

GNSS Application in Aviation: Nepal

**ICG Experts Meeting: Global Navigation Satellite Systems (GNSS) Services
Vienna International Center, 15-18 December, 2015, Vienna, Austria**

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**Reliable, Secure and Safe
Aerospace Services**





Agenda

- About DLR GfR
- Nepalese Aviation: Scenario, Demands, and GNSS Potentials
- GNSS Augmentation Systems: GBAS
- GBAS Readiness Assessment Service

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DLR



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
- Approx. 120 engineers and specialists take care of the operational safety of the Galileo satellites and the control center
- Commercial services and products in the air/space domain
- DLR GfR holds an Air Navigation Service Provider (ANSP) certificate, being the first and only space control center worldwide to do so



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DLR GfR in Co-operation with Austro Control

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A company of



austro
CONTROL

Since 2013 co-operation with Austrian Air Traffic Control

Main Objectives:

- Joint products and services for ANSP domain
- Precise Landing Systems (e.g. GBAS) and Training as core topics
- Ionospheric Measurement Station at Vienna International Airport
- Joint proposal for Airspace Modernization and PBN development in **Nepal** delivered in May, 2015

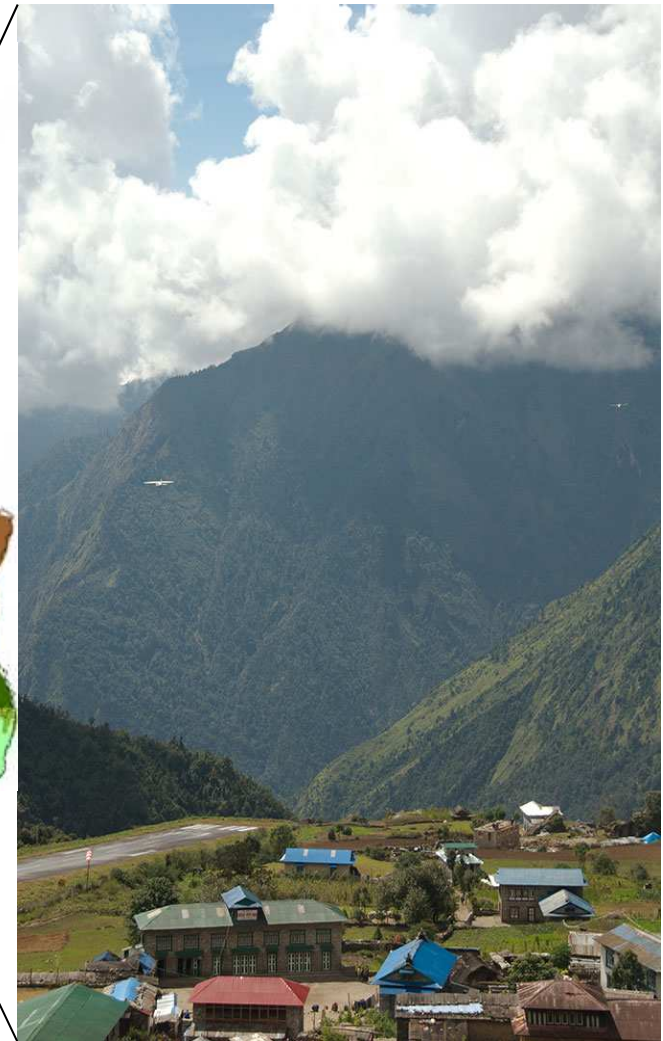
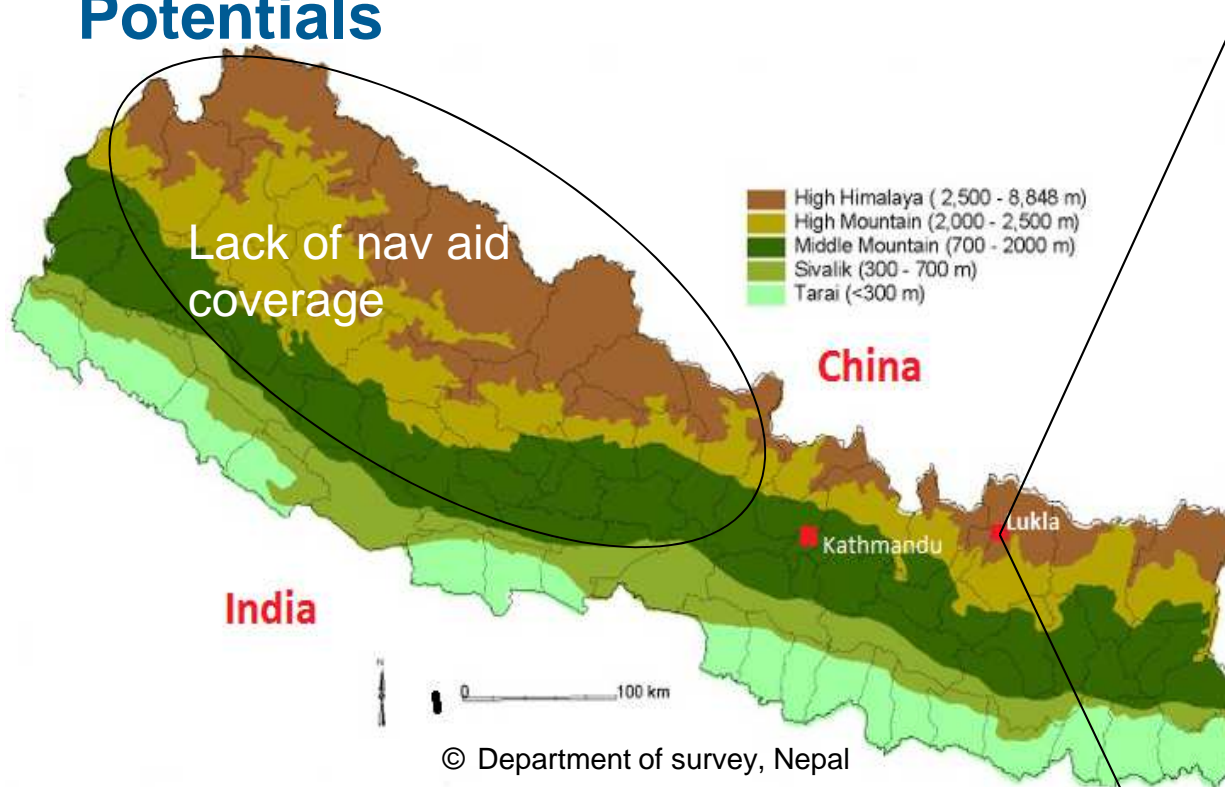


