

GROUND BASED AUGMENTATION SYSTEM

GBAS CAT I AT FRANKFURT AIRPORT



DFS Deutsche Flugsicherung

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PROJECT OVERVIEW

- Based on the experience DFS has gained over many years with GBAS R&D projects and especially with the GBAS Project in Bremen, DFS was able to implement GBAS at Frankfurt Airport over a period of 16 months
 - 7 May 2013: FRAPORT (Airport Operator of Frankfurt Airport) and DFS signed a cooperation contract for implementing and operating a GBAS CAT I Station at Frankfurt Airport;
 - 3 September 2014 entry into service of GBAS at Frankfurt Airport;

PROJECT OBJECTIVES AND EXPECTATIONS

- Frankfurt Airport is the first hub in Europe with GBAS CAT I approaches. Gaining experience with GBAS in a very challenging environment is seen as an important step towards GBAS CAT III.
- GBAS is one element of active noise abatement at Frankfurt Airport
 - As a first step, ILS look-alike approaches should be implemented for all thresholds
 - Secondly, all prerequisites needed to use GBAS for parallel independent approaches should be fulfilled
 - Thirdly, approaches with a 3.2° glide path angle for all thresholds should be implemented
 - Further plans to use the potential of GBAS are envisaged, e.g. curved approaches

PROJECT ELEMENTS 1/2

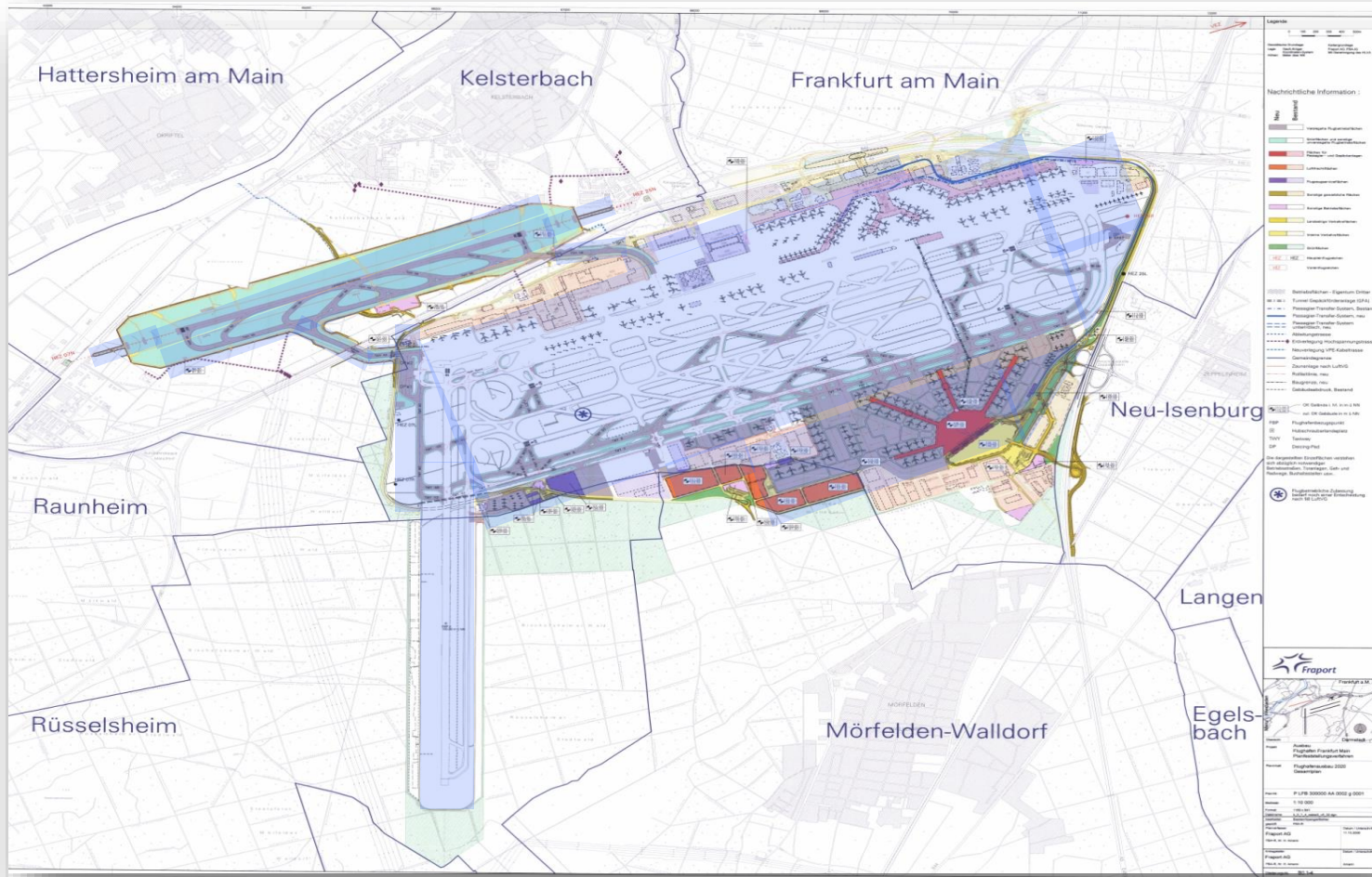
- Project management
 - achieve the project objectives
 - financial controlling
 - coordination of all activities and parties involved
 - purchase of a certified GBAS station including spare parts
 - obtain all necessary permission and licenses (frequency, building, etc.)
- Installation and technical elements
 - site selection and qualification
 - site preparation and construction
 - set up the GBAS station
 - connection to power and data networks
 - GBAS configuration
 - site acceptance of GBAS station

