EGNOS Multimodal Adoption Plan 2017

EGNOS Adoption activities in aviation, maritime, rail, agriculture and surveying market segments

EGNOS Service Provision Workshop
Athens 3rd-4th October 2017
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- EGNOS in Aviation
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- EGNOS in Agriculture & Mapping
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GSA Adoption Strategy overview

EC Policy Objectives

Market trends and needs

2016 User Satisfaction Survey

E-GNSS adoption strategy
- Priorities
- ESSP Objectives
- Action plan
- Time plan
- Per market segment

Implementation of defined actions
Fostering adoption
Technical assistance
Specific user support
EGNOS responds needs of the users and brings public and commercial opportunities

- Make smaller airports and helipads more accessible, increases safety and facilitates business across Europe.

- EGNOS contributes to a more accurate, reliable and safer navigation. GNSS has become the primary means of obtaining PNT information at sea.

- EGNSS solutions can offer enhances safety for lower cost, e.g. in railway signalling and is becoming a generic system widely used in non—safety relevant applications.

- EGNSS applications represent a key enabler for the integrated farm management concept. Drone uptake in agriculture is increasing.

- Falling device prices drive the democratisation of mapping. GNSS remains the backbone technology in increasingly sophisticated applications.
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EGNOS in aviation

- EGNOS Multimodal Adoption Plan Priorities for 2017
- Objectives and achievements
- Tools & Actions placed to foster EGNOS adoption
Applications

- EGNOS based procedures – **LPV200 approaches equivalent to CAT I instrument landing system (ILS) procedures**
- Rotorcraft operations, e.g. Point in Space
- Support to navigation in other phases of flight
- Surveillance, e.g. ADS-B
- Airport operations
- Drone guidance and navigation

Where we want to be by 2020:

- All NPA runways by 2020
- Growing number of retrofit solutions and equipped operators
- EGNOS/EGNSS as a key enabler for **Communication, Navigation and Surveillance** for all flight phases

How to get there:

- Promote benefits of EGNOS based approaches and other applications
- Funding for procedure/operators and other applications
- Feasibility studies, CBAs, technical assistance and new applications development and validation
- Partnership with user communities and user groups establishment
- Contribution to regulation (e.g. PBN IR, SPI IR, pilot training, non instrument runways)

The first LPV-200 approaches were implemented at Paris Charles de Gaulle Airport (LFPG) on 3 May 2016 after LPV200 declaration on 29 September 2015

As of today: **52 LPV200**
AVIATION
EGNOS Multimodal Adoption plan 2017 Priorities

**Quantitative objectives**
- Increase the number of operational EGNOS procedures
  - By using tools developed during the last years (CBAs, TA, solutions, ...)

**Qualitative objectives**
- Boost EGNOS equipage of operators (business, regional, general, rotorcraft)

**Identification of priority aerodromes by GSA**
- EWA signature
- New LPV planned procedures
- LPV procedures in service

**Identification of priority operators by GSA**
- Engaged aircraft/rotorcraft
- Aircraft/rotorcrafts achieving certification or Operational approval
- Engagement of PART21/EOM to develop new EGNOS solution
AVIATION
EGNOS Multimodal Adoption plan 2017 Priorities

Quantitative objectives
- Analysis, studies
  - EGNOS-enabled avionics and upgrade solutions available
  - LPV usage monitoring
  - lessors

Support to GSA on regulatory activities

Promotion
- EGNOS benefits
- new SBAS solutions

Support to EGNOS users, technical assistance and advice

Guidance and training materials, brochures

Qualitative objectives

Market Adoption

EGNOS, it’s there. Use it.
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EGNOS in aviation
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  - Objectives and achievements
  - Tools & Actions placed to foster EGNOS adoption
AVIATION

