Air Navigation Services- India

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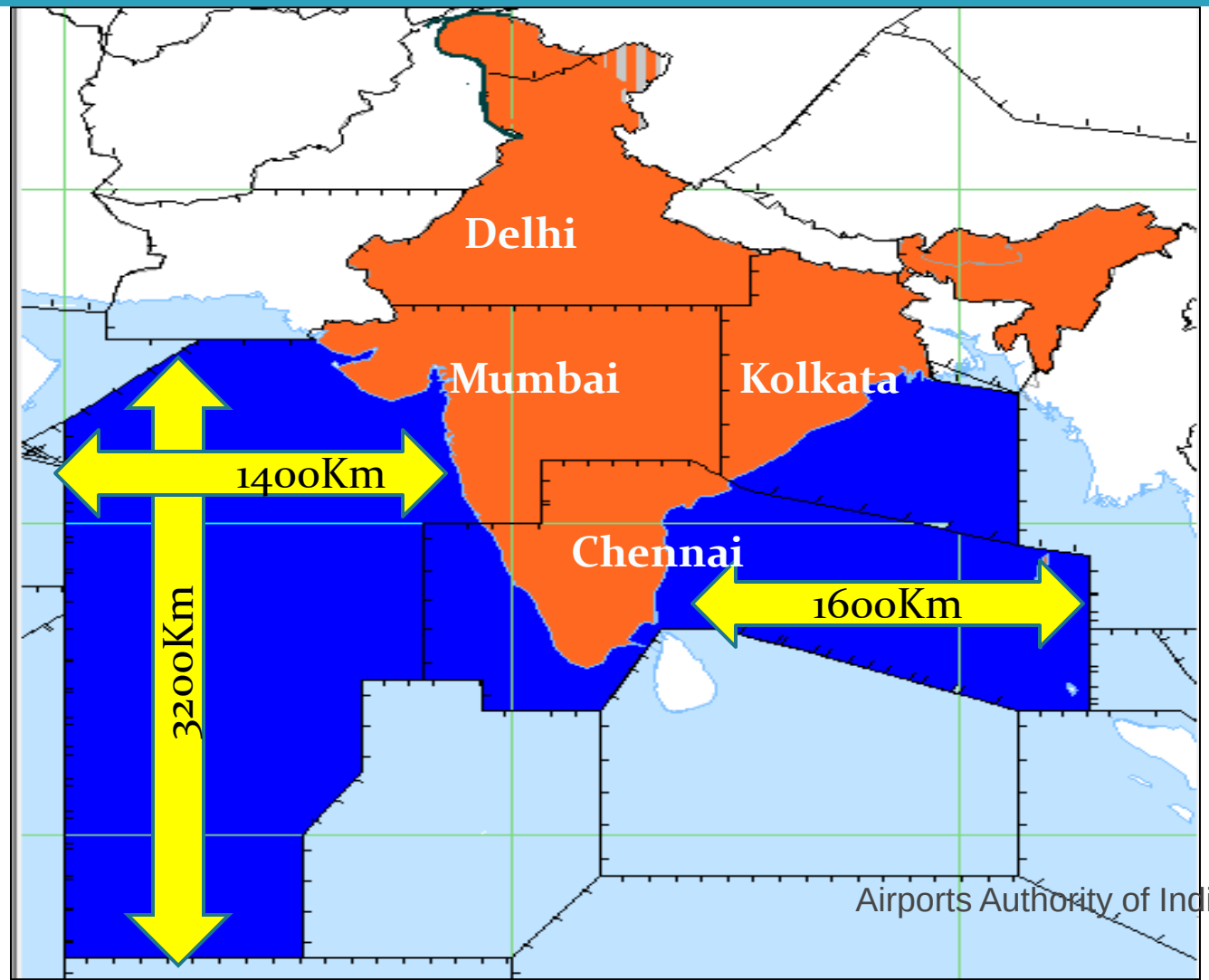
ANS Service jurisdiction



Total airspace :
2.8 million Sq.NM
(9.5 M Sq.Km)

Continental :
1.04 million Sq.NM

Oceanic :
1.76 million Sq NM
Delegated to India

FIRs : 4 (Flight Information Region)
Kolkata, Delhi, Mumbai, Chennai
Sub FIR : Guwahati

12 neighboring states

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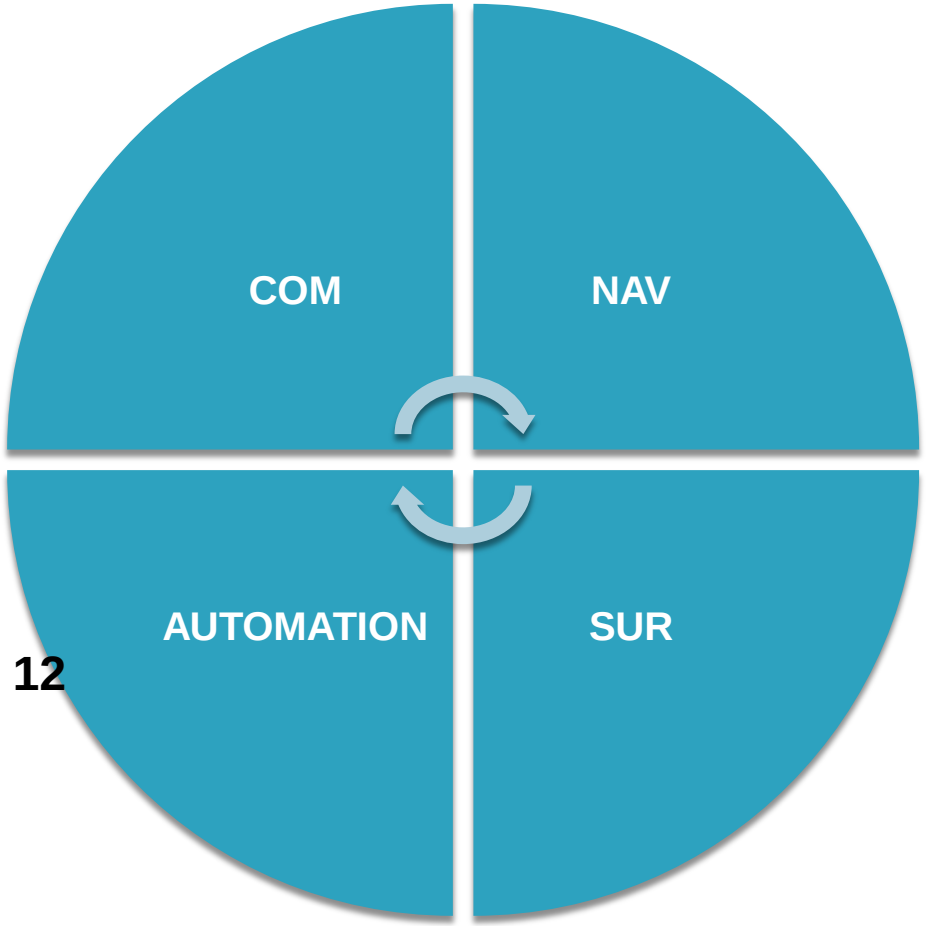
INDIA - ANS INFRASTRUCTURE

