ADS-B Workshop – SP/10

Planned use of ADS-B in the Asia Pacific Region

11 August 2010

Civil Aviation Authority of Singapore

Applications for ADS-B

- Air & Ground Surveillance Applications
  - ➢ Non-radar areas
    - ✓ Reduced separation
    - ✓ Enhanced situation awareness
    - ✓ Enhanced safety and efficiency
      - FIR Boundaries
      - LHD (Large Height Deviation)
      - GNE (Gross Navigation Error)
  - ➢ Radar areas
    - ✓ Faster update rate → Improve surveillance accuracy
    - ✓ Backing up existing radars → Improve surveillance sensor availability
    - ✓ Covering radar gaps → Improve reliability of surveillance coverage

Applications for ADS-B

- Ground Surveillance Applications
  - Airport surface
    - ✓ Surface movement surveillance (Low cost, all weather conditions & vehicle movement tracking)
    - ✓ Supplement surface movement radars and multi-lateration systems → Improve coverage
  - Supporting ATC tools
    - ✓ ATC safety alert tools → faster and more accurate alerts
    - ✓ Multi-Surveillance Tracking System →Early track initialisation
  - Reference sensor for verification of surveillance sensor accuracy
  - Monitoring of NTZ

Applications for ADS-B

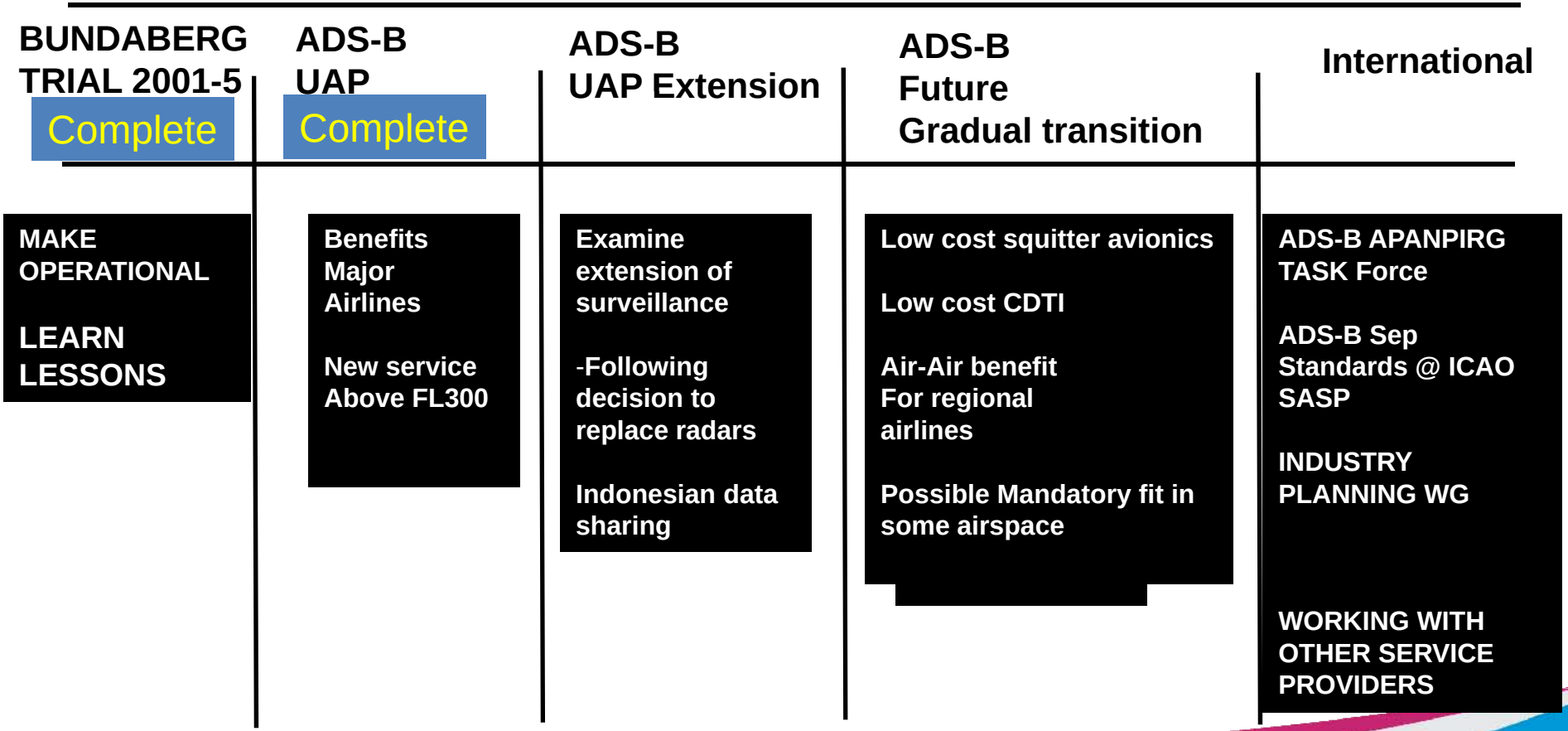
- Aircraft to Aircraft Surveillance Applications
  - Enhanced cockpit traffic situational awareness on the airport surface
  - Enhanced traffic situational awareness during flight operations
  - Enhanced visual separation on approach
  - In trail procedures in oceanic airspace
  - Enhanced sequencing operations

Regional ADS-B Developments

- States/Regions Covered
  - Australia
  - Brunei Darussalam
  - China
  - Fiji
  - Hong Kong
  - Indonesia
  - Malaysia
  - New Caledonia
  - Pakistan
  - The Philippines
  - Republic of Korea
  - Singapore
  - Taiwan
  - Thailand
  - Viet Nam

Note: The USA are covered in other agenda items.

Airservices Australia
ADS-B Activities



Information as in Aug 2010. Slide from Airservices Australia

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Australia (Upper Airspace project)

- Phase 1: Installed 28 ADS-B Stations in low density Non Radar Airspace (NRA)

- Phase 2: Additional 16 ADS-B Stations to be added :
  - First station installed in Lord Howe Island

UAP key points

- ATC coverage of continent
  - Project Objective was traffic above FL300
- Voluntary equipage
- Safety benefit
  - Safety nets
  - Situational awareness
  - FIR boundaries
- Efficiency benefit
  - Reduced separation standards
  - Increased clearance approval
  - Operational priority
  - Reduced pilot/ATC workload