2016 objectives

Remarks

• ANSPs are aware about the need to establish agreements for the use of EGNOS SoL
• Allowing States to plan for new LPVs
  ▪ 204 plans added during 2015
  ▪ 127 plans added during 2016
• Slow but continuous implementation of new LPV approach procedures (~80/year)
• Airlines: raising awareness thanks to GSA/ESSP, funding mechanisms and growing number of LPVs in operation

| EWAs signed: | 10/10 | ✓ |
| Operational LPVs: | 78/130 | X |
| Planned LPVs: 2020 | 127/233 | X |
| GSA funded aircraft: | 35 (on track) | ✓ |
| Operational aircraft: | 36/62 | X |
| Planned aircraft: grants | 59/100 | X |

LPV Procedures evolution

Swiss CS100
Air Baltic CS300
Nextjet Saab 340
AVIATION
Objectives for 2017

More EWAs signed
Target: 58
Today: 56

More published LPVs
Target: 105
Today: 59

More planned RWYs
Target: 140
Today: 98

More approved A/C
Target: 65
Today: 79

More planned A/C
Target: 70
Today: 34
What is preventing LPV plans from being timely accomplished?

- Reported plans from States tend not to be timely accomplished
- Reasons, as reported from contacted Stakeholders:
  - Lack of resources the biggest issue
    - Common among large ANSPs and authorities in charge of procedures approval
    - Large ANSPs have reported in different fora the lack of qualified/trained procedure designers within their teams
    - Some States/authorities do not accept airspace changes from other entities than the National ANSP

Support offered by GSA for conceptual/feasibility designs
AVIATION Achievements

Cargo airlines

WEST ATLANTIC
Under study
x20 BAe ATP-F
x13 B733/4

Cargo air
LPV retrofit
x3 B733
x5 B734

ASL
Under study
x29 B733/4

Military transport

SPANISH AIR FORCE (CECAF)
LPV retrofit
x1 Citation V
Under study
x2 Citation V

PORTUGUESE AIR FORCE
Under study
x3 Falcon 50

AIRBUS DEFENCE AND SPACE
LPV by default
CN235
C295W
Certification under EASA rules opens the door for civil users!
On-board avionics provides LPV as preferred approach

airBaltic CS300 pilot feedback: “a LPV approach and it’s details are loaded seamlessly on our CS300, allowing minimum pilot effort in the approach selection and execution.”

“The accuracy and stability of the LPV guidance is impressive. The approach procedure is straight and simple, and there is no necessary changeover regarding the FGS with respect to conventional approach aids”

LCY PLANS FOR LPV-200
BACKGROUND

A320 represents the largest fleet of commercial aircraft in Europe. **Shall be LPV!**

- Engagement work started in 2014
- Application for CEF Transport call in 2016
- Proposal accepted with subsequent allocation of funds...

SBAS LPV FUNCTION (SLS) TO BE DEVELOPED FOR A320 NEO FAMILY

WHAT’S NEXT?

- **Launch development** of SLS function on **A320 ( & A330 TBC)** family in 2017
- **Certification** expected by **2020**
- **EasyJet** (largest A320 operator) is the **SLS launch customer**

Airbus:
“SLS is ILS look-alike
Approach is more stable”
Under a leasing contract:

lessee = aircraft owner
lessee = aircraft operator/airline

IATA - Guidance Material and Best Practices for Aircraft Leases, Feb 2016

“It is expected that approximately half of all aircraft worldwide will be under an operating lease in the next decade”

“[lessor] will be seeking to maximize asset value”

“The parties will negotiate [...] the general condition of the aircraft including [...] any agreed modifications” \rightarrow \text{cost-sharing agreements}
AVIATION
Achievements
Market analysis - Lessors

On-going work

• Identification of existing lessors whose fleet operate in Europe
  ▪ Current targets focus on regional aviation lessors

• Promotion of EGNOS solutions amongst them to increase “asset value”
  ▪ Marketing Intelligence → supporting commercial campaigns from:
    - engineering companies (EASA Part-21, design organisations)
    - avionics manufacturers
On-going work

- Identification of Part 145 organisation in Europe
  - > 1,500 approved organisations
    - AOCs
    - Part-21s
    - General aviation focussed
  - > 230 holding C3 rating (Comms and Nav)

