



*International Civil Aviation Organization*

**Automatic Dependent Surveillance – Broadcast (ADS-B)  
Study and Implementation Task Force**

Brisbane, Australia, 24-26 March 2003

**Agenda Item 3: Evaluate information available on the selection of link technology as the preferred technology for Asia/Pacific Region**

**ADS-B GROUND INFRASTRUCTURE AVAILABILITY**

**SUMMARY**

Significant progress has occurred in the development of ADS-B technology and standards during the past few years. Production quality ground infrastructure hardware and software is now readily available and being deployed around the world at a reasonable cost. This paper presents the perspective of an ADS-B subsystem manufacturer regarding the maturity and availability of ADS-B technology.

(Presented by Australia)

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**1. Background**

1.1 ADS-B offers the potential for enhanced aviation surveillance at a fraction of the cost of traditional rotating radar systems. Successful transition to ADS-B usage depends upon positive cost/benefit cases, creation of regulatory standards, ground infrastructure availability/deployment, avionics availability/deployment and ATC automation updates.

**2. ADS-B Status**

2.2 Significant progress has been made over the past several years on many of the issues that stand between the current radar-based ATC system and one that is augmented by ADS-B surveillance. Standards have been solidified. Production ground and airborne equipment is available. Numerous operational trials and experimental demonstrations are underway around the world.

2.3 One of the primary impediments to industry progress on ADS-B is the issue of a link decision. Three possible links exist – Mode S 1090ES, UAT and VDL Mode 4. The standards defining all three links are fairly mature. Each link has benefits and drawbacks depending on the application to which it is applied. Progress on this issue has now been made. Of particular note:

- In the past year, both the FAA and EUROCONTROL have formally announced link decisions;
- In both cases, the Mode S 1090ES link is the preferred link for early adoption and development of applications, particularly for transport class aircraft;
- EUROCONTROL acknowledges the need for an additional link to support more advanced, future data link concepts and proposes the use of VDL Mode 4;

- The FAA similarly acknowledges the need for an additional link to support more advanced, future data link concepts and proposes the use of UAT.

2.4 Supporting these broad link decisions by the FAA and EUROCONTROL are some industry developments that further clarify the link issue including:

- Airbus has stated its intent to begin equipping all new transport class aircraft it produces with Mode S 1090ES as a standard feature;
- The FAA's ASDE-X airport surface management system with integral Mode S 1090ES processing, once deployed, offers a significant ADS-B ground infrastructure in the US (see Figures 7 - 8 for details);
- Eight major European airports are installing similar airport surface management system with integral Mode S 1090ES processing (see Figure 9 for details);
- NASA, FAA and US Department of Transportation are conducting ongoing Mode S 1090ES ADS-B trials in the Gulf of Mexico (see Figures 4 - 6 for details);
- Airservices Australia is completing preparation for an operational trial of Mode S 1090ES in Bundaberg, Queensland, Australia (see Figures 1 - 3 for details);
- UPS, a US freight carrier, is in the process of installing Mode S 1090ES ADS-B avionics on all 107 Boeing 757s and 767s it operates;
- Several avionics vendors have certified Mode S 1090ES avionics solutions available for purchase today – for both transport-class as well as for business jet and general aviation.
- Sensis Corporation, the supplier of the ground infrastructure for the above mentioned programs has shipped over 150 ground stations capable of processing Mode S 1090ES ADS-B messages and also offers a DO-260A compliant airport vehicle transponder (see Figure 10 for details).

2.5 The above points demonstrate the maturity and availability of the Mode S 1090ES equipment – both avionics and ground infrastructure. As important as the availability of these systems is the affordability of them. Prices may vary widely based on customer-specific requirements and quantity purchased, but a single Mode S 1090ES ADS-B ground station can cost anywhere from \$150,000 - \$300,000 USD, including installation. The variability of pricing typically depends upon customer requirements regarding redundancy, training, documentation, testing, logistic support and site preparation. Large quantity purchases typically result in significant discounts from these prices. Customer project management, oversight, data communication services and other similar costs are not included in this estimate.

