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

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# GNSS-EGNOS approaches to European airports

*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

## Presentation Outline

- **ACCEPTA Project:**
  - Project overview
  - Consortium
  - LPV Procedures to be published
  - Aircraft to be upgraded with SBAS capability
- **Conclusions**
- **References**

## Company presentation

# " INECO"

## Largest Engineering and Consultancy company in the transport area in Spain

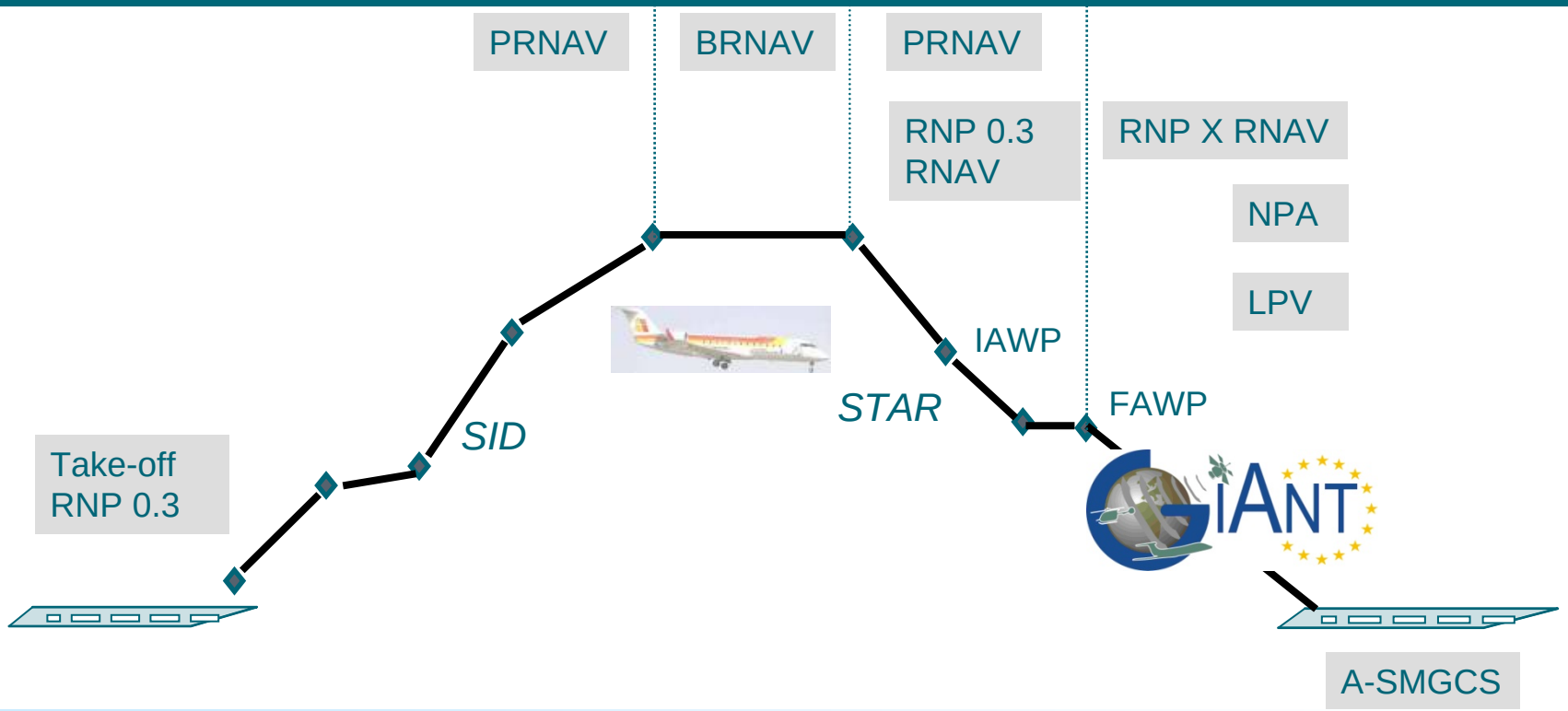
- Aeronautical: airports and air navigation
- Railway
- Road
- Over 3000 employees

## 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

# GNSS Applications for Civil Aviation



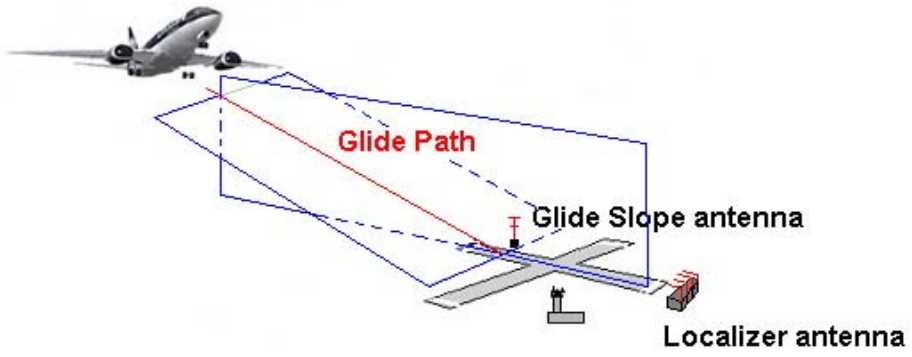

- Valid sensor for all phases of flight: take-off, departure, en-route, TMA, arrival and approach (down to LPV)
- Provides navigation services to all airspace users: airliners, regional, General & Business aviation, helicopters…

