EGNOS Services Implementation Roadmaps

EGNOS Service Provision Workshop 2015

29th September 2015
Table of Contents / Goals

- EGNOS System and Services status
- EGNOS Services Implementation roadmaps
EGNOS Status

EGNOS System Release v241M

Entry in operations on 30th June 2015
EGNOS Status

- Obsolescence issues solution
- Space Segment update
- Improvement of system robustness
- Qualification of LPV-200 capability

ESR v241M
Solves some obsolescence issues in the ground segment telecommunication network

New NLES G2 sites deployed (Redu and Betzdorf)

- New HW and SW to deal with legacy obsolescence issues
- Linked to GEO space segment update with GEO SES-5 (PRN 136)
EGNOS Status

EGNOS Space Segment update

From 20th August 2015 ....

- **EGNOS OPS**: PRN120 & PRN136 broadcast EGNOS messages to provide the operational SIS

- **EGNOS TEST**: PRN126 is used by industry for ESR tests, operators training and qualification.

Details of “EGNOS Space Segment” are given in EGNOS Service Notice #15:
[http://egnos-user-support.essp-sas.eu/new_egnos_ops/content/service-notices](http://egnos-user-support.essp-sas.eu/new_egnos_ops/content/service-notices)
EGNOS Status

Improves system robustness ...

... against disturbances in the behaviour of IONOSPHERE

- Corrections of identified problems with IONO monitoring (IGPs) in the south
- Adjustment of some internal IONO parameters at CS level

General improvement of IGPs monitoring during periods with degraded IONO behavior
EGNOS Status

Improves system robustness ...

... against disturbances in the behaviour of

IONOSPHERE

GPS CONSTELLATION

- Corrections of identified problems with GPS SV monitoring by RIMS

General improvement of GPS SVs monitoring
EGNOS Status

Qualified for “LPV-200 service level” capability

Is compliant with **ICAO Annex 10 Category I precision approach SiS performance requirements**

Supports next NAV SPEC as of ICAO PBN Manual: RNP APCH down to **LPV minima as low as 200 ft**

Enables **3D instrument approach operations Type A or Type B Category I**

A key milestone for EGNOS Programme
## EGNOS SoL Service Level: LPV-200

### ICAO ANNEX 10 Vol I – SiS PERFORMANCE REQUIREMENTS

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
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<td>220 m (720 ft)</td>
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<td>16.0 m (52 ft)</td>
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<td>1 – 2x10⁻⁷ in any approach</td>
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</tr>
<tr>
<td>40 m (130 ft)</td>
<td>50 m (164 ft)</td>
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</table>
# EGNOS SoL Service Level: LPV-200

## CURRENT EGNOS SERVICE LEVELS

### ICAO ANNEX 10 Vol I – SiS PERFORMANCE REQUIREMENTS

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### En-route (oceanic/continental)

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### En-route, Terminal

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### Initial/Intermediate App / NPA / Departure

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### APV-I

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### Category I precision approach

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<td>16.0 m (52 ft)</td>
<td>6.0 to 4.0 m (52 ft)</td>
<td>$1 \times 2 \times 10^{-7}$/h in any approach</td>
<td>6 s</td>
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### ICAO PBN Manual (NAV SPEC)

- RNAV 10*
- RNP 4*
- RNP 2
- RNP 5, 2, 1
- RNP 0,3
- RNP 1
- RNP APCH down to LP / LPV (DH >250')
- RNP APCH down to LPV (DH >200')

*non sbas receivers
## EGNOS SoL Service Level: LPV-200

### ICAO ANNEX 10 Vol I – SiS PERFORMANCE REQUIREMENTS

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**En-route**
- **(oceanic/continental)**
- **Terminal**
- **Initial/Intermediate App / NPA**

**Category I precision approach**

- APV-I
- RNP APCH down to LP / LPV (DH >250')
- RNP APCH down to LPV (DH >200')
- RNAV 5, 2, 1 RNP 0.3
- RNAV 1 RNP 0.3
- RNAV 10* RNP 4* (non sbas receivers)
- RNAV 2

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**EGNOS SoL Service Level:** LPV-200 service level

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# EGNOS SoL Service Level: LPV-200

LPV-200 and APV-I service levels share some requirements

LPV-200 vertical performance requirements more stringent than APV-I

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<td>1 – 2x10⁻⁷ in any approach</td>
<td>6 s (in ICAO Doc 9613)</td>
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EGNOS SoL Service Level: LPV-200