- Raising awareness and promotion of EGNOS opportunities amongst them:
  - Financial incentives
  - Supplemental Type Certificates, Approved Model Lists
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EGNOS in aviation

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Investing in the development of new tools to ease decision making process

Example of Traffic Assessment for an operator

- 36% of destinations have at least 1 LPV procedure published
- An additional 36% of destinations will have at least 1 LPV procedure by 2020

We study the availability of LPV approaches within the network of destinations of a given aircraft operator/airline.
AVIATION: Tools & Actions
Investing in the development of new tools to ease decision making process

Building statistical models for Cost Benefit Analyses

60 airports analysed:
- 44 Northern EU
- 16 Southern EU

% avoided DDCs (N/S)
- No ILS: 9.38 / 3.00 %
- 1 ILS: 0.90 / 0.09 %
AVIATION: Tools & Actions
Investing in the development of new tools to ease decision making process: **CBA example**

- Largest regional airline in Sweden
- 10 Saab 340 @ 20 destinations (most served by 1 ILS)
- Avoided disruptions (lower DH):
  - **57.55** per year (0.8%): €337,477.31 savings from 2020
- Mission savings
  - **36,87h** per year (Avoided DME arcs at 5 airports): €65,831.33 from 2020
- Costs: €165K per aircraft (20% shared with ADSB+CPDLC installation)
- Results:
  - No funding: Breakeven **4.42y**
  - 60% funds: Breakeven **2.45y**

*Retrofit on-going (Receiving GSA funding via call for grants 2015)*

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**Business case results**

- **Scenarios**
  - Positive
  - Base
  - Negative

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AVIATION

Bits and pieces of what we do

Free on-line access to all tools and docs at the EGNOS USER SUPPORT WEBSITE

TRAFFIC ASSESSMENTS and CBAs under request at egnos-adoption@essp-sas.eu
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EGNOS in maritime

- EGNOS Multimodal Adoption Plan Priorities 2017
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EGNOS in maritime
GSA Strategy

Applications

- Navigation
  - SOLAS vessels (SoL) / Non-SOLAS vessels
  - Inland waterways
- Positioning:
  - Traffic Management and surveillance (incl. including Automatic Identification System - AIS)
  - Port operations and Environmental protections

Where we want to be:

EGNOS adopted by maritime users for safety-related applications.

By 2020: EGNOS complementing DGNSS infrastructure providing integrity information for inland and coastal waters.

How to get there:

- EMRF WG: Service provision aspects
- RTCM SBAS WG: Guidelines for SBAS shipborne receivers
- IALA PNT WG: Guidelines for the transmission of EGNOS corrections via IALA beacons and AIS
- Pilot project for transmission of EGNOS corrections via IALA beacons/AIS with National Maritime authorities

Ca. 80% of GNSS receivers models are EGNOS enabled
High level roadmap for EGNOS in maritime

- **EGNOS V2**
  - Use EGNOS V3 SiS
  - New receivers (SBAS or multisystem)
  - New maritime information in SiS (if need be)

- **EGNOS Maritime Safety Service (EGNOS V2 1046)**
  - Use existing EGNOS SiS
  - Adapted receivers (standardised – SBAS or multisystem)
  - Specific EGNOS maritime safety service/service level

- **EGNOS via AtoN (AIS or IALA beacons)**
  - Use existing EGNOS V2 SiS and/or EDAS

- **2020+**
MARITIME
EGNOS Multimodal Adoption plan 2017 Priorities

GENERAL NAVIGATION

1. Cost-benefit analysis for recapitalization of marine radiobeacons using EGNOS
2. Analysis of EGNOS v2 performances for its use in maritime using integrity data
3. Guidelines for the implementation of SBAS in shipborne receivers
4. Guidelines for transmission of EGNOS corrections via AIS stations
5. Guidelines for transmission of EGNOS corrections via IALA beacons

LEISURE

6. Provide support in communicating EGNOS benefits to users and receiver manufacturers/dealers
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EGNOS in maritime