Thursday Is ADS-B
Next to wind turbines

Information as in Aug 2010. Slide from Airservices Australia

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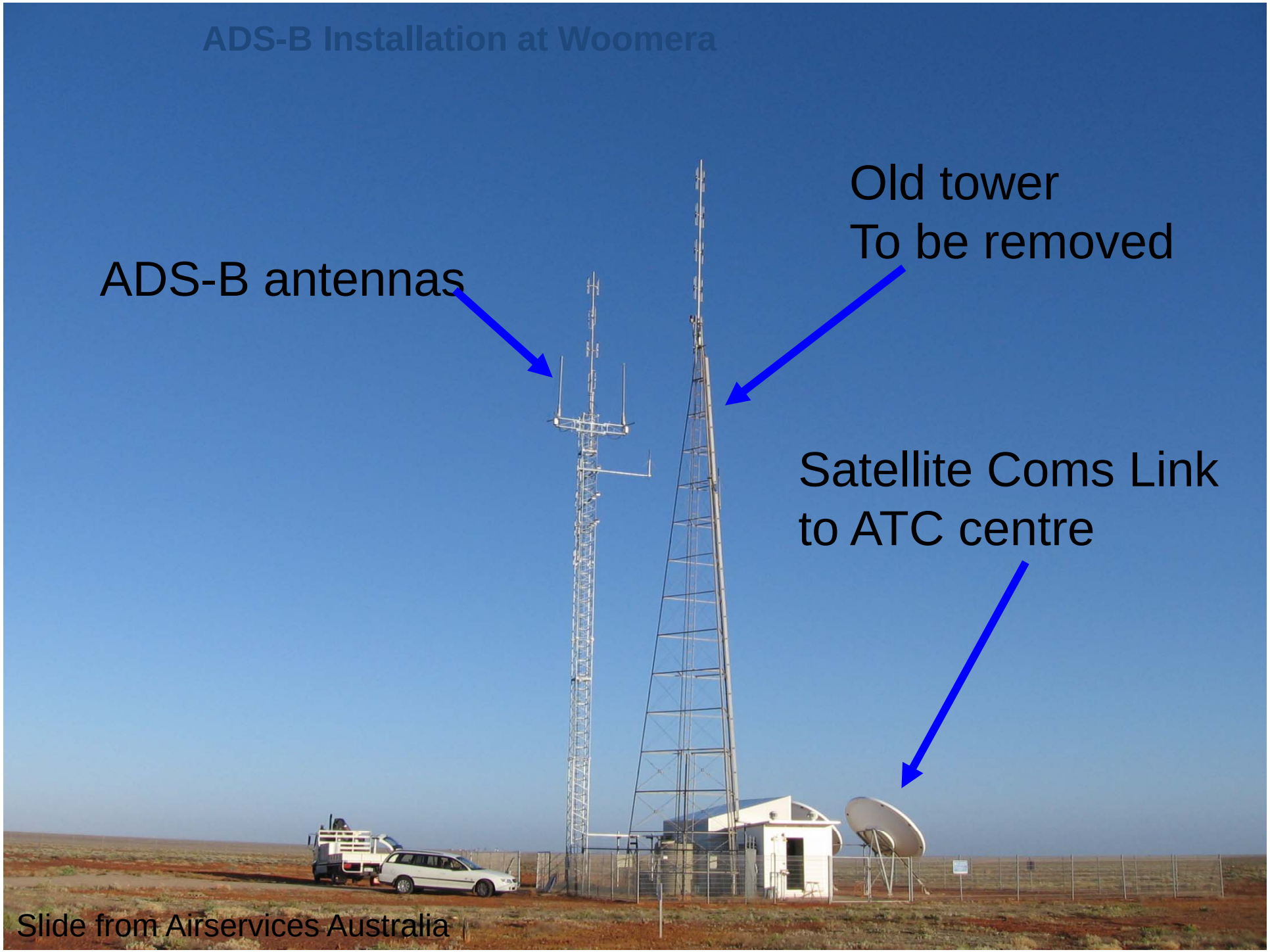
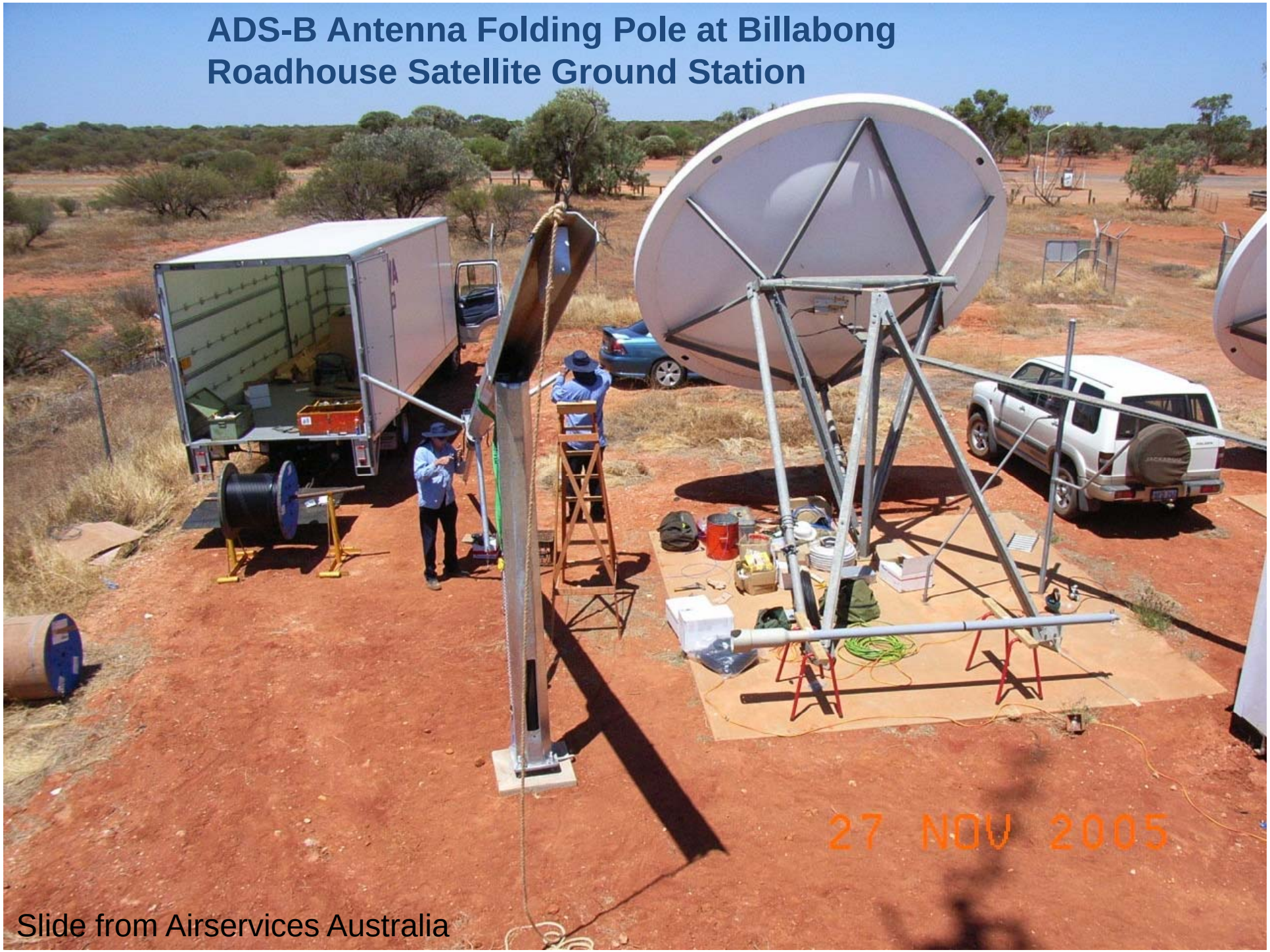
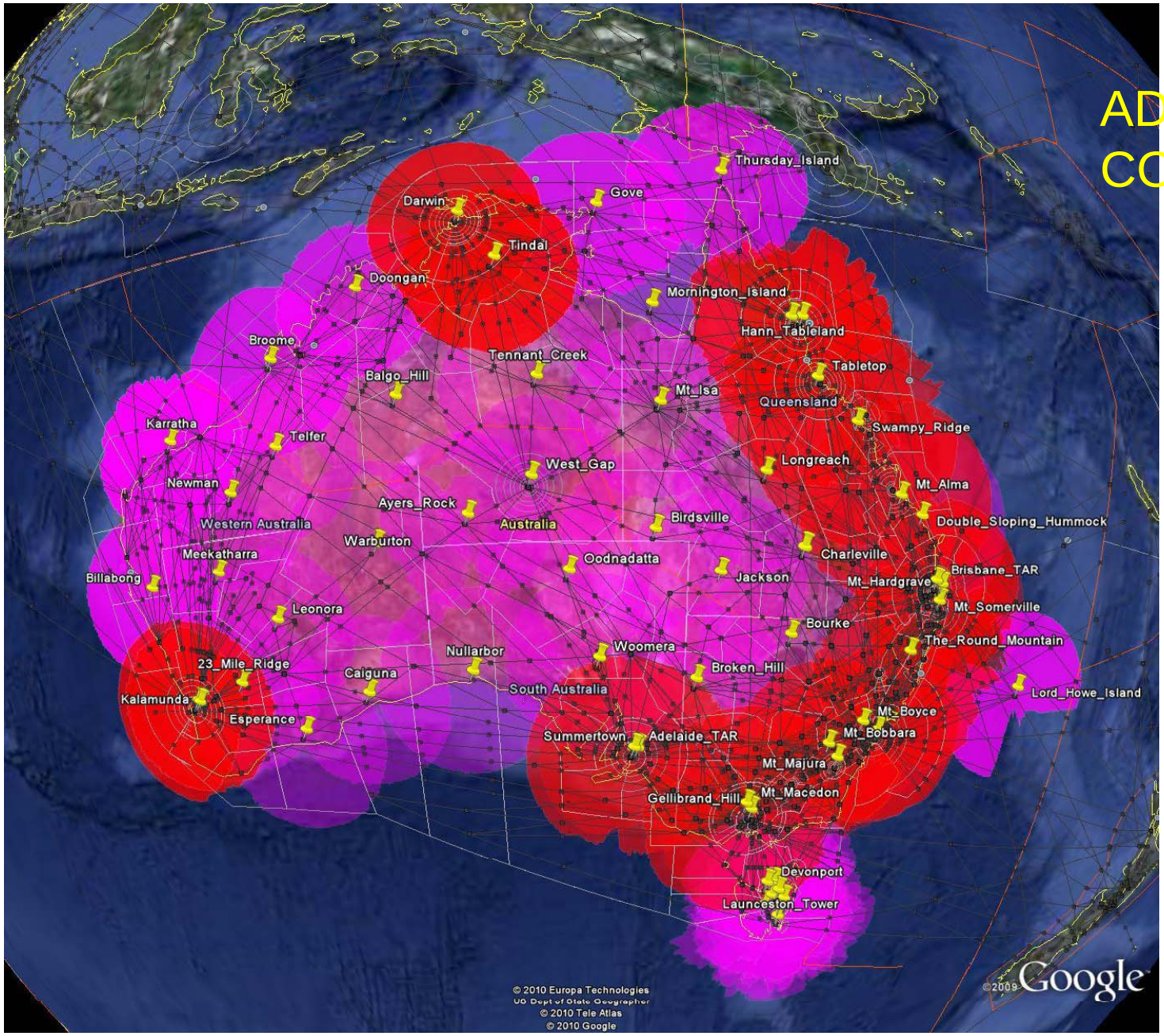

ADS-B Installation at Woomera
ADS-B antennas
Old tower
To be removed
Satellite Coms Link
to ATC centre
Slide from Airservices Australia

