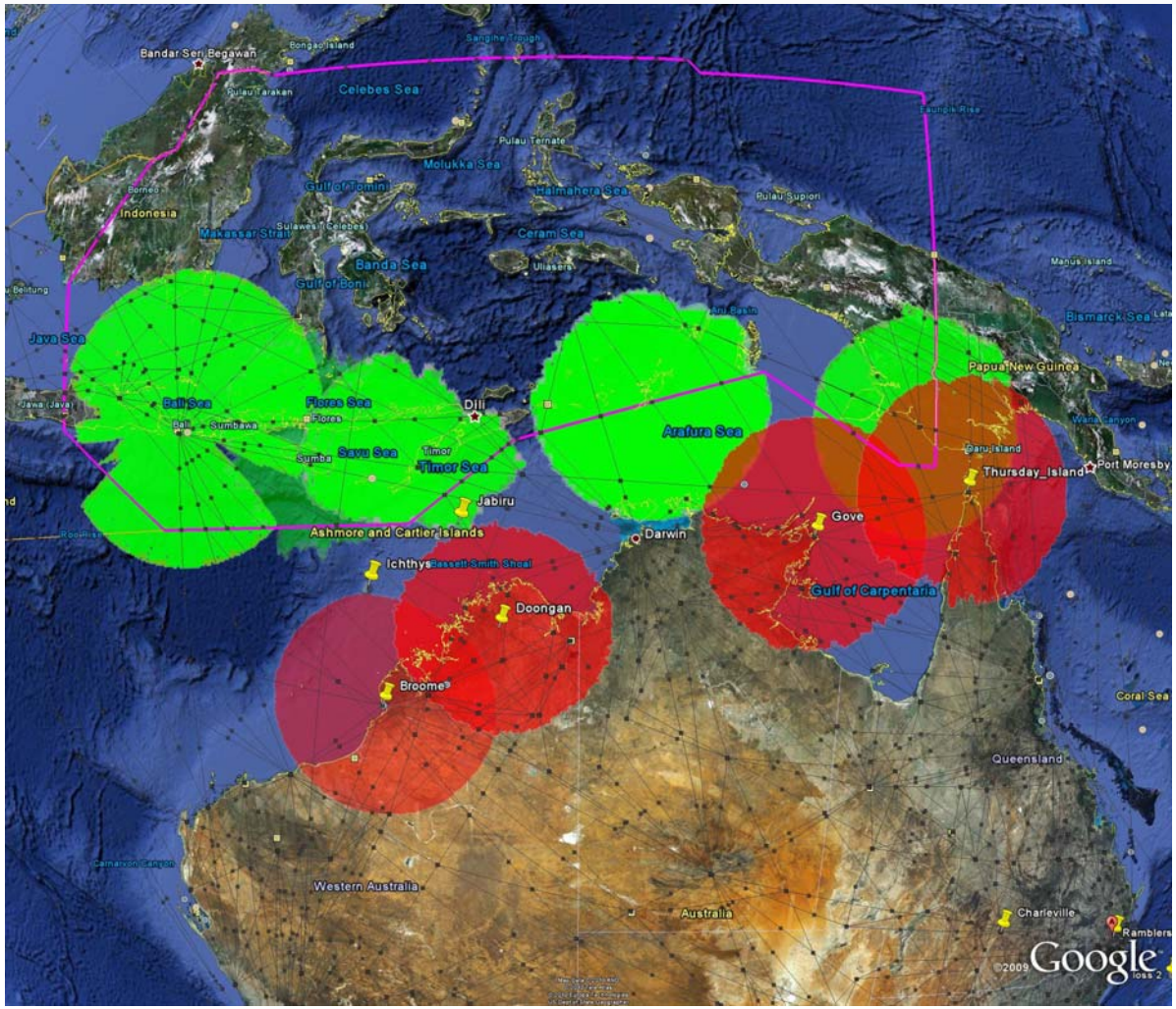
airservices

Continent wide system operational in Australia

necting australian aviation

In 2010

ADS-B data sharing operational

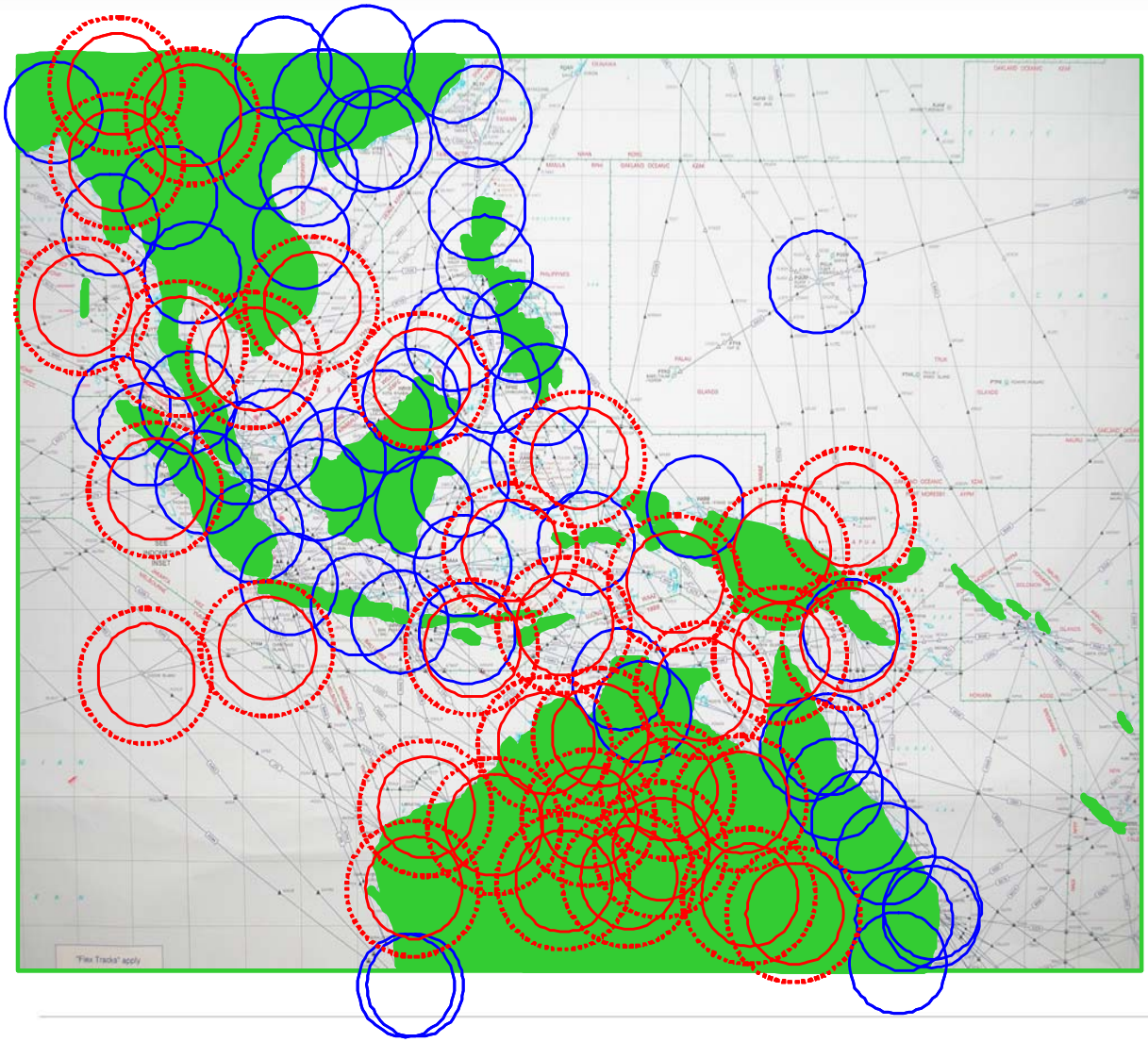


Indonesian data is “on screen” in Brisbane ATC centre

Impact on safety of FIR boundary

- Increased safety
  - Error detection
  - Safety nets
  - Increased situational awareness

We dreamt of filling in Surveillance holes in SE Asia



- ADS-B (in red)
- More to do, but much achieved here !