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Maritime
EGNOS corrections via IALA beacons & AIS stations (I)

- European Waters are served with DGPS & AIS stations
- Some DGPS networks are experiencing obsolescence issues
- AIS networks need GPS corrections to send MT17 (mainly in inland waters)

There is room for EGNOS

IALA beacons location and status
Maritime
EGNOS corrections via IALA beacons & AIS stations (II)

DGNSS station: GNSS receiver + MF transmitter. Courtesy: MxMarine
Maritime
EGNOS corrections via IALA beacons & AIS stations (II)

High level architectures of an EGNOS based DGNSS service over IALA beacons EGNOS SIS or/and EDAS guides

UNDER IALA APPROVAL

For interested AtoN authorities, it is offered:
- Architecture analysis & EGNOS based architectures proposal
- Cost analysis

Done for:

Puertos del Estado

Cerema

DGNSS station: GNSS receiver + MF transmitter. Courtesy: MxMarine
Maritime
Preparing the needed background for an EGNOS maritime service

Sub-group in EMRF/NMSP to ensure an European common and harmonized approach for the Services provision aspects in the EGNOS introduction in the Maritime domain

On the 5th & 6th October: in the same venue as the EGNOS workshop, next EMRF meeting
Maritime
Preparing the guidelines for Rx manufacturers

Keep on working on the “Draft Guidelines for Manufacturers for the Implementation of SBAS in Shipborne Receivers”:

- To establish the minimum set of SBAS messages to be processed by an SBAS receiver for the maritime sector to be compliant with the IMO Resolution A.1046.
- Presentation in RTCM SC-104
- Creation of a SBAS subgroup in RCTM SC-104 to

Guidelines
Maritime
Understanding maritime charts & navigation requirements

- Although the precision requirement in ports’ nautical charts is 2 meters, these charts are compiled with greater accuracy. Data are gathered with more precision even though the chart says that the minimum required precision is 2 meters.
- Port management activities are performed using the charts produced by the port authority which are renewed very frequently (e.g.: Port of Amsterdam: they renew their charts every 48 hours).
- Electronic Navigation Charts (ENCs) that the port produces can be used internally within the port, in Vessel Traffic Management Systems (VTMS) or on Portable Pilot Units (PPUs), for example, for detailed berthing or manoeuvring of vessels.

Chart displayed in a PPU (ORCA Pilot G2)
Maritime
EGNOS used in charts by means of bathymetries

An average area of 685000 square kilometres in the Cantabric EEZ, has been surveyed using EGNOS by the IHM-Spain.

EGNOS complies with accuracy requirements posed by IHO S-44 for areas away from the coast (200miles)

Bathymetry corresponding to Cape Sacratif, where EGNOS corrections were used. IHM courtesy
Maritime non-SOLAS Equipment

- All new COBRA, FURUNO, KODEN, LOWRANCE and RAYMARINE devices are SBAS compatible and mention EGNOS

- 48 new or revamped non-SOLAS navigation equipment (officially authorised)
- 39 are SBAS compatible
- In 37, EGNOS is explicitly mentioned in documentation

SBAS compatible

- 19% NO
- 81% YES

EGNOS mentioned

- 5% NO
- 95% YES
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EGNOS in rail

- EGNOS Multimodal Adoption Plan Priorities for 2017
- Actions placed to foster EGNOS adoption
# E-GNSS value proposition for different RAIL applications

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<th>Logistics</th>
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<td><strong>Low density lines</strong></td>
<td><strong>Asset management</strong></td>
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<td>Improve safety and reduce the cost of signalling (requires very few or no line side components)</td>
<td>Improve monitoring of the railway infrastructure both for operators and infrastructure managers</td>
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<tr>
<td><strong>Main lines</strong></td>
<td><strong>Cargo monitoring</strong></td>
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| Reduce the number of physical balises and to improve the precision of the odometry | Improve availability of the supply chain visibility information to the LSP/LSC:  
- Georeferenced cargo status monitoring  
- Corridoring, Geofencing |
| **Passenger information systems** | **改善 precision and availability of positioning for on board PIS** |