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Nepalese Aviation Scenario, Demands and GNSS Potentials



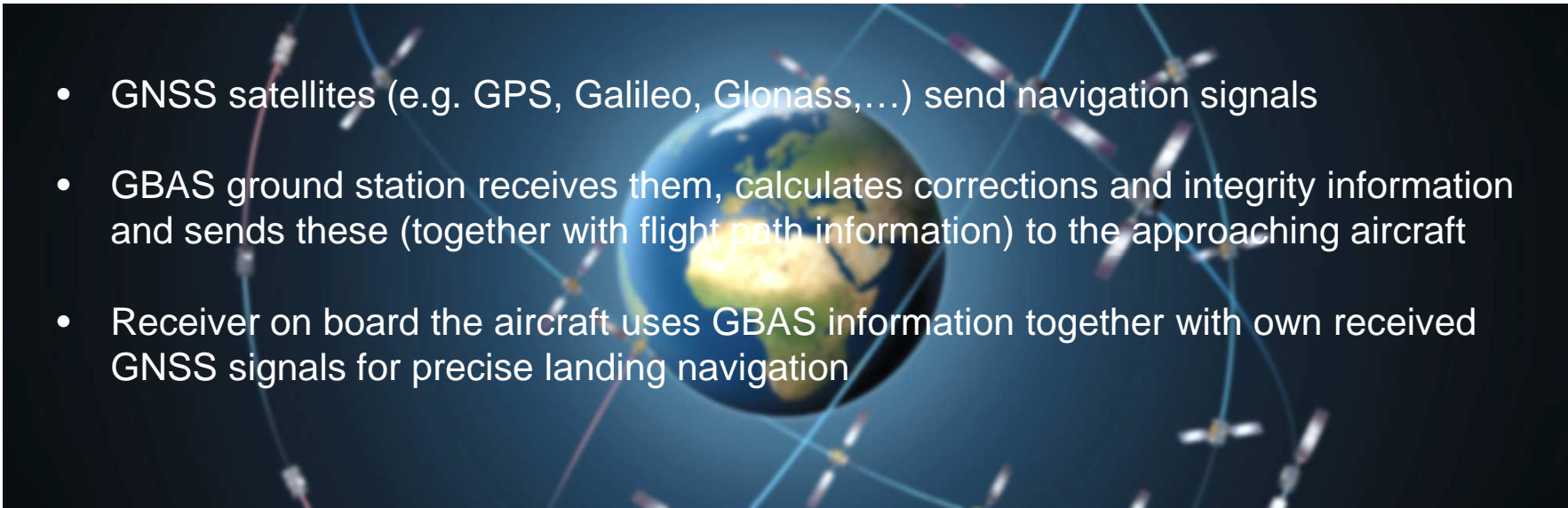
Lukla Airport © 2015 Himalayas-trekking-pictures

- Difficult terrain, drastic weather conditions
- Conventional non-precision approach and landings
- Tribhuvan International airport, the only international airport

