GNSS-EGNOS approaches to European airports

United Nations International meeting on the Applications of Global Navigation Satellite Systems

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December 12th-16th 2011; Vienna
Presentation Outline

• **Introduction**
  - GNSS applications and benefits for Civil Aviation
  - LPV / APV approaches based on EGNOS (SBAS)

• **Previous experience: GIANT project**
  - Aircraft & Helicopter Flight Trials

• **GIANT-2 Project**
  - Flight Trials: Corporate and General aviation

• **Other European projects**
  - SESAR and Eurocontrol TEN-T

Vienna, 12th-16th December 2011
UN International meeting on GNSS applications
Presentation Outline

• ACCEPTA Project:
  • Project overview
  • Consortium
  • LPV Procedures to be published
  • Aircraft to be upgraded with SBAS capability

• Conclusions

• References
“INECO”
Largest Engineering and Consultancy company in the transport area in Spain
• Aeronautical: airports and air navigation
• Railway
• Road
• Over 3000 employees

Owned by the Ministry of Transport of Spain
• Shareholders:
  • Aena, Spanish Air Navigation Service Provider (ANSP) and Airports manager
  • ADIF, Spanish railway infrastructure manager
  • Renfe, Spanish railway operator
Valid sensor for all phases of flight: take-off, departure, en-route, TMA, arrival and approach (down to LPV)

Provides navigation services to all airspace users: airliners, regional, General & Business aviation, helicopters…
GNSS benefits for aviation

- GNSS Applications for Civil Aviation
- EGNOS (SBAS) Applications for Civil Aviation
  - LPV Approaches
- GNSS Operational benefits
- GNSS Safety benefits
- GNSS Environmental benefits
- GNSS Economic benefits
Technical viewpoint

**ILS**
- Broadcast Path
- Local Ground Based Navaids
- Only one RWY served

**SBAS**
- FAS loaded into DB
- No local Navaids
- Multiple RWYs served
GIANT Project
“GNSS Introduction in the Aviation Sector”

Galileo, 6th Framework Programme
Flight Trials: Aircraft

- LPV approaches
  - Based on EGNOS
  - Runways not equipped with ILS
  - Rich obstacle environment

- Airports
  - Valencia (Spain)
    - 21 October 2006
  - San Sebastian (Spain)
  - Bologna (Italy)

- Airline: Air Nostrum
  - Regional airline

- Aircraft
  - Dash 8, stand alone avionics
  - CRJ 200, integrated avionics
Flight Trials: Helicopters

• LPV approaches
  • Based on EGNOS
  • Low altitude IFR flights

• Scenarios
  • Hospital helipads: Lausanne (Switzerland)
    • 6-7 June 2007
  • Oil rigs: North Sea (UK, Norway)

• Operators
  • REGA
  • Bond, Scotia, CHC

• Helicopters:
  • Eurocopter EC155
GIANT-2 Project
“EGnos Adoption in the Aviation Sector-2”
http://giant2.ineco.es

Galileo, 7th Framework Programme
Flight Trials: General Aviation

• **Cordoba airport** (South Spain)
  • Limited approach capabilities: just visual approaches
  • LPV RWY 03 / 21
  • Procedures already designed
  • Database generated by Garmin.

• **Pre-demo flight:**
  • Cuatro Vientos AD (Madrid)
  • LPV RWY 10

• **Aircraft:**
  • **Cessna 172**, operated by American Flyers
  • Integrated Garmin 1000 avionics

• **Date:** 10 February 2011
Flight Trials: SAR Helicopters

- EGNOS as a high precision positioning sensor for Helicopter Search and Rescue (SAR) Operations
- **Objective:** Perform Helicopter flight trials including typical SAR operation based on EGNOS
- **Selected Scenario:**
  - *Italian sea coast: Genova*
- **Helicopter:**
  - *AgustaWestland AW139*
- **Date:** 8 February 2011
SESAR projects (SJU) and TEN-T projects (Eurocontrol)
SESAR WP 5.6.3 “APV” procedures

