



EGNOS ADOPTION IN AVIATION: STRATEGY & MAIN ACHIEVEMENTS

EGNOS Service Provision Workshop 2015

Copenhagen, 29th September 2015

Carmen Aguilera
Aviation Market Development Officer

Agenda

-  EGNOS for RNP Approaches. LPV implementation status
-  EGNOS for Helicopters
-  EGNOS for ADS-B
-  EGNOS for Drones
-  Future applications

GSA and aviation stakeholders join forces to bring EGNOS to users



EGNOS Service provider
Technical assistance to foster EGNOS adoption



Cooperation agreement to implement European Union GNSS policies as they apply to the field of aviation.



Safety oversight
PBN Implementation, GNSS regulatory advice
Safety, pilot training, airworthiness criteria



User organisations: business, general aviation, user associations, avionics manufacturers



Working with Aviation value chain

Device manufacturers

Main Players:



Aircraft manufacturers

Main Players:



Airlines/ Aircraft owners

Main organisations:



Air Navigation Service Provider

Main Organisations:



Aerodromes

Main Categories:

- International airports
- Regional airports
- Private airports

- Technical & financial support for avionics development
- Prototyping
- Research on new functionalities

- Cost benefit analysis
- Co-funding of Service Bulletin
- Facilitate operators' request for LPV

- Technical & financial support for upgrade to LPV capabilities
- Dedicated training
- Cost benefit analysis
- Avionics analysis

- Dedicated Training
- Technical & financial support
- Contribution to regulation evolution

- Technical & financial support for procedure implementation
- Cost benefit analysis

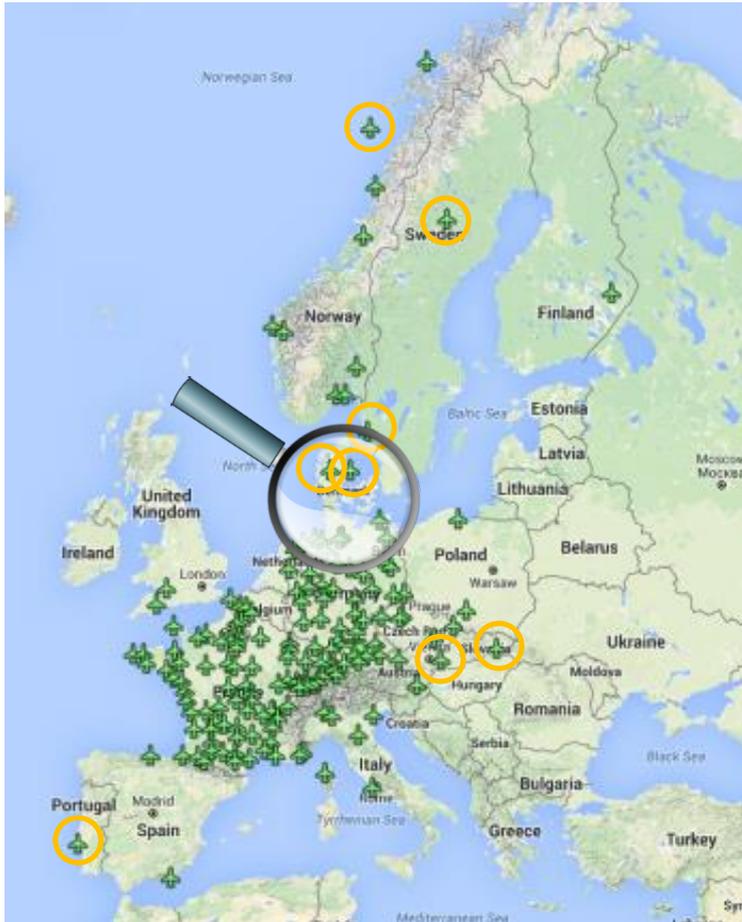
Examples of GSA initiatives

A large white commercial airplane is parked on a tarmac. In the background, there is a large glass hangar. The sky is blue with some clouds. The text "FOCUS ON LPV" is overlaid in blue, bold, sans-serif font with a reflection effect.

