EGNOS

EGNOS, it's there. Use it.

Generic Cost Analysis focused on relevant architectures for the transmission of SBAS corrections over IALA beacon and AIS

ENAV20-13.16

European Global Navigation Satellite Systems Agency

ESSP

Precise navigation, powered by Europe

Outline

- Activity overview and methodology description.
- Reference and alternate scenarios generalities.
- Generic cost assessment for the transmission of SBAS corrections over IALA beacons.
- Generic cost assessment for the transmission of SBAS corrections over AIS stations.
- Customised cost analysis

Outline

- Activity overview and methodology description.
- Reference and alternate scenarios generalities.
- Generic cost assessment for the transmission of SBAS corrections over IALA beacons.
- Generic cost assessment for the transmission of SBAS corrections over AIS stations.
- Customised cost analysis

Activity overview

- Generic Cost Analysis for the recapitalization of IALA DGNSS and AIS networks using EGNOS corrections

EGNOS-based architectures identification: ENAV19-13.13 and SBAS Guidelines

↓

Could they lead to potential cost savings?

- **Objective:**
  - To provide an analysis of the incurred costs and benefits due to the modifications to introduce EGNOS, in comparison with current deployments.
  - To determine options that provide the best approach in terms of costs.

Methodology description

Identify the “reference” (current) and “alternate” (EGNOS-based proposal) scenarios.

Set the hypotheses for the assessment. Clearly description of assumptions.

Identify the costs applicable in both reference and alternate scenarios, focussing on the difference.

Make an economic analysis of the different scenarios.

Draft conclusions.

Outline

- Activity overview and methodology description.
- Reference and alternate scenarios generalities.
- Generic cost assessment for the transmission of SBAS corrections over IALA beacons.
- Generic cost assessment for the transmission of SBAS corrections over AIS stations.
- Customised cost analysis

