Technology Transfer and Capability Building in GNSS for Airspace Modernization in Nepal


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Reliable, Secure and Safe Aerospace Services
Agenda

- DLR GfR AirMeetsSpace Programme
- Nepalese Airspace: Scenario, Demands, and GNSS Application
- Technology Transfer and Capability Building
- International Collaboration
- Conclusion and Recommendation
DLR GfR: Combining Air & Space Know How

• DLR GfR (est. 2008) is a subsidiary of the German Aerospace Center (DLR) with headquarters at the DLR site Oberpfaffenhofen/Munich

• Responsible for operational safety of the Galileo satellites and the control center

• Exploration of topics in space traffic management under European Space Agency (ESA) study

• DLR GfR holds an Air Navigation Service Provider (ANSP) certificate, being the first space control center worldwide to do so

• Joint proposal (with AustroControl) for Airspace Modernization and Performance Based Navigation (PBN) development in Nepal (study cancelled due to procedural and economic constraint)
Nepalese Airspace Scenario, Demands and GNSS Potentials

- Importance in landlocked and mountainous country
- Diverse geographical features and difficult terrains
- Airspace limited to Southern Region

Figure 1. Airspace Routes

- Operational infrastructure and aviation safety main concerns
- GNSS as a foundation to address these issues.

Figure 2. ICAO Safety Oversight audit result 2016
GNSS Application

- Performance Based Navigation (PBN) Roadmap (2012-2025)
- Required Navigation Performance Authorization Required (RNP AR) Approach Procedure at Tribhuvan International Airport (TIA) since 2012

Realized benefits from RNP AR approach procedure at TIA

- Required airport runway visibility reduced from 2800 m (VOR/DME) to 900 m
- Reduction in traffic congestion and flight diversion
- Better accuracy, integrity and reliability
- Economic benefits (reduction in flight time and fuel consumption)

Implementation of RNP approach procedure at other major airports in process!!
Technology Transfer (Know-how) and Capability Building

- Technology learning to gradually move from conventional nav aids to GNSS
- The progress has been slow in the absence of National Innovative System
- Weak technology absorptive capacity
- Issues of technology leap-frog?? Example: GNSS based RNP AR APCH implemented with technical assistance from foreign firm but not enough technology learning in GNSS

There needs a balance between technology transfer and technology learning!!
Technology learning: GNSS Information Monitoring System

- Allows the state to comply with ICAO requirements – Annex 10 “monitoring and recording of GNSS Information”

- ICAO guidance for “monitoring of GNSS radio frequency interference”

Remote monitoring station
Integrated interference monitoring system
Performance assessment
Signal quality & interference
Technology learning: GNSS Augmentation System

- Ground based augmentation system (GBAS)
- Precision approach and landing
- Extension to nation wide augmentation system
- Data available as a CORS network

Feasibility Study

Step 1: Ionospheric Gradient Assessment
Step 2: Radio Frequency Interference Assessment
Step 3: Multipath Analysis
Step 4: Site Survey Siting
Technology learning: Challenges of drone operation

Drone related incidents increasing in Kathmandu
(The international airport is very close to the city)

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<thead>
<tr>
<th>Technology</th>
<th>Regulations</th>
<th>Acceptance</th>
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<tr>
<td>• Optimization of flight path over long distance Beyond Visual Line of sight (BVLOS)</td>
<td>• Airworthiness</td>
<td>• Safe operation</td>
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<td>• Availability and reliability</td>
<td>• Airspace integration</td>
<td>• Low noise level</td>
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<td>• Public and environmental safety</td>
<td>• Accepted use case</td>
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<td>(huge potential in remote health care)</td>
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<td>• Privacy policy</td>
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Necessity of drone identification and reporting system

• Radio communication link monitoring
• Monitoring fence around the protected zones
Technology learning: Automatic Data Surveillance Broadcast System (ADS-B)

- RADAR surveillance coverage limited in mountainous regions of Nepal
- ADS-B ground station feasibility study envisaged in Nepal by CAAN

Based on GNSS

Fig. 3: Space based ADS-B
Source: ADS-B Technologies

Fig. 4: ADS-B ground station (at DLR GfR, Munich) tracking aircraft
Regional and International Collaboration

• Collaboration in GNSS for Aviation nonexistence

• Utilize the regional CORS newtwork

• Potential of GNSS technical assistance project through ICAO SAFE Fund (e.g. Support from Germany, ICG and UNOOSA)

• Continuous support from Asian Development Bank, Government of Japan and other nations.
Conclusion and Recommendations

• GNSS is becoming the key capacity for Airspace modernization
• Technology transfer for the successful GNSS implementation
• GNSS Information Monitoring and Recording System a good learning step
• Drone a real threat to civil aviation
• Active cooperation and collaboration inevitable
• Potential of ICAO SAFE Fund to strengthen safety oversight
Thank you for your attention!!!