



EGNOS status and plans

Joint ACAC/ICAO MID Workshop on GNSS
Rabat, 5 April 2016



Ugo Celestino
European Commission





EU GNSS Programmes

□ EGNOS

- SBAS
- Improves GPS performance (and Galileo)
- 3 services (operational since 2009)
- Continental coverage



□ Galileo

- Autonomous infrastructure
- Performances similar to GPS
- 5 services (under development, start 2016)
- Worldwide coverage



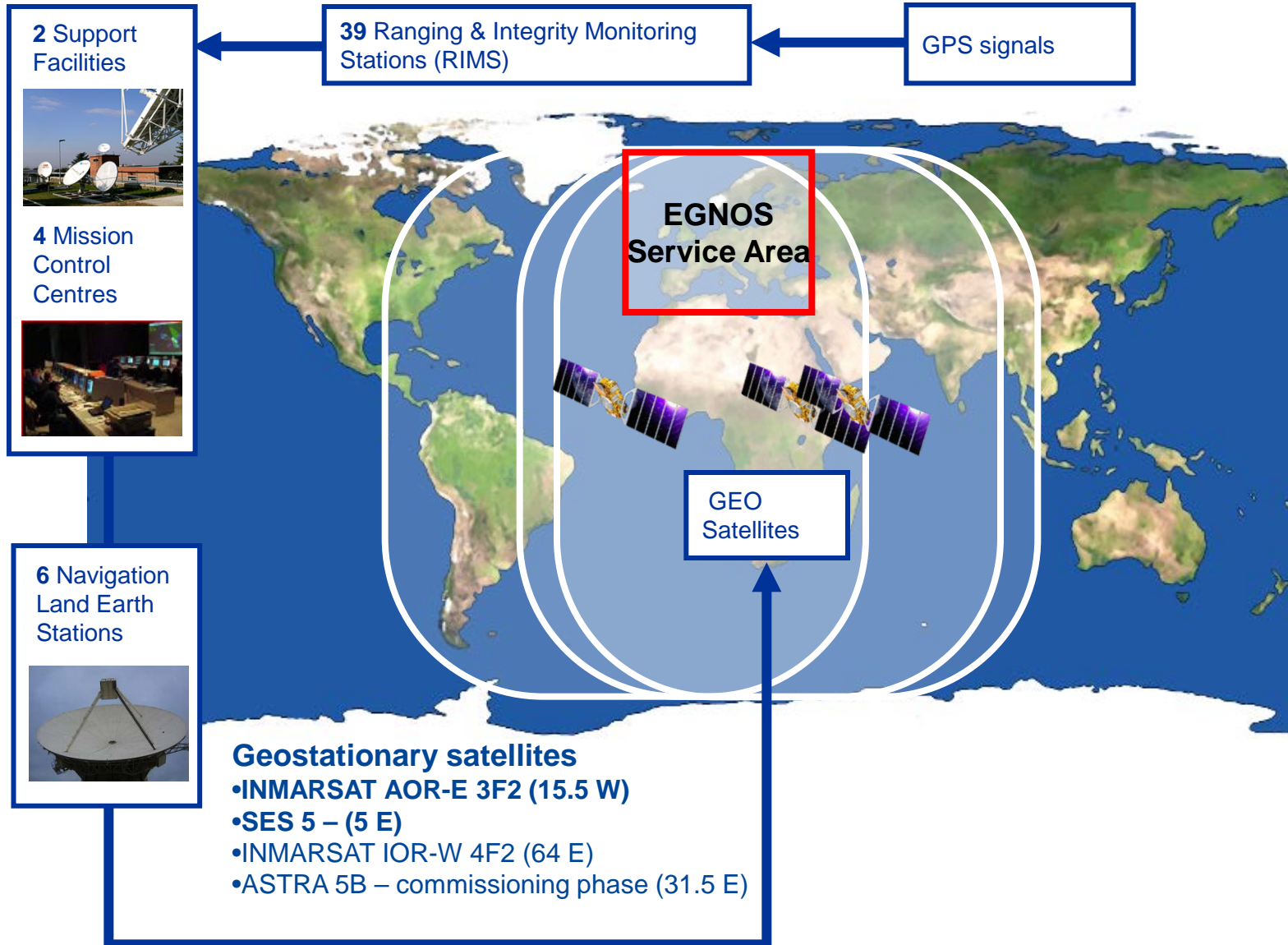


European
Commission




EGNOS



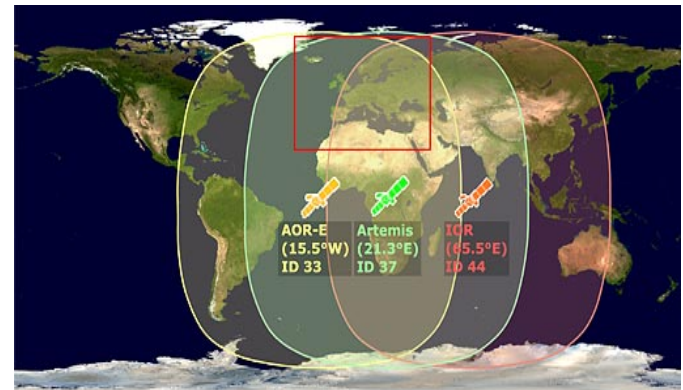
EGNOS System Architecture and Service Area



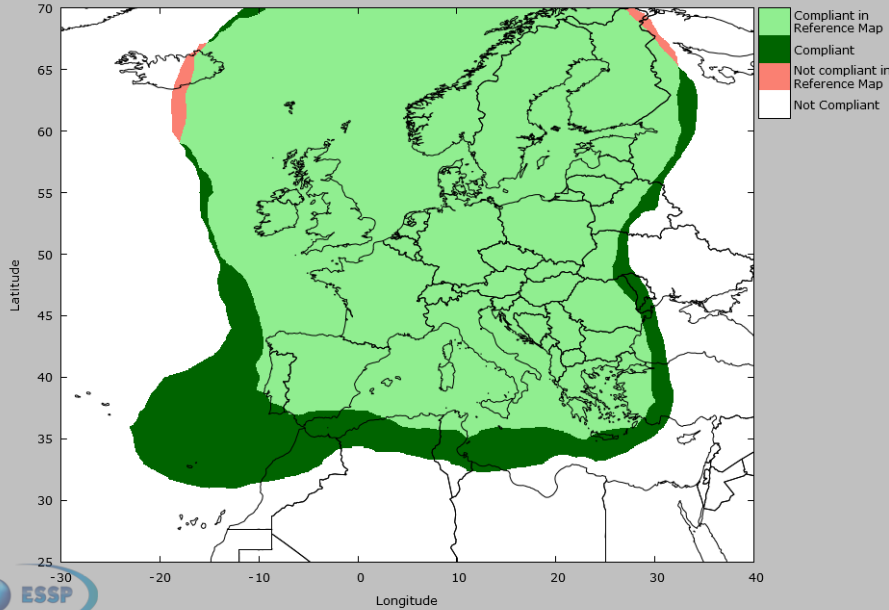
EGNOS services will be delivered on a long-term basis

Open Service (OS)	Accuracy ~1m, free	Available since October 2009	
Safety of Life Service (SoL)	Accuracy ~1m, compliant to aviation standards	Available since March 2011	
EGNOS Data Access Service (EDAS)	Accuracy <1m, corrections provided by terrestrial networks	Available since July 2012	

- ❑ **Safety of Life** service has been declared operational in March 2011
- ❑ EU committed to keep it free of charge (letter to ICAO), for at least 20 years and with 6-years notice
- ❑ Service provider certified based on the Single European Sky Regulatory package
- ❑ EGNOS landing procedures being developed around EU for their benefits:
 - Very precise vertical guidance
 - Safer landings at airports not equipped with ground-based navigation aids (e.g. ILS)
 - Increased airports capacity

