The use of space-based systems and equipment in Air Navigation Services of Mongolia

Boldbayar BATBOLD
1. Mongolian airspace structure

2. Current use of GNSS
   • Performance Based Navigation (PBN)
   • Automatic Dependent Surveillance Broadcast (ADS-B)

3. Planning for future use
   • GBAS, SBAS
   • Satellite based ADS-B

4. Focus
MONGOLIAN AIRSPACE STRUCTURE

RUSSIA AND MONGOLIA: 10

CHINA AND MONGOLIA: 6

16 EXIT/ENTRY POINT
95 AIRWAYS
25 AIRPORTS
6 SECTOR
CURRENT USE OF GNSS

What is PBN?

- PBN defines performance requirements for aircraft navigating on an ATS route, on a terminal or on an approach procedure. Those routes and procedures are composed of way-points which are expressed by WGS 84 coordinates rather than fixes expressed by radial/bearing and distance from ground navigation aids and permit the flexibility of point-to-point operations.

Benefits of PBN

- Through the application of Area Navigation (RNAV) and Required Navigation Performance (RNP) specifications, altogether components of PBN, PBN can provide the means for flexible routes and terminal procedures, reduce aviation congestion, conserve fuel, protect the environment, reduce the impact of aircraft noise, improve safety and accessibility to challenging airports, and increase airspace capacity.
CURRENT USE OF GNSS

3 Types of Navigation

Conventional
- Limited Design Flexibility
- Current Ground-Based NAVAIDs

RNAV
- Increased Airspace Efficiency
- Waypoints

RNP
- Narrower protected areas
- Seamless Vertical Path
- Curved Paths
- Optimized Use of Airspace
CURRENT USE OF GNSS

• The International Civil Aviation Organization (ICAO) has been promoting the Performance Based Navigation (PBN) program since 2007.
• In 2009, Mongolia submitted a plan to implement PBN program to ICAO.
• To date, Mongolia has successfully implemented Phases I and II of PBN plan and Phase III to be implemented by 2025.
CURRENT USE OF GNSS

- Within the framework of Phase I and II (2017)
  - 10 RNAV ATS routes established
  - 23 PBN flight procedures at 9 locations
CURRENT USE OF GNSS

Surveillance radar

Automatic Dependent Surveillance Broadcast (ADS-B)
The performance of Global Navigation Satellite Systems (GNSSs) can be improved by regional Satellite-based Augmentation Systems (SBAS), such as the European Geostationary Navigation Overlay Service (EGNOS). SBAS improves the accuracy and reliability of GNSS information by correcting signal measurement errors and by providing information about the accuracy, integrity, continuity and availability of its signals.

SBAS uses GNSS measurements taken by accurately located reference stations deployed across an entire continent. All measured GNSS errors are transferred to a central computing centre, where differential corrections and integrity messages are calculated. These calculations are then broadcast over the covered area using geostationary satellites that serve as an augmentation, or overlay, to the original GNSS message.

Existing SBAS
Several countries have implemented their own Satellite-based Augmentation System. For example, in Europe EGNOS covers the majority of the European Union (EU), along with some neighboring countries and regions. Other national SBASs include:

- **USA**: Wide Area Augmentation System (WAAS)
- **Japan**: Michibiki Satellite Augmentation System (MSAS)
- **India**: GPS-aided GEO-Augmented Navigation (GAGAN)
- **China**: BeiDou SBAS (BDSBAS) (in development)
- **South Korea**: Korea Augmentation Satellite System (KASS) (in development)
- **Russia**: System for Differential Corrections and Monitoring (SDCM) (in development)
- **ASECNA**: SBAS for Africa and Indian Ocean (A-SBAS) (in development)
- **Australia and New Zealand**: Southern Positioning Augmentation Network (SPAN) (in development)
PLANNING FOR FUTURE USE

Automated dependent surveillance broadcasting system ADS-B

Surveillance radar

Satellite based ADS-B
FOCUS RELATED TO THE USE OF GNSS

• Reliable operation of GNSS system.

• Training and developing employees
  • Complex, and high-tech equipment is required.
THANK YOU
FOR
YOUR ATTENTION!