ADS-B Antenna Folding Pole at Billabong Roadhouse Satellite Ground Station



Slide from Airservices Australia



ADS-B UAP
COMPLETED

Information as in Aug 2010. Slide from Airservices Australia

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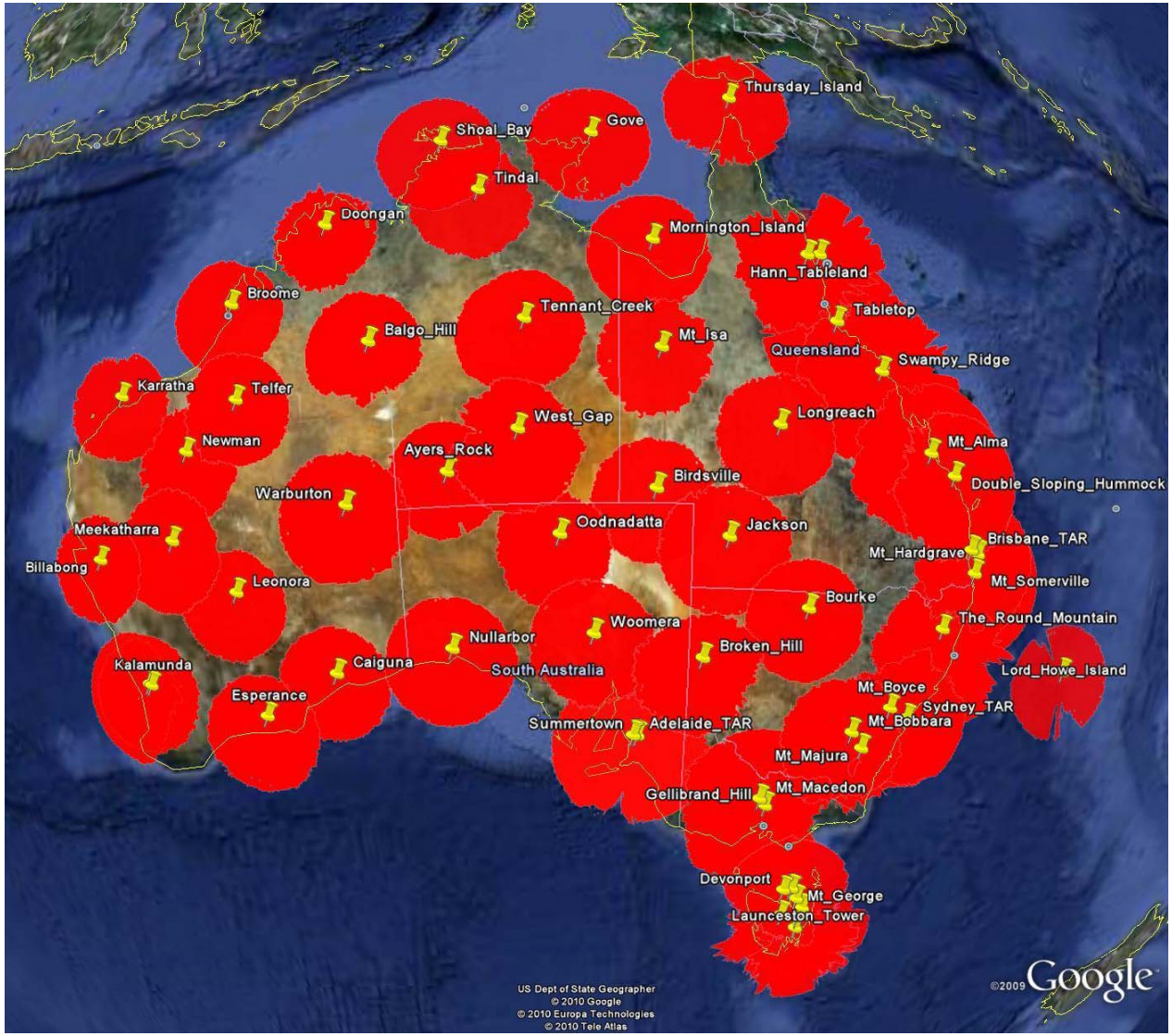

10,000 feet

ADS-B already provides significant coverage in lower level airspace

Information as in Aug 2010. Slide from Airservices Australia

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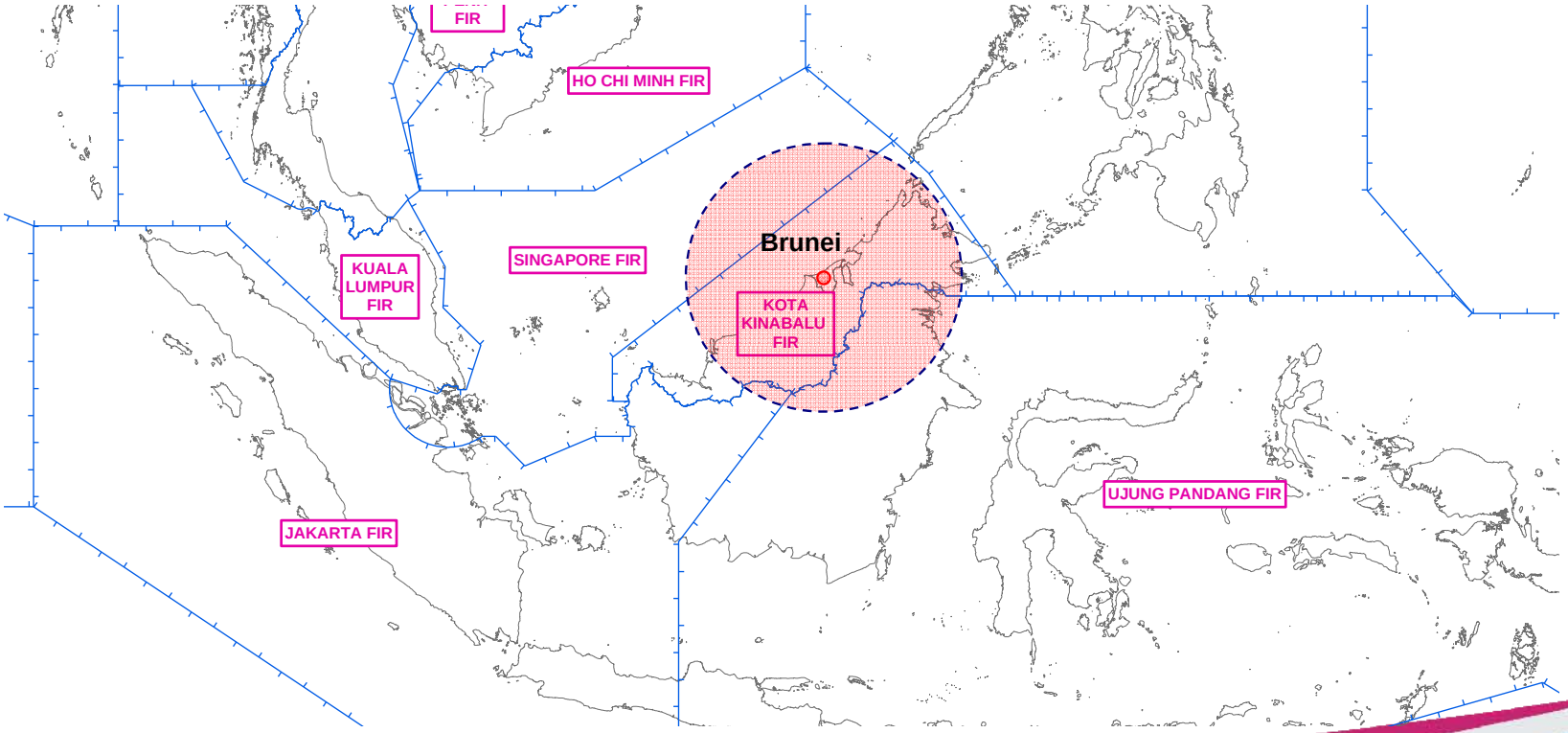
Australia (Wide Area Multi-Lateration & Other ADS-B Applications)

- Installed WAM/ADS-B at
  - Tasmania with 14 sites, commissioned.
- Planned WAM/ADS-B at
  - Sydney.

- Examining RVSM monitoring using ADS-B with FAA
- possible regional ADS-B requirements below FL290

Brunei Darussalam

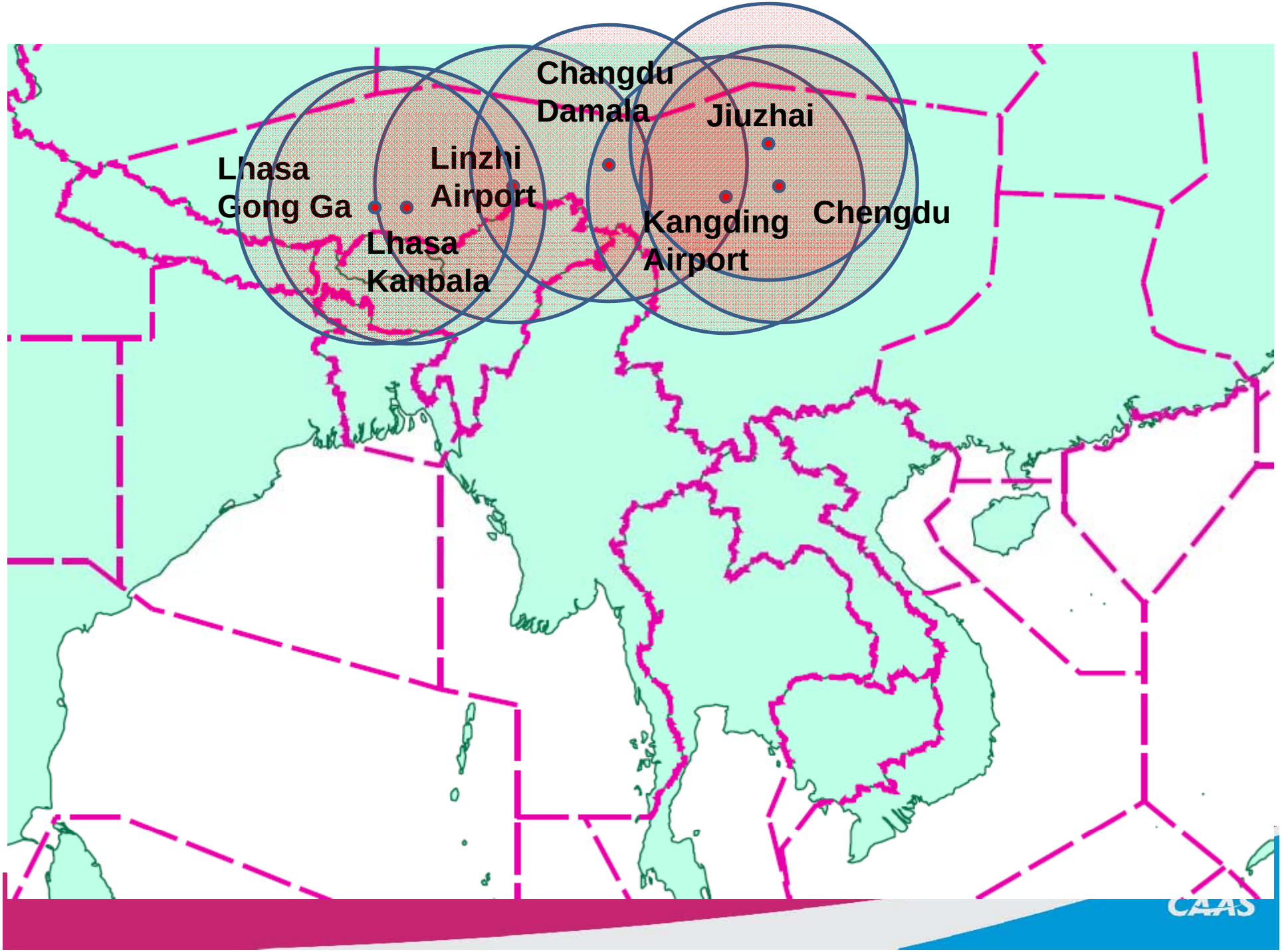
- Plans to install an ADS-B station to backup ATC surveillance system (as in Feb 2009).