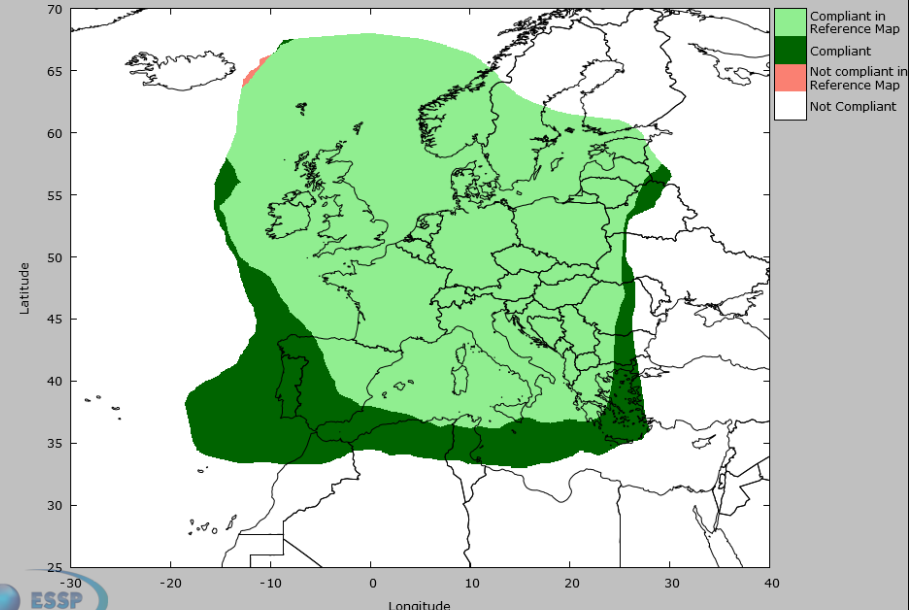


APV-I Availability over 99% with respect to Reference Area



APV-I
November 2015

LPV200 Availability over 99% with respect to Reference Area

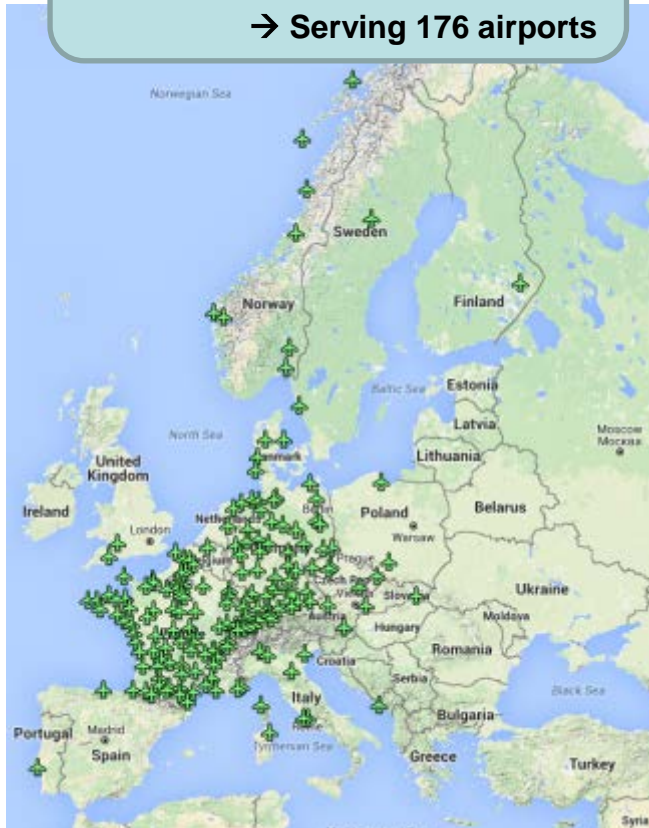


LPV-200
November 2015

LPV Airport Implementation status and forecast

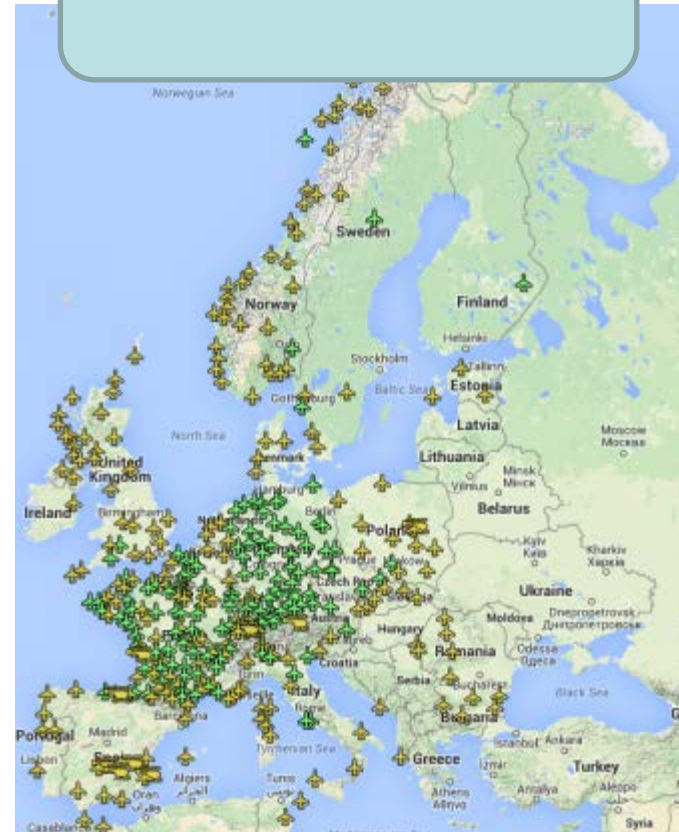
As of today

249 LPV procedures
70 'EGNOS enabled' APV Baro
→ Serving 176 airports



Plans by 2018

> 450 LPV procedures





Most common SBAS-ready aircraft/rotorcraft in Commercial, Business and General Aviation...

COMMERCIAL/REGIONAL




ATR42-600, 72-600

Airbus A350, Beluga




Bombardier CRJ
700/900/1000, CS100/300,
Dash 8 Q400




AW109SP, AW119Kx,
AW139, AW169,
AW189





Bell 429, 505,650




H135, H145, H175,
H225, EC135, EC145

BUSINESS





Challenger 300/350,
Learjet 70/75/60XR






Citation Mustang, M2, CJ2+,
CJ3+, CJ4, XLS+, Latitude,
Sovereign+, X+ and Longitude




SB Falcon 900LX/5X/
7X/2000LXS/2000S;




G650 and G280, SB
G150/G550/G450/G350

King Air, Baron, Bonanza ,
Hawker 400XPR/800XPR


GENERAL




Citation, Caravan and
Single Engine




Pilatus PC6, PC24
and PC12/47E (SB)




DA20, 40XLT, 40CS,
D-Jet,42 and 50




SR20, SR22, SR22T , and Vision SF50




Meridian, Seminole, Mirage, Matrix, Archer,
Seneca V and Arrow

... and other have retrofit solutions available



Bombardier CL60



Bombardier GL5T



Bombardier 850



BAE H25B (800 series)



GulfStream GV-SP



Dassault 900LX



Dassault 7X



Dassault 2000LXS



Dassault 2000S



Pilatus PC-12



Piaggio Avanti I



Avanti II & evo



Beech kingAir200



Beech 1900



Beech 300



Bell 412



EC 135



Cessna Citation II



Cessna 525



Cessna 500

REGIONAL

Aurigny



2x BN2B Trislander

Air Nostrum



5x ATR 72-600



15x CRJ 1000

Skybus



Twin-Otter

Chalair



2 x
Beechcraft1900

CityJet (VLM)



8x Fokker 50

Loganair



2x Twin Otter

Hebridean Air



2x BN2B Islander

Wideroe



DHC 8-100

BUSINESS

Inaer



Bell 412

NetJets



Hawker 750

Specsavers



2x Beech 350

REGA



Eurocopter
EC135

GENERAL

NLR



Fairchild Metro II



Cessna Citation II

Air Charters Europe



King Air 300



King Air 1900D

Aviation South West



Piper P28A



Beechcraft 76

Royal Star-Aero

**Dutch & MartinAir Flight
Academies**



Piper PA-34 Seneca II
Lund University School
of Aviation



4x Diamond DA42

Ljungbyheds Flygklubb



Cirrus SR20



DA40-180

Rotorcraft operations

EGNOS as enabler of:

- Point in Space (Pins)
- Low Level RNAV Routes
- Simultaneous Non Interference
- Curved procedures/RNP-AR



EGNOS benefits:

- Increased accessibility in all weather
- Increased capacity

RPAS/Drones

EGNSS Role:

- Component of Guidance, Navigation and control
- Component of detect and avoid functions
- Support to integration in non segregated airspace

EGNOS benefits:

- Reliable PVT: precise positioning/ orientation
- Robust safe navigation



Surveillance-ADS-B

EGNSS Role:

- Current ADS-B Out European mandates requires GNSS:
 - June 2016 for new aircraft, June 7th 2020 for retrofit
 - GNSS required, not SBAS

EGNSS benefits:

- SBAS ensures 99% availability (= radar)
- Ground Infrastructure rationalisation
- Increased safety



Search and Rescue

EGNSS Role:

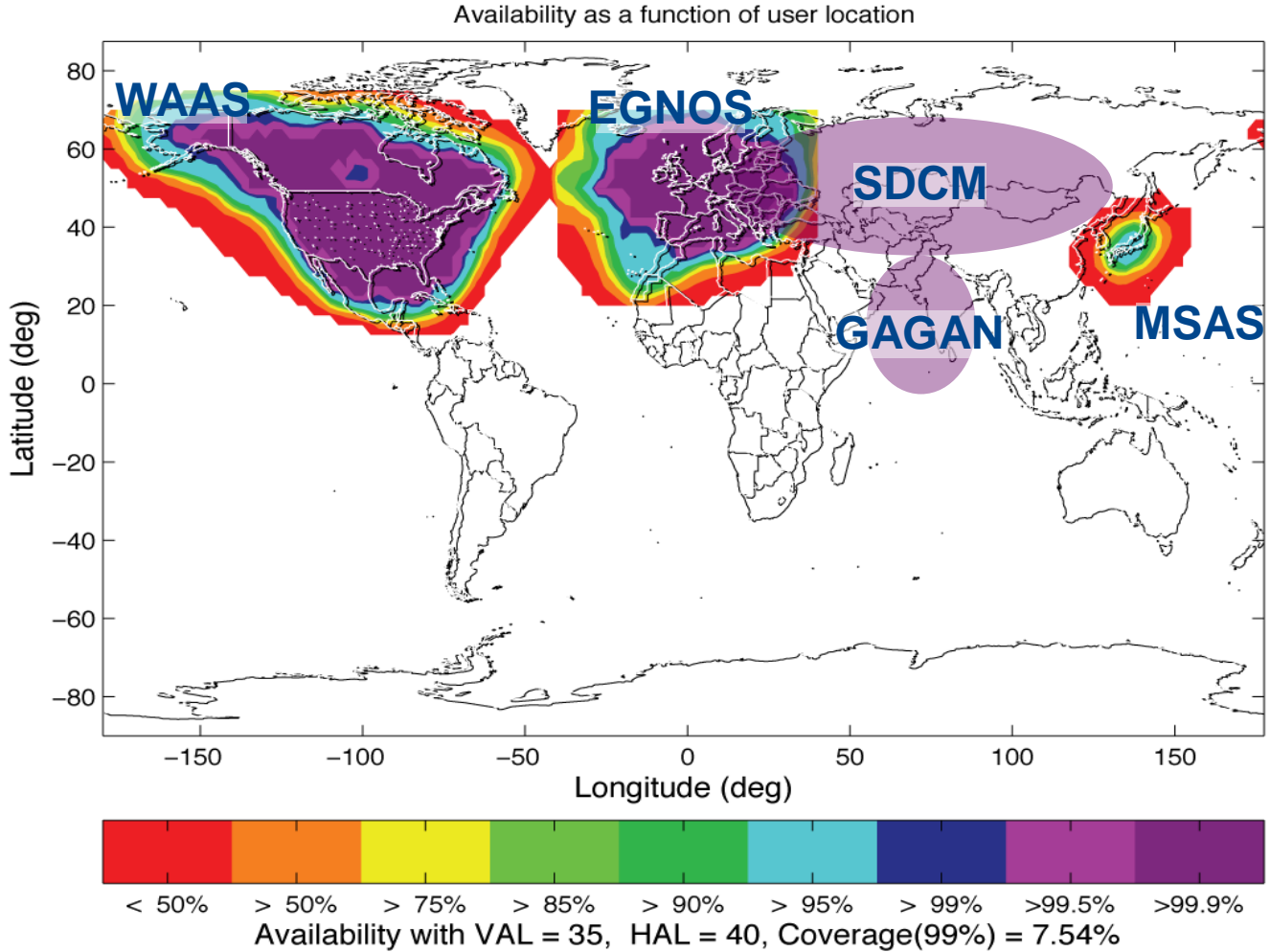
- ELT required for every aircraft with >19 passengers
- More and more pilots carry handheld PLB's
- Many ELTs/PLBs use GNSS to report their position when triggered.

EGNSS benefits:

- EGNOS improves accuracy
- Galileo SAR in Second Generation Beacons



All SBAS systems are designed by the same standard (ICAO SARPs) - current coverage: GPS + monofrequency