- **Spain**
  - Girona airport

- **Italy**
  - Rome Ciampino airport

- **United Kingdom**
  - Glasgow airport

- **Norway**
  - Trondheim airport
Eurocontrol TEN-T funded projects

- Projects managed by Eurocontrol (European Organisation for the Safety of Air Navigation) and supported by TEN-T funds:
- AURIGNY (NATS-UK)
  - Aircraft: **Britten Norman Trislander**
  - Airport/Procedures: **Southampton and Alderney**
  - Receiver: **Garmin GNS430W**
- AIRBUS ATI (DSNA-France)
  - Aircraft: **Beluga – Airbus A300-600ST**
  - Airport/Procedures: **(Clermont-Ferrand), Pau**
  - Receiver: **CMC electronics, both FMS and sensor**
- MIELEC (PANSA-Poland)
  - Aircraft: **Piper PA-34 Seneca II**
  - Airport/Procedures: **Mielec and Katowice**
  - Receiver: **Garmin GNS430W**
Flight demonstrations conclusions

• EGNOS-based LPV approach demonstrations and related technical support studies and analyses already being performed in different projects:
  • Key interested markets
  • Benefits demonstrated
• Ready to start a European wide-scale real-life adoption of EGNOS and GNSS in aviation
  • No more single-aircraft, single-airport tests
• EC/GSA, Eurocontrol and Member States to facilitate, foster and provide support to:
  • Airlines and end users
  • ANSPs and airports
ACCEPTA Project
“ACCelerating EGNOS AdoPTion in Aviation”
http://accepta.ineco.es

Galileo, 7th Framework Programme
• The purpose of ACCEPTA is:
  • To accelerate development, certification and marketing of EGNOS enabled **avionics**
  • To promote the development and publication of EGNOS LPV **approach procedures**
  • Promote adoption of EGNOS LPV approaches and avionics by **commercial airlines, general aviation** and **end users**
  • Marketing activities, technical assistance, training, cost-benefit analyses, etc.
Initial Consortium

Vienna, 12th-16th December 2011  UN International meeting on GNSS applications
GNSS-EGNOS (LPV) planned procedures

- LPV procedures are being published all around Europe

- Newcomer countries:
  - Portugal
  - Italy
  - UK
  - Netherlands
  - Finland
  - Austria
  - Czech
  - Slovakia
GNSS-EGNOS in Europe - Central

- **France**
  - Le Bourget
  - Clermont-Ferrand
  - Pau
  - Marseille
  - Toulouse
  - Guernsey
  - etc.

- **Switzerland**
  - Les Eplatures
  - Alternheim

- **The Netherlands**
  - Groningen

Groningen Airport
Le Bourget Airport
Clermont Ferrand Airport
Les Eplatures Airport
GNSS-EGNOS implementation in Europe – The Netherlands

- Groningen Airport

King Air 300

Diamond DA42

Cessna Citation II

Fairchild Metro II

Beech 1900
GNSS-EGNOS in Europe – North

• Finland
  – Joensuu

• Norway
  – Trondheim / Vaernes

Trondheim Airport

Joensuu Airport

Joensuu Airport
GNSS-EGNOS in Europe - South

- **Portugal**
  - Lisbon

- **Spain**
  - Santander
  - Girona
  - Almería
  - Algeciras
  - Ceuta
  - ...

- **Italy**
  - Milan
  - Rome
GNSS-EGNOS in Europe - East

- **Czech Republic**
  - Brno
  - Ostraav

- **Slovakia**
  - Bratislava
  - Kosice

- **Austria**
  - Graz
  - Linz

Austria + Cezch Rep. + Slovakia

Graz Airport  Kosice Airport  Bratislava Airport
GNSS-EGNOS implementation in Europe – UK

- **Scotland**
  - Hebrides Islands
  - Sumburgh
  - Kirkwall
  - Inverness
  - Dundee
  - Glasgow
  - ...

- **England**
  - Exeter
  - Blackbushe
  - Southampton
  - ...

- **Northern Ireland**
  - Belfast
Aircraft upgraded with GNSS-EGNOS capability

- **Air Nostrum**
  - CRJ 1000
  - ATR 72-600

- **CityJet**
  - Fokker 50

- **NetJets**
  - Hawker 750
References

- For further information:

[2] ICAO 36th Assembly
[3] GIANT Website: www.gnss-giant.com
[5] ACCEPTA Website: http://accepta.ineco.es/
[6] EUROCONTROL Website: www.ecacnav.com
[8] ESA-EGNOS Website: http://www.esa.int/esaNA/egnos.html
Thank you very much for your attention!

Questions?

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