China

- To install ADS-B ground stations by 2009 at*:
  - Lhasa Kanbala, Lhasa Gong Ga, Linzhi Airport, Changdu Damala and Kangding Airport
  - To enhance procedure control on ATS route between Chengdu and Lhasa
- Civil Aviation Flight University of China (CAFUC) installed*:
  - 7 ADS-B stations
  - ADS-B equipment on about 160 aircraft
- Installed ADS-B trial ground stations at**
  - Chengdu and Jiuzhai

*Information as in Apr 2008
**Information as in May 2009


Changdu
Damala
Jiuzhai
Linzhi
Airport
Lhasa
Gong Ga
Chengdu
Kangding
Airport
Lhasa
Kanbala

Fiji

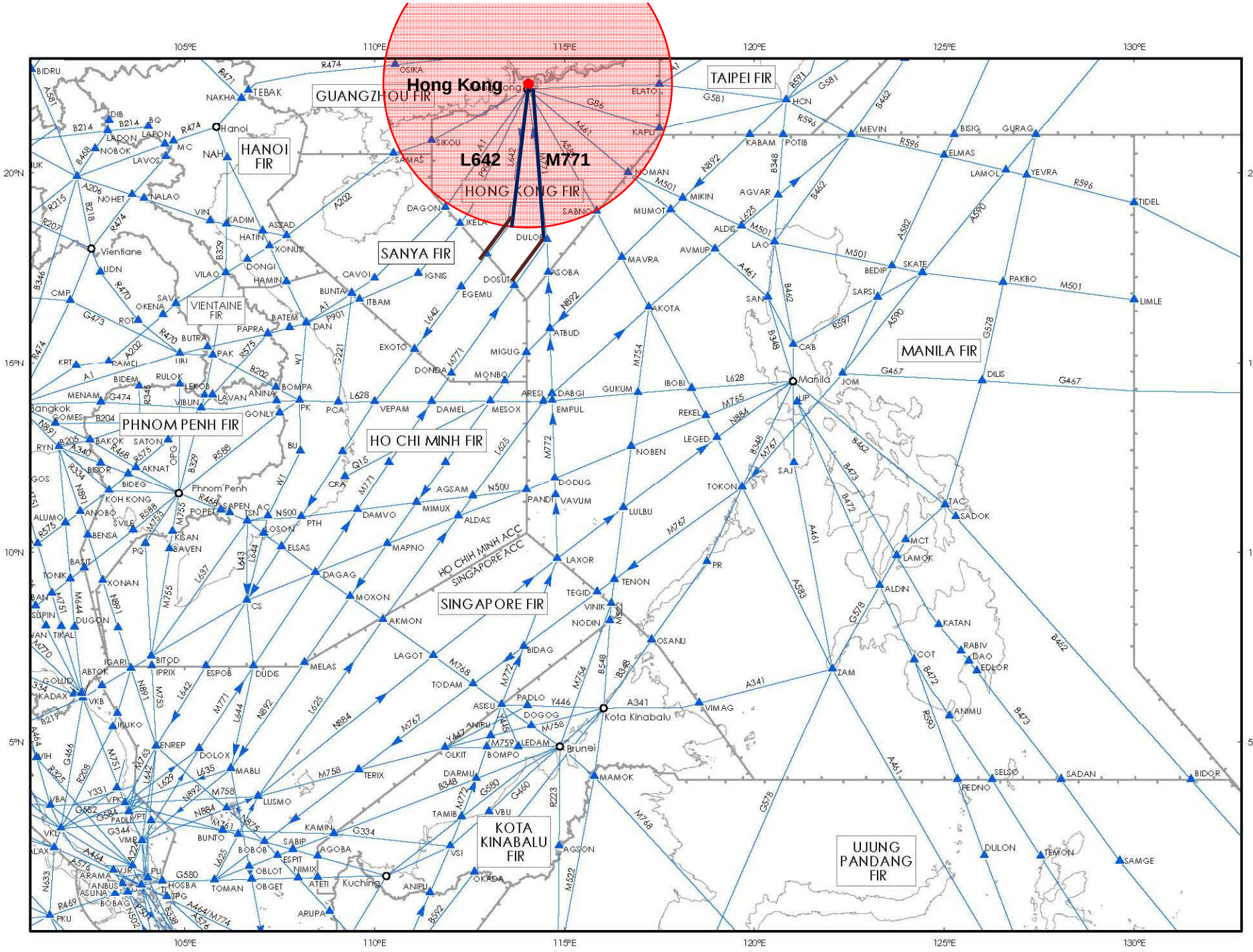
- No surveillance systems previously
- Plans to commission the following by end of 2009:
  - ATM system upgrade and/or replacement;
  - 8 ADS-B ground systems;
  - Provision of ADS-B avionics for Fiji –registered aircrafts; and
  - Airspace Restructure

Information as in May 2009

Hong Kong, China

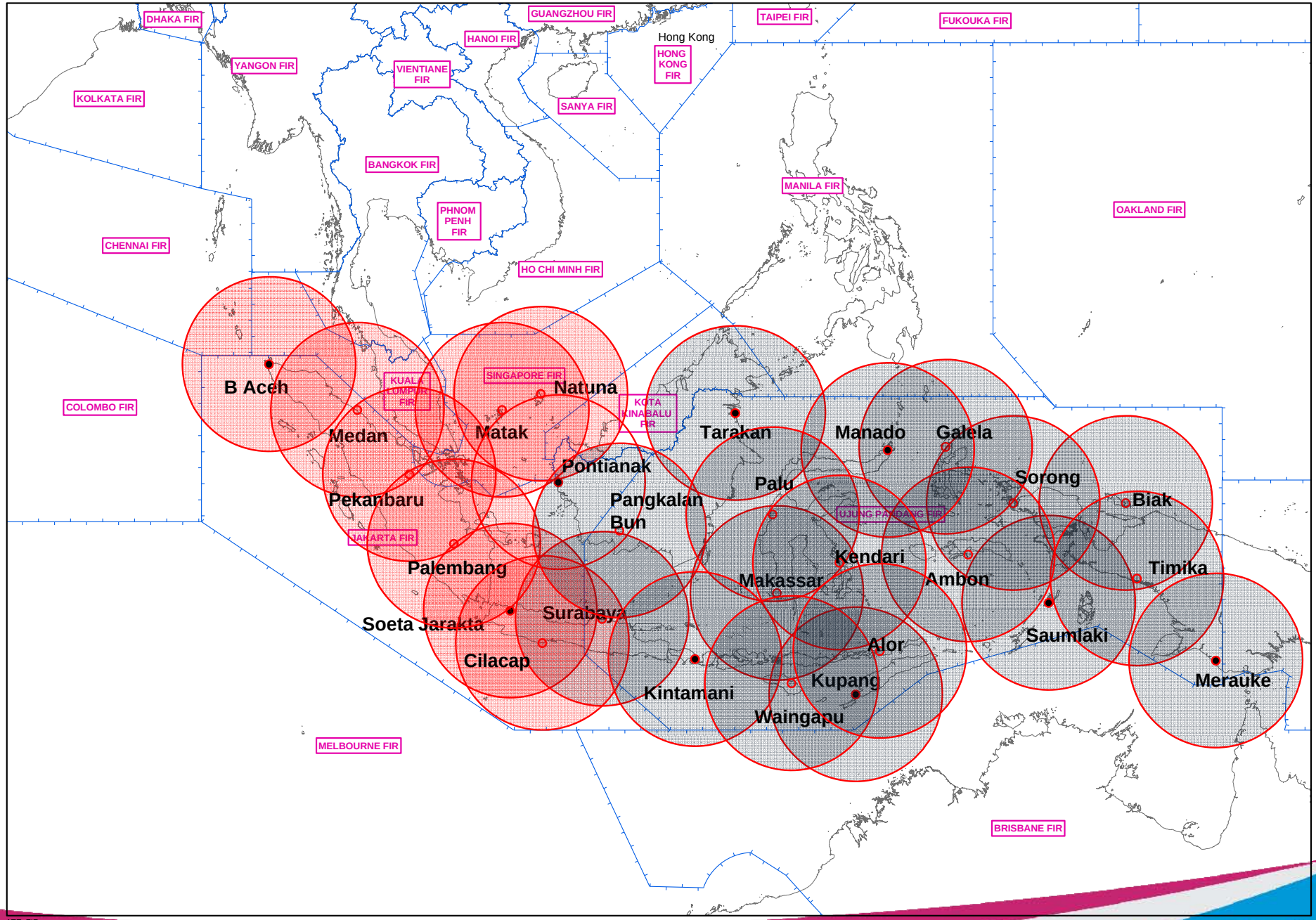
- Plans to install an ADS-B station
- Mandate ADS-B carriage by end 2013
  - for aircraft flying over L642/M771
- Mandate ADS-B carriage by end 2014
  - for all aircraft flying within the Hong Kong FIR
- Mandate ADS-B carriage after 2015 (TBC)
  - for low flying aircraft, including general aviation aircraft and helicopters.