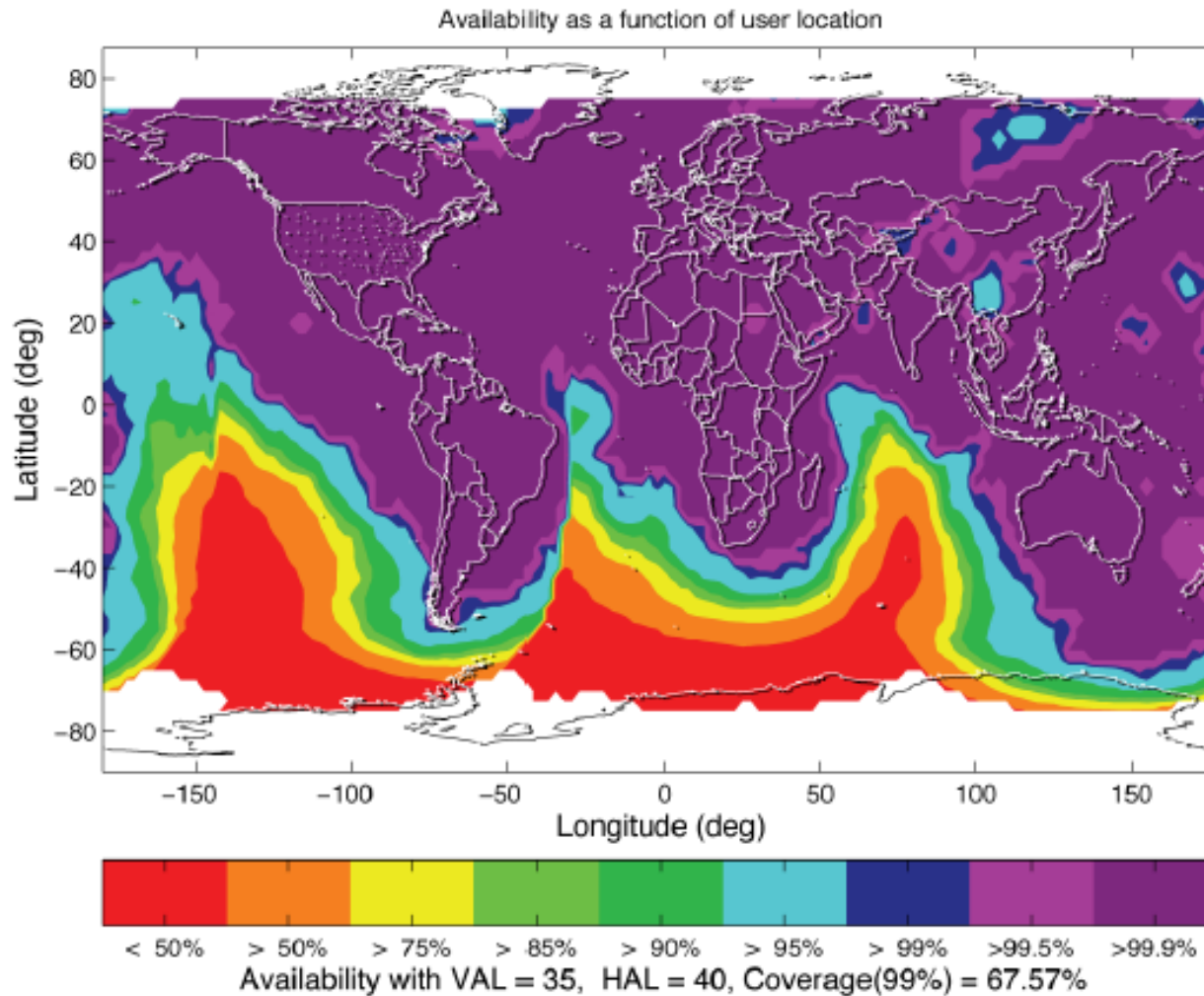
VAL: Vertical Alert Limit

HAL: Horizontal Alert Limit

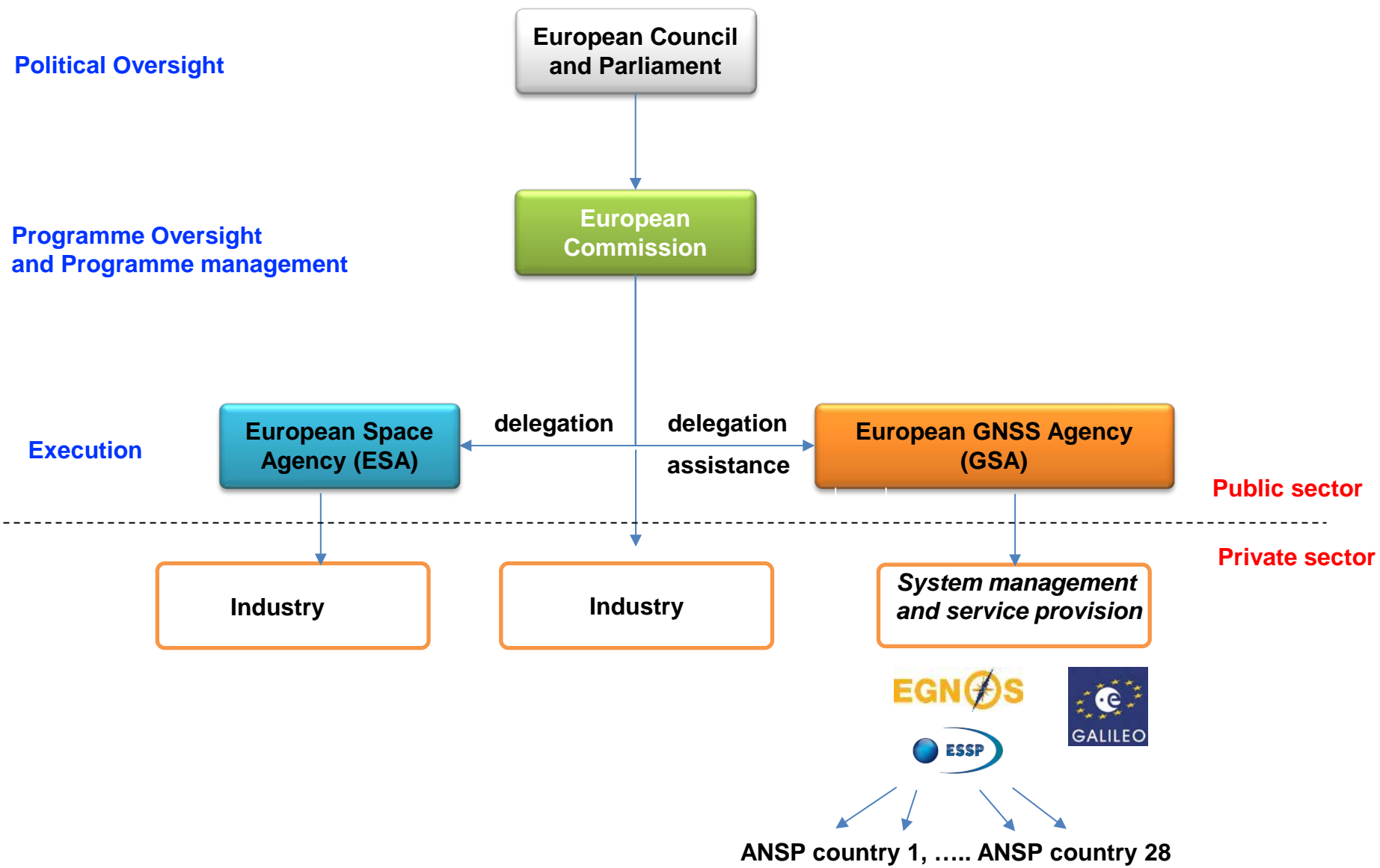
SBAS Future Coverage: Dual Constellation (GPS + Galileo + dual frequency EGNOS V3) + extended networks



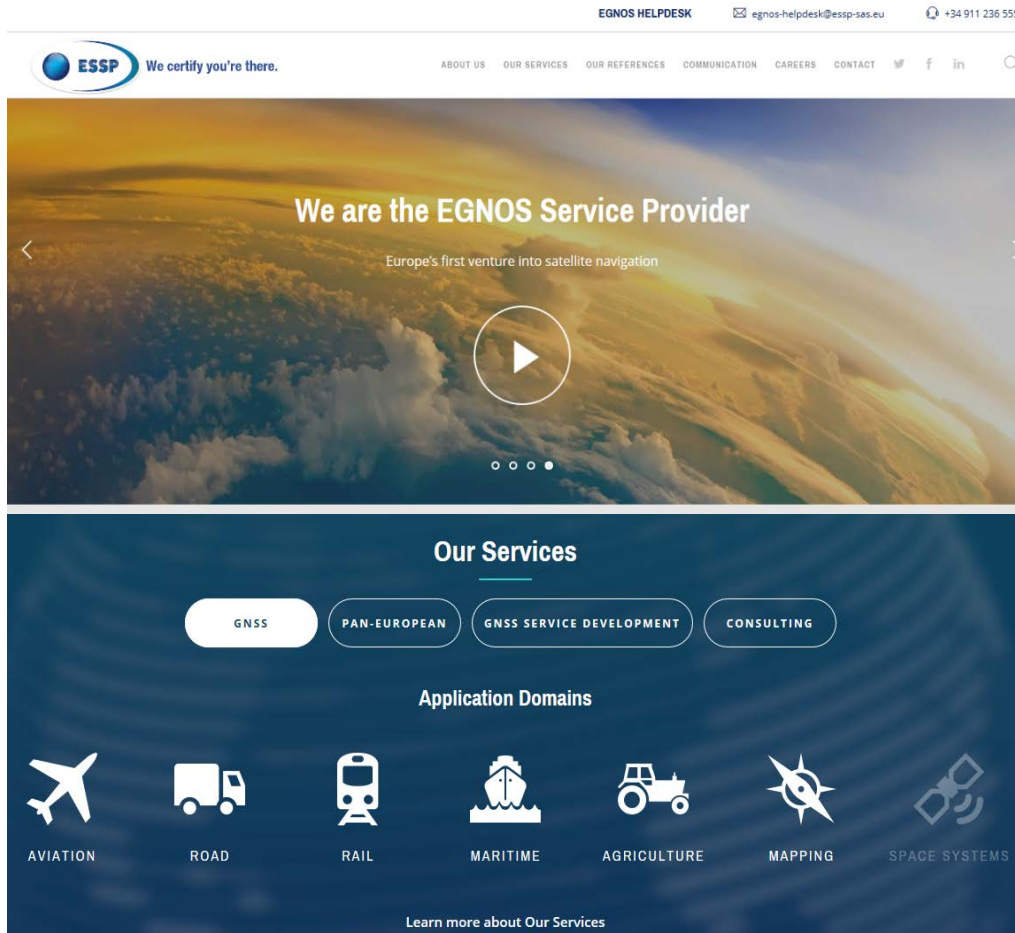
Navigation solutions powered by Europe



Who provides EGNOS services?