VHF : 365 +
RCAG:60
HF : 20
DATIS : 47
DSCN : 70
VCCS: 44
DATALINK : 6

INTEGRATED ATM SYSTEM: 12
TOWER AUTOMATION :32



DVOR/DME: 93
ILS/DME– CAT 1: 66
CAT 2: 3
CAT 3 : 3 AT IGI AIRPORT
NDB : 55 (BEING PHASED OUT)
GAGAN :COMMISSIONED ON
14 FEB 2014
GBAS : PILOT PROJECT IN CHENNAI
RADAR-
ENROUTE : 13 MSSR
TERMINAL : 19 (PSR/MSSR) + 3
ADS-B - 21
ADS-C- 4
ASMGCS - 6 + 5

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Flight Calibration

- ANSP's FLIGHT CALIBRATION UNIT HAS
  - TWO DO228 AIRCRAFT
  - KING AIR (BEECHCRAFT BE350)
- GROUND LABORATORY FOR TESTING AND CALIBRATION OF ON-BOARD FLIGHT INSPECTION EQUIPMENT.
- FULLY AUTOMATIC FLIGHT INSPECTION UNITS IN AIRCRAFT.

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Major Indian ANS Initiatives

- Route optimization
- ADS-B /RADARs
- CDO (Continuos Descent Operation)
- Upper Airspace harmonization
- ATM Automation
- FUA (Flexible Use of Airspace)
- R &D
- ATFM (Air Traffic Flow Management)
- GAGAN (SBAS), GBAS (Ground Based Augmentation System)

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ROUTE OPTIMIZATION

- EMARSSH ROUTES (Asia to the Middle East and Europe, Route Structure, South of the Himalayas)
- RNP 10 ROUTES
- RNAV 5 ROUTES
- RNAV 2 ROUTES (PLANNING STAGE)
- REDUCTION IN Long. SEP MINIMA
  - 40NM Long Sepn Min implemented (Delhi/Chennai & Delhi/Kolkata)
  - RNP4 based 30NM RLS to be implemented from 18 Sep 2014
    (N571/P574/M300/P570)

PBN Implementation In India

Enroute Phase

- **Implemented**

RNAV 5 City pair routes

- In Process

RNAV-2 Routes
- Delhi/Chennai
- Delhi/Kolkata

Terminal Phase

- **Implemented**

RNAV 1 SID/STAR
- 9 Airports

RNP 1 SID//STAR
- 1 Airport

- In Process

RNAV-1 & RNP 1 SID/STAR for 6 Airports

Approach Phase

- **Implemented**

RNP Approach
-1 Airport

- In Process

RNP AR RWY 32 Mumbai

GBAS Chennai

RNP AR and RNP Approach for Other Airports

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PBN Implementation In India

- AAI Flight Procedure Design Team as approved by GCAA is designing instrument approach procedures for new Runway 12/30 at Sharjah as a Consultancy Project.

- AAI Flight Procedure Design Team is also assisting Maldives to validate their BASIC RNP 1 procedures using automated tools.

- AAI Flight Procedure Design Instructor will be providing training to the Operational staff of Qatar Airways in Doha under ASIOACG/INSPIRE flagship.

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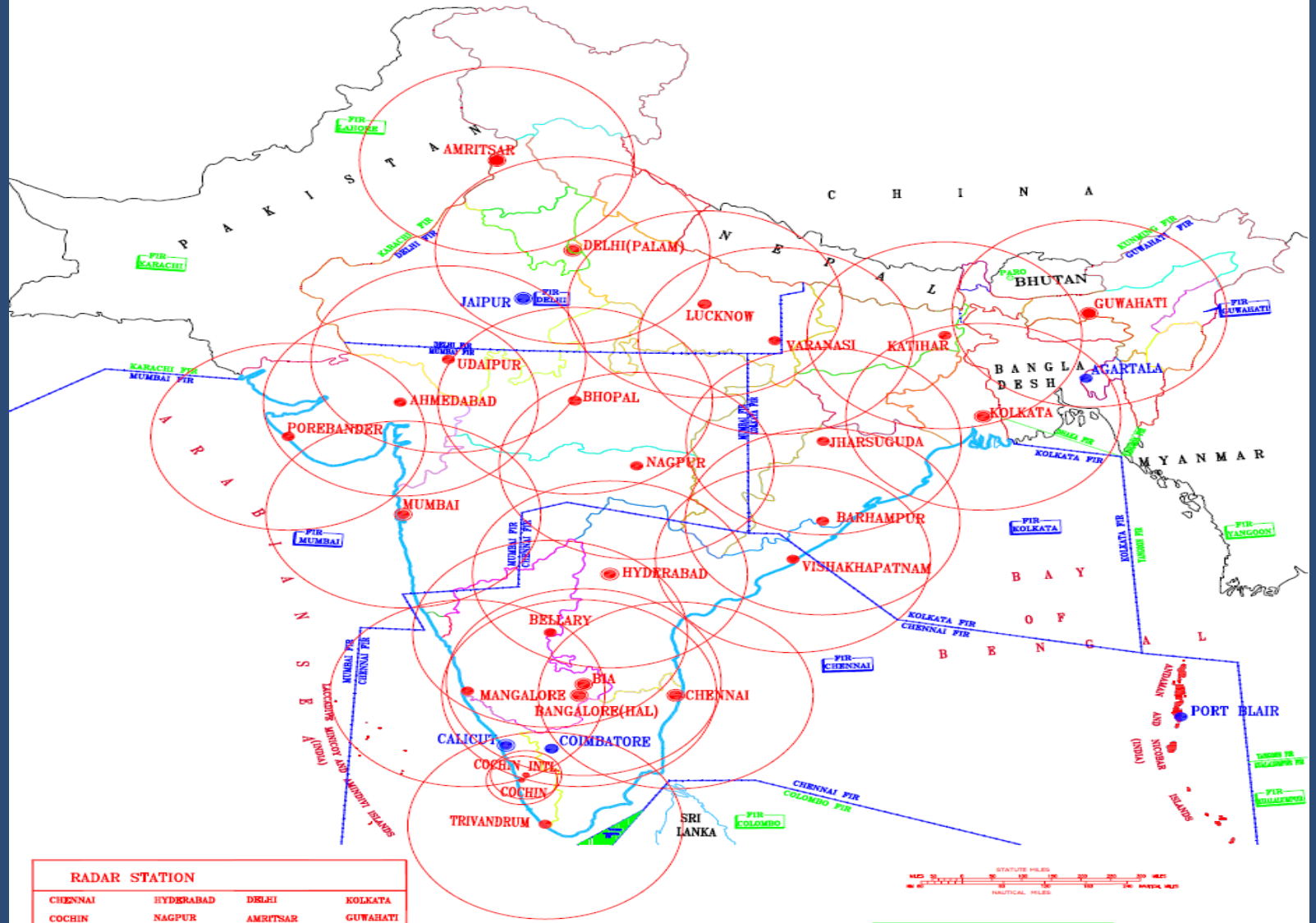
ADS-B & RADAR