Information as in Jan 2010


Hong Kong
L642
M771
HONG KONG FIR
GUANGZHOU FIR
TAIPEI FIR
HANOI FIR
SANYA FIR
VIENTAINE FIR
PHNOM PENH FIR
HO CHI MINH FIR
SINGAPORE FIR
MANILA FIR
KOTA KINABALU FIR
UJUNG PANDANG FIR
HO CHIH MINH ACC
SINGAPORE ACC
105°E
110°E
115°E
120°E
125°E
130°E
20°N
15°N
10°N
5°N
Hanoi
Vientiane
Bangkok
Phnom Penh
Manila
Kota Kinabalu
Brunei
Kuching

Indonesia

- Installed 27 ADS-B Stations at (as on Jan 2010):
  - Banda Aceh, Medan, Pekanbaru, Palembang, Matak, Natuna, Soeta Jakarta, Tarakan, Cilacap, Kintamani, Pontianak, Pangkalan Bun, Palu, Makassar, Waingapu, Kupang, Alor, Ambon, Sorong, Merauke, Saumlaki, Galela, Manado, Biak, Timika, Kendari, Syrabaya.
- 18 Stations in the East connected to Makassar Air Traffic Service (MAATS) ATM System
- 9 Stations in the West connected to RCMS of Jakarta Air Traffic Service (JAATS) ATM System



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Indonesia

- Plans:
  - To set up ADS-B Implementation Team Task Force for ADS-B planning.
  - Short Term:

    use ADS-B for ATC situational swareness in Makkasar Air Traffic Service Center (MATSC).
  - Initial Application:

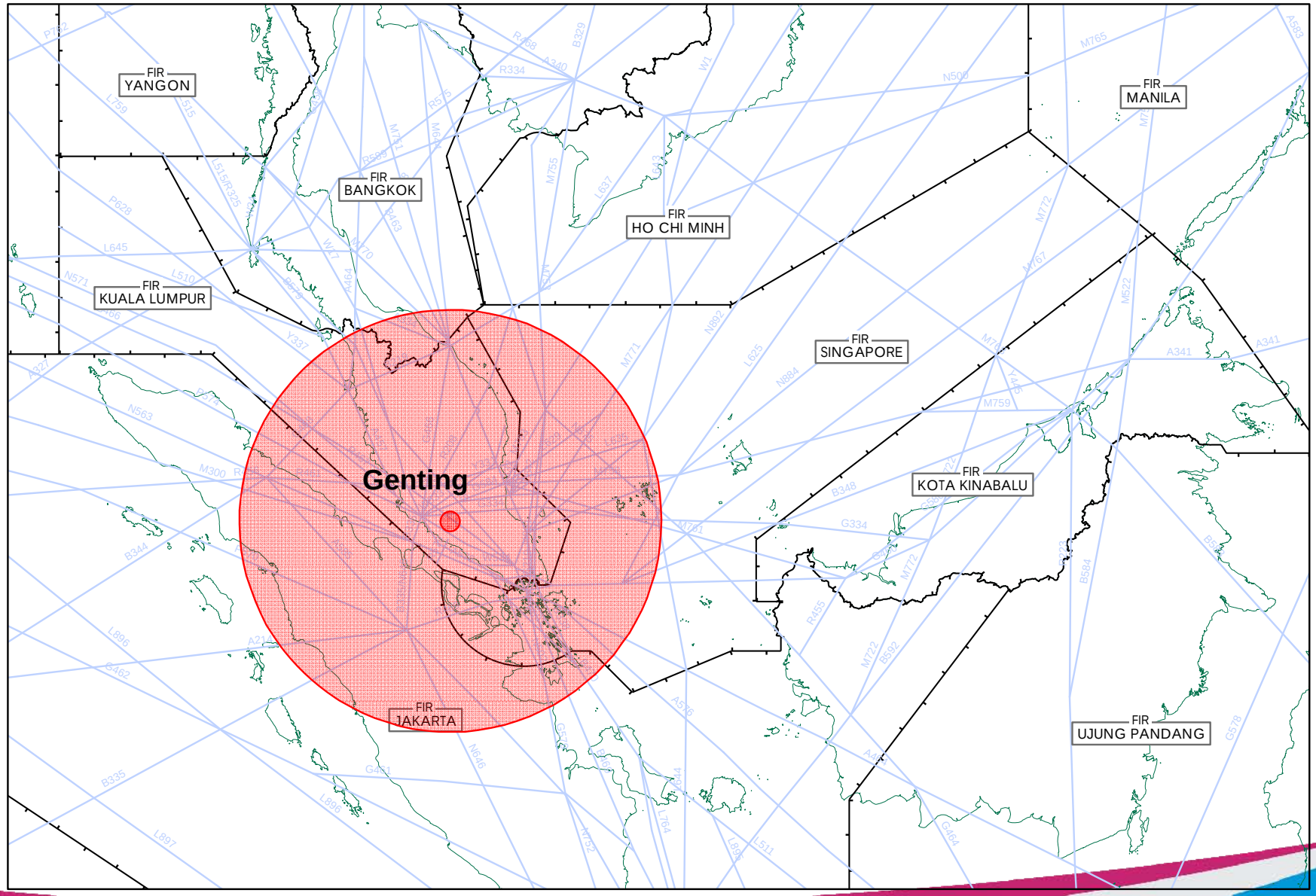
    cross FIR operational data sharing.
  - After succesful situational awareness phase: provision of separation services.

Malaysia

- Installed 1 ADS-B trial station in Genting (since Nov 2008).
- Installed Multi-lateration in Terengganu Airport (commissioned end of 2009).
- To upgrade ATM system by Apr 2011 to integrate with ADS-B**.

**Information as in Jan 2010

SINGAPORE AND ADJACENT FLIGHT INFORMATION REGIONS



New Caledonia

- ADS-B installation plans as follows:
  - Three ground stations will be installed at existing VHF sites by Mar 2009
  - Technical demonstration: Jul to Oct 2009
  - Technical testing: Oct to Dec 2009
  - Operational testing: end 2009 to mid 2010
- AFTN circuit between New Caledonia and Fiji will be upgraded by early 2010. Circuit can be used to carry ADS-B data.

Information as in May 2009

Pakistan

- One ADS-B station installed at Karachi ACC for one year trial (info as in May 2009)