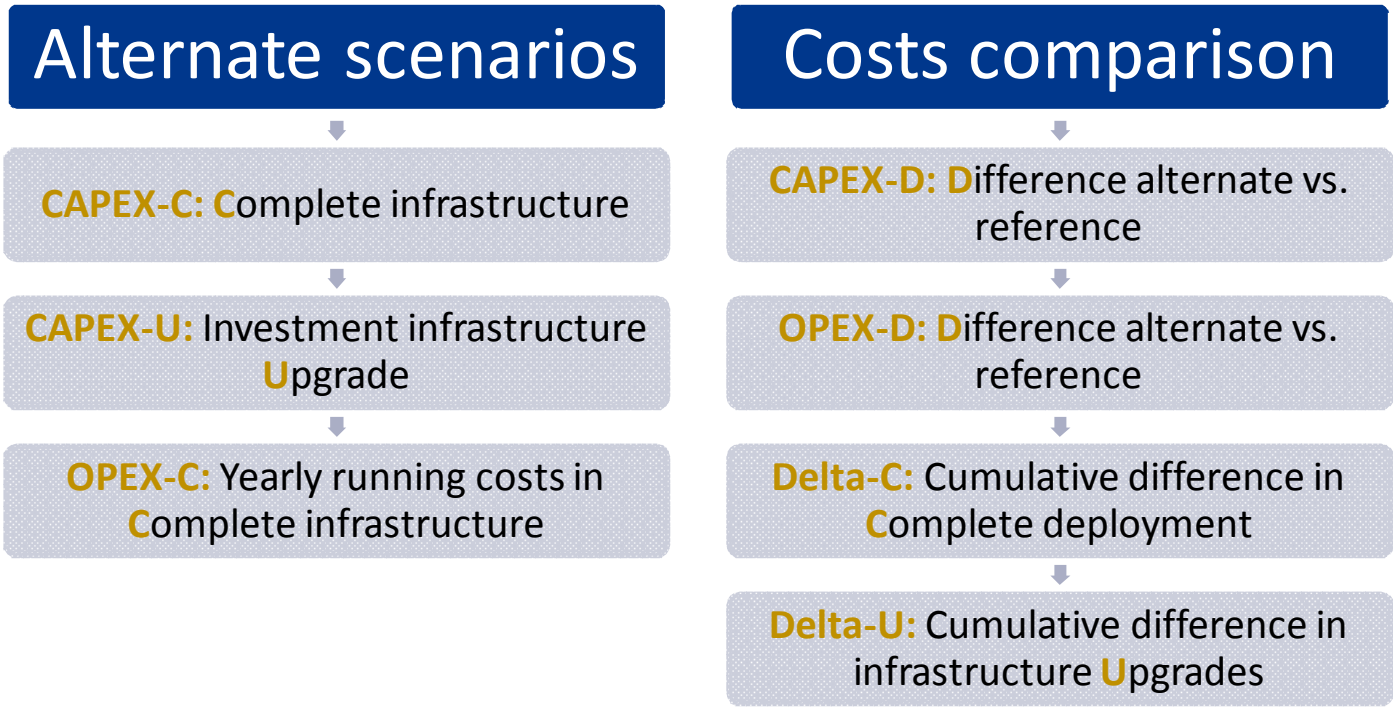
Reference scenario

Starting point	Assumptions are necessary	Considered reference scenario
• Thorough definition of the reference scenario taking as basis a typical network.	• In terms of components and redundancies. • Estimations of costs.	• Classic approach and Full-redundant architecture. • List of components and apportionment of costs.

- **CAPEX-C:** cost of the permanent assets of the **C**omplete infrastructure.
- **OPEX-C:** yearly operating expenditures which include **maintenance** and **communication lines**, associated to the **C**omplete infrastructure.
  - ➢ It is highly dependable on specific contracts and difficult to estimate on a generic basis → assumptions are needed.

Alternate scenarios

- EGNOS-based architecture proposals (classic approach or network approach).
- New components are listed. Depending on the proposed architecture some of these components could be centralized or located at each site.



Outline

- Activity overview and methodology description.
- Reference and alternate scenarios generalities.
- Generic cost assessment for the transmission of SBAS corrections over IALA beacons.
- Generic cost assessment for the transmission of SBAS corrections over AIS stations.
- Customised cost analysis

EGNOS over IALA beacons: Scenarios

- Three alternate scenarios have been analysed:

Scenario 1: Hybrid Decentralised Architecture: Traditional DGNSS + SISNeT Based

Scenario 2: Hybrid Centralised Architecture: Traditional DGNSS + EGNOS Based VRS

Scenario 3: Redundant Fully EGNOS Based Solution

EGNOS over IALA beacons: Costs comparison

10 stations Infrastructure upgrade	Scenario 1 Hybrid Decentralised	Scenario 2 Hybrid Centralised	Scenario 3 Redundant fully EGNOS
CAPEX-U	3%	4%	11%
OPEX-D	▼5,3%	▼13,7%	▼15,8%
Payback	5th year	3rd year	6th year

- **Infrastructure upgrade** (by reusing some parts of the current architecture):
  - The most promising architecture in terms of costs is the "Hybrid Centralised".
  - The payback would happen after three years of operation and the cumulative savings after 5 years of operation are higher than in the other alternatives.

10 stations New infrastructure	Scenario 1 Hybrid Decentralised	Scenario 2 Hybrid Centralised	Scenario 3 Redundant fully EGNOS
CAPEX-D	▼5,3%	▼14,8%	▼16,9%
OPEX-D	▼5,3%	▼13,7%	▼15,8%

- **New infrastructure**:
  - the "Redundant fully EGNOS" alternative is the most cost-effective if compared with the deployment of the reference scenario, both of them built from scratch.

Outline

- Activity overview and methodology description.
- Reference and alternate scenarios generalities.
- Overview of the most relevant outcomes of the generic cost assessment for the transmission of SBAS corrections over IALA beacons.
- Generic cost assessment for the transmission of SBAS corrections over AIS stations.
- Customised cost analysis

EGNOS over AIS: Scenarios

- Corrections from the IALA DGNSS stations feed the AIS Base Stations.
- Assumption: One IALA beacon feeds five AIS Base Stations.
- Costs of the reference scenario include the AIS network and also the IALA DGNSS infrastructure.