PROJECT ELEMENTS 2/2

- Integration into the technical environment at Frankfurt Airport and DFS
 - integration of indicators for approach and tower controllers
 - integration in central monitoring system for CNS Systems
 - implementation of maintenance procedures
 - training of maintenance staff
- Procedure design and integration into operational environment of DFS
 - procedure design for all approaches and STARs
 - generation of FAS Data for GBAS station
 - training and briefing for controllers
- Approval for operation
 - acceptance and integration tests
 - ground and flight inspection of GBAS station
 - flight validation of procedures
 - EC declaration of verification of systems

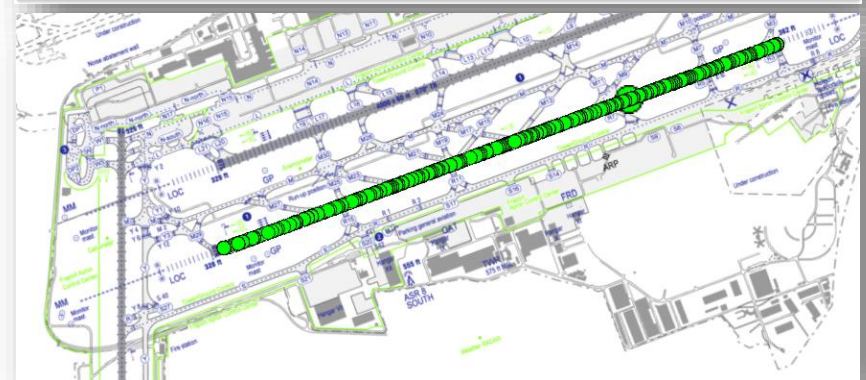
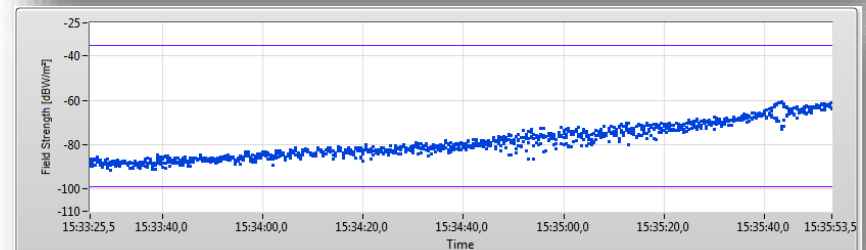
SITE SELECTION

- FRA is a very crowded airport
- Map and paper study -> white zones on the airport can be used (VDB criteria only)