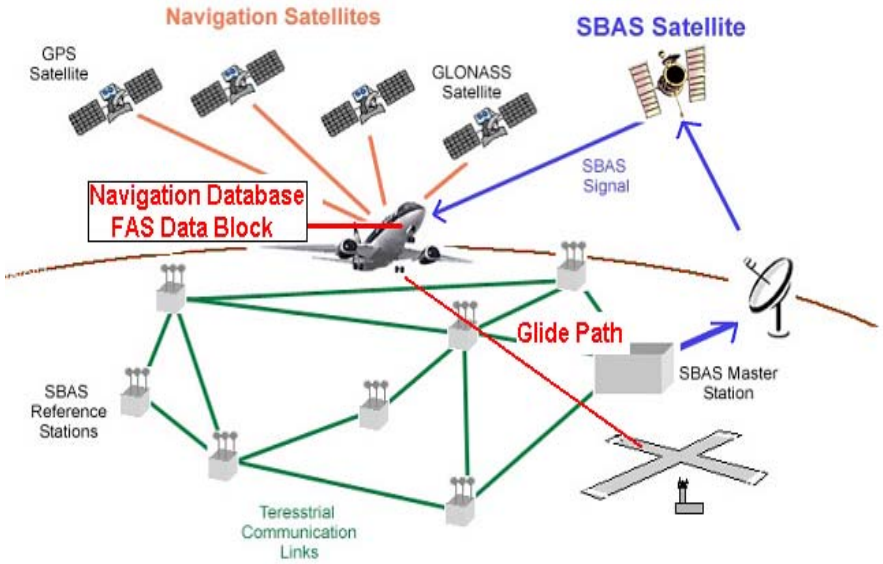
# GNSS benefits benefits for aviation

- 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

# LPV Approach: Concept of operations → *ILS look alike*

## Technical viewpoint




### ILS

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

### SBAS

- **FAS** loaded into **DB**
- **No** local **Navaids**
- **Multiple RWYs** served

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EUROCONTROL

# GIANT Project
# "GNSS Introduction in the AviatioN SecTor"

***Galileo, 6th Framework Programme***

GIANT

## 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

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# 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

Girona airport


Rome airport

Glasgow 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

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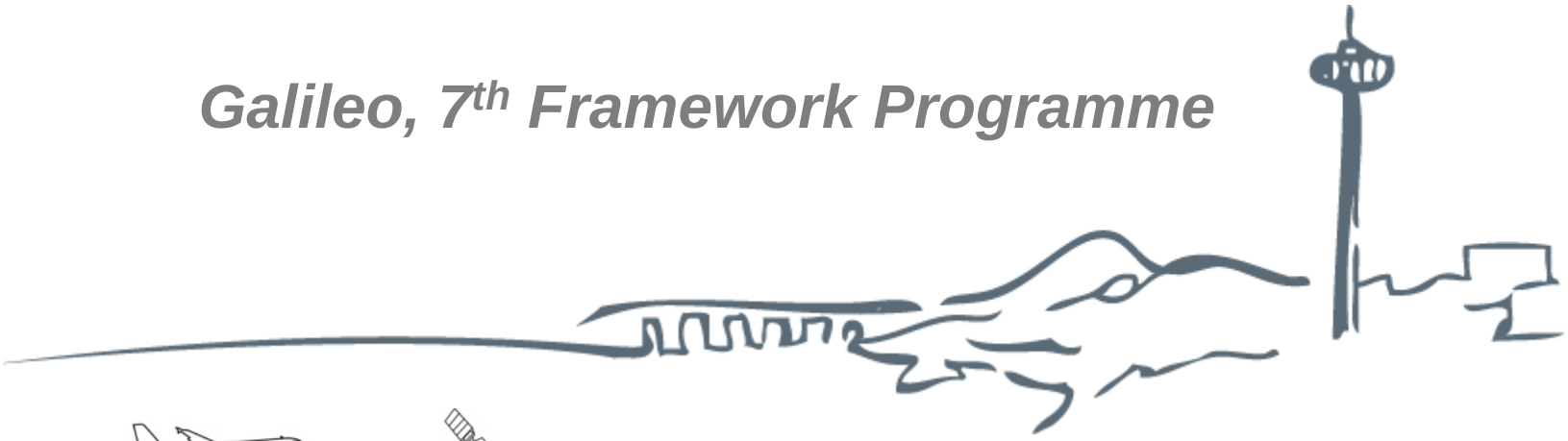
# ACCEPTA Project