- 23 RADAR and 21 ADS-B GROUND STATIONS
- MAJOR INTERNATIONAL AIRPORTS HAVE REDUNDANT RADARS
- RADARS UNDER INSTALLATION IN THREE MORE LOCATIONS
- REGULATORY APPROVAL OF ADS-B GROUND STATIONS IN PROGRESS
- ADS-B INFORMATION INTEGRATED INTO THE ATS AUTOMATIONS SYSTEMS
- OPERATIONAL USE OF ADS-B ON OPPORTUNITY BASIS

RADAR COVERAGE WITH IN INDIAN FIR

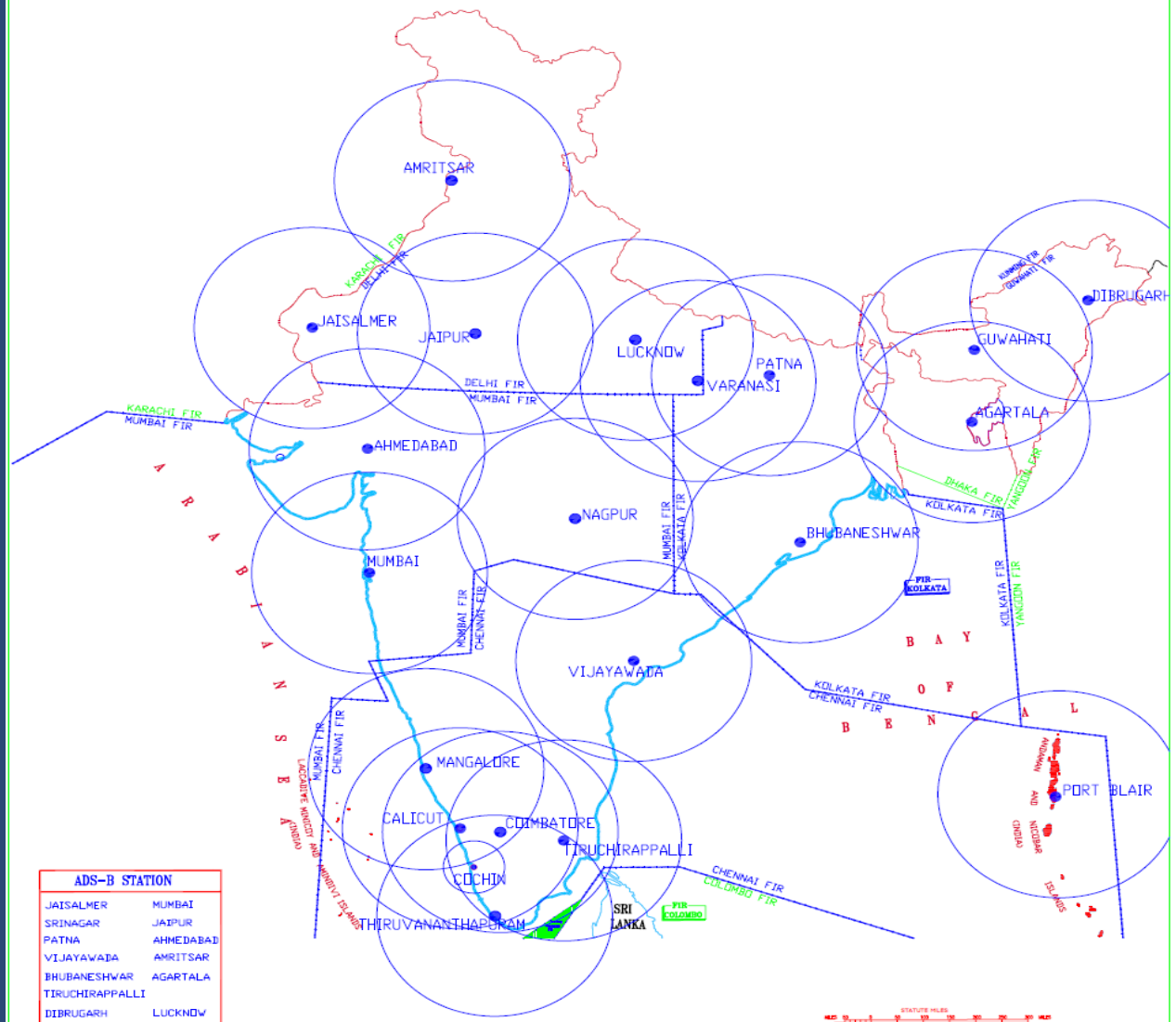


RADAR STATION			
CHENNAI	HYDERABAD	DELHI	KOLKATA
COCHIN	NAGPUR	AMRITSAR	GUWAHATI
TRIVANDRUM	MUMBAI	VARANASI	KATIHAR
MANGALORE	COCHIN INTL (INS GARUDA)	PORBANDER	
	BELLARY	VISHAKHAPATNAM	
BANGALORE (HAL)	BHOPAL	JHARSUGUDA	
BANGALORE INTL. AIRPORT (BIA)	UDAIPUR AHMEDABAD	BARHAMPUR	

REFERENCES

RADAR STATION

ADS-B COVERAGE WITHIN INDIAN FIR



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CONTINOUS DESCENT OPERATIONS (CDO) & CONTINOUS CLIM OPERATIONS (CCO)

- INTRODUCED IN SELECT TERMINAL AIRSPACES
- OPPORTUNITY BASIS
- RNAV 5 CITY PAIRS AND RNAV 2 CITY PAIRS DESIGNED (UNIDIRECTIONAL) TO ACCOMMODATE CDO/CCO
- RNAV 1 SIDS AND STARS ENABLERS IN CDO/CCO