Combination of E-GNSS with sensors for precise train positioning for use in safety of life CCS applications or with conventional communication technologies for logistics applications.
EGNOS in RAIL

Where we want to be:
- EGNSS adopted as one of the key elements of the train command and control solutions enabling safe and efficient operations of low density lines
- EGNSS adopted within evolutions of ERTMS for main lines

How to get there:
- Support UNISIG in their effort to define industry requirements
- Coordinate relevant R&D activities together with key funding and standardization bodies (EC, ERA, ESA, ESSP, UNIFE, UNISIG and Shift2Rail)
- Cooperate with railway associations and EC to foster the role of EGNSS in the evolutions of ERTMS standard and in the standardization and certification of EGNSS receivers

GSA is leading development of signalling and train control solutions based on GNSS together with key partners with the key objective to include E-GNSS into ERTMS.
RAIL
EGNOS Multimodal Adoption plan 2017 Priorities

GSA Strategic objectives

- EGNSS functionalities included into the ERTMS
- EGNOS benefits promotion and support to users and relevant stakeholders

Market Adoption Actions

- Support to GSA with EGNOS promotion and awareness
- Provide technical consultancy on safety relevant applications
- Support to EGNOS users

*CAP – Common Agriculture Policy
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EGNOS in rail

- EGNOS Multimodal Adoption Plan Priorities for 2016
- Actions placed to foster EGNOS adoption
Rail supporting GSA

In safety relevant applications

✓ Paving the way for service provision scheme for SoL use

Exploring possibilities for

✓ Public Transport

✓ Location of GSM-R reports

✓ EGNOS transmitted by the RBC to the on-board unit

Keeping contact with stakeholders, gather feedback, attend key events

EGNOS, it’s there. Use it.

European Global Navigation Satellite Systems Agency

ESSP

International Conference on the Single European Railway Area
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EGNOS in agriculture & mapping

- EGNOS Multimodal Adoption Plan Priorities for 2017
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EGNOS in Mapping/Surveying

**Applications:**
- Thematic Mapping for municipalities
- Forestry/park management
- Construction surveying
- Utility Infrastructure monitoring

**87% of GNSS receivers are EGNOS enabled**

**Where we want to be by 2020:**
- EGNOS preferred entry technology for mapping and GIS in Europe, Africa and Middle East

**How to get there leveraging EGNOS benefits:**
- Service definition: EGNOS V3 with dual frequency and dual constellation capabilities from 2020+
- Strengthen partnerships with mapping/GIS users
- Leverage specialised media and events
- Build on H2020 and FE R&D activities in order to cross fertilise with overall Surveying/Mapping strategy
MAPPING & SURVEYING
EGNOS Multimodal Adoption plan 2017 Priorities

Users
- Increase the number of mapping professionals using EGNOS

Market Adoption
- Identification of priority user groups
  - Direct contact with institutional user groups
  - EGNOS visibility maps available
  - Updates on the PRN change
- Identification of main manufacturers by GSA
  - Direct support to manufacturers to integrate EGNOS
  - Formulate guidelines for EGNOS usage in GIS/mapping receivers
  - Engagement of key stakeholders
  - Support protocol change for EDAS adoption

Equipment manufacturers
- Handheld devices with EGNOS compatibilities
EGNOS in Agriculture

Applications:
- Tractor guidance
- Variable Rate Technologies
- Asset Management
- Forest Management

Where we want to be by 2020:
- EGNOS preferred entry technology for precision agriculture in Europe, Africa and Middle East

How to get there:
- Service definition: EGNOS V3 with dual frequency and dual constellation capabilities from 2020+
- Strengthen partnerships with associations of farmers and paying agencies
- Leverage specialised media and events
- Build on H2020 and FE R&D activities in order to cross fertilise with overall Agriculture strategy

Key Trends:
- GNSS stimulates integrated farm management’s uptake
- The drones uptake