### **3. Recommendation**

3.1 The meeting is recommended to acknowledge the broad support for Mode S 1090ES data link for transport-class aircraft and early application development as well as the availability and affordability of the necessary technology to support deployment of ADS-B airborne and ground systems.

**Airservices Australia Bundaberg ADS-B Trial**

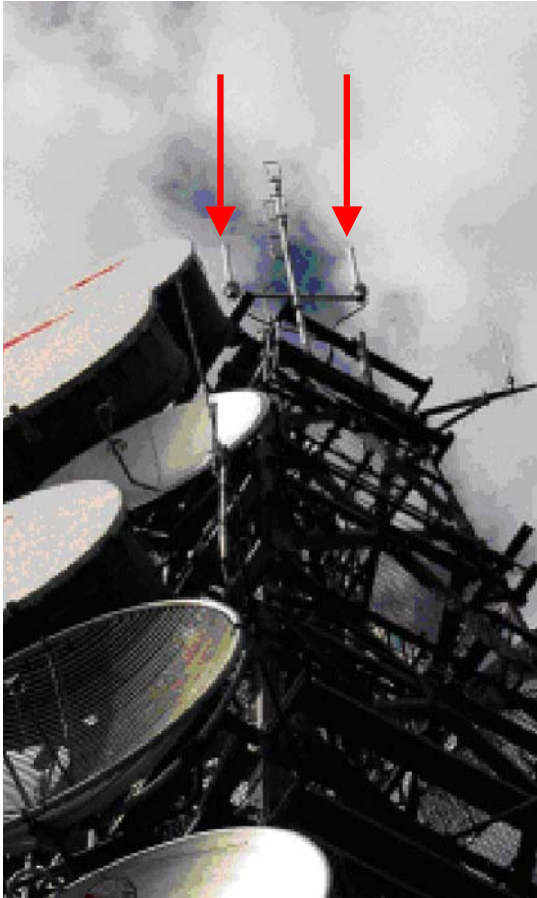


Figure 1 -- Mode S 1090ES ADS-B Antennas Installed On Existing Communication Tower



Figure 2 -- Redundant Mode S 1090ES ADS-B Ground Stations Installed In An Shelter At Base of Communication Tower  
**NASA HITS/GOMEX ADS-B Trial**

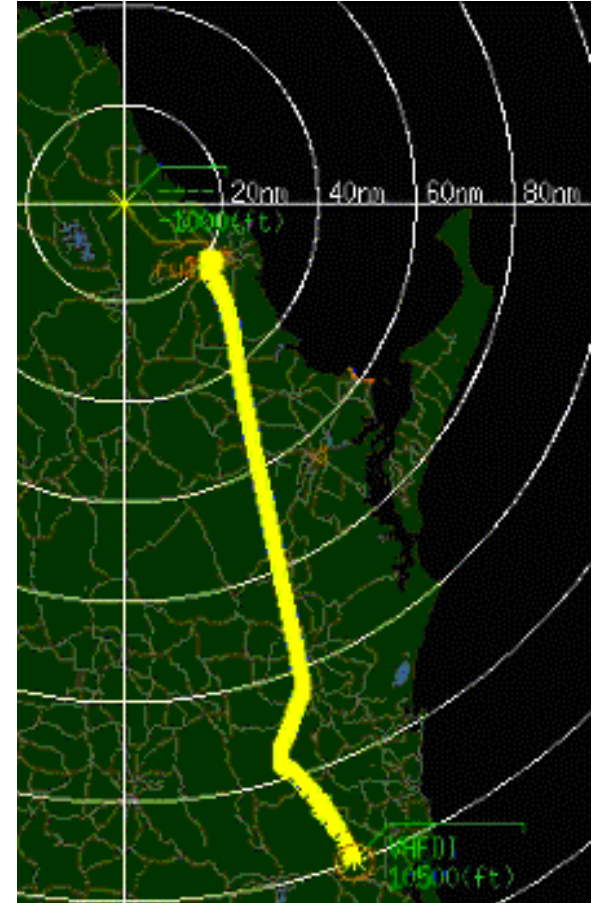


Figure 3 -- Surveillance Track of Mode S 1090ES ADS-B Equipped Aircraft with Coverage In Excess of 140 nmi