EGNOS Service Provision: ESSP (European Satellite Service Provider)



The screenshot shows the ESSP website homepage. At the top, there is a navigation bar with the ESSP logo and the tagline "We certify you're there." followed by menu items: ABOUT US, OUR SERVICES, OUR REFERENCES, COMMUNICATION, CAREERS, CONTACT, and social media icons for Twitter, Facebook, and LinkedIn. A search icon is also present. Below the navigation bar is a large hero section with a background image of a sunset over a landscape. The text in this section reads "We are the EGNOS Service Provider" and "Europe's first venture into satellite navigation" with a play button icon in the center. Below the hero section is a "Our Services" section with four buttons: GNSS, PAN-EUROPEAN, GNSS SERVICE DEVELOPMENT, and CONSULTING. Underneath is an "Application Domains" section with icons and labels for AVIATION, ROAD, RAIL, MARITIME, AGRICULTURE, MAPPING, and SPACE SYSTEMS. At the bottom of this section is a link "Learn more about Our Services".

- ❑ Certified provider of **Safety of Life service** in aviation in EU in March 2011.
- ❑ Each EU-28 Air Navigation Service Provider **has to sign an EGNOS Working Agreement (EWA) with ESSP** to be able to activate use of EGNOS SoL in its country.
- ❑ Other uses (non-SoL) take place without any formal step.

<https://www.essp-sas.eu/>



EGNOS

Extension beyond EU-28



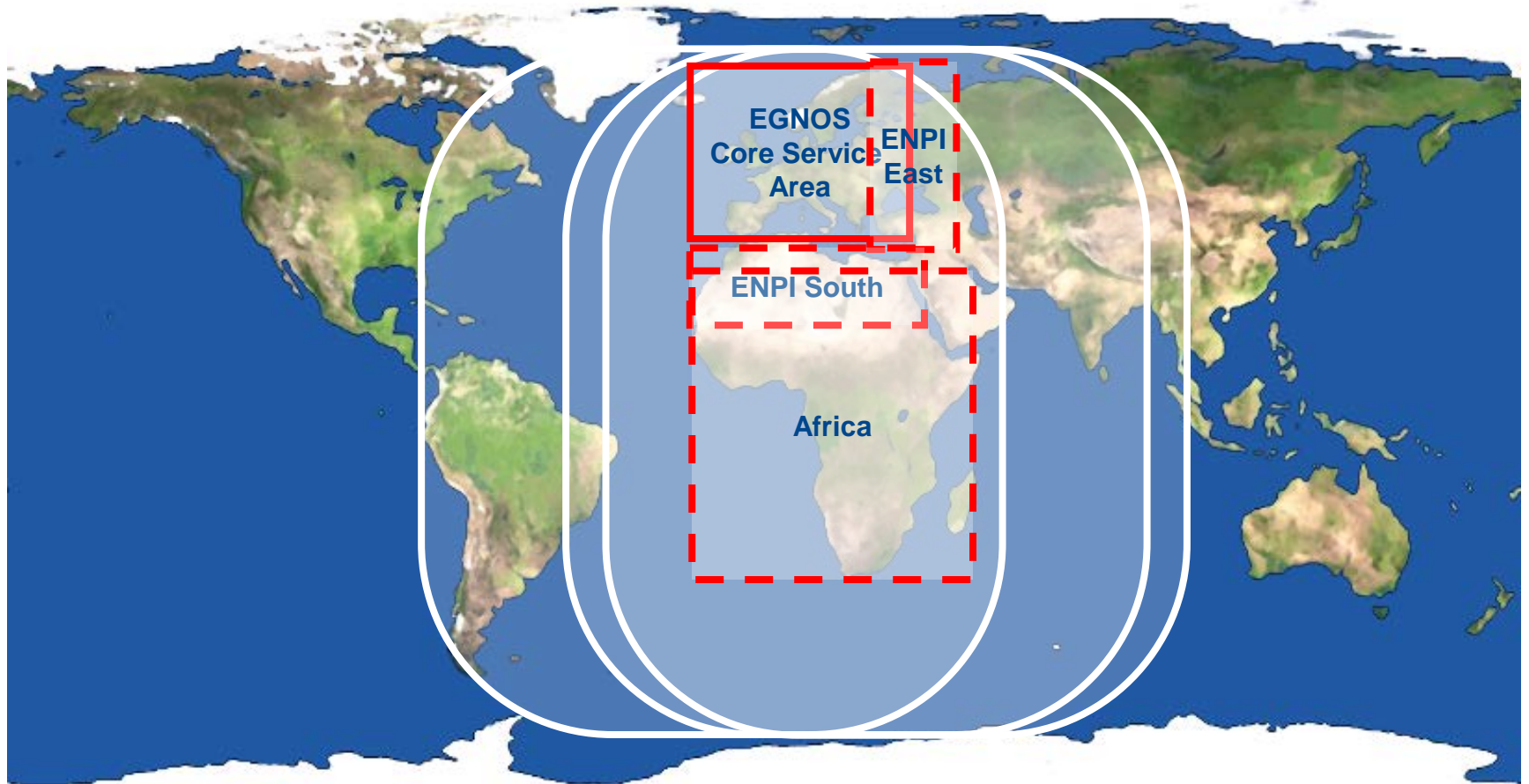
- Promote use of SBAS, especially for air transport.
- Pursuing other EU policies (i.e. cooperation, external relations, neighbouring, transport harmonisation).
- Enhance the opportunities for the European GNSS technologies and application industries (upstream and downstream).

- Aviation: use EGNOS to comply with ICAO requirements on PBN
 - Save on ILS investment
 - Increase safety
 - Open new routes
 - Improve operations efficiency