LPV-200 and APV-I service levels share some requirements

Vertical performance requirements more stringent in LPV-200 than APV-I

LPV-200 based approaches impose **novel requirements on**

**Accuracy tail distribution**

Remaining 5% of the time
LPV-200 and APV-I service levels share some requirements

Vertical performance requirements more stringent in LPV-200 than APV-I

LPV-200 based approaches impose novel requirements on Accuracy tail distribution

Accuracy tail Requirements

ICAO SARPS – Acceptable Means for Category I precision approach with VAL >10m

In nominal conditions:
Probability (VNSE > 10m) < $10^{-7}/150s$

In degraded conditions:
Probability (VNSE > 15m) < $10^{-5}/150s$
EGNOS SoL Service Level: LPV-200

**LPV-200 benefits:**

- Provides angular lateral and vertical guidance without any visual contact to the ground until a Decision Height down to 200 ft.
- Enables RNP APCH down to LPV minima as low as 200 feet and supporting 3D approach procedures Type A and B Category I.
- Enables Precision approaches where today it is not possible.
- Equivalent to a Category I ILS approach.
- Lower DH minima than with APV-Baro.
- With low operational impact keeping safety levels.
- Brings additional direct and indirect benefits.
EGNOS system is ready to support RNP APCH down to LPV minima as low as 200 feet
As part of the EGNOS SoL service provision, LPV-200 service level is currently available for operational use.
1. Press Release on LPV-200
2. New version of the SoL SDD for LPV-200

EGNOS Status

**EGNOS SoL Service Definition Document (SDD)** describes characteristics, commitments and liabilities of and access conditions to EGNOS SoL service.
For the computation of LPV-200 AVAILABILITY, two new requirements in addition to \( xPL < xAL \) are defined regarding the probability that the VNSE exceeds.

a) 10m in nominal system operation conditions, set to \( 10^{-7} \) per approach, and

b) 15m in degraded system operation conditions, set to \( 10^{-5} \) per approach.
**EGNOS Status**

**LPV-200 coverage in ECAC Member States**

(LPV-200 availability 99% isoline)
For the computation of LPV-200 CONTINUITY, the same new two requirements as in LPV-200 AVAILABILITY are applied.
EGNOS Status

Obsolescence issues solution
Space Segment update
Improvement of system robustness
Qualification of LPV-200 capability
EGNOS Status

**2x MCC**
Mission Control Centers

**39x RIMS**
Ranging & Integrity Monitoring Stations

**6x NLES**
Navigation Land Earth Stations

**GPS signal**

**EGNOS**
3 GEO satellites
EGNOS Services

How does ESR v241M impact EGNOS services?
• Improvement of OS performances specially in terms of better continuity values.
• Improvement of OS service area in the south

• SBAS messages from SES-5 (PRN 136) are available

• Improvement of SoL performances specially in terms of better continuity values.
• General improvement of SoL service area (NPA and APV-1 levels) in particular in the south-west
• LPV-200 service level readiness for operational use.
EGNOS Services Implementation roadmaps

EGNOS Services Implementation roadmaps (SIRs) provide a high-level overview of

- EGNOS Services current status
- EGNOS Services foreseen evolutions in a 3-year timeframe linked to
  - Consecutive EGNOS System Releases’ deployments
  - Information/interfaces improvements/changes.

These roadmaps are mainly focused on 4 different aspects:

- Service Area (OS & SoL) or Data availability (EDAS)
- Service Level
- Service Robustness
- User Interfaces

Current version is v3.2 covering the period: Q1 2015 – Q4 2017

http://egnos-user-support.essp-sas.eu/new_egnos_ops/content/service-implementation-roadmaps

Next update foreseen in Q4 2015 (updated in a 6 months-basis)
EGNOS Services Implementation roadmaps

Service Area

**ESR v2.4.1M:**
- Deployment timeline: In operation
- Service Areas Improved: SoL, OS
  - General improvement of OS and SoL service (NPA and APV-1 levels) areas specially in south-west of Europe
  - Full NPA coverage area in ENI countries
  - LPV-200 coverage area defined in the SoL SDD