FOCUS ON LPV

NEW TOOLS, NEW OPPORTUNITIES

Procedures results and trend are encouraging: 202 Operational LPVs



http://egnos-user-support.essp-sas.eu/egnos_ops/lpv_map/map.php

202 operational LPV in 130 airports in 18 countries
+ 69 additional 'EGNOS Enabled' APV-Baro
...+ Tailored/PinS LPV

22% directly supported by GSA



Welcome to countries with first LPV in end 2014/2015!

- Denmark: Aarhus and Karup
- Portugal: Lisbon
- Slovakia: Bratislava and Kosice
- Sweden: Gothenburg City and Storuman

Looking forward to the upcoming ones

- Belgium: Antwerp
- Croatia: Dubrovnik
- Ireland: Dublin
- Romania: Cluj Napoca

Joint work in Denmark

- **2012:** GSA Analysis of EGNOS based RNP APCH potential benefits for Danish regional airports
- **2013:** Coordination with Naviair, Trafikstyrelsen and regional airports
- **2014-2015:** Support to RNP APCH Implementation at Aarhus and Karup



(EKAH)

- 6000 movements and 468 000 passengers (2010 data)
- Instrument Procedures available:
 - ILS cat I RWY 10R
 - ILS cat II RWY 28L
 - VOR/DME RWY 10R/28L
- LPV as backup for ILS, and ability to decommission Cat I in the future



KARUP AIRPORT*

(EKKA)

- Combined military and civil airport
- 3800 movements and 200 000 passengers (2010 data)
- Instrument Procedures available:
 - ILS RWY 27L/09R
 - VOR/DME RWY 27L/09R
 - NDB/DME RWY 27R
- LPV as backup for ILS

Different users...different needs

One solution DOES NOT fill all



General aviation (I): Demand LPV to less equipped airfields

The challenge:
LPV to non-instrument runway
(ATS? Runway? MET/COM?)



"GA need help to increase GNSS approaches implementation and increase safety"

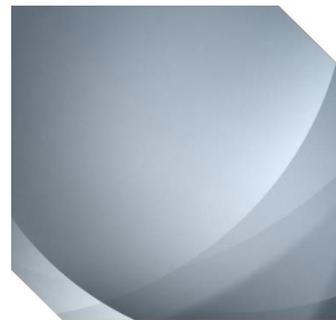


Paul Sherry, PPL/IR Europe.

Regulatory framework:
The UK CAP 1122

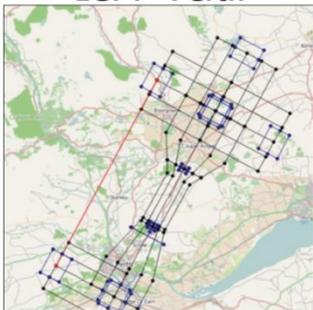
Applying for instrument approach procedures to aerodromes without an instrument runway and/or approach control

CAP 1122

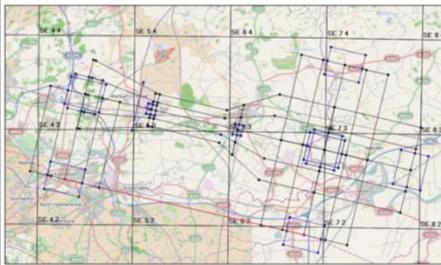


Pilot cases in UK and Spain

EGPT - Perth



EGCJ - Sherburn-in-Elmet



Towards an harmonised implementation framework

Together with



General Aviation (II): Demand cost effective avionics

GSA has supported the EASA approval for the avionics system most widely used by GA pilots: Garmin GNS430 & GNS530 (September 2015)



- Garmin GNS 430W/530W: GNSS/SBAS avionics most used by IFR GA in EU
- LPV retrofit with GNS 430W/530W is considered a Major Modification



Solution: Approved All Model List STC for LPV capability

- Applicable to **CS 23 (light GA aircraft)**
- Existing Garmin GPS unit of the following versions GNS530W, GNS530AW, GNS530W-TAWS, GNS530AW-TAWS, GNS430W and GNS430AW.
- Cost **€300** per aircraft registration for GNS-W versions



From **10000 €**



To **300€**

Together with:



EGNOS is the preferred option for Business Operators

Memorandum of Understanding (MoU) to promote the wide use of EGNOS – precision-based navigation (PBN) – at regional airports in Europe



+



Demand for LPV procedures

- 10 priority airfields selected
- Implementation ongoing

The fleet is already equipped and ready to fly LPV.