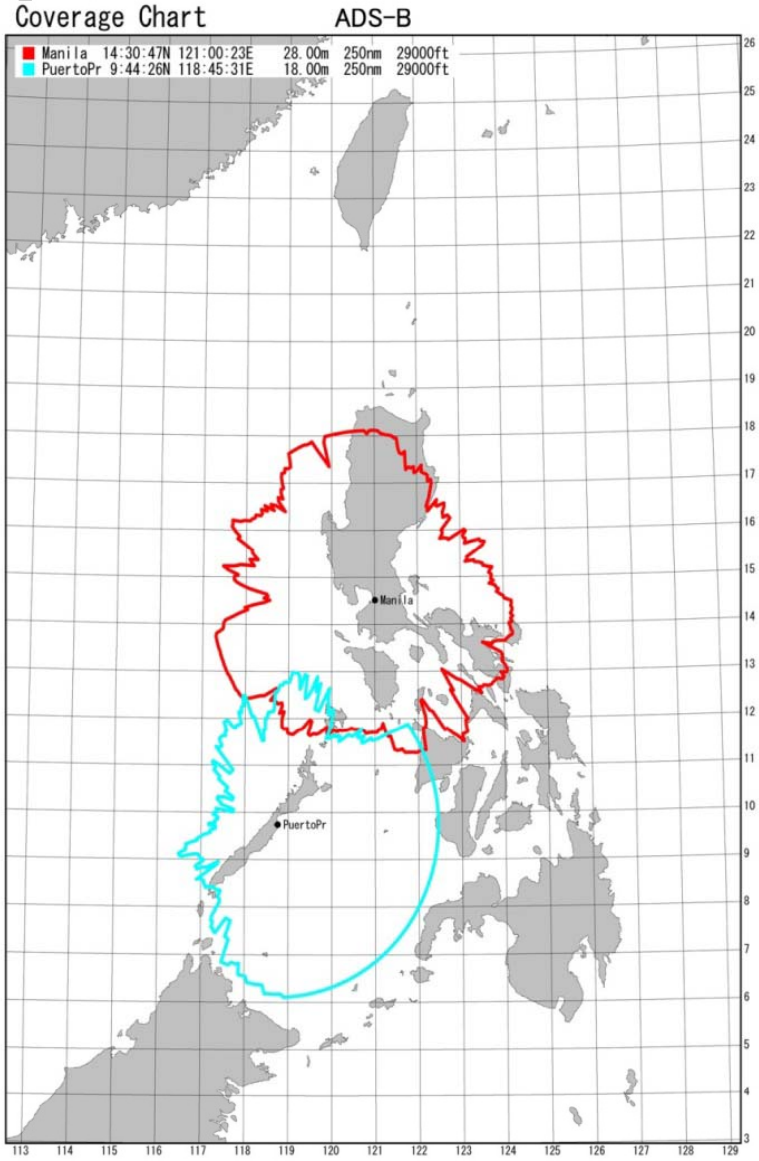
The Philippines

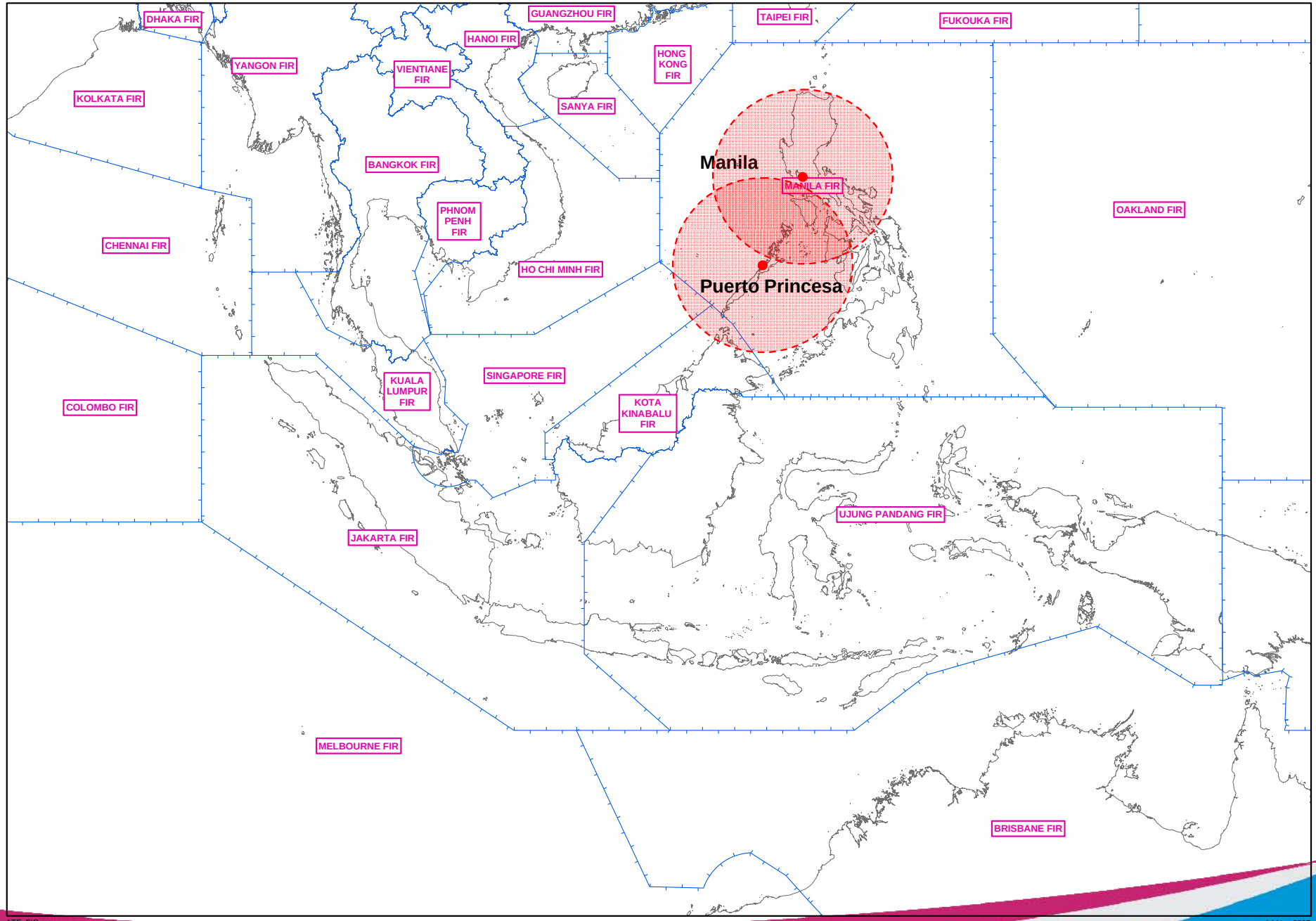
- Plans to install ADS-B stations by 2013 in Manila and Puerto Princesa*

- Additional ADS-B sites are being considered by CAAP. The possible sites are Aparri (North), Jomalig (East) and Quezon Palawan (Southwest)

* Information as on Aug 2010

The Philippines





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Republic of Korea

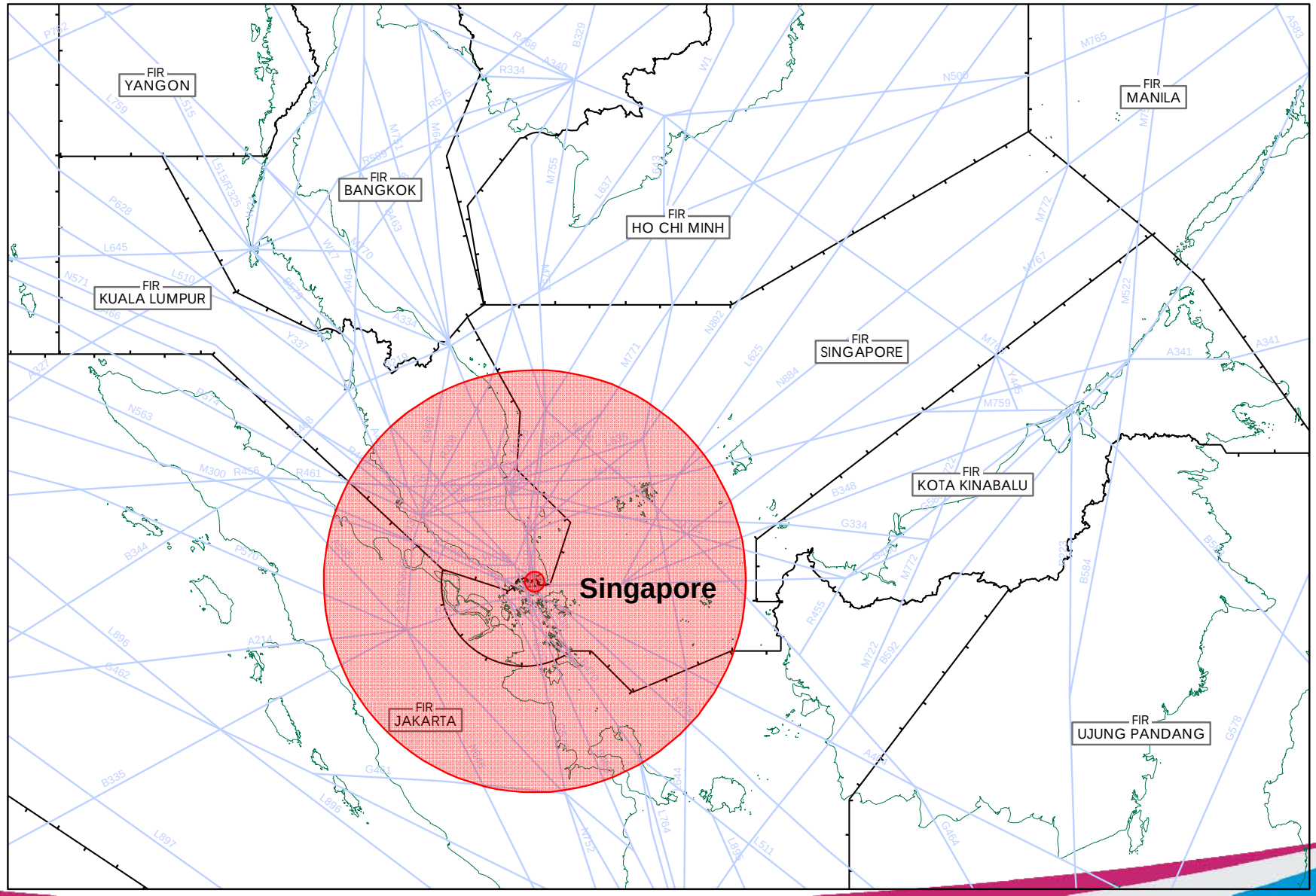
- Installed 2 ADS-B stations at Incheon International Airport.
- 35 ADS-B vehicle transmitters are installed for vehicle monitoring
- 15 portable ADS-B vehicle transmitters are available for future use