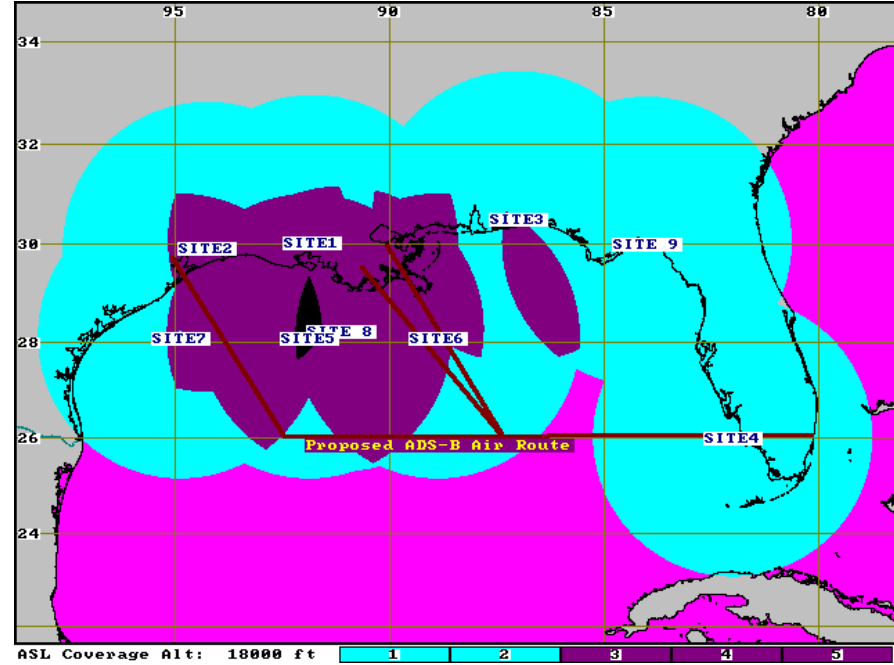


Figure 4 -- Mode S 1090ES ADS-B and Multilateration Ground Stations Deployed On Oil Platforms In Gulf of Mexico For Helicopter and En Route Tracking

Figure 5 -- Mode S 1090ES ADS-B and Multilateration Antennas Installed On Existing Communication Tower On Representative Oil Platform

Figure 6 -- Proposed Expansion of HITS/GOMEX System Under Phase II of Project. Provide Significant Wide Area Multilateration Coverage (Inner Region) And ADS-B Air Route To Florida (Outer Region)



**FAA ASDE-X Program**



Figure 7 -- Sample Mode S Multilateration and 1090ES ADS-B Ground Station Installation for FAA ASDE-X Program.