- Most OEMs for business aviation and high end helicopters provide SBAS/EGNOS equipage in new models
- Analysis of members fleet and availability of retrofit solutions

Operational approval guidelines developed with ESSP



GSA support to Regional airlines

DONE!

Upgrade in 2015

Chalair



Beechcraft1900

Wideroe



DHC 8-100

New funded projects

ON-GOING

HOP!



13xATR42-500

Equipment: CMC electronics
STC development: AeroConseil

Air Baltic



12xDHC-8-402

Equipment: x8 UNS-1E, x4 UNS-1Ew



17x Jetstream 41

Equipment: UNS1-LW FMS + LPV monitor
STC development: CranField Aerospace Ltd



9x Saab 2000

Developing a new tool for airspace users: Identify a suitable STC for LPV



www.sbas4aviation.eu

Main features :

- ✓ Direct and continuous entry of data into the database
- ✓ Easy interface for user to find LPV solutions matching their aircraft
- ✓ Market information for manufacturers and MRO's

European SBAS Database

Home

Home

▶ Add your aircraft

▶ View your aircraft

▶ Find suitable avionics

▶ European registered fleet

▶ My account

▶ Log out

Add Your Aircraft

Registration:

New registration: Yes No

Registration date:

GPS/SBAS avionics installation date:

GPS/SBAS avionics:

If your avionics is not listed above, please specify your GPS enabled avionics below:

ICAO Designator:

Manufacturer:

Model:

Copyright © 2014. All Rights Reserved.

A
B
C



EGNOS FOR ROTORCRAFT

EGNOS for rotorcraft operations: a technology enabler in SESAR

Current situation and needs

IFR Rotorcraft are constrained to use procedures designed for airplanes

Generally heliports are not well equipped in terms of ground navigation aids

Rotorcraft operations should not be limited to VFR/VMC conditions (specially HEMS)!



Enabler for IFR rotorcraft operations

Direct Approach with Vertical guidance (LPV)

Point in Space

Curved procedures/RNP-AR (with RF)