Almost 80% of European GNSS enabled tractors are using EGNOS
GNSS is a core component in Integrated Farm Management Systems

Integrated Farm Management Systems support farmers in their decision-making

EGNSS as key component or complement:
- Linking the data to specific geographical coordinates
- Providing geo-location
- Tracking and positioning

Uptake of Drones in Precision Farming increases the use of GNSS

GNSS is the backbone of commercial drones and a key enabler ensuring safe navigation and reliability

Agriculture alone could be a $350 million market in 2025

Fragmented regulation over Europe - barriers to the development of commercial use drones

* GSA GNSS Market Report, Issue 5
AGRICULTURE & MAPPING
EGNOS Multimodal Adoption plan 2017 Priorities

GSA Strategic objectives

- Encourage EGNOS/EDAS usage
- Fostering the growth of user groups to share experience
- Demonstrate EGNOS benefits
- Further uptake of EGNOS in CAP

Market Adoption Actions

AGRICULTURE

- Supporting materials
- Contact with paying agencies
- UAV in Agriculture

COMMON AGRICULTURE AND MAPPING

- Visibility maps
- Co-marketing actions
- Technical support to users

*CAP – Common Agriculture Policy
EGNOS in agriculture & mapping

- EGNOS Multimodal Adoption Plan Priorities for 2017
- Tools & Actions placed to foster EGNOS adoption
Agriculture & Mapping
Awareness campaign on PRN change

PRN configuration in equipment is found one of the major problems for OS users. Farming being probably the most affected user market segment by this fact.

I got asked about outages of EGNOS in the last time. I think this is related to outdated firmware that does not support all actual PRN.

- Guidance material prepared
- PoCs identified to receive information
- Specific communication campaign launched (helpdesk, website etc)
Agriculture & Mapping
3D EGNOS Visibility maps

EGNOS is available in all Europe, but how **terrain surface is affecting GEO visibility**?

SOON AVAILABLE ON THE EGNOS USER SUPPORT WEBSITE!
Agriculture & Mapping
3D EGNOS Visibility maps

The map supports zooming

Will allow users to identify “EGNOS shadow areas”.

Central Prynee valley
Agriculture & Mapping
User devices (I)

Users need portable, easy to handle devices, rugged, connected and with GIS SW

**Saving Time is saving €**
- Time needed to obtain information has to be as small as possible
- If there is a need to locate thousands of point, minimum time has to be spent

Geolocating in the field

Office work afterwards
Users need portable, easy to handle devices, rugged, connected and with GIS SW

**Saving Time is saving €**
- Time needed to obtain information has to be as small as possible
- If there is a need to locate thousands of point, minimum time has to be spent

Manufacturers for such type of devices identified and contacted
Agriculture & Mapping
User devices (II)

EGNOS on mobile GIS+GNSS equipment

- 69 devices support EGNOS out of the 98 identified (70%)
- 17 different brands, 4 of them from EU (Leica, Handheld, Stonex, and Satlab Geosolutions)
- Typically 4-5 different models per manufacturer

FEEDBACK HIGHLIGHTS:

• All showed interest in EDAS
• GENEQ: “Yes, we are aware of EGNOS user support webpage and our tech support team consults it regularly”
PUBLIC SECTOR:

- Awareness actions triggered towards JRC: their lab in Ispra premises has an EGNOS enabled equipment used to gain insight and promote EGNOS use as positioning source in parcels identification
- Supporting training for CAP inspectors for EGNOS use and configuration

PRIVATE SECTOR:

MATERIAL
Agriculture

PUBLIC SECTOR:

• Awareness actions triggered towards JRC: their lab in Ispra premises has an EGNOS enabled equipment used to gain insight and promote EGNOS use as positioning source in parcels identification

• Supporting training for CAP inspectors for EGNOS use and configuration

PRIVATE SECTOR:

GETTING CLOSER TO KEY STAKEHOLDERS

CaseNH Group confirmed they consult the EGNOS User Support Website for obtaining information to support their users
Agriculture & Mapping
Increasing Awareness
Thank you!

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