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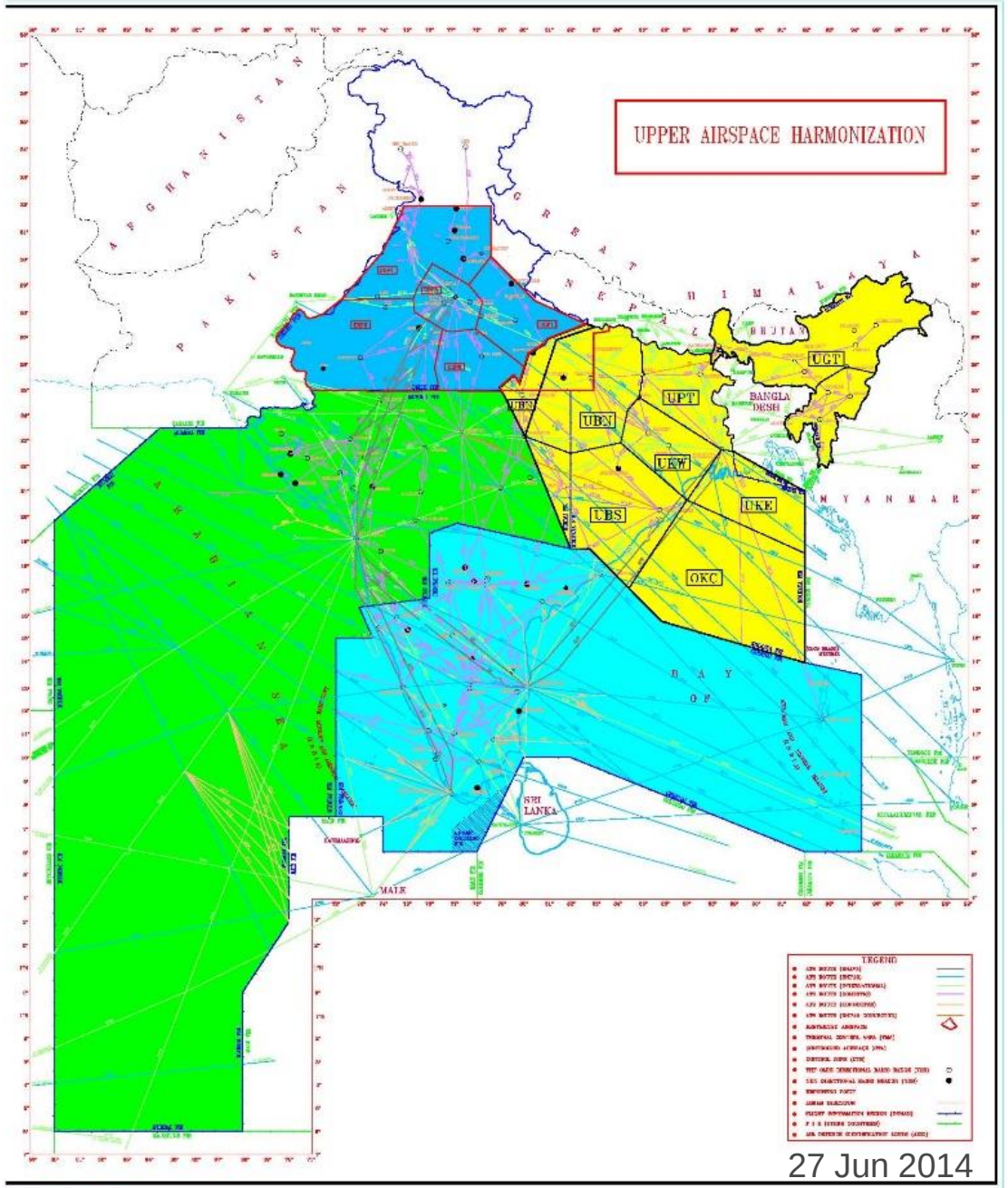
UPPER AIRSPACE HARMONIZATION

- FUSION OF SURVEILLANCE INFORMATION INTO METRO ATCCs ATS SURVEILLANCE SYSTEMS
- FL260+ CONTROLLED FROM METRO ATCC
- LOWER ACCs (LACC) CONTROL FL155-FL255 BAND AND ACTS AS BACK UP IN CASE OF LINK FAILURES WHEREIN LACCs VERTICALLY CONSOLIDATE WITHIN THEIR LATERAL JURISDICTION AND PROVIDE ATS SURVEILLANCE SERVICES
- VHF → Cross coupling/ IP Based /IBSU

UPPER AIRSPACE HARMONIZATION

- UAH COMPLETED IN CHENNAI FIR IN 2012
- KOLKATA FIR UAH PDC October 2014
- DELHI FIR UAH PDC June, 2015
- MUMBAI FIR UAH PDC DECEMBER, 2015


UPPER AIRSPACE HARMONIZATION
AFGHANISTAN
PAKISTAN
GREAT HIMALAYA
NEPAL
BHUTAN
BANGLA DESH
MYANMAR
ARABIAN SEA
BAY OF
SRI LANKA
MALE
UGT
UPT
UBN
UKW
UKE
UBS
OKC
LEGEND
27 Jun 2014

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ATM AUTOMATION

- 38 Major ATM Centres Automation Completed
- Chennai/Kolkata ATM Automation Completed
- DELHI ATM Automation System Migration PDC June 2015
- MUMBAI ATM Automation System Migration PDC December, 2015
- AIDC Chennai-Mumbai Implemented
- AIDC Chennai-Kualalumpur trial completed
- Other AIDC under Testing

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FLEXIBLE USE OF AIRSPACE

- NATIONAL HIGH LEVEL AIRSPACE BODY CONSTITUTED
- NATIONAL AIRSPACE MANAGEMENT ADVISORY COMMITTEE CONSTITUTED
- DRAFT FUA MANUAL PREPARED
- PILOT PROJECT FOR VALIDATION OF FUA MANUAL TO BE CONDUCTED
- EXTENSIVE FUA INITIATIVES BEING UNDERTAKEN

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RESEARCH AND DEVELOPMENT

- R & D CENTER ESTABLISHED AT HYDERABAD, IN COLLOBRATION WITH MITRE CORPORATION
- HUMAN-IN-THE-LOOP (HITL) SIMULATION LAB USING THE MITRE SOFTWARE.
- AAI UNDERTAKING AIRPORT AND AIRSPACE SIMULATION STUDY UNDER KNOWLEDGE TRANSFER FROM JEPPESEN USING TOTAL AIRPORT AND AIRSPACE MODELLER (TAAM) SOFTWARE TOOL.

AIR TRAFFIC FLOW MANAGEMENT

- C-ATFM SYSTEM CONTRACT AWARDED TO ATEC-BRAZIL
- CATFM PHASE-I TO BE IMPLEMENTED BY NOV 2015.

AIRPORT COLLABORATIVE DECISION MAKING (ACDM) CSI AIRPORT MUMBAI

- GREEN INITIATIVE FROM MUMBAI ATC TO CURB WASTAGE OF AVIATION FUEL BY REDUCING DELAY AT HOLDING POINT.