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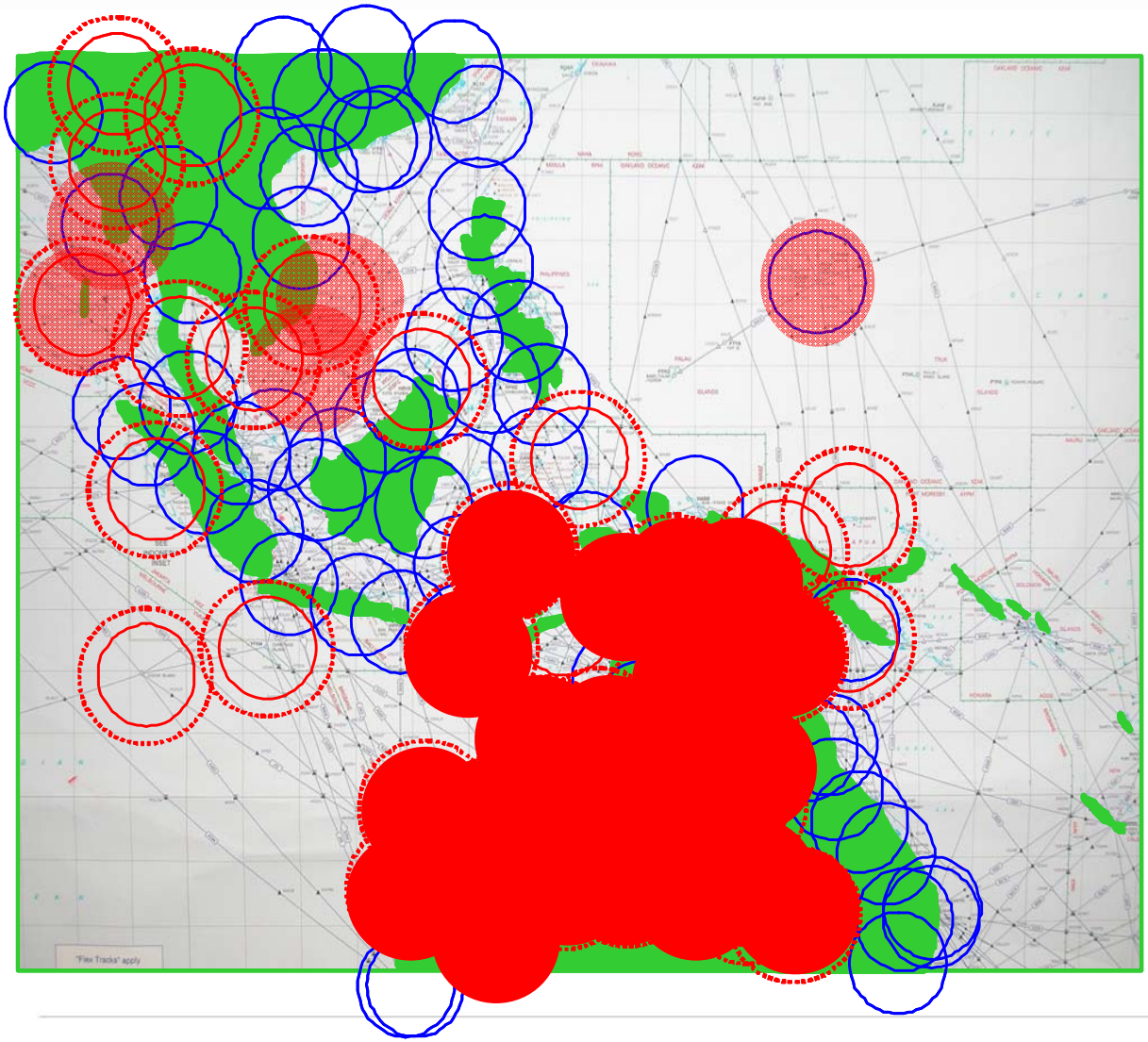
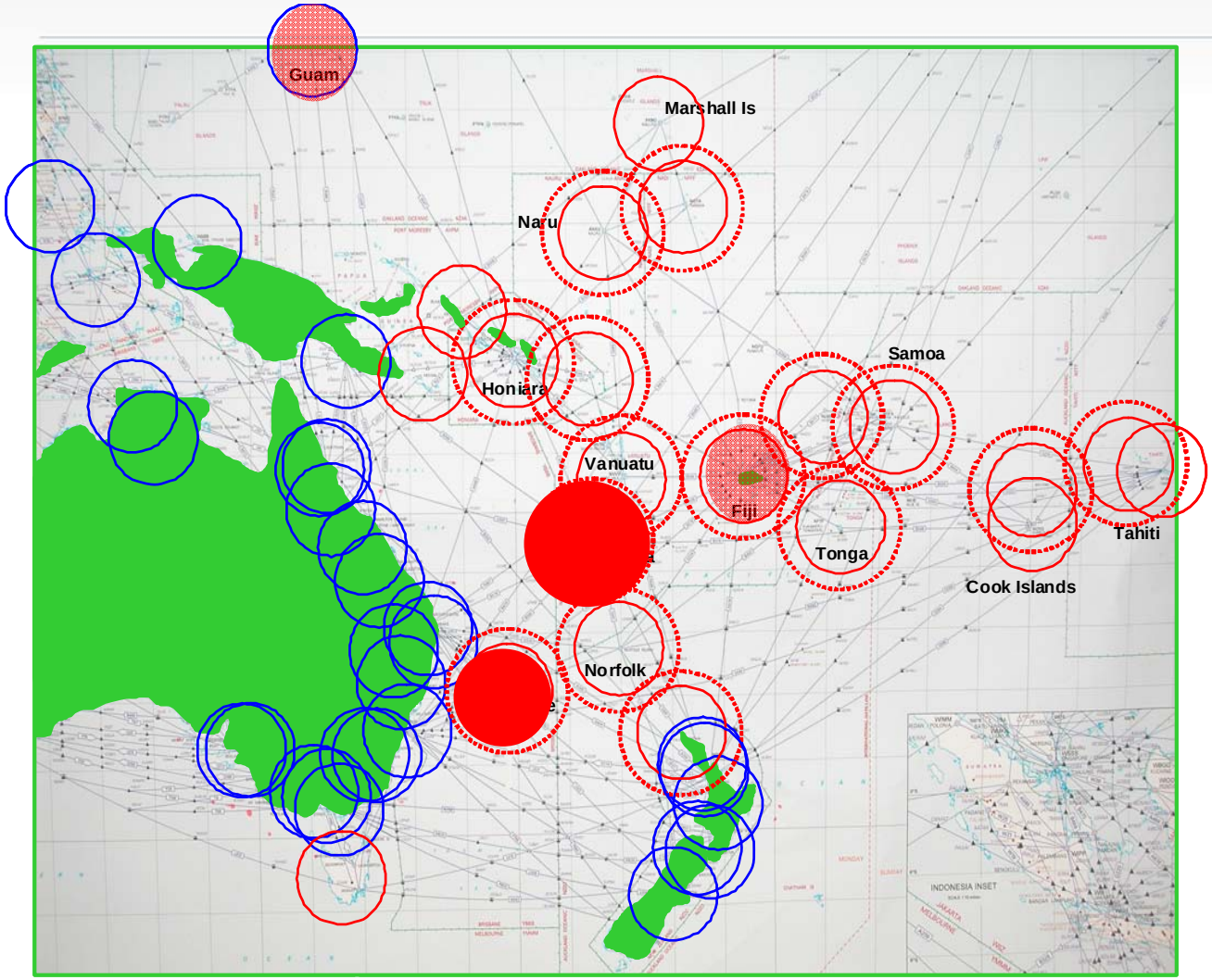