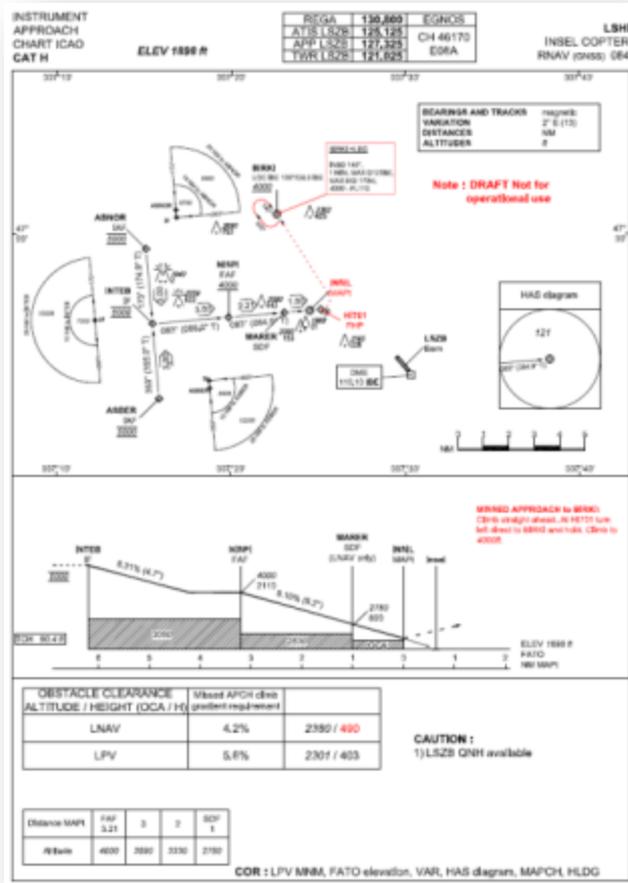
Low Level RNAV routes

Simultaneous non interfering operations

Rotorcraft Point-in-Space



PinS APCH at Insel hospital heliport

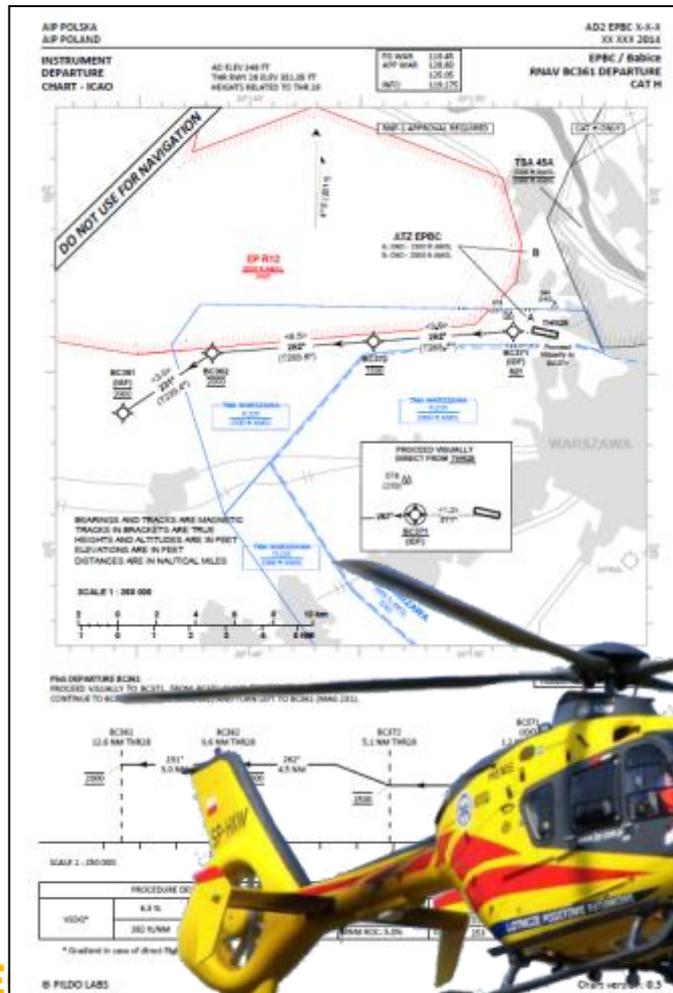


- ✓ RNP APCH
- ✓ First PinS LPV procedure approved within Europe
- ✓ Proceed Visually



Rotorcraft Point-in-Space

PinS at Babice with Low Level Route to Lodz airport



Simulator pre-flight



"Our priority is safety for the client and the pilot: to be safe back home when after take-off the weather doesn't allow performing the mission. Here is when EGNOS comes into the picture. You can fly safely also at night!"