Information as in Apr 2008

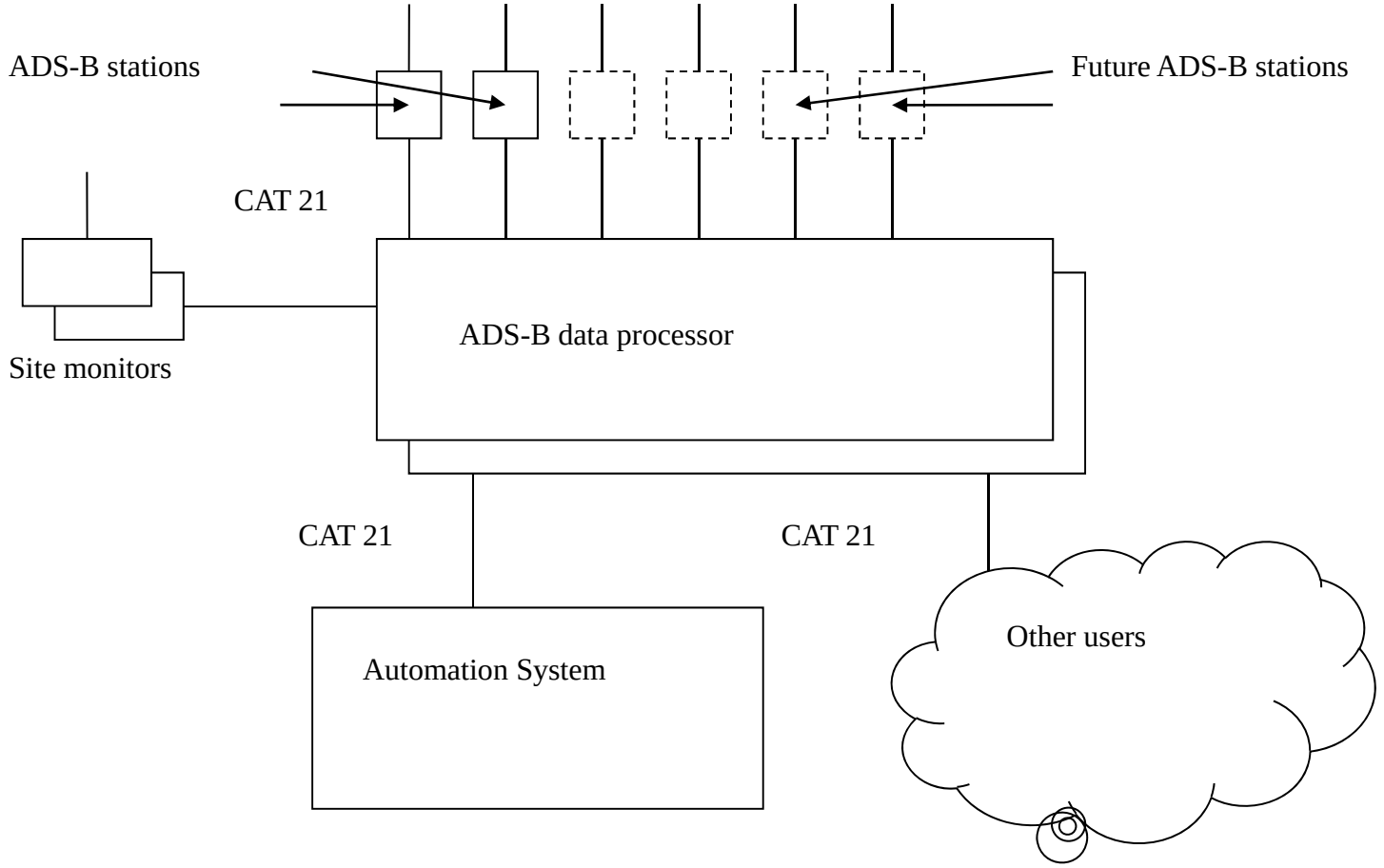
Singapore

- ADS-B
  - Installed 1 ADS-B station with filtering processor
  - Stand-alone position for operational trial: 2011
  - New ATM System with ADS-B processing capability: early 2012
  - Collaboration with Indonesia & Vietnam on ADS-B data and VHF comms facilities sharing
  - Plan to mandate ADS-B carriage by 2014
    - ✓ for aircraft flying over L642/M771
- Multilateration
  - Installed multi-lateration system at Changi Airport, with 21 stations, in Dec 2007

SINGAPORE AND ADJACENT FLIGHT INFORMATION REGIONS



ADS-B Architecture



Installation Sites

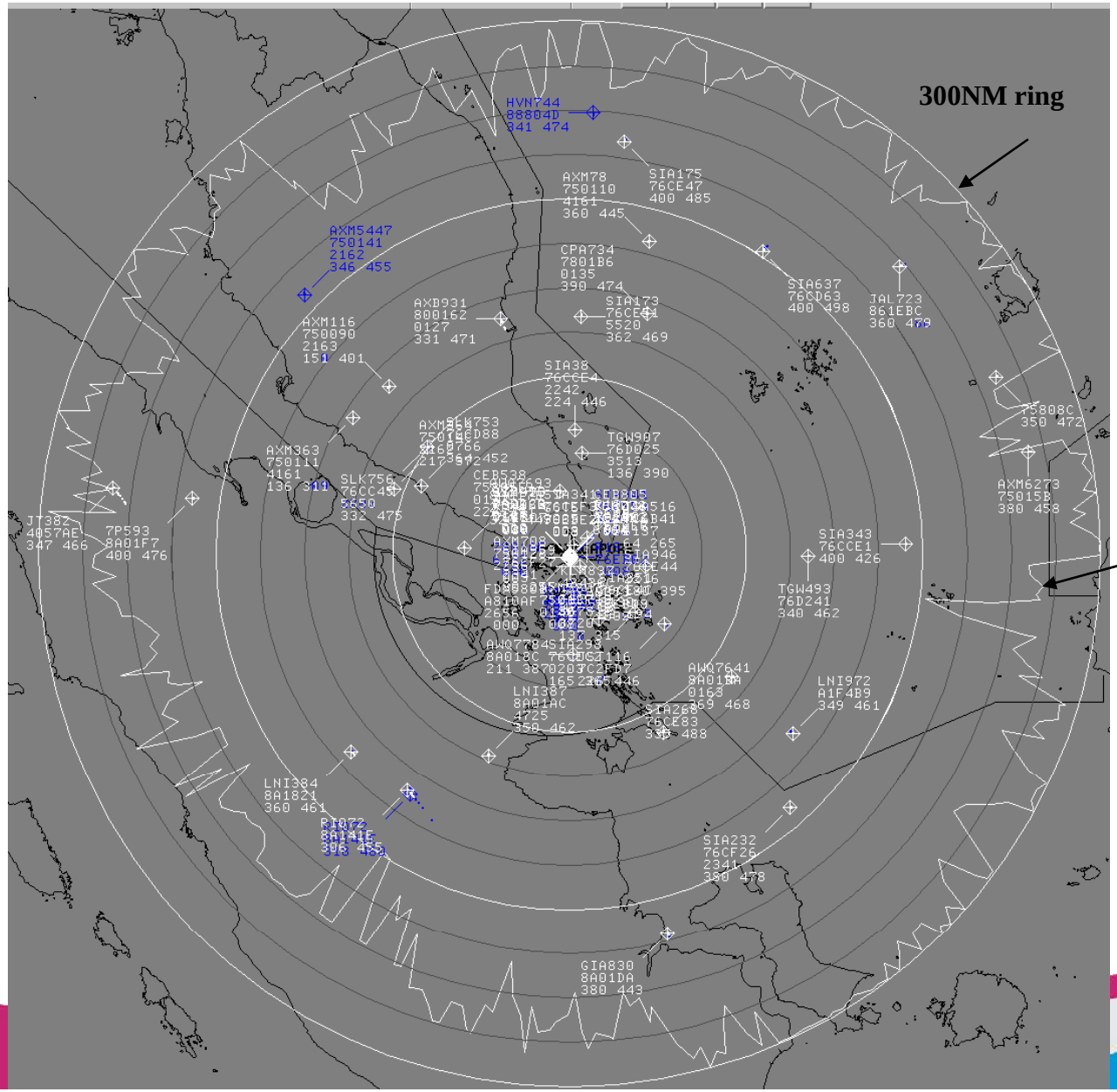
Sensor A

Site Monitors

Sensor B

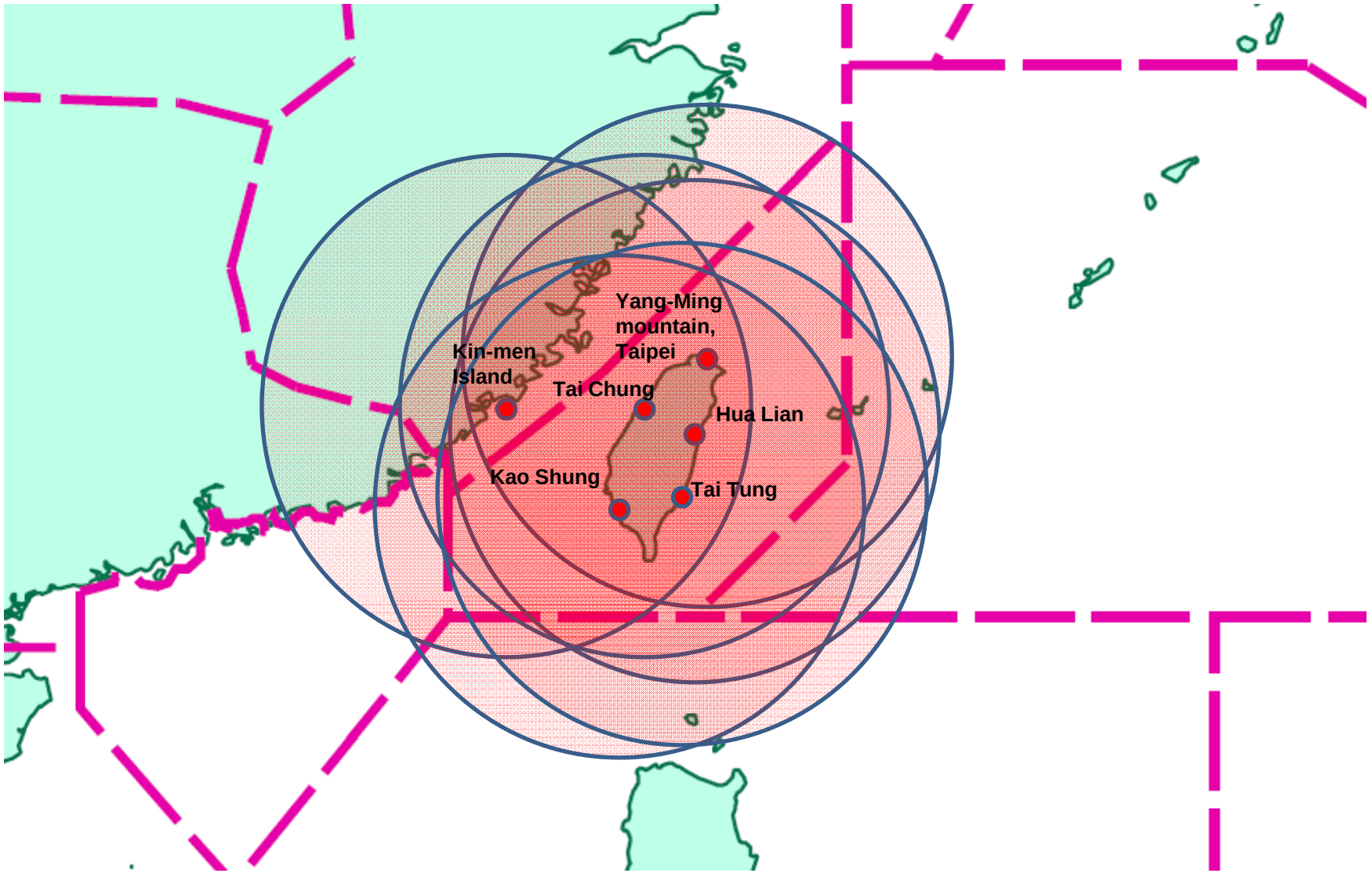
Data processor

ADS-B Coverage



Taiwan

- Installed 6 ADS-B trial stations at:
  - Yang-Ming Mountain (Taipei), Hua Lian, Tai-Tung, Kao-Shung, Tai-Chung and Kin-Men
- Installed Airport Multilateration at
  - Kinmen Airport with 6 sensors
  - Taoyuan Airport with 16 sensors
- Performing trials on Wide-Area Multilateration using the 6 ADS-B trial stations.