- ADS-B (in red)
- More to do, but much achieved !

& the Pacific



- ADS-B (in red)
- We are commencing in the Pacific

Task Force has produced :

- ADS-B Implementation Guidance Material
- Guidelines for Airworthiness/Operational Approval for ADS-B
- Avionics Baseline ADS-B service performance parameters
- Guidance on building a safety case for ADS-B
- Sample data sharing agreement
- Guidance on multisensor fusion inc ADS-B
- Guidelines for development of an ADS-B Plan
- Surveillance Strategy for Asia Pacific
- Guidance Material on Comparison of Surveillance Technologies
- Guidance material on use of Asterix Cat21 for ADS-B messages (TBC)
- Guidance for advice to military regarding ADS-B data sharing (TBC)

We are planning multi state projects

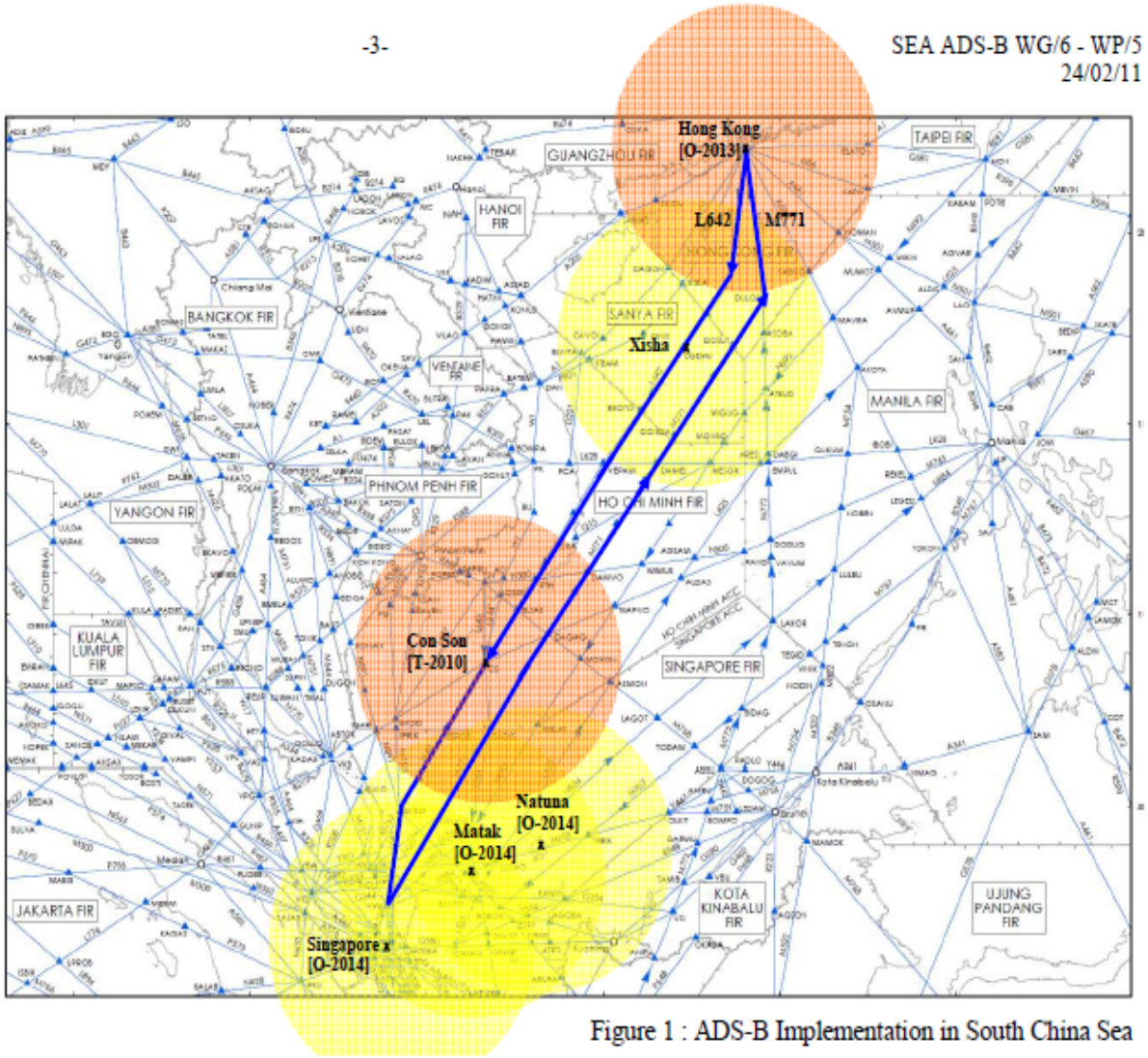


Figure 1 : ADS-B Implementation in South China Sea

SEA project 1

Singapore

Vietnam

Hong Kong China

China

SEA project 2

Singapore

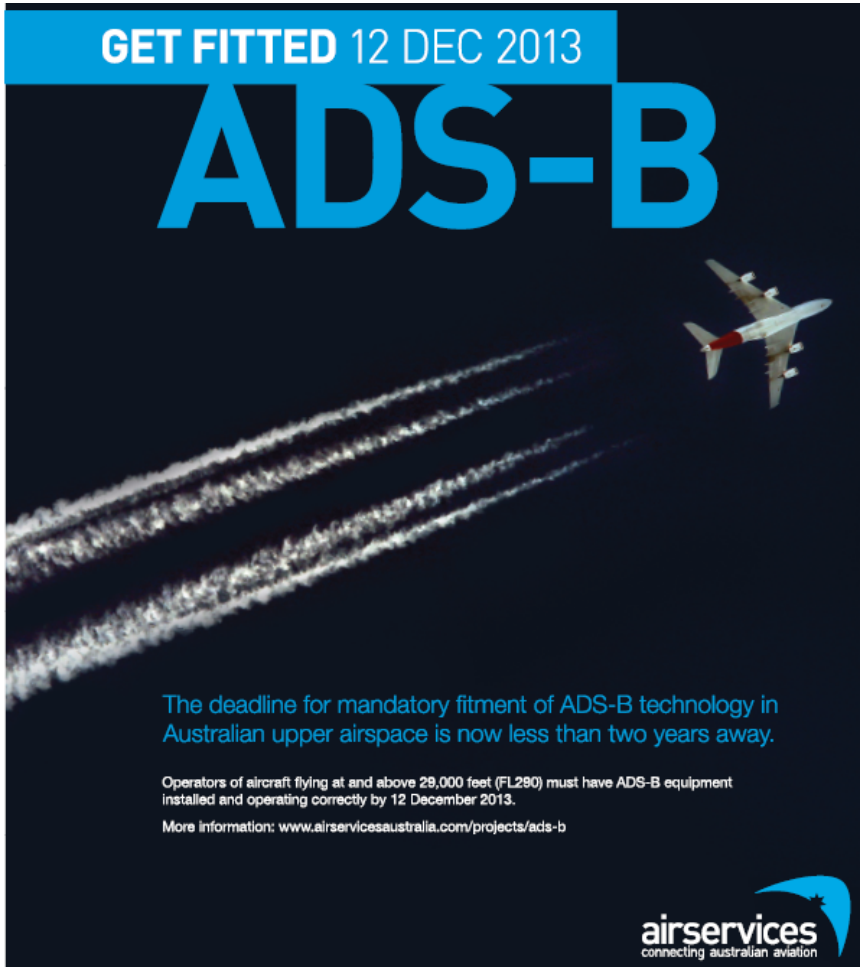
Philippines

Malaysia

Indonesia

Asia Pac States have published mandates

- USA (2020)
- Australia (2013)
- Singapore (2013)
- Hong Kong China (2013)
- Fiji (2010)
  - Domestic fleet equipage
  - exemptions granted till December 2013