Mieszko Syski , LPR



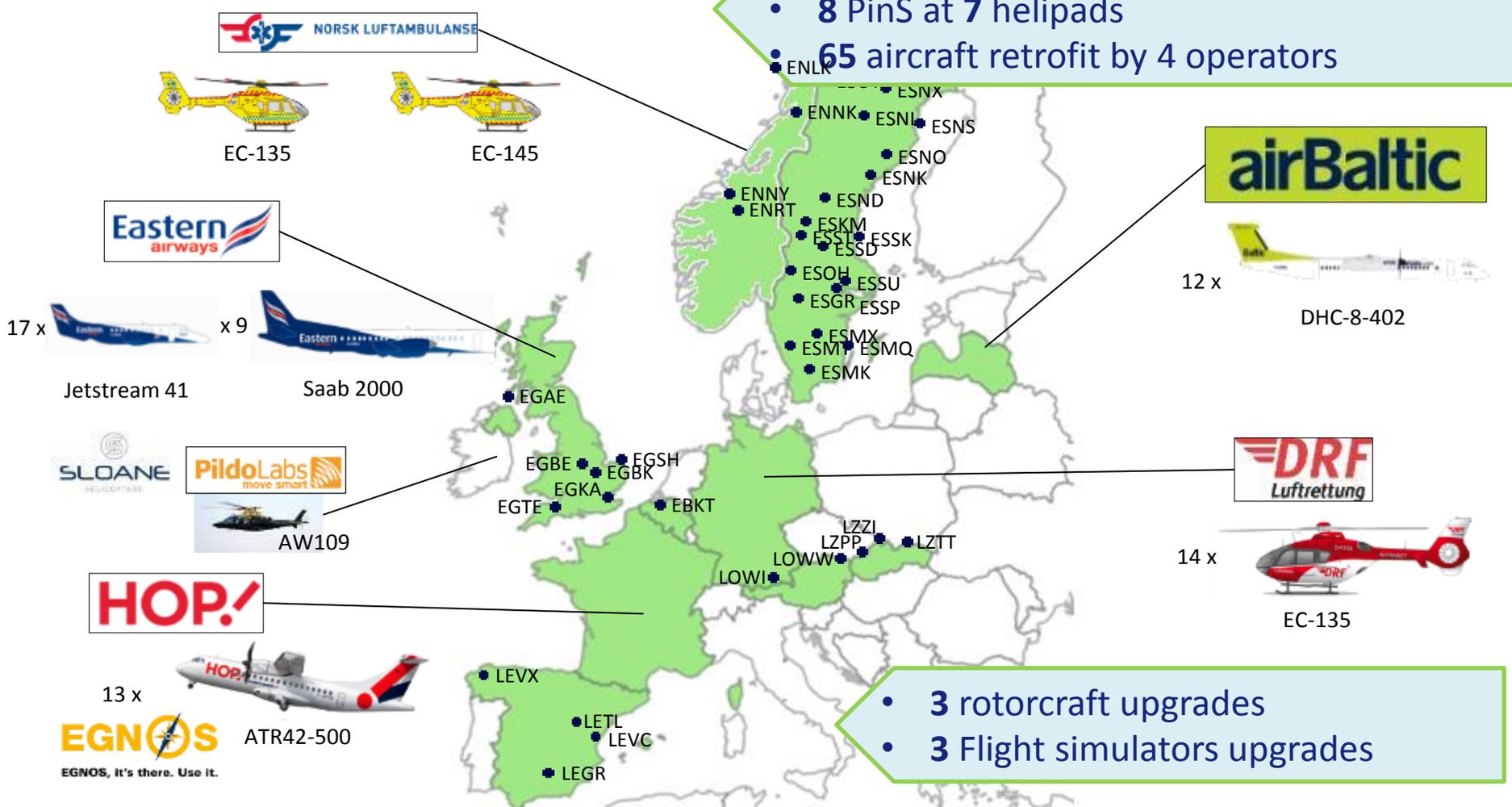
E
EGNOS, it's there. Use it.

© PRDO LABS
Ordn version: 0.3
Satellite Support Agency



Coming soon: 13 GSA funded projects kick off

- 69 EGNOS based procedures at 36 airports
- 8 PinS at 7 helipads
- 65 aircraft retrofit by 4 operators



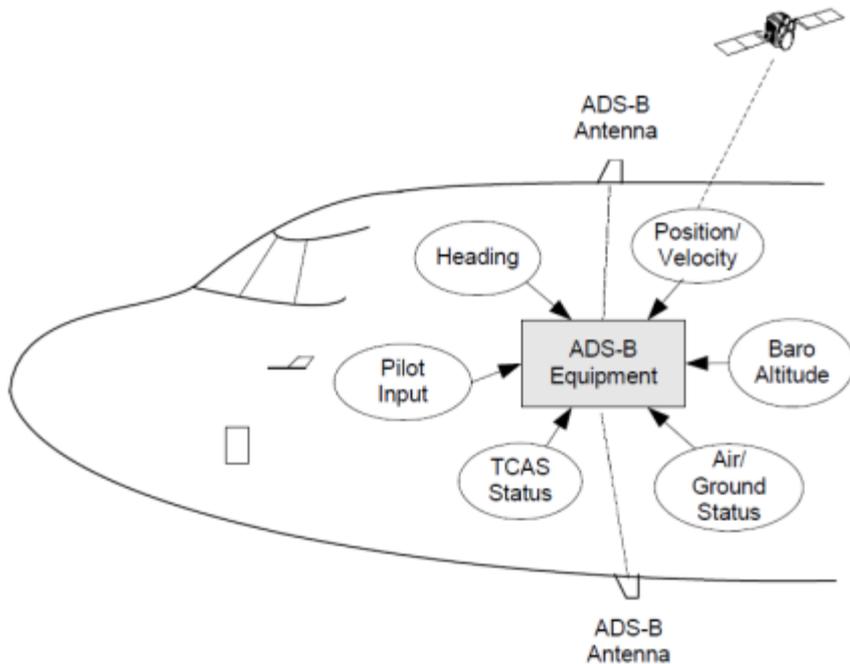
- 3 rotorcraft upgrades
- 3 Flight simulators upgrades