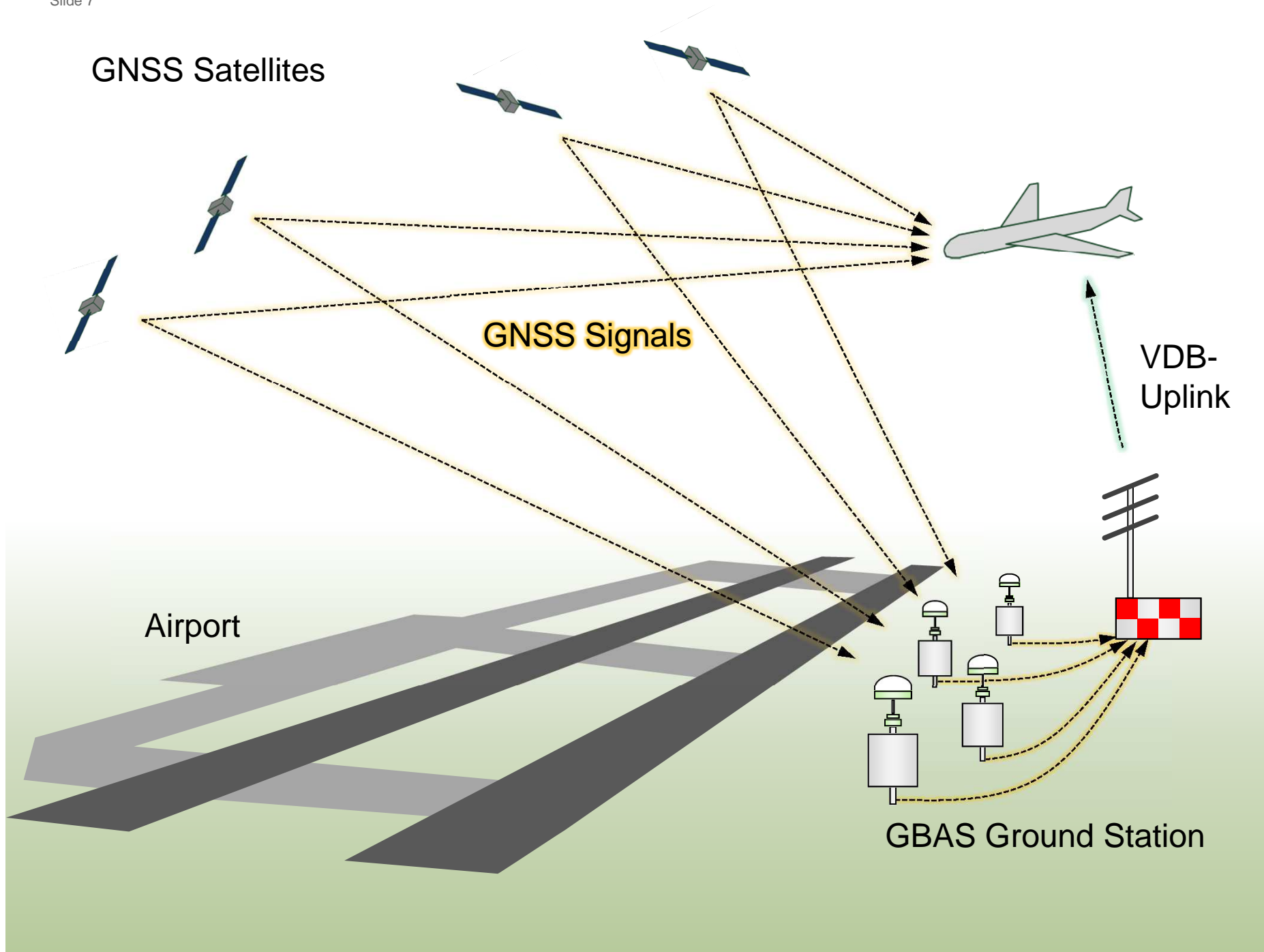


GNSS Augmentation: GBAS

- Stand alone GNSS based operations are affected by various error sources
- Safety of life (SoL) application needs stringent requirements (Integrity, accuracy, availability and continuity)
- Met by augmenting GNSS signals

- 
- GNSS satellites (e.g. GPS, Galileo, Glonass,...) send navigation signals
 - GBAS ground station receives them, calculates corrections and integrity information and sends these (together with flight path information) to the approaching aircraft
 - Receiver on board the aircraft uses GBAS information together with own received GNSS signals for precise landing navigation





GBAS Benefit Areas

- Higher safety, especially in difficult terrain conditions
- Increase in Airspace capacity
- Less physical space for installation, less stringent siting
- Less affected from terrain disturbances (omni directional broadcast)
- Operational and maintenance cost reduction
- All weather precision approach and landing

How does landing look like in zero visibility?

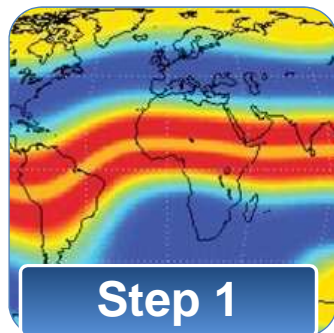


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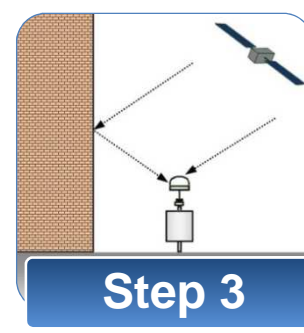
Our GBAS Readiness Assessment Service