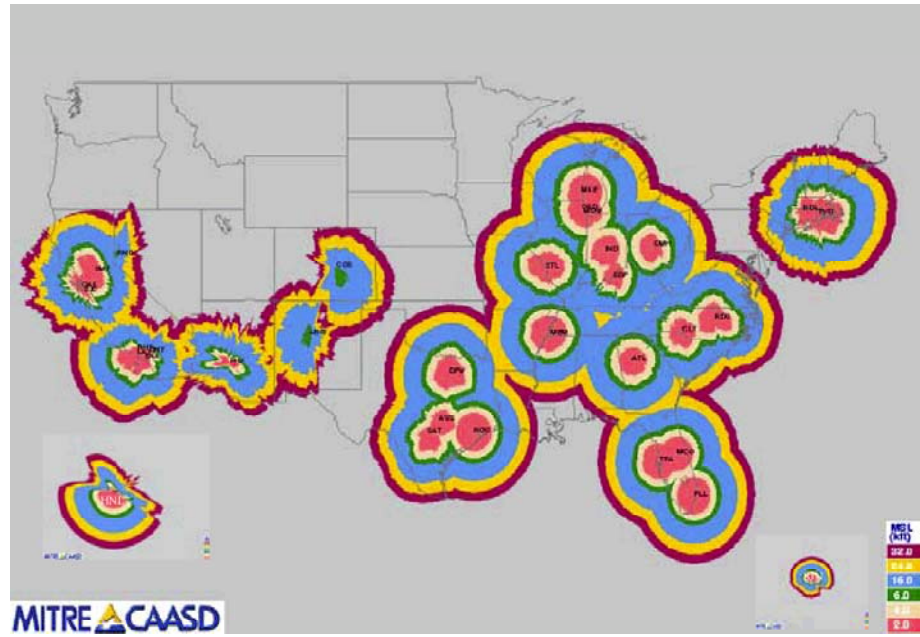


Figure 8 -- Theoretical Mode S 1090ES ADS-B Coverage From ASDE-X Airports – Significant Potential Coverage of Major Terminal And En Route Airspace.

**Other Supporting Projects**

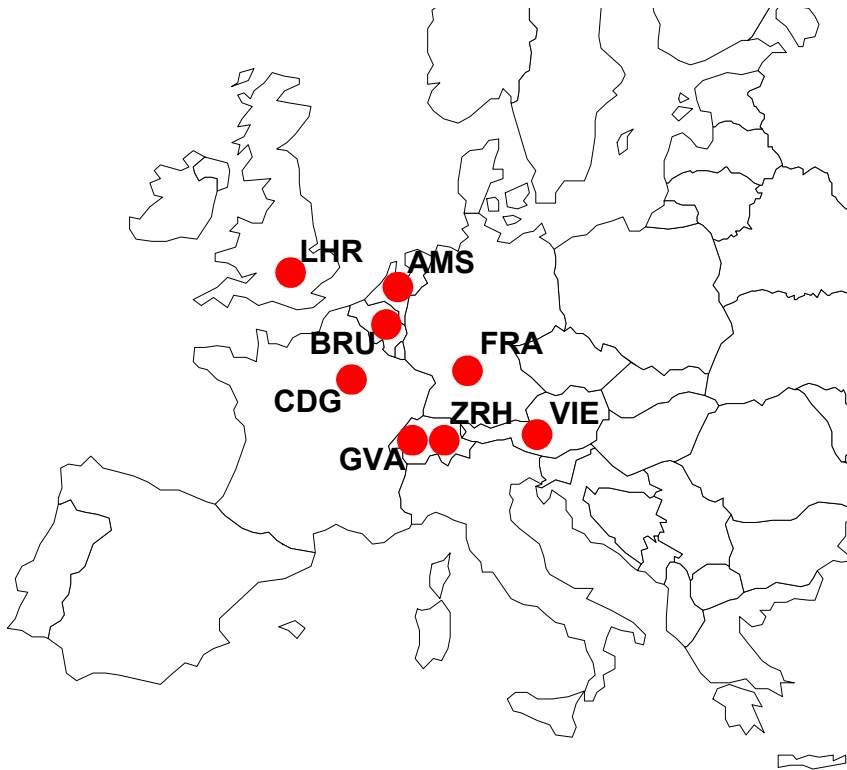


Figure 9 -- European Airports With Operational or Ordered Mode S Multilateration and 1090ES ADS-B Airport Surface Surveillance Systems.



Figure 10 -- Low Cost Mode S 1090ES, DO-260A Compliant, Vehicle Transponder. Transmit Only for Airport Surface Vehicles.