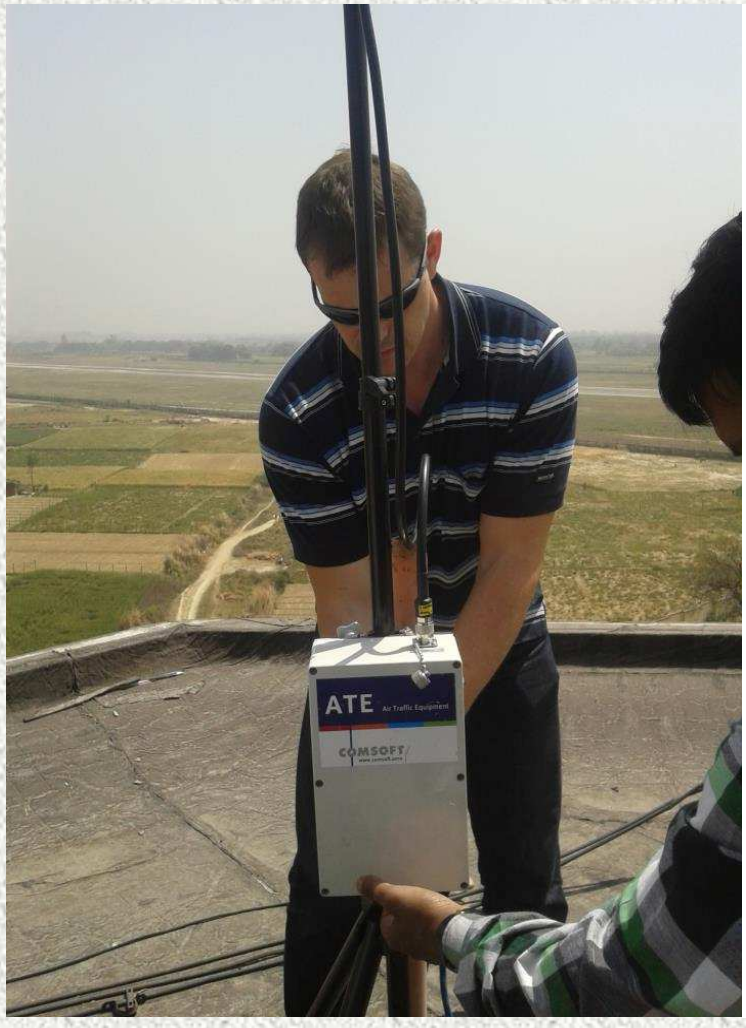
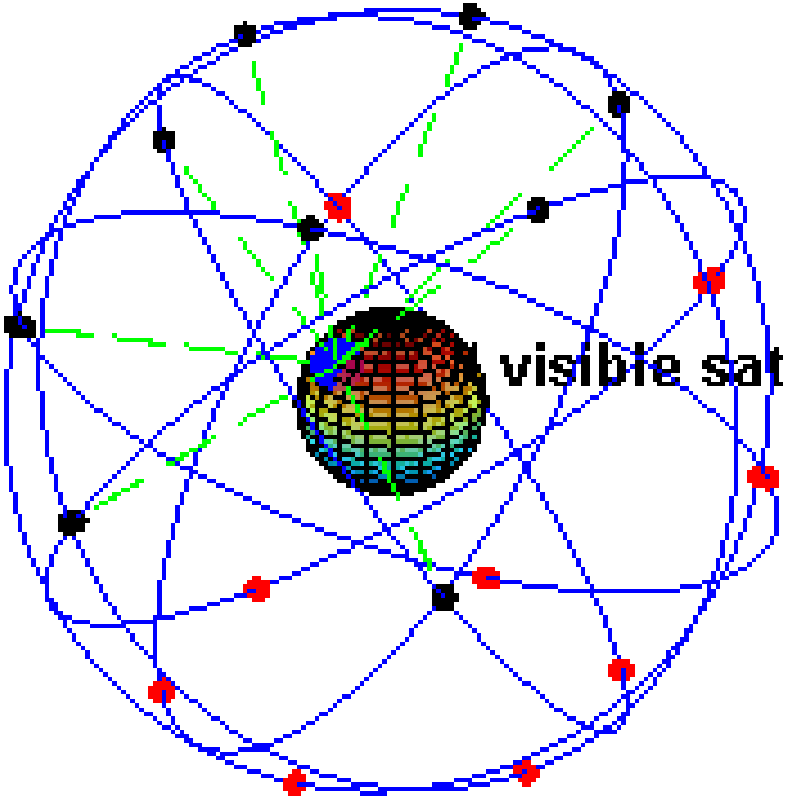
ADS-B: OPERATIONAL IMPLEMENTATION ADVANTAGES





GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

ACRONYMS

ADS-B	Automatic Dependent Surveillance – Broadcast
ASTERIX	All Purpose Structured Eurocontrol Radar Information Exchange
FOM	Figure of Merit used in ASTERIX messaging
HPL	Horizontal Protection Level
NUC	Navigation Uncertainty Category
NAC	Navigation Accuracy Category
NIC	Navigation Integrity Category
SIL	Surveillance/Source Integrity Level

MULTI-PATHING

- GPS: Multipath is possible, but the possibility of multipath errors are at least minimized with a clear sky view since the GPS will have more than the minimum 4 satellites in view and can discard the "bad" measurements.

- ADS-B: The time stamp is accompanied on each ADS-B broadcast signal, multi-pathing may NOT result in wrong position reporting . Further safeguards NUC/NIC, NAC, SIL unlike Radars.

POSITION UPDATING

- Radar: Typical 4-5 second update (ASR)
  Typical 12-15 second update (ARSR)
- ADS-B: Two position updates per second.

- Controller automation display: Screen refresh rate approx. every 5 seconds for uniformity. Controllers cognitive skills are not affected adversely.

Hex	Binary
2CB862	00101100 10111000 01100010

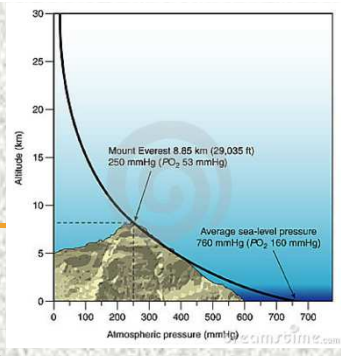
FLIGHT_ID / 24-BIT ADDRESS

- Mode A / Mode C: 4-digit octal numbers. Maximum 4096 combinations. Discrete codes limited to 4032 for worldwide use.
- Mode-S: 24-bit address. More than 16 million combinations possible.

- ADS-B: 24-bit address (Mode-S extended squitter). Benefitted with uniqueness of addresses. Six digit hex code.

Flight_Id needs to be checked/ updated before each flight .

GEOMETRIC ALTITUDE
SUPERIOR TO PRESSURE ALTITUDES



- Pressure Altitude: Based on imaginary standard atmospheric conditions. Pressure gradient may not behave as assumed.
- Geometric altitude: Mathematically calculated altitude available for aviation. Would find place in future developments.

Vertical accuracy of the order of 10 to 20 meters is achievable. Even these errors can then be corrected for in the mathematical processing in the receiver.

ADS-B: ADVANTAGES

- ADS-B increases safety and efficiency.

- ADS-B receives data directly from transmitters rather than passively scanning for input like radars, so it does not have a problem with clutter.