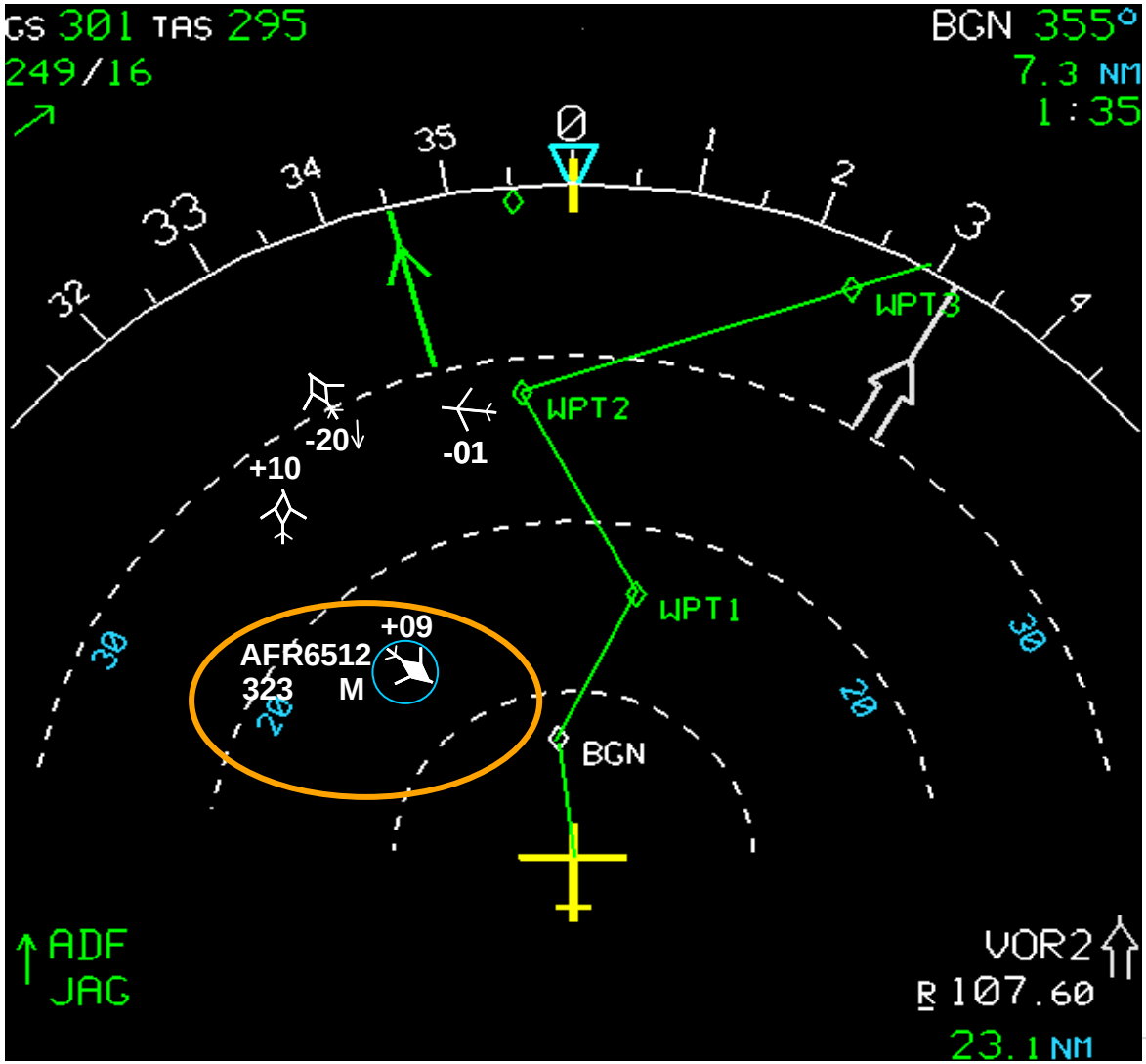


We know the Benefits of Surveillance

- Improved safety
  - ✓ Automated safety alerts for ATC
  - ✓ Increased situational awareness for ATC
  - ✓ Improved Search & Rescue
  - ✓ Less transactional work for ATC/Pilots

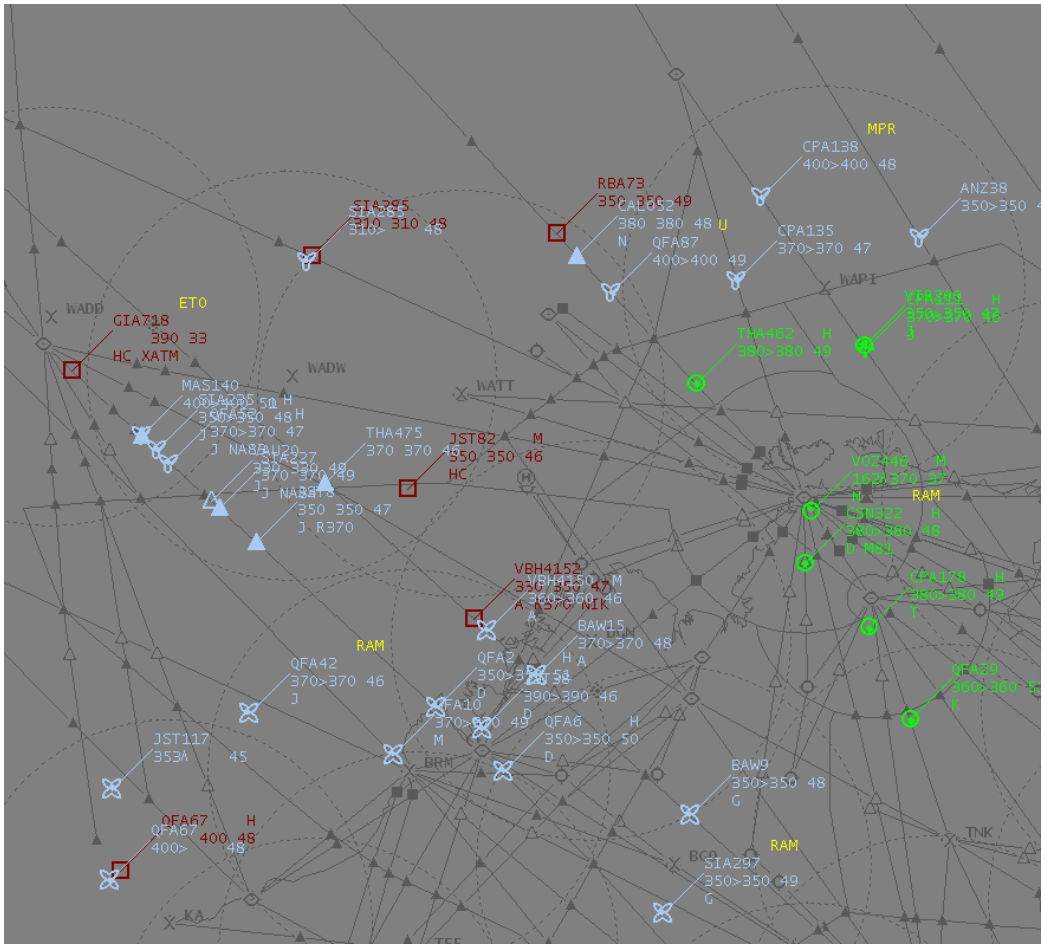
- Improved efficiency for users
  - ✓Reduced & more flexible separation standards
  - ✓More clearances to requested route/level
  - ✓Reduced stepped climb/descent
  - ✓Increased flexibility in poor weather
  - ✓Less delay
  - ✓Lower pilot workload
  - ✓Reduced fuel burn & operating time