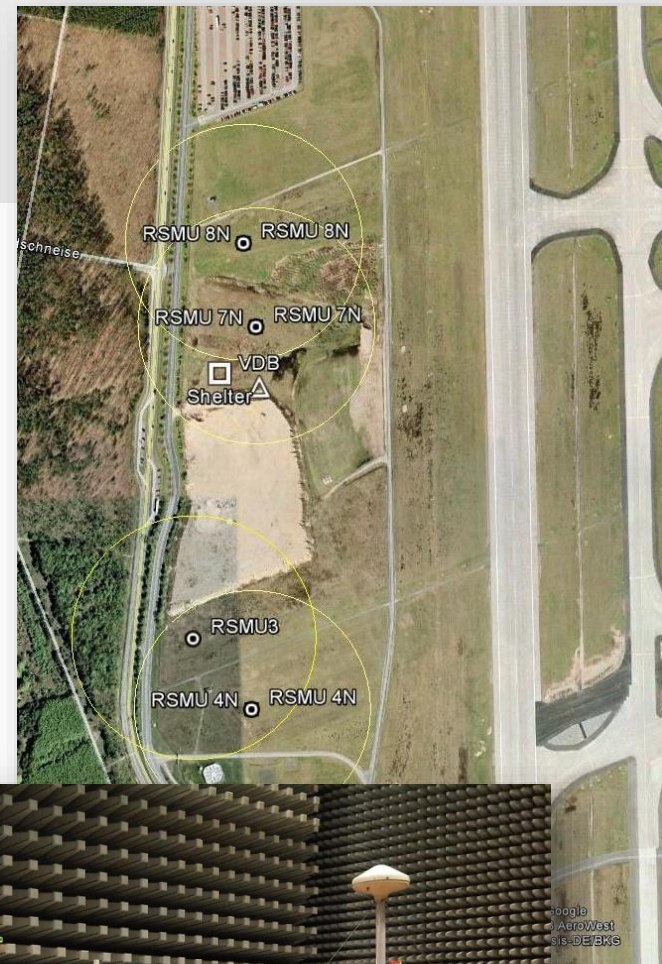
SITE SURVEY

- 8 GPS and 2 VDB candidate sites have been surveyed
- Each GPS site: 24 hours data recording
- Runway coverage measurements for both candidate VDB sites
- Flight inspection for both candidate VDB sites with various antenna heights



SITE QUALIFICATION

- Final position chosen for GBAS station to the west of runway 18
- Position was selected and checked by ground and flight measurements. Ground measurements were conducted by DFS in coordination with Honeywell. For flight measurements, aircraft of the University of Braunschweig were used.
- This is the best position considering the restrictions set by ICAO and manufacturer but not optimal for GBAS.



RE-CERTIFICATION PROCESS

- For the GBAS CAT I station in Frankfurt, Honeywell supplied improved software (Block I) (better availability, more robust against interference, better maintainability, etc.) compared to what was used in Bremen. A major improvement for DFS was the extended range of up to 6.5 km from the GBAS reference point to the CAT I decision point, as this allowed for GBAS approaches to all thresholds at Frankfurt Airport.
 - DFS supported Honeywell in the certification process with the German Federal Supervisory Authority for Air Navigation Services (BAF)
- GBAS software (Block 1) was approved in April 2014 by BAF.

CONSTRUCTION WORK

- The construction work was carried out by FRAPORT in compliance with DFS specifications.