- WEB BASED APPLICATION PLATFORM BEING DEVELOPED FOR INFORMATION SHARING AMONG AVIATION PARTNERS AT CSI AIRPORT, MUMBAI.

- DESIGN AND DEVELOPMENT OF DYNAMIC WEBSITE WITH PROVISION OF INPUTS FROM AIRLINE OPERATORS AND INPUTS OF PARAMETERS FROM ATC, WHICH WILL GENERATE TARGET START-UP APPROVAL TIME (TSAT), WHICH CAN BE USED THROUGH DECISION SUPPORT TOOLS BY THE STAKE HOLDERS.

AIRPORT COLLABORATIVE DECISION MAKING (ACDM) IGI AIRPORT NEWDELHI

- MANAGEMENT OF OPERATIONS THROUGH CDM, ESPECIALLY POST FOG PERIOD

- FACILITIES AT IGI AIRPORT FOR FOG/ LOW VISIBILITY MANAGEMENT:
  - RUNWAYS 28/29/11 ARE EQUIPPED FOR CAT IIIB OPERATIONS
  - CAT IIIB ARRIVALS CAN LAND AT IGI AIRPORT UPTO RVR OF 50 METERS
  - LVTO DEPARTURES CAN OPERATE DOWN TO RVR OF 125 METERS
  - IGI AIRPORT IS EQUIPPED WITH ASMGCS

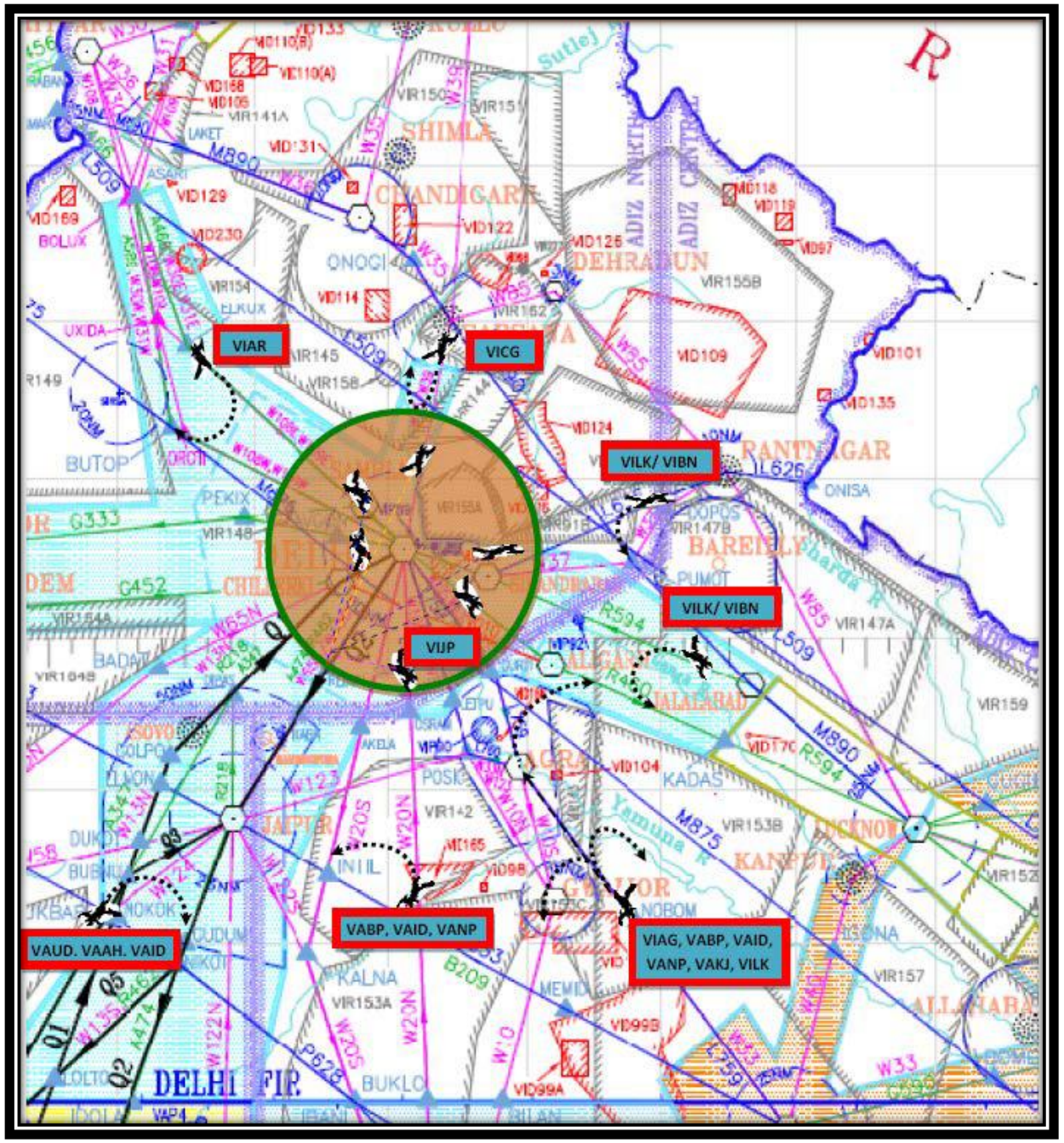
(2 SMR AND 23 M-LAT SENSORS (ASMGCS) WITH AGL SYSTEM)

AIRPORT COLLABORATIVE DECISION MAKING (ACDM) - DELHI

- ARRIVALS ARE INFORMED IN ADVANCE ABOUT PARKING BAYS AND CONDITIONS AT NEARBY AIRPORTS FOR PLANNING OF SUITABLE DIVERSION ALTERNATE

- WHEN FORECAST DOESN'T INDICATE IMPROVEMENT IN NEXT 30 MINUTES, A DECISION IS TAKEN TO DIVERT THE ARRIVALS, IMMEDIATELY

- ARRIVALS, ENROUTE TO DELHI ARE ASSIGNED SUITABLE ALTERNATES NEAREST TO THEIR PRESENT POSITION.