Yang-Ming
mountain,
Taipei
Kin-men
Island
Tai Chung
Hua Lian
Kao Shung
Tai Tung

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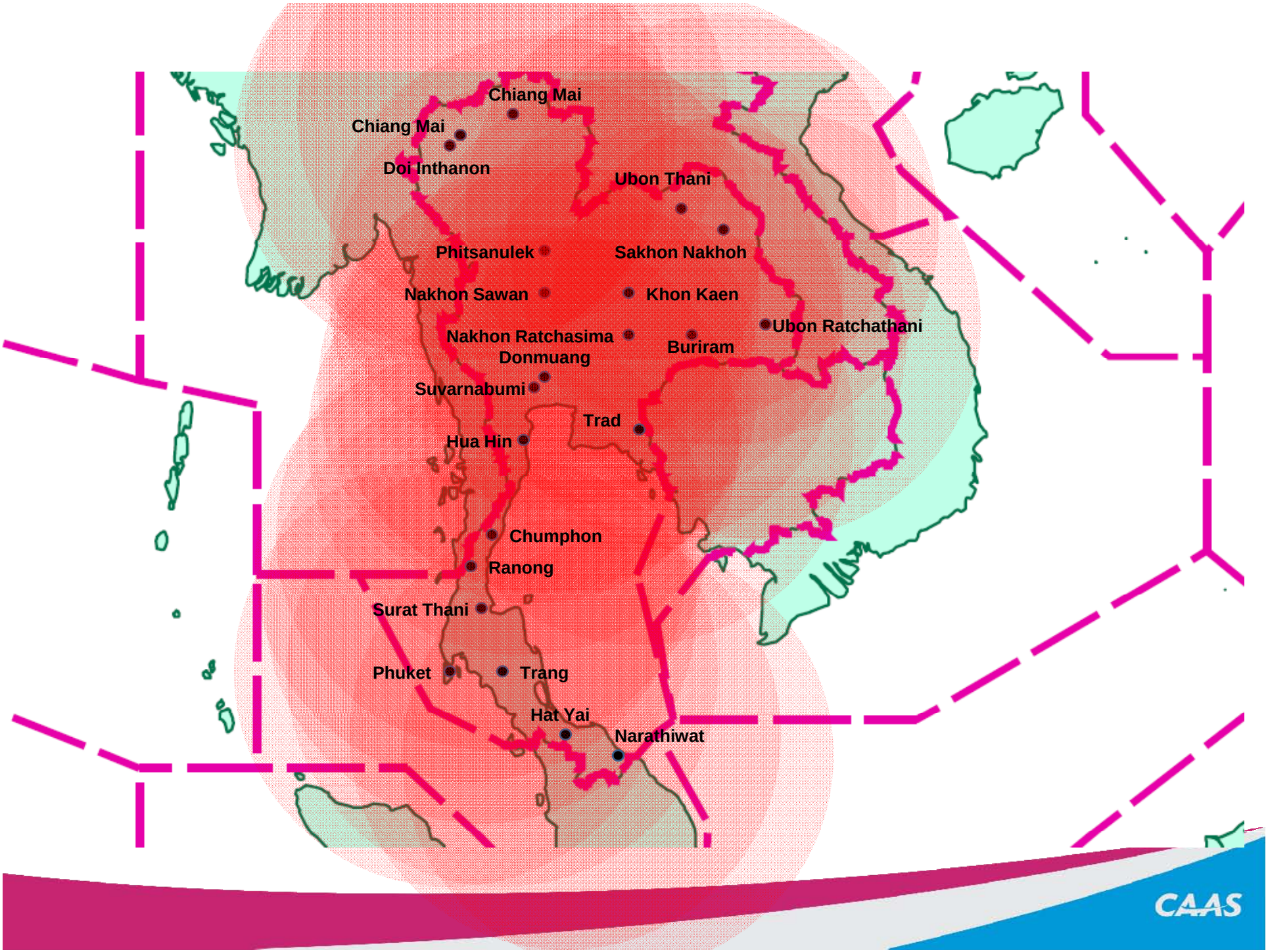
Thailand

- Installation of 22 ADS-B Stations in progress*:
  - Ubon Ratchathani, Hat Yai, Udon Thani, Chumphon, Trang, Samui (Surat Thani), Chiang Mai, Chiang Rai, Khon Kaen, Phitsanulok, Doi Inthanon (Chiang Mai), Nakhon Ratchasima, Sakhon Nakhon, Buriram, Suvarnabhumi (Samut Prakan), Donmuang (Bangkok), Hua Hin (Prachuap Khiri Khan), Phuket, Narathiwat, Trad, Nakhon Sawan, and Ranong.
  - FAT scheduled to be completed in Sep 2010**
  - Project scheduled to be completed by end 2010**

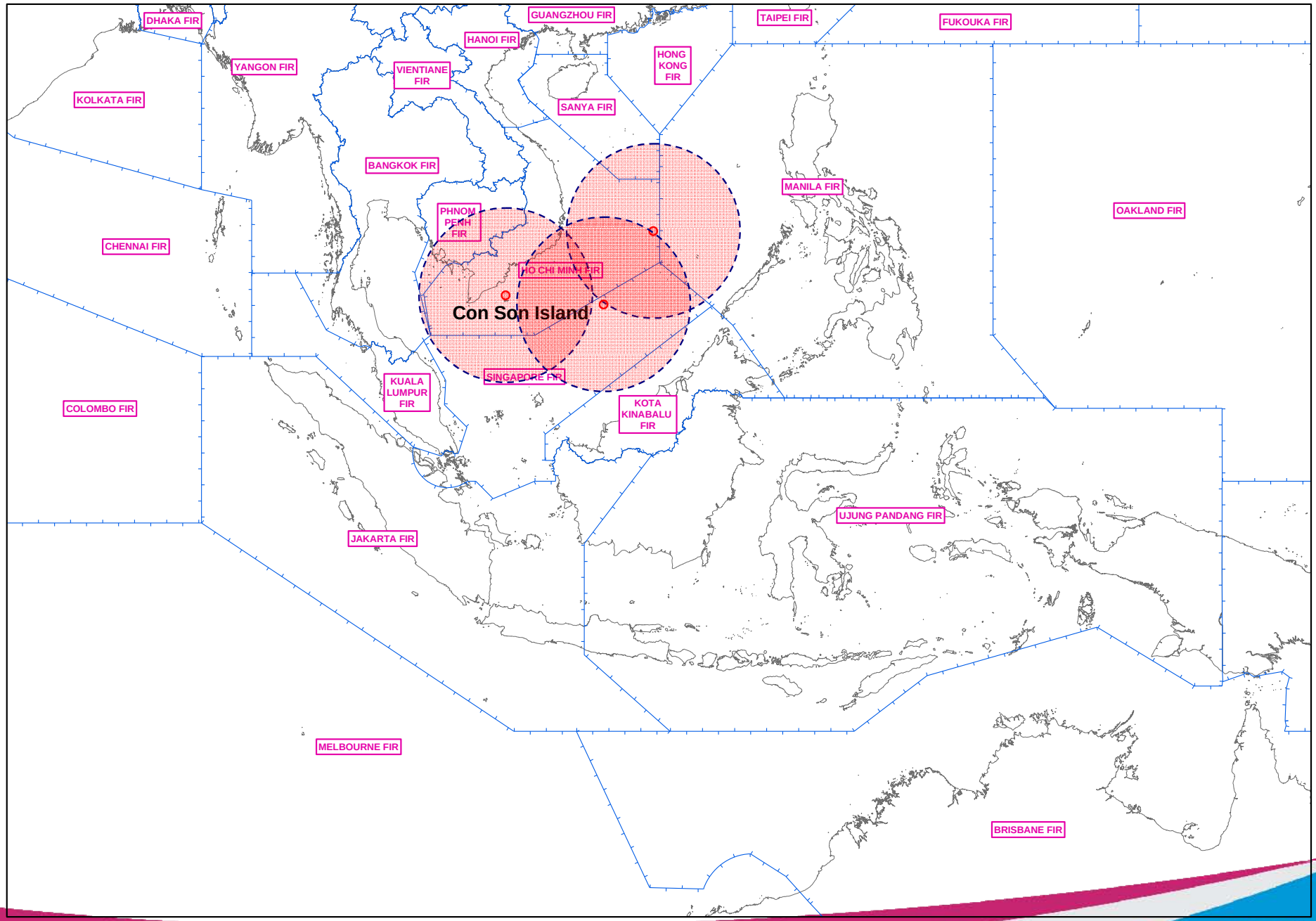
*Information as in Feb 2009
**Information from supplier as in Aug 2010


Chiang Mai
Chiang Mai
Doi Inthanon
Ubon Thani
Phitsanulek
Sakhon Nakhoh
Nakhon Sawan
Khon Kaen
Ubon Ratchathani
Nakhon Ratchasima
Donmuang
Buriram
Suvarnabumi
Trad
Hua Hin
Chumphon
Ranong
Surat Thani
Phuket
Trang
Hat Yai
Narathiwat
CAAS

Viet Nam

- Plans to install three ADS-B stations including one at Con Son island*
- Considering installation of VHF radio station at Con Son for Singapore's use**
- Plans to upgrade ATM system in Ho Chi Minh to integrate with ADS-B**
- Plans to install new ATM system with ADS-B processing capability at Hanoi**

*Information as in April 2008
** Information as in May 2009



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14 Nov 2007

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Conclusion

- ADS-B is widely installed in Asia Pacific Region
- Large percentage of aircraft will be equipped following the equipage mandates in the region
- Expect significant operational benefits from ADS-B implementation

Thank You