EGNOS APV-I AND HEDGE PROJECTS IMPLEMENTATION IN POLAND

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The implementation of the EGNOS system to APV-I precision approach operations, according to ICAO requirements in Annex 10. This need many analysis accuracy, integrity, continuity and availability SIS (Signal in Space) to define useful and certification EGNOS like SBAS (Satellite Based Augmentation System) in aviation, especially in landing. Also, the project will try to exploit the excellent accuracy performances of EGNOS to analyze the implementation of GLS (GNSS Landing System) approaches (Cat I-like approached using SBAS, with a decision height of 200 ft), Chełm Town located near Polish-Ukrainian border is also at the east border of planned EGNOS coverage for ECAC states. In this place there is a navigation center with EGNOS and EUPOS receivers. The starting of the project is close to October 2008. According to current EGNOS program schedule, the project activities will be done with EGNOS system v2.2, which is the version released for civil aviation certification. Therefore, the project will allow to demonstrate the feasibility of the EGNOS certifiable version for civil applications. Other project that we will present in our article is HEDGE (Helicopters Deploy GNSS in Europe). The project objectives are to achieve the following by the end of the project:

- to develop the helicopter SOAP (SBAS Offshore Approach Procedure) procedure (and necessary avionics) and then to successfully demonstrate it to the user community.

- to develop helicopter PINS (Point in Space) procedures for mountain rescue and HEMS (Helicopter Emergency Medical Services), and to then successfully demonstrate them to the user community.

- to demonstrate EGNOS (European Geostationary Navigation Overlay Service) APV (approach with vertical guidance) approaches to general aviation in Spain, Poland and Greece.

- to develop an integrated navigation/surveillance concept and demonstrate it in Greece.

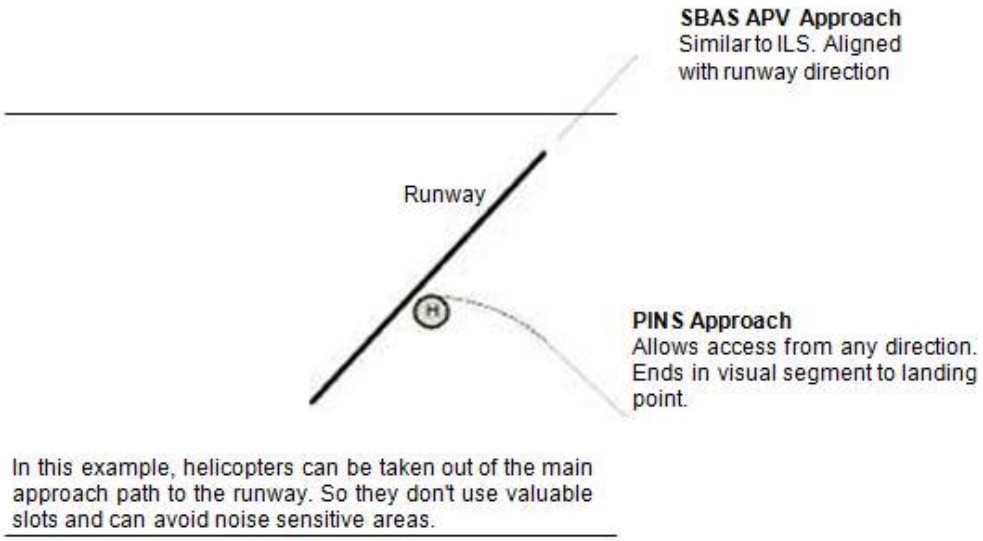


Figure 1-1: Examples of EGNOS APV and PINS approaches