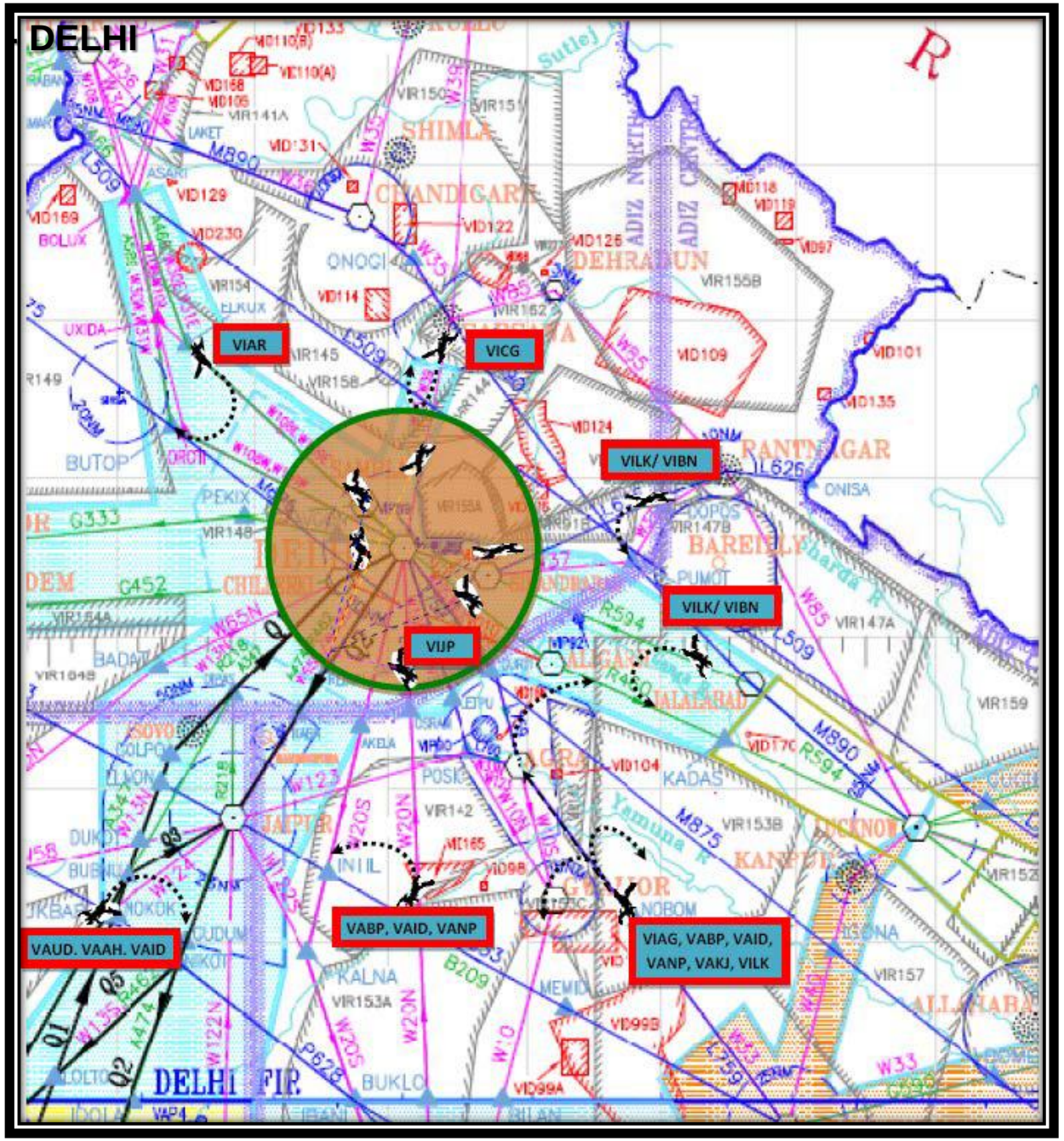


AIRPORT COLLABORATIVE DECISION MAKING (ACDM) - DELHI

- DEPARTURES ARE INFORMED IN ADVANCE ABOUT EXPECTED DEPARTURE TIME

- AIRLINES WILL DECIDE ABOUT THE SEQUENCE OF FLIGHTS THAT WILL DEPART IN THEIR ALLOCATED SLOTS AND UPDATE TOBT

- ATC WILL ISSUE **TSAT** THROUGH DA-CDM PORTAL ON THE BASIS OF **TOBT** ENTERED BY THE AIRLINES



OTHER INDIAN ANS INITIATIVES

AERONAUTICAL INFORMATION MANAGEMENT

- E-AIP AVAILABLE IN www.aai.aero
- AIS TO AIM TRANSITION SHALL BE IN LINE WITH ASBU SYSTEM WIDE INFORMATION MANAGEMENT (SWIM) IMPLEMENTATION

AIRPORT INFORMATION MANAGEMENT SYSTEM (AIMS)

- INTRANET BASED DASHBOARD FOR ATC INCIDENTS IN AIMS (AIRPORT INFORMATION MANAGEMENT SYSTEM) DEVELOPED.
- ALL THE OPERATIONAL AIRPORTS REPORT THE DETAILS OF ATC INCIDENTS ON AIMS
- AIMS COLLATES THE DATA IN THE DASHBOARD.
- ANALYSIS TOOLS FOR INCIDENT DATA TREND ANALYSIS IS UNDER DEVELOPMENT

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OTHER INDIAN ANS INITIATIVES

ONLINE FLIGHT PLAN SUBMISSION

- ONLINE SUBMISSION OF FPL THROUGH AAI PORTAL FACILITY ESTABLISHED
- FACILITY FOR FLIGHTS OPERATING WITHIN INDIA IMPLEMENTED AND EXTENDED TO
  - DOMESTIC OPERATORS
  - GENERAL AVIATION
  - INDIAN MILITARY AUTHORITIES.

INDIAN SBAS (SATELLITE BASED NAVIGATION SYSTEM)
(GAGAN – GPS AIDED GEO AUGMENTED

- JOINT PROJECT OF AAI AND ISRO
- GAGAN OVERLAY COVERS FROM AFRICA TO AUSTRALIA.
- POTENTIAL FOR EXTENSION OF GAGAN SERVICES TO NEIGHBORING COUNTRIES AND ALSO IN ASIA-PACIFIC, EUROPE AND AFRICA REGIONS

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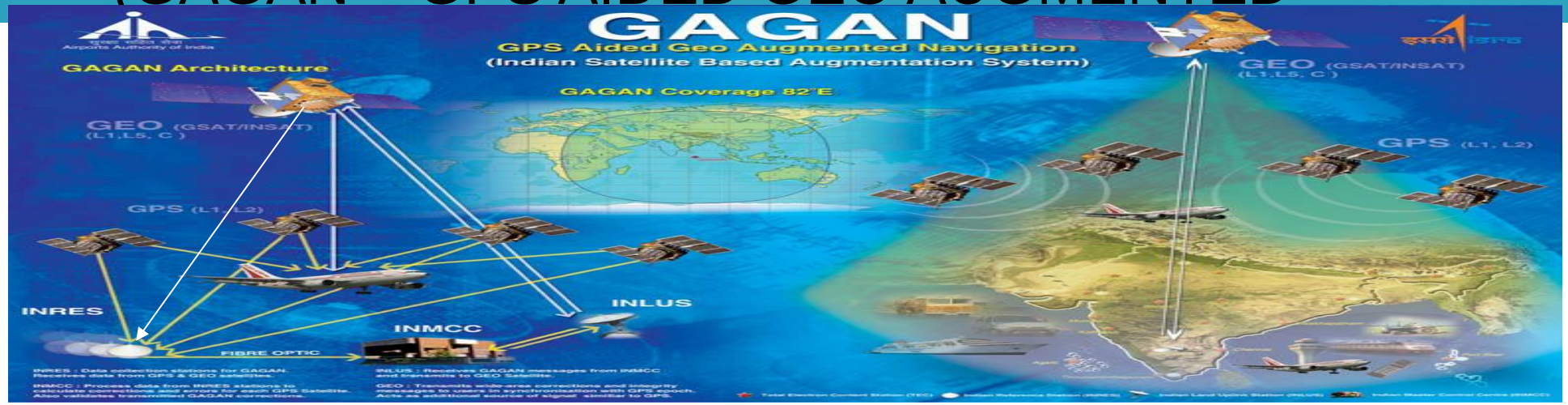
INDIAN SBAS (SATELLITE BASED NAVIGATION SYSTEM)
(GAGAN – GPS AIDED GEO AUGMENTED