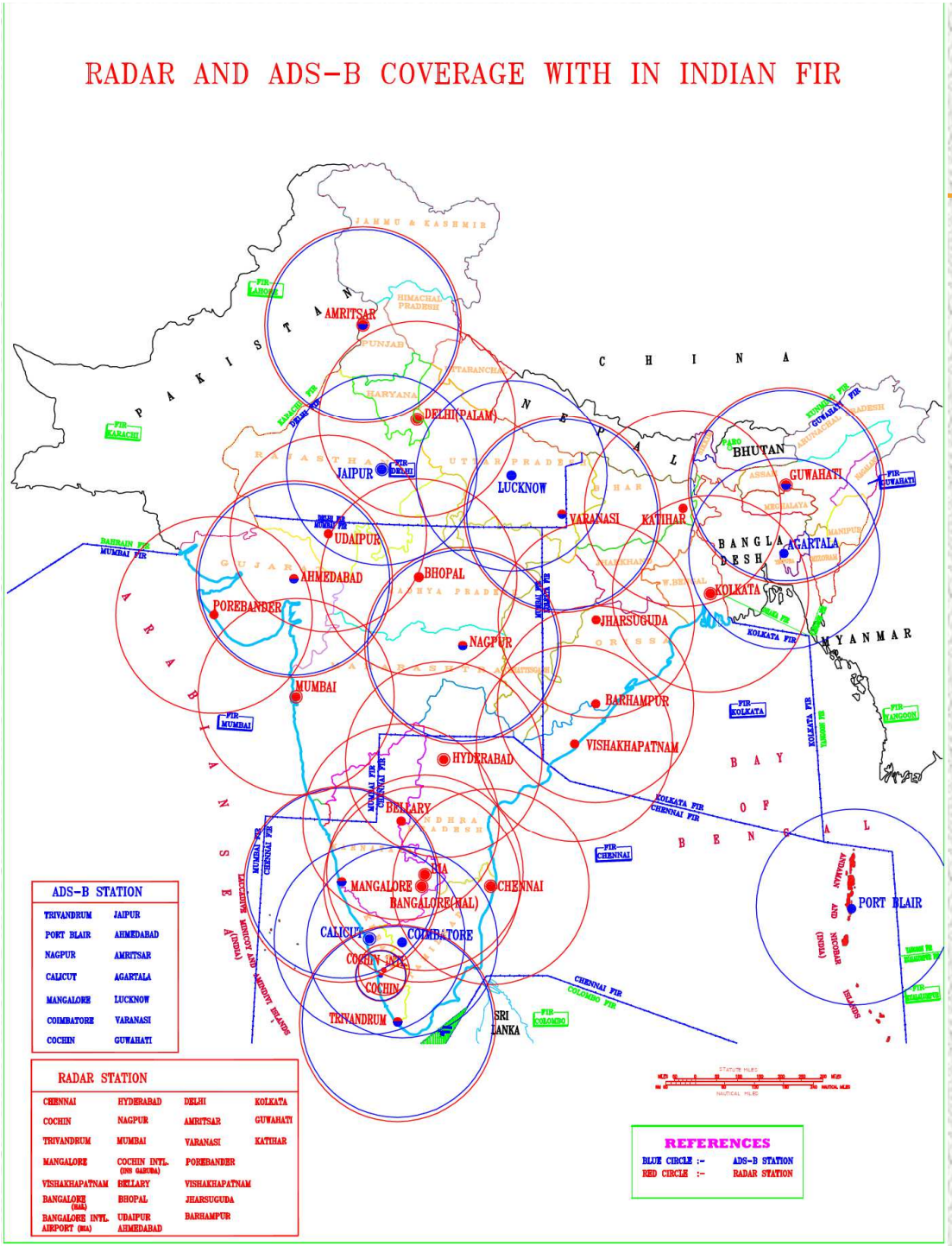
- ADS-B's accuracy doesn't degrade with distance.

- ADS-B updates in real time.

- ADS-B ground stations are inexpensive compared to radar and with no moving parts, easy to maintain.

- ADS-B ground stations can be deployed to regions that are too remote for radars.

- ADS-B is cost effective.



AAI is deploying Automatic Dependent Surveillance–Broadcast (ADS–B) technology across India at:

Fourteen ground stations:

1. Amritsar
2. Jaipur
3. Lucknow
4. Varanasi
5. Ahmedabad
6. Nagpur
7. Calicut
8. Cochin
9. Coimbatore
10. Mangalore
11. Port Blair
12. Trivandrum
13. Guwahati
14. Agartala

[UNDER DISCUSSION]
PROPOSED ADS-B TIME LINE FOR INDIA

Date On or after	Phase	Service / Eligibility	Areas / Airports covered
27th June 2013	Enroute Phase FL290 – FL460	Aircraft equipped with operative ADS-B within exclusive ADS-B coverage may stand benefitted with ATC applying the principle of least average delay. ATS surveillance services will be provided to eligible aircraft in order to enhance airspace safety and capacity.	Within the ADS-B coverage of Port Blair, Trivandrum, Ahmedabad, Mangalore, Nagpur and Varanasi.
	Terminal Phase GND – FL150		Trivandrum, Ahmedabad, Amritsar, Guwahati and Cochin.
12th Dec 2013	Enroute Phase FL290 – FL460		Within the ADS-B coverage of Chennai, Delhi, Kolkata and Mumbai FIRs.
	Terminal Phase GND – FL150		Mangalore, Nagpur, Varanasi, Calicut, Jaipur, Lucknow, Coimbatore and Agartala.
30th June 2015	Airspace Mandate Enroute Phase FL290 – FL460	*All aircraft operating within the designated airspace shall carry serviceable ADS-B transmitting equipment meeting the ICAO standards and have the operational approval from the state of registry.	Complete Indian Airspace within the vertical band.
30th June 2016	Airport Mandate Terminal Phase GND – FL150		Amritsar, Mangalore, Nagpur, Varanasi. Jaipur, Lucknow, Coimbatore and Agartala.

* Special authorization for State aircraft by DGCA if required.

THANK YOU