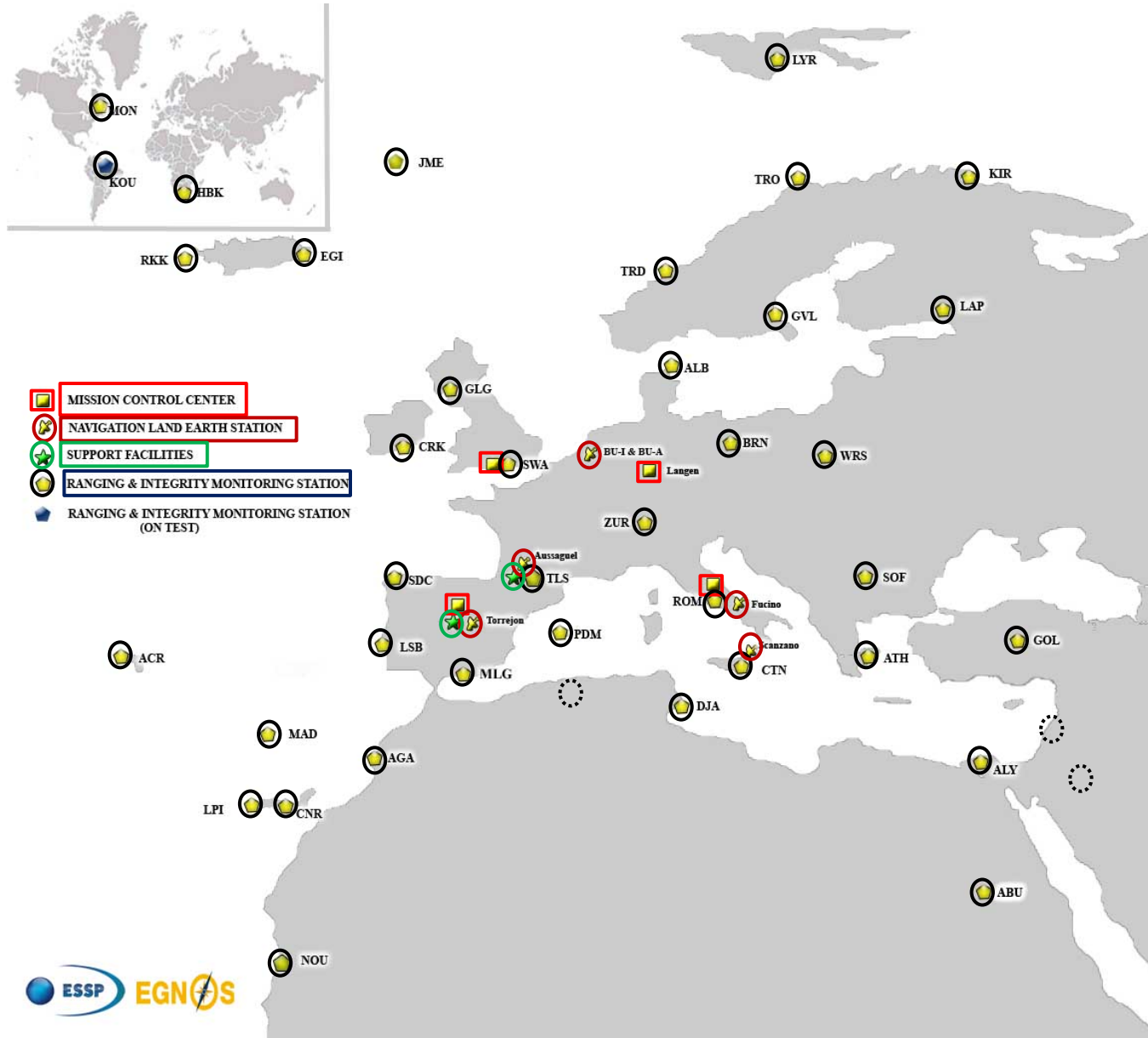
- Use the EU SBAS technology in other transports & non-transport domains.

- Cooperate with EU on space matters.

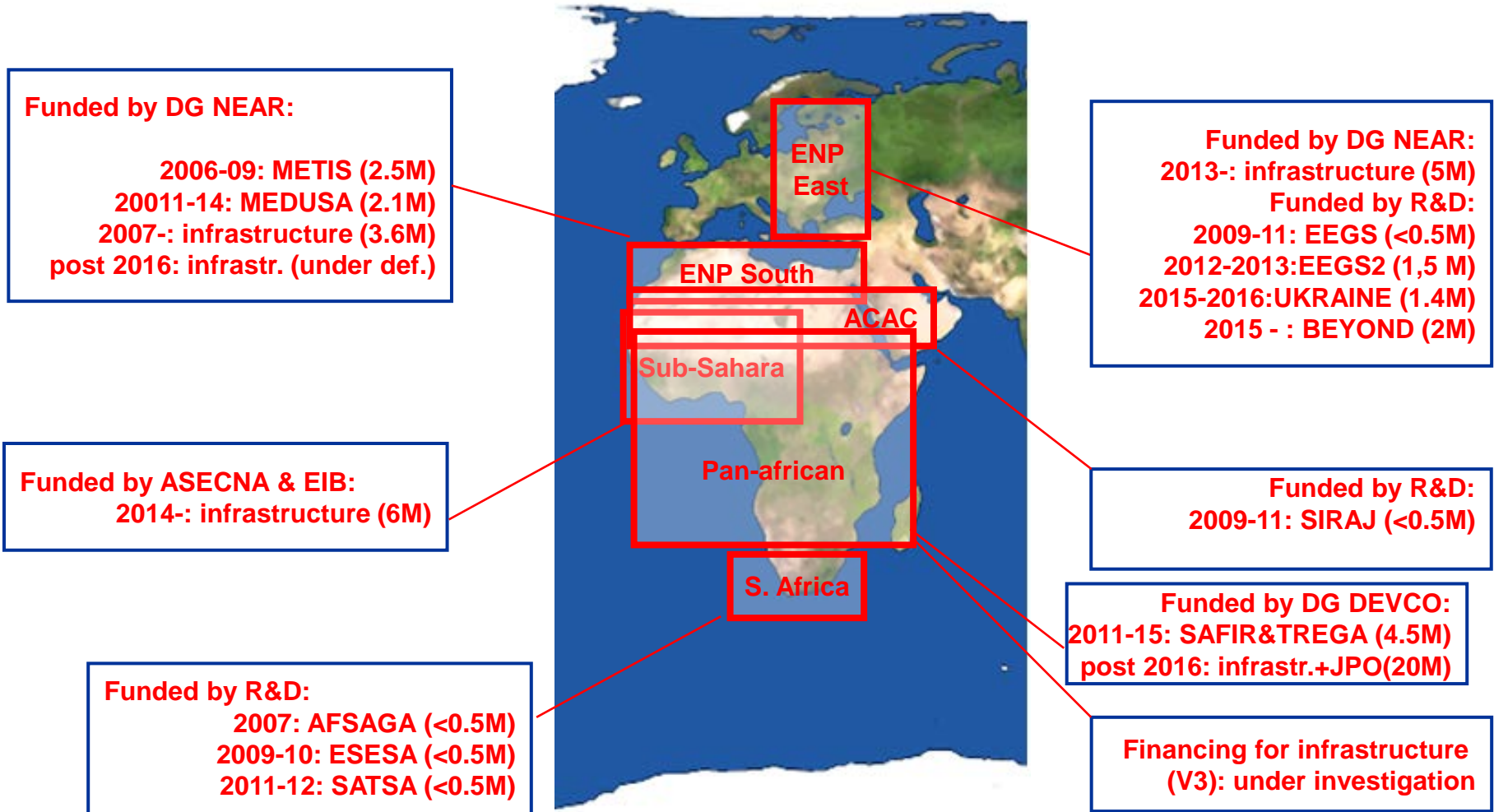
EGNOS extensions possible within satellite footprints...



...with expansion of EGNOS ground segment



EGNOS beyond EU – activity to date



Funded by DG NEAR:
2006-09: METIS (2.5M)
20011-14: MEDUSA (2.1M)
2007-: infrastructure (3.6M)
post 2016: infrastr. (under def.)

Funded by DG NEAR:
2013-: infrastructure (5M)
Funded by R&D:
2009-11: EEGS (<0.5M)
2012-2013:EEGS2 (1,5 M)
2015-2016:UKRAINE (1.4M)
2015 - : BEYOND (2M)

Funded by ASECNA & EIB:
2014-: infrastructure (6M)

Funded by R&D:
2009-11: SIRAJ (<0.5M)

Funded by R&D:
2007: AFSAGA (<0.5M)
2009-10: ESESA (<0.5M)
2011-12: SATSA (<0.5M)

Funded by DG ENTR/RSA:
2009-13: EGSA

Funded by DG DEVCO:
2011-15: SAFIR&TREGA (4.5M)
post 2016: infrastr.+JPO(20M)

Financing for infrastructure (V3): under investigation

Four areas covered:

- 1) Users needs, real life tests and demo (e.g. SoL)
- 2) GNSS skills
- 3) System infrastructure
- 4) Governance, regulatory roadmap to adoption

EU and African partners are working to provide SBAS services based on EGNOS over Africa

■ Objective

- Identify appropriate technical and financing solution for covering Africa with SBAS services, based on the EGNOS current and future technology.

■ Implementation

- GNSS cooperation reaffirmed with the adoption of the Roadmap (2014-17) at the Africa-EU Summit in April 2014, and funds allocated (2016-) as part of the pan-African Cooperation and Development Instrument (DCI).
- Commission received a mandate from Member States to negotiate with ASECNA conditions for cooperation towards provision of SBAS services based on EGNOS.
- **Technical solutions, financing, governance and service provision aspects are the subjects of the ongoing technical work and discussions.**

EU and Ukraine cooperation for EGNOS SoL extension Adoption of EGNOS SoL in Western Balkans

■ Objectives

- To extend the EGNOS SoL coverage to the Ukrainian territory.
- To enable six W. Balkans countries to use EGNOS SoL.