**YSR #2:**
- Deployment timeline: Q2 2017
- Service Areas Improved: SoL, OS
  - Inclusion of RIMS Haïfa improving SoL coverage in the south-east of Europe
  - Full OS coverage in EU 28 (excluding Azores)
  - MT27 extension to 72ºN for SoL service
EGNOS Services Implementation roadmaps

Service Area

- (Q1) 2015: Target full NPA in EU28
- (Q3) 2015: APV-I improvement in south-western service area
  - NPA service area extension to ENI region (ESR v2.4.1 M)
  - LPV200 first commitment area
- (Q3) 2015: OS area extension to southern regions (ESR v2.4.1M)
- (Q2) 2017: Service Area extension to 72°N and to the south-eastern Europe (YSR2)
- (Q2) 2017: Target full OS in EU28, except Azores (YSR2)

EGNOS
EGNOS, it's there. Use it.
ESR v2.4.1M:
- **Deployment timeline:** Q3 2015
- **Service:** EDAS

ESR v2.4.1N:
- **Deployment timeline:** Q2 2016
- **Service:** EDAS

**YSR #2:**
- **Deployment timeline:** Q2 2017
- **Service:** EDAS

- SES-5 (PRN 136) replacing INMARSAT 4F2 EMEA (PRN 126). From then on, SBAS messages will be available from SES-5 (PRN 136) through EDAS.

- ASTRA-5B (PRN 123) replacing INMARSAT 3F2 AOR-E (PRN 120). From then on, SBAS messages will be available from ASTRA-5B (PRN 123) through EDAS service.

- Inclusion of RIMS Haïfa leading to more information to be available through EDAS service.
EGNOS Services Implementation roadmaps

Data Availability

- (Q3) 2015: Space Segment Update
- (Q2) 2016: Space Segment Update
- (Q2) 2017: New RIMS

DATA AVAILABILITY

01/01/2015 to 31/12/2017
New SoL service level “LPV-200”:

- **Service Declaration:** 29th Sep. 2015
EGNOS Services Implementation roadmaps

Service Robustness

**ESR v2.4.1M:**

- **Deployment timeline:** In operation
- **Robustness improved in:** SoL, OS
  - PRN 126 replacement by new SES-5 (PRN136) to improve GEO orbital stability.
  - Increased robustness against IONO disturbances
  - Improvement in SV monitoring
  - Deployment of two new NLES G2 sites

**ESR v2.4.1N:**

- **Deployment timeline:** Q2 2016
- **Robustness improved in:** SoL, OS
  - ASTRA-5B (PRN 123) replacing INMARSAT 3F2 AOR-E (PRN 120) so as to ensure the level of robustness and GEO orbital stability
EGNOS Services Implementation roadmaps

Interfaces with Users

**EGNOS Services Generic I/Fs:**

  - New upgrade with improved usability, availability and robustness
  - Contents improvement in order to increase usability, user experience, friendly-user interfaces
Interfaces with Users

EGNOS Services Generic I/Fs:

- EGNOS Service Definition Documents (SDD):
  - New SoL SDD for LPV-200 declaration published TODAY
  - OS SDD update in Q1 2016 (ESR v2.4.1M): Service area extension to the southern regions
  - SoL SDD update in Q2 2016 (ESR v2.4.1M):
    - NPA coverage extension to fully ENI with 99.9% availability
    - APV-I coverage extension in the south-west of the service area
    - LPV-200 coverage extension is foreseen in line with the APV-I coverage trend
  - OS SDD update (YSR2) in Q4 2017: Target full OS availability in EU28 (except Azores)
  - SoL SDD update (YSR2) in Q2 2018: Extension to 72ºN + Improve availability in the south-east Mediterranean due to Haïfa RIMS
  - EDAS SDD update (YSR2) in Q4 2017: New RIMS in Haïfa and new GEO constellation
EGNOS Services Implementation roadmaps

Interfaces with Users

EGNOS Services Generic I/Fs:

- EGNOS User Support Website Update (Q2) 2015
- EGNOS SoL SDD v2.2 (Q3) 2015
- EGNOS OS SDD v2.2 (Q2) 2015
- EGNOS OS SDD (ESR v2.4.1M) (Q1) 2016
- EGNOS SoL SDD (ESR v2.4.1M) (Q2) 2016
- EGNOS OS SDD (YSR2) (Q4) 2017
- EDAS SDD update (Q4) 2017 31/12/2017

EGNOS, it's there. Use it.
Thanks for your attention ...
It’s time for Q & A