EGNOS FOR ADS-B

GNSS source for ADS-B



GNSS is required for the horizontal position and velocity data source

In principle, EGNOS (SBAS) and GNSS + RAIM (ABAS) can support ADS-B Out

Only SBAS source can provide an equivalent level of service as for Radar Surveillance:

SBAS ensures 99.9 % of availability

WAAS role for ADS-B introduction in US



The FAA only recognizes SBAS as the only way to get 99.9 % availability

SBAS is “de facto” required

Positioning Service (receiver standard)	Predicted Availability (ADS-B Compliance)
GPS (TSO-C129) (SA On)	$\geq 89.0\%$
GPS (TSO-C196) (SA Off)	$\geq 99.0\%$
GPS/SBAS (TSO-C145/TSO-C146)	$\geq 99.9\%$

The combined use of SBAS source for Navigation and Surveillance brings significant Safety improvements to the system and allows Ground Infrastructure Rationalization



GNSS FOR CIVIL DRONES



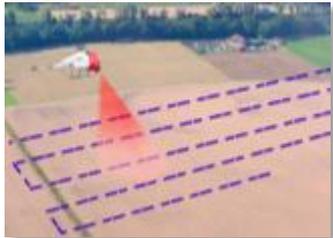
Leveraging EGNOS and Galileo for robust platform navigation and application development



Projects concluded
2010-2014

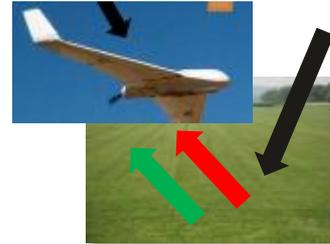


Projects ongoing
2015-2017



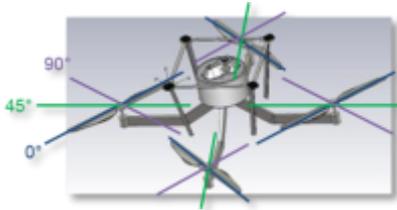
FIELDCOPTER

EGNOS Based Precision Agriculture Using Unmanned Aerial Vehicles



MISTRALE

Monitoring of Soil moisture and water-flooded areas for agriculture and environment



LOGAM

Low cost GNSS attitude and navigation system with inertial MEMS aiding



COREGAL

Combined Positioning-Reflectometry Galileo Code Receiver for Forest Management



CLOSE-SEARCH

Accurate and safe EGNOS-SoL Navigation for UAV-based low-cost SAR operations'



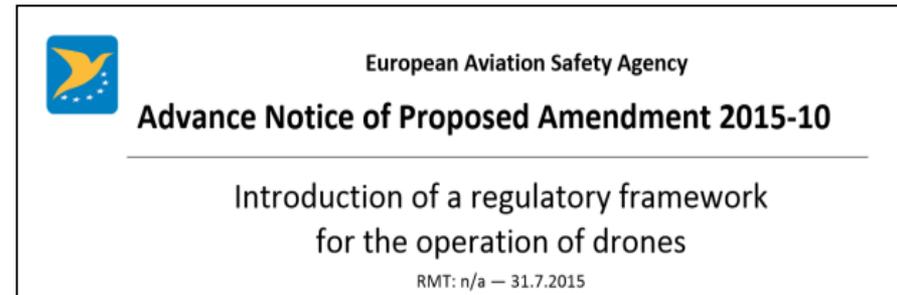
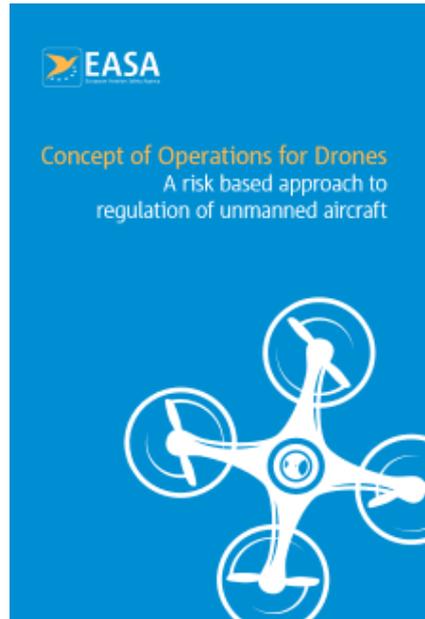
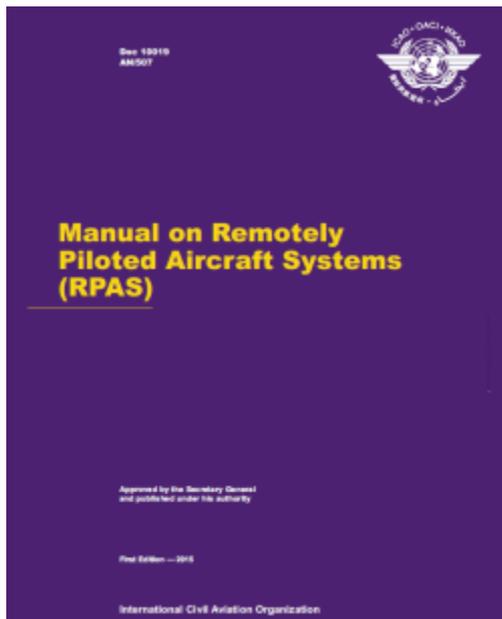
MAPKITE