- GAGAN WILL REALIZE A ICAO SARPS COMPLIANT, CERTIFIED AND OPERATIONAL SBAS, FOR ALL PHASE OF FLIGHT TO PROVIDE NAVIGATION SUPPORT
  - UP TO APV 1.0
  - APV 1.5 PRECISION APPROACH OVER THE 90% OF THE LAND-MASS WITHIN INDIAN FIR.
- COMMISSIONED ON 14TH FEB, 2014

Advantages of GAGAN

- GAGAN REDUCES
  - SATELLITE ORBIT ERROR
  - SATELLITE CLOCK ERROR
  - IONOSPHERIC DELAY ERROR
- GAGAN REMOVES OUTLIERS
- GAGAN GUARANTEES ERROR BOUNDS
- GAGAN PROVIDES INTEGRITY LIMITS

ACCURACY	
Without GAGAN	With GAGAN
Position Error 20 m (99%)	Position Error 5 m (99%)

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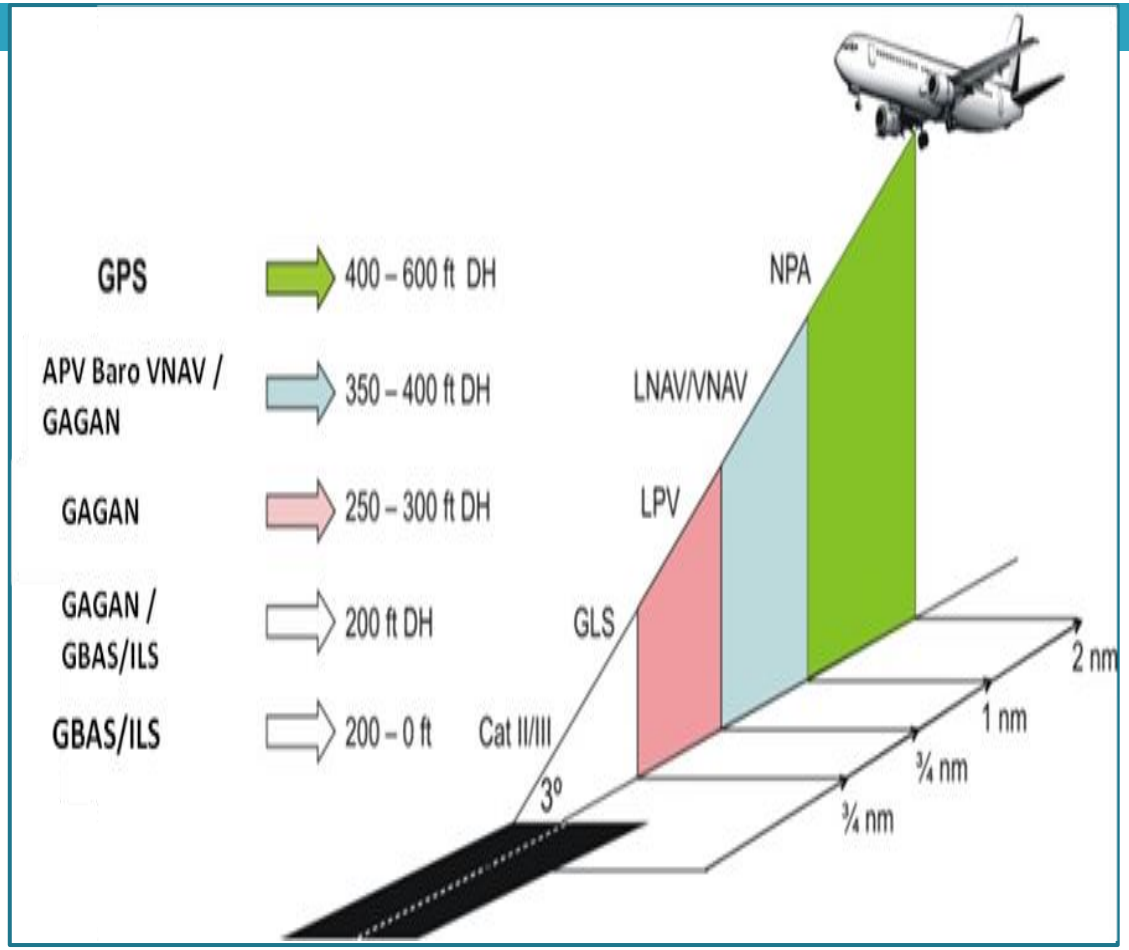
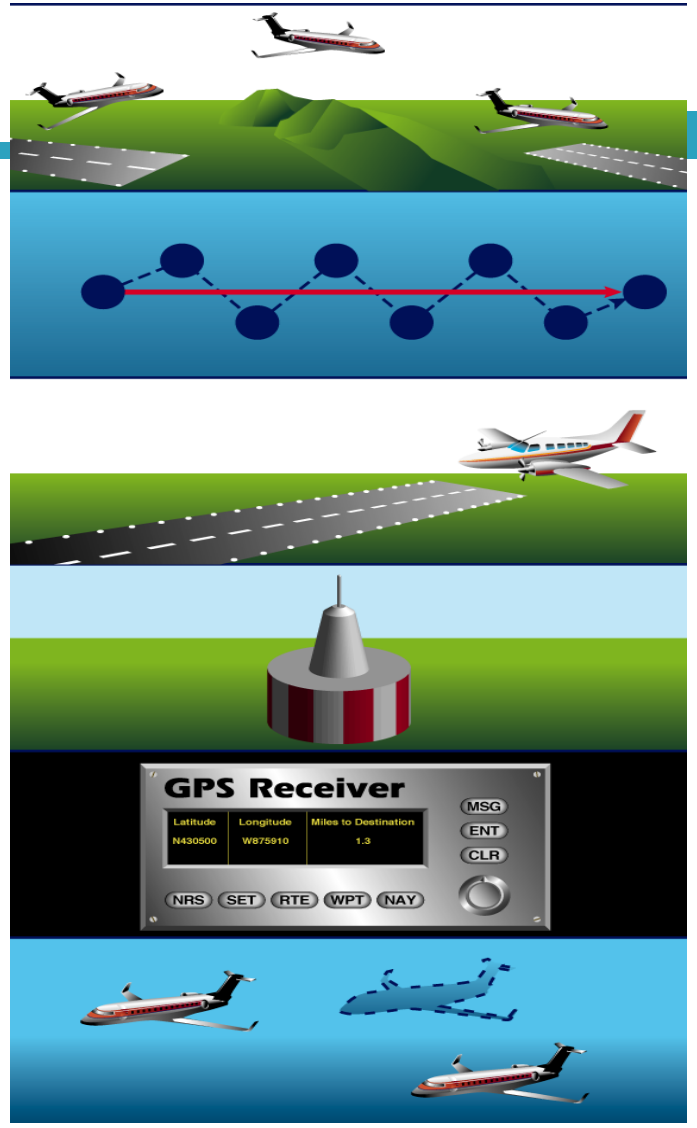
Advantages of GAGAN