■ Implementation

- EU-Ukraine GNSS Agreement (entered into force in 2013) foresees the possibility to extend EGNOS to Ukraine. Joint Statement (2013) expressed intention to extend.
- EU-Ukraine Association Agreement (June 2014) promotes transport cooperation, use of space systems and GNSS.
- Financing Agreement (August 2014) between the Commission and Ukraine, reserving 5M€ from the European Neighbourhood funds to extend EGNOS.
- **To implement the extension a new international agreement is needed. The Commission is preparing the negotiating guidelines for this agreement.**
- **No need of funds and International Agreement for W. Balkans (to be confirmed)**

EU and ENP South partners have been working since 2006 to extend the EGNOS SoL coverage over N. Africa/M. East

- **Objective**
 - Leveraging the EGNOS core service area infrastructure to extend coverage to 10 Mediterranean countries.

- **Implementation**
 - Commission's Communication (8/3/11) on cooperation with Southern Mediterranean countries, reinforced by the Ministerial Transport Conference of the Union for the Mediterranean (14/11/13), the area of Satellite Navigation is being pursued as field of technical cooperation, for its impact on transport efficiency, safety (e.g. civil aviation) and regional cooperation (RTAP 2014-20).
 - Euromed GNSS I & II (METIS, MEDUSA, ESA, 2007-15): CBA per country, initial infrastructure, technical demonstrations, service demo in aviation and logistics, definition of institutional framework.
 - **Funding under definition** to provide EGNOS SoL coverage.
 - **Bilateral International Agreements needed.**

EGNOS beyond EU: ENP South priorities

- Priority Area 1 (green airports)
- Priority Area 2 (yellow airports)
- Priority Area 3 (red airports)



Source: MEDUSA Analysis with ENP Countries, Jan 2014

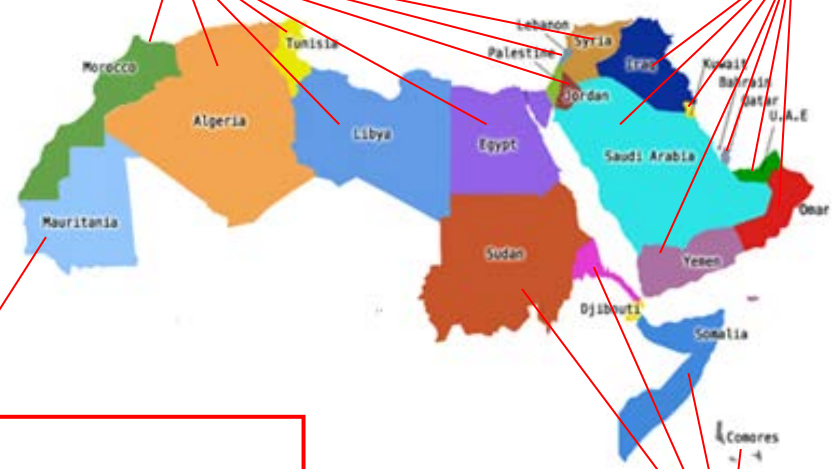
ENP South extension of EGNOS core system

We need:

- 1) Infrastructure for signal (RIMS stations)
- 2) International agreements with each State (therefore a letter before Aug. 2016)

Arabic Peninsula, Middle East (no ENP South)

Another potential extension. Feasibility study, Cost-Benefit Analysis can be performed, following official request from ACAC and the concerned countries (co-signed letter ad director level to Commission)



West Africa

Technical solution (i.e. infrastructure) being developed via development funds, in parallel with international agreement negotiations with ASECNA

East Africa

Infrastructure for signal coverage potentially covered by development funds.

EGNOS extensions in GNSS Regulation (1285/2013)

- (12) "...Subject to technical and financial constraints and on the basis of international agreements, the geographical coverage of the services provided by the EGNOS system could be extended to other regions of the world, in particular to the territories of candidate countries, of third countries associated with the Single European Sky and of countries in the European Neighbourhood Policy..."
- (42) "... In view of the global nature of the systems, it is essential that the Union enter into agreements with third countries and international organisations in the context of the Galileo and EGNOS programmes under Article 218 TFEU, in particular to ensure their smooth implementation, deal with certain questions relating to security and charging, optimise the services provided to citizens of the Union and meet the needs of third countries and international organisations..."
- (Art. 2-c) "... The geographical coverage of the EGNOS system may be extended to other regions of the world, in particular to the territories of candidate countries, of third countries associated with the Single European Sky and of countries in the European Neighbourhood Policy, subject to technical feasibility and on the basis of international agreements. The cost of such extension, including the related exploitation costs, shall not be covered by the resources referred to in Article 9. Such extension shall not delay the extension of the geographical coverage of the EGNOS system throughout the Member States' territories geographically located in Europe..."

What is needed for EGNOS SoL service in non-EU ?

SoL signal coverage



• System Mission & Architecture

-
-

• Funding

- Capex
- Opex

• Governance

-
-

• Security

-
-

• Liability

-

• Certification

-

A bilateral International Agreement between EC and the non-EU State

Service provision



ANSP Country 1, N

• Regulatory Framework

-
-

• Operations

-
-

A Working level Agreement (non-EU EGNOS WA) between ESSP and the non-EU country's ANSP

What is needed for EGNOS SoL service in non-EU ?

SoL signal coverage



- **System Mission & Architecture**

-
-

- **Funding**

- Capex
- Opex

- **Governance**

-
-

- **Security**

-
-

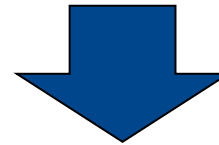
- **Liability**

-

- **Certification**

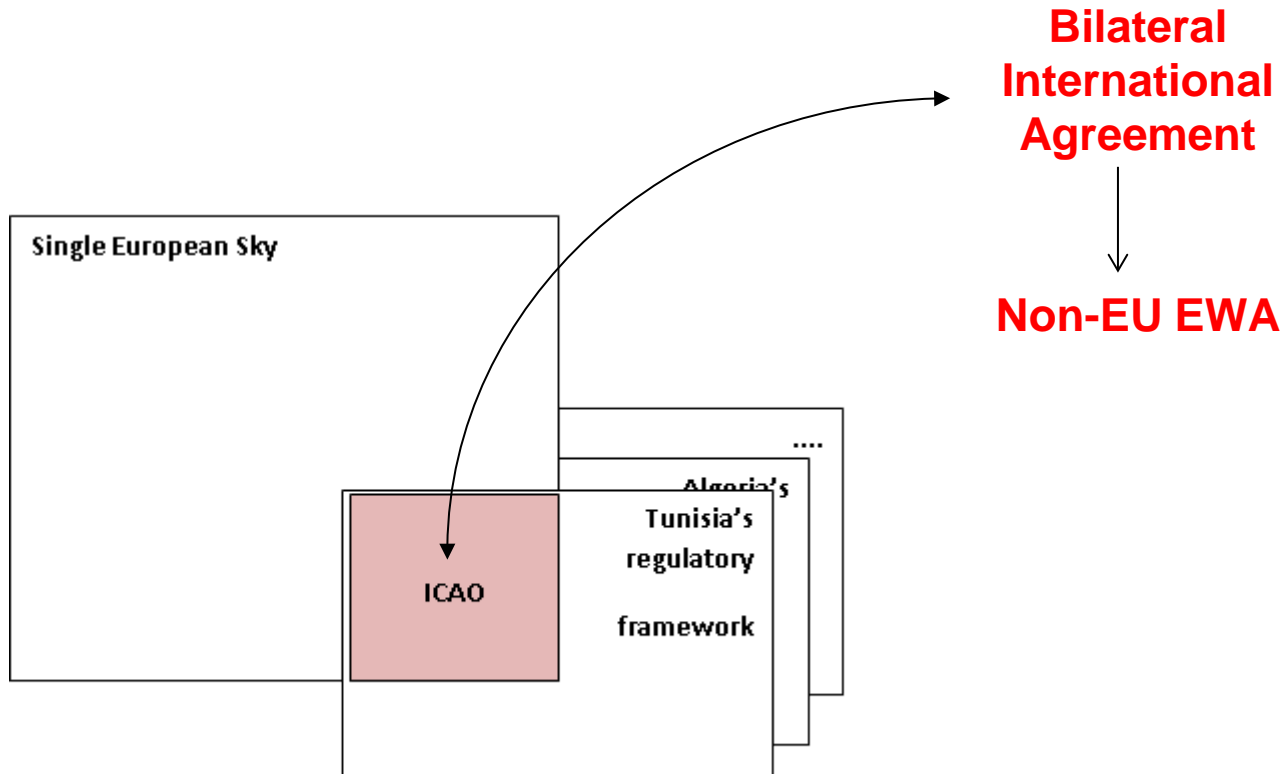
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**A bilateral International Agreement
between EC and the non-EU State**



Negotiation can take as long as SoL coverage extension, so the two processes should run in parallel.