# "ACCelerating EGNOS AdoPTion in Aviation"

http://accepta.ineco.es

***Galileo, 7th Framework Programme***



## ACCEPTA Project

- 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

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AIR NOSTRUM

NETJETS

Aena

dgac DSNA

BRITAIR

skyguide

Rockwell Collins

NATS

HELIOS

EBAA European Business Aviation Association

era european regions airline association

*Plus …*
*new partners*

# 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

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

Lisbon Airport

Milan Airport


Girona Airport

# GNSS-EGNOS in Europe - East

- **Czech Republic**
  - Brno
  - Ostraav
- **Slovakia**
  - Bratislava
  - Kosice
- **Austria**
  - Graz
  - Linz


Austria + Cezch Rep. + Slovakia

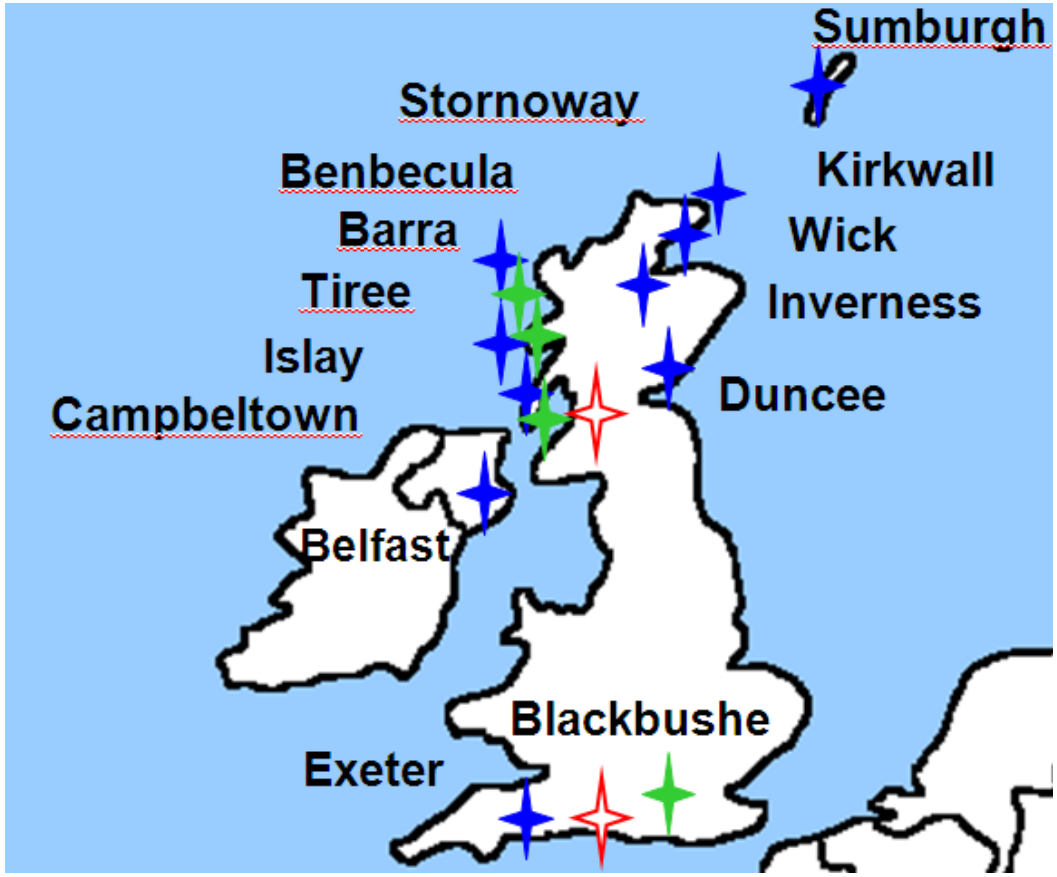
Graz Airport

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

ATR 72-600

CRJ 1000

Fokker 50

Hawker 750

## References

- For further information:

[1] EGNOS Service Provision Yearly Report (Apr09-Mar10)
[2] ICAO 36th Assembly
[3] GIANT Website: www.gnss-giant.com
[4] GIANT-2 Website: http://giant2.ineco.es/
[5] ACCEPTA Website: http://accepta.ineco.es/
[6] EUROCONTROL Website: www.ecacnav.com
[7] GSA Website: http://www.gsa.europa.eu/
[8] ESA-EGNOS Website: http://www.esa.int/esaNA/egnos.html
[9] ESSP SAS corporate website: www.essp-sas.eu

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# Thank you very much for your attention!

## Questions?


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