We know ADS-B provides lower cost surveillance



plus provides base for ADS-B IN

Some states : Fully operational



- Operational Ground stations
- ATC in operation with ADS-B
- 5 nautical separation standards
- Reaping benefits
  - ✈ Low cost surveillance
  - ✈ Safety
  - ✈ RVSM monitoring
  - ✈ Data sharing

Some states are implementing

- Ground stations being acquired and deployed
- ATC systems being upgraded
- Rulemaking in progress
- ATC training
- Procedure development
- Safety cases

Some states impeded

- Without a firm ADS-B plan
  - Some have radar and consider no need for ADS-B
    - ✈ But replacement is never far away
  - Others could benefit from ADS-B; but an impediment exists
    Perhaps ….
    - ✈Concern about reliance on GNSS
    - ✈Too hard to equip fleet (always will be until you start)
    - ✈Financial or budgetary constraints
      - ✈NB: but customers want benefits from their investment
    - ✈Unacceptable to mandate fitment of avionics
    - ✈Capability constraints (complexity, knowledge, procedures, confidence)
    - ✈Possibly blocking benefits to the Industry
    - ✈Possibly preventing a seamless service

- How can ADS-B Task Force help?

DGCA Conference :

Recently urged States to review their strategy on surveillance coverage (for both Radar and ADS-B) and submit their ADS-B Implementation Plan to ICAO APAC Regional Office.

Ref.: T 8/10.17, T 8/10.21:AP050/12 (CNS)

Subject: Follow-up action on DGCA Conference Action Item 48/4 on ADS-B Implementation Plan

Action Req'd: To provide ADS-B Implementation Plan to ICAO Regional Office as soon as possible, preferably, **by 30 April 2012**

Also note :
ICAO ASBU B0-84
Includes ADS-B Ground based surveillance

Plan to ICAO APAC Regional Office. The Conference reaffirmed the need for expediting implementation of ADS-B and developed following action item:

Action Item 48/4

Recognizing that the full benefits of ADS-B would only be achieved through harmonized implementation, the Conference urges States and Administrations to expedite ADS-B implementation and share with ICAO Regional Office their implementation plan.

To convert talk to reality !

How to get ADS-B fitment to occur

- Provide a service to those equipped
- Publish mandates – difficult if you do not provide a service
- Work with your key airlines (they become champions)

How to deliver a service

- Develop a step by step plan and obtain approval of the plan
  - ✈ Fill coverage holes to start
  - ✈ Talk to neighbours
- Get a project established to consider all aspects

Conclusion

- We have come a long way with ADS-B
- But we have taken a long time
- Consider your ADS-B plan
- And move to implementation
- Tell the Task Force meeting about what the blockages are.

  ✈How we can help?