Infrastructure upgrade

- **Reference scenario**: AIS network (implementing MT17) associated to an existing IALA DGNSS deployment.
- **Four alternate scenarios** have been analysed:
  - **Scenario 1**: Decentralised EGNOS SIS
  - **Scenario 2**: Decentralised EDAS
  - **Scenario 3**: Centralised EGNOS SIS
  - **Scenario 4**: Centralised EDAS

New infrastructure

- **Reference scenario**: AIS network (implementing MT17) associated to an IALA DGNSS infrastructure (to be deployed).
- **Two alternate scenarios** have been analysed, assuming that there is no IALA DGNSS infrastructure, hence a centralised computation of corrections is performed in the Central Segment:
  - **Scenario 3**: Centralised EGNOS SIS
  - **Scenario 4**: Centralised EDAS

EGNOS over AIS: Costs comparison

20 stations Infrastructure upgrade	Scenario 1 Decentralised EGNOS-SIS	Scenario 2 Decentralised EDAS	Scenario 3 Centralised EGNOS-SIS	Scenario 4 Centralised EDAS
CAPEX-U	5,2%	2,5%	9,6%	8,9%
OPEX-D	=	▲0,8%	▼5,9%	▼6,8%
Payback	NA	NA	13th year	11th year

- **Infrastructure upgrade**:
  - A return of the investment is not possible in the decentralised alternate scenarios.
  - The earliest return of the investment happens in the "Centralised - EDAS" alternative.
  - The most promising architecture in terms of costs is the "Centralised - EDAS" alternative.

20 stations New infrastructure	Scenario 3 Centralised EGNOS-SIS	Scenario 4 Centralised EDAS
CAPEX-D	▼36,9%	▼37,6%
OPEX-D	▼8,9%	▼9,7%

- **New infrastructure**:
  - The decrease in OPEX leads to a growing profit result along the years.
  - Both centralised alternatives yield similar savings, being the "Centralised EDAS" slightly better in terms of costs.

Outline

- Activity overview and methodology description.
- Reference and alternate scenarios generalities.
- Generic cost assessment for the transmission of SBAS corrections over IALA beacons.
- Generic cost assessment for the transmission of SBAS corrections over AIS stations.
- Customised cost analysis

Customised Cost Analysis (CCA)

- Taking as basis the generic cost analysis, it is needed to customise it according to the current infrastructure's characteristics and particular needs of an Authority or AtoN provider.
  - Regarding the reference scenarios, the lack of a mandatory architecture specification has lead to different implementations in each country: **Specificities has to be clearly described.**
  - Procurement and installation costs vary from one country to another and even from one network to another. It is essential **to validate the costs with the interested stakeholders.**
- Methodology and guidelines set up in order to develop CCAs.
  - Iterative process with interested entities in charge of IALA DGNSS or AIS networks.
  - Steady communications with AtoN providers [illegible] discussing and exchanging information.

Conclusions

- In some cases, EGNOS-based alternatives could be introduced in IALA DGNSS and AIS systems in a cost-effective way and transparent to the final users.
- There are several configurations which could bring cost savings in the short term, mainly due to the rationalization of part of the current infrastructure and the subsequent reduction in OPEX.
- The most promising architectures in terms of costs according to this generic cost analysis are:

EGNOS over IALA beacons	EGNOS over AIS
• Infrastructure upgrade (10 stations): "Hybrid Centralised"	• Infrastructure upgrade (20 stations): "Centralised EDAS"
• New infrastructure (10 stations): "Redundant fully EGNOS"	• New infrastructure (20 stations): "Centralised EDAS"

- It is recommended to assess which specific parts of the infrastructure could be reused, potential benefits of each proposal and other issues related with the architecture, prior to choose an alternative based only on potential savings.

Keep on working!

- In order to fine tune the cost analysis, figures and components need to be assessed by those having a deep knowledge of these networks, especially in regards to the costs and the architectures already in place.
- Feedback from the Authorities and AtoN providers is also essential to fine tune the assumptions and estimations made in the generic cost analysis.
- We encourage Maritime Authorities and other AtoN providers to provide information on components and costs with regard to their current networks as starting point to develop a CCA.

Interested stakeholders to have a customised CBA, please contact:

EGNOS-adoption@essp-sas.eu

EGNOS
EGNOS, It's there. Use it.

European Global Navigation Satellite Systems Agency

ESSP

Precise navigation, powered by Europe

EGNOS

EGNOS, it's there. Use it.

Thank you!

www.essp-sas.eu

EGNOS-adoption@essp-sas.eu

http://egnos-user-support.essp-sas.eu

egnos-helpdesk@essp-sas.eu

+34 911 236 555 (H24/7)

Corporate Video

EGNOS information transmitted via IALA beacons and AIS stations