Step 1
Ionospheric
Gradient
Assessment



Step 2
Radio Frequency
Interference Assessment



Step 3
Multipath Analysis

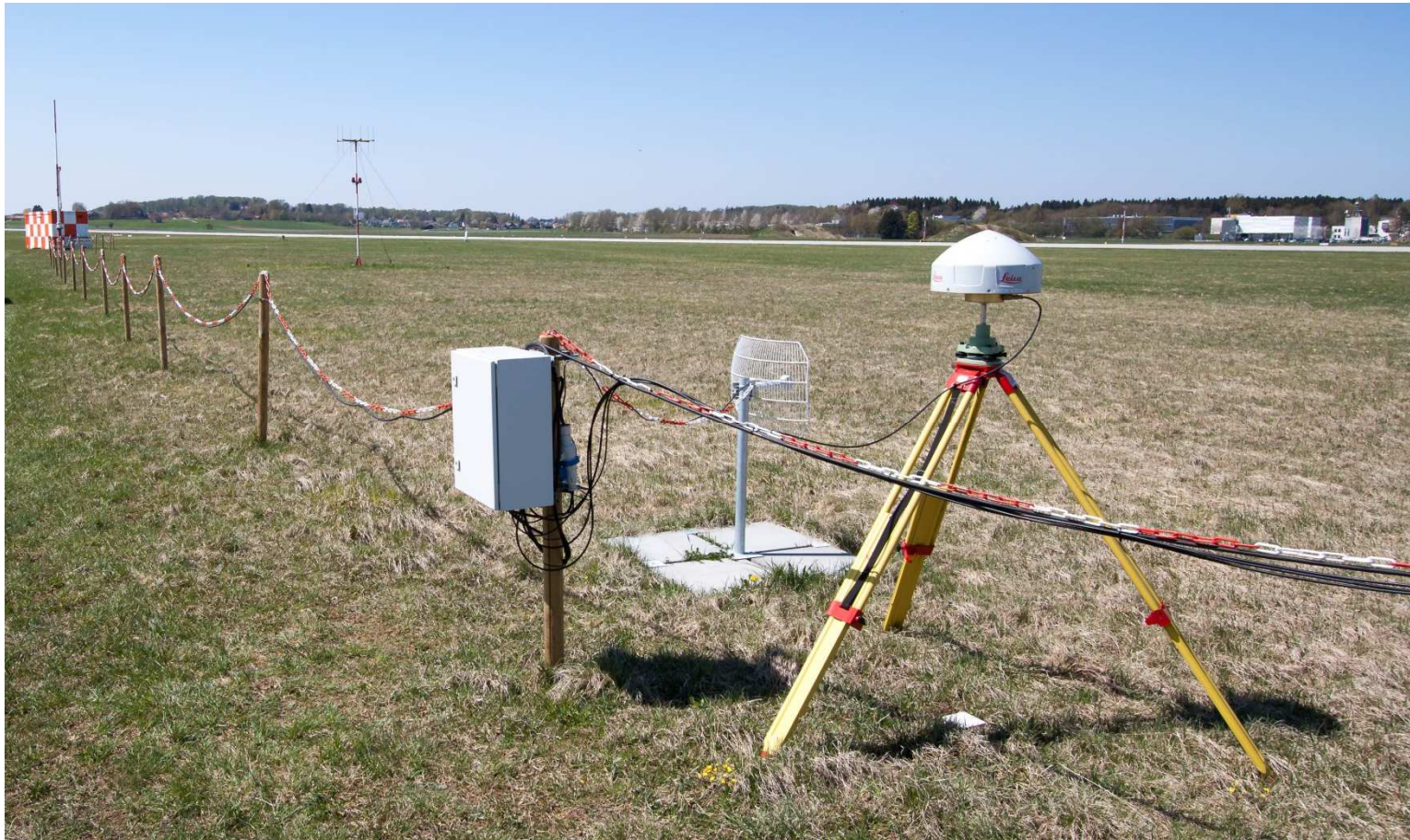


Step 4
Site Survey
Siting

- Systems engineering, procurement and installation
- Operations and Maintenance
- Documentation
- Certification Readiness Preparation



GBAS Testbed at Oberpfaffenhofen Special Airport



Summary and Outlook

- GNSS is becoming the key capacity for Air navigation
- Nepal's topography present a unique environment for Air operation
- GBAS will be the future precise navigation aid worldwide
- AmS program at DLR GfR offers manufacture independent GBAS services
- DLR GfR is on the way to become the main European GBAS Operator



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Ladies and Gentlemen, we are now preparing to land at Tribhuvan International Airport in zero visibility



Thank Your For Your Attention

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