- GAGAN TRANSMITS SIGNAL SIMILAR TO GPS SIGNAL
- GAGAN SATELLITES CAN BE USED AS ADDITIONAL GPS SATELLITES
- INCREASES THE NUMBER OF VISIBLE SATELLITES IN URBAN CANYON, FOREST CANOPY AND WHEN AN AIRCRAFT MANEUVERS
- IMPROVES THE DOP AND AVAILABILITY OF GPS

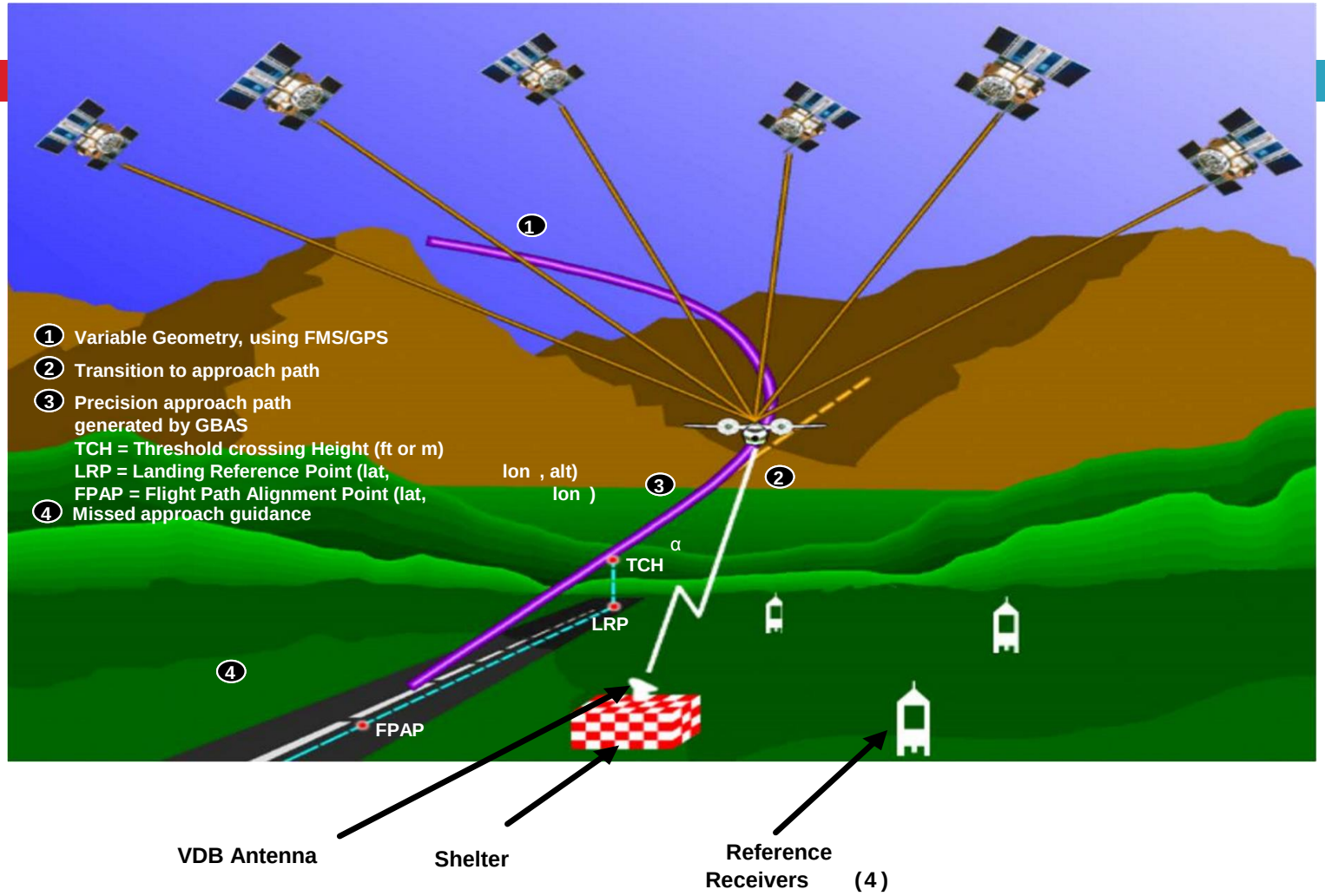


GAGAN:OPERATIONAL BENEFITS



- PRIMARY MEANS OF NAVIGATION - TAKE-OFF, EN ROUTE, APPROACH AND LANDING
- MORE DIRECT ROUTES - NOT RESTRICTED BY LOCATION OF GROUND-BASED EQUIPMENT
- PRECISION APPROACH CAPABILITY - AT ANY QUALIFIED AIRPORT
- DECOMMISSION OF OLDER, EXPENSIVE GROUND-BASED NAVIGATION EQUIPMENT
- REDUCED/SIMPLIFIED EQUIPMENT ON BOARD AIRCRAFT
- INCREASED CAPACITY - REDUCED SEPARATION DUE TO IMPROVED ACCURACY
- INCREASE SAFETY BY USING 3D APPROACH

GBAS IMPLEMENTATION



PILOT PROJECT AT CHENNAI SMARTPATH EQUIPMENT TO ALLOW DESIGN OF 26 APPROACHES INCLUDING CURVED PATH APPROACHES WHICH WILL HELP IN KEEPING FLIGHT PATH CLEAR OF NOISE SENSITIVE ZONES