Foundation for RSMU



Foundation for shelter



Cable route

INSTALLATION



4x GPS reference antenna



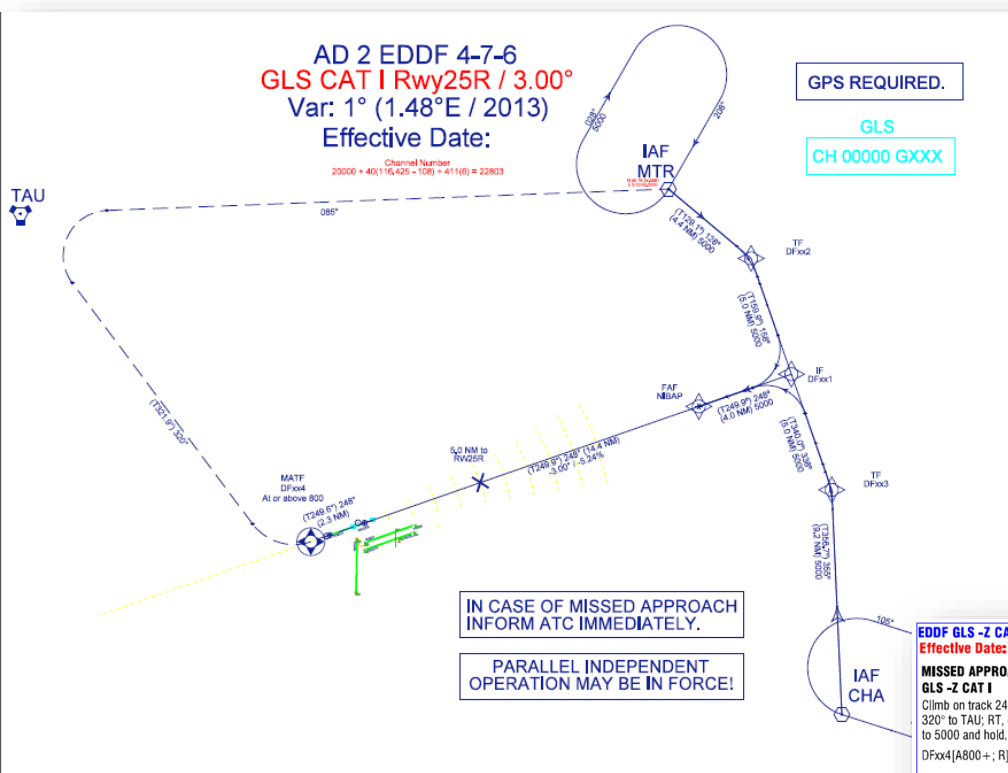
GBAS shelter with Honeywell SLS-4000 cabinet



1x VDB Tx antenna

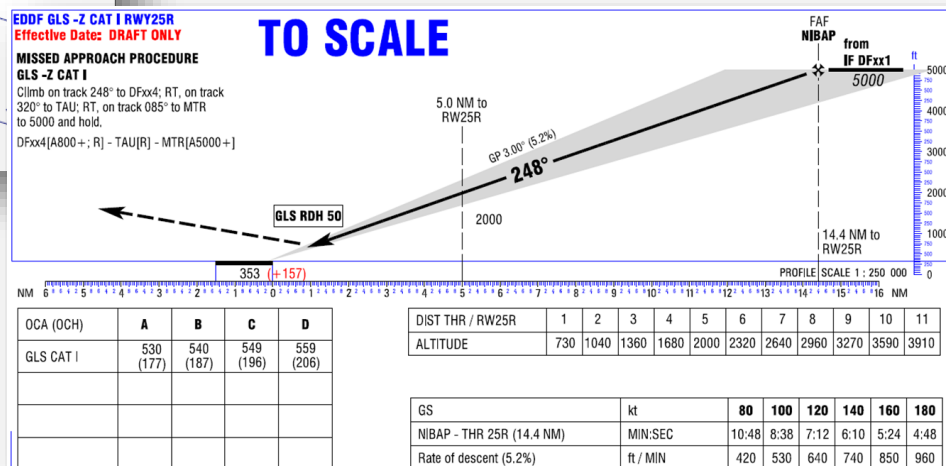
PROCEDURE DESIGN / OPERATIONAL APPROVAL

Flight procedure example for 25R



Criteria for procedures:

- Final starts at 5,000 ft
- Descent starts at NIBAP (14.4 NM to threshold)
- Angle of descent 5.24 % / 3.00°
- GBAS RDH 15 metres (50 ft) over THR 25R



OPERATIONS

- On 3 September 2014, GBAS Frankfurt become operational with five GBAS CAT I approach procedures (3°-glide slope ILS look-alike)
- In September and October 2014, more than 110 GBAS approaches were flown mainly by A 380, B748 and B737 NG



NEXT STEPS

- Improve operations (e.g. removal of restriction in coverage, parallel independent approaches)
- GBAS Frankfurt will be part of the SESAR Large Scale Demonstrations “Augmented Approaches to Land” with trials for “RNP to xLS” approaches
- GBAS approach procedures for all runway thresholds with 3.2° glide slope

Thank you!