Agreements will be based on "Minimum Regulatory Baseline" (20 ICAO provisions)



- **EU Commission envisages an 'Common Template' Agreement to define all key issues for a specified set of countries (ENP South, Ukraine) – 2017-2018. With bilateral negotiations.**
- **Ad hoc agreement with ASECNA, international organization representing a specified set of countries (Sub-saharian Africa) – 2018.**
- **Special cases: Western Balkans – 2016 onwards**
 - Signatory to the European Common Aviation Area (ECAA) agreement
 - Compliant with SES (80-100%)
 - EU candidate / associate countries
 - No need of additional infrastructure. SoL signal already available

ENP South countries

- Governments need to express formally their interests in entering discussions for the international agreement on EGNOS (i.e. **a formal request has to reach Commission by August 2016**)
- Four countries already took this step

EU

- Mobilise funds for SoL signal coverage extension
- Ask Council for mandate to negotiate international agreements

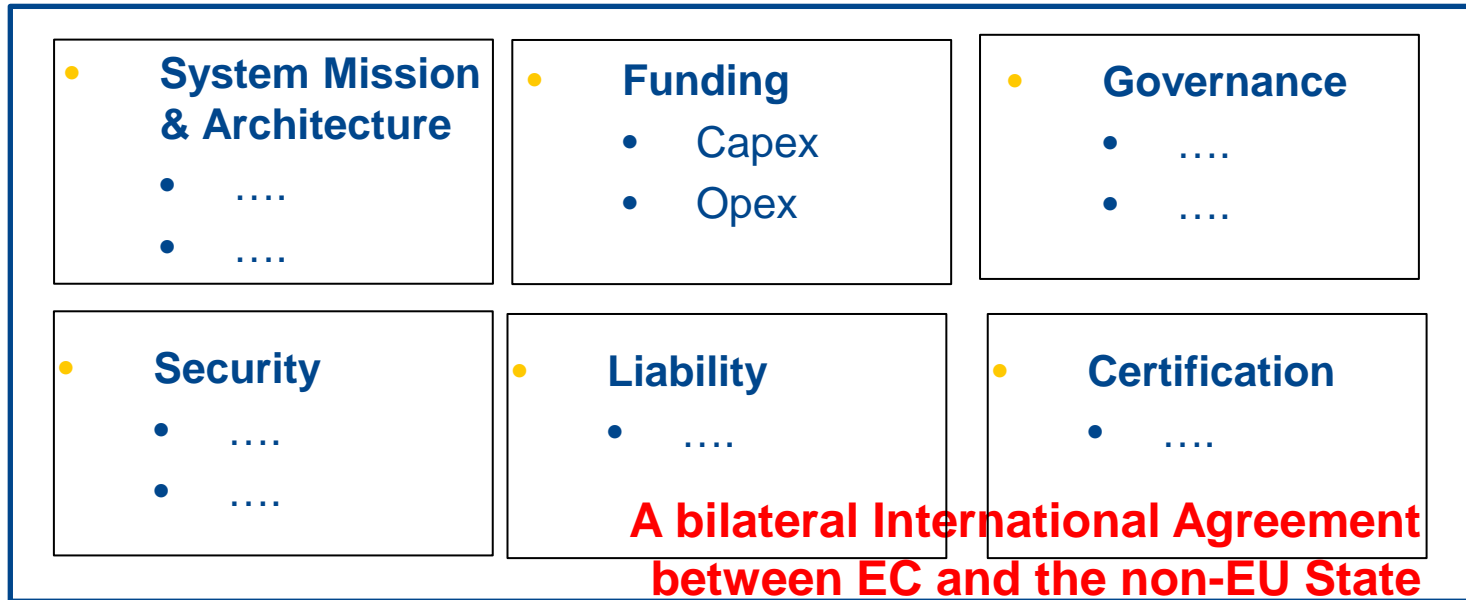
EGNOS extensions – where we were (2014)

Needed steps	UA		MA	DZ	TU	LY	EY	IL	JO	LE	PA	SY		Asecna	SA
GNSS Cooperation Agreement	OK		OK	-	-	-	-	OK	-	-	-	-		OK	OK
International Agreement															
- Official request	OK		-	-	-	OK	-	-	-	-	-	-		OK	-
- Council mandate	-	-	-	-	-	-	-	-	-	-	-	-		-	-
- Negotiation	-	-	-	-	-	-	-	-	-	-	-	-		-	-
- Signature	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Non-EU EWA	n.a.		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.

EGNOS extensions – where we are (2016)

Needed steps	UA		MA	DZ	TU	LY	EY	IL	JO	LE	PA	SY		Asecna	SA
GNSS Cooperation Agreement	OK		OK	-	-	-	-	OK	-	-	-	-		OK	OK
International Agreement															
- Official request	OK		-	-	OK	OK	-	OK	-	OK	-	-		OK	-
- Council mandate	OK	-	-	-	-	-	-	-	-	-	-	-		OK	-
- Negotiation	-	-	-	-	-	-	-	-	-	-	-	-		OK	-
- Signature	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Non-EU EWA	n.a.		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.

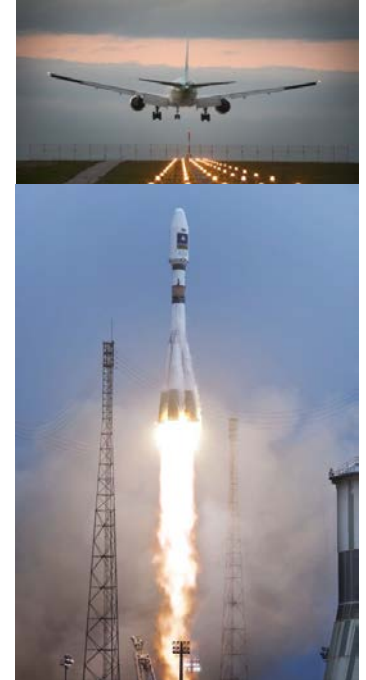
Announcement: workshop on EGNOS International Agreement for interested Countries



Representatives from Foreign Affairs, Transport and Aviation will be invited.

September 2016 (precise date tbc)

- **EGNOS is operational:** OS since October 2009, SoL service since March 2011
- **Galileo is taking off**
 - Deployment is being accelerated (12 Satellites / 30)
 - Early OS/SAR/PRS services from 2016, full services by 2020
- **International**
 - Balkans: legal/institutional framework is to be finalised
 - Ukraine: ongoing extension of EGNOS SoL, international agreement to be negotiated (start June 2016)
 - ASECNA: provision of SBAS services based on EGNOS
 - International agreement under negotiation (Mar 2015 – 2016)
 - Africa:
 - Study to be launched in 2016 to define budget, timeline and development plan of EGNOS V3 extension to the whole Africa
 - North Africa/Middle East: want to use EGNOS, need to formalise interest by Aug. 2016. Workshop on EGNOS International Agreement in 2ndH 2016
 - Other ACAC members: cooperation possible on specific needs & geography





Thanks for your attention

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