EGNOS-GPS/GALILEO-based high-resolution terrestrial-aerial sensing system.



Regulatory framework for drones

The use of RPAS is growing rapidly worldwide.
High industrial interest to use drones in civil applications
Regulatory initiatives
Drones require safe navigation



EGNOS contributes to accurate, safe navigation

EGNOS supports drone navigation with higher accuracy and integrity

- Combined GNSS/inertial measurements meet user navigation requirements
- EGNOS enhances positional accuracy (horizontal and vertical)
- EGNOS integrity data can be used in the control law/Kalman filtering
- EGNOS integrity data can be used to compute protection levels suited to drone navigation
- Autonomous flights require EGNOS to increase safety (although not only...)

Ongoing work

- Navigation requirements and EGNOS contribution per application
- Explore the contribution of EGNOS reliable PVT for navigation/'detect-and-avoid' function
- Respond to users flying at low altitude

2015 Call for proposals to foster EGNOS adoption in aviation



Objectives

- ✓ Foster the implementation of EGNOS based operations: RNP APCH, PinS LPV
- ✓ Development and/or installation of GPS/EGNOS enabled avionics
- ✓ Development of Service Bulletin and/or Supplemental Type Certificate
- ✓ Other EGNOS based operations and development of Enablers
- ✓ EGNOS for drones



EU Funding

Maximum budget of this call: 6 M€

Maximum EU financing rate:

Direct costs: 60% funding; Indirect costs: flat rate 7% of the direct costs

Timing

Publication: 24 June 2015

Deadline for submitting applications: 10 October 2015

2015 Call for proposals to foster EGNOS adoption in aviation



Objectives

- ✓ Foster the implementation of EGNOS based operations: RNP APCH, PinS LPV
- ✓ Development and/or installation of GPS/EGNOS enabled avionics
- ✓ Development of Service Bulletin and/or Supplemental Type Certificate
- ✓ Other EGNOS based operations and development of Enablers
- ✓ EGNOS for drones



10 Days left!

Timing

Publication: 24 June 2015
Deadline for submitting applications: 10 October 2015

Opportunities and challenges ahead

Looking at LPV...

- LPV in Non Instrument Runways
- Helicopter operations i: PinS, RNP 0.3
- Combined use of SBAS receiver for Navigation (LPV) and Surveillance (ADS-B)
- High demand at high latitudes
- Increase availability for LPV retrofit solutions
- LPV-200 capability, enabling CAT I approach procedures

And beyond...

- EGNOS for other applications: Surveillance, Vertical Separation
- EGNOS added value for drones
- Multi-constellation Multi-frequency concept of operations

THANK YOU FOR YOUR ATTENTION



Carmen Aguilera

Aviation and R&D Market Development Officer, GSA

Carmen.Aguilera@gsa.europa.eu

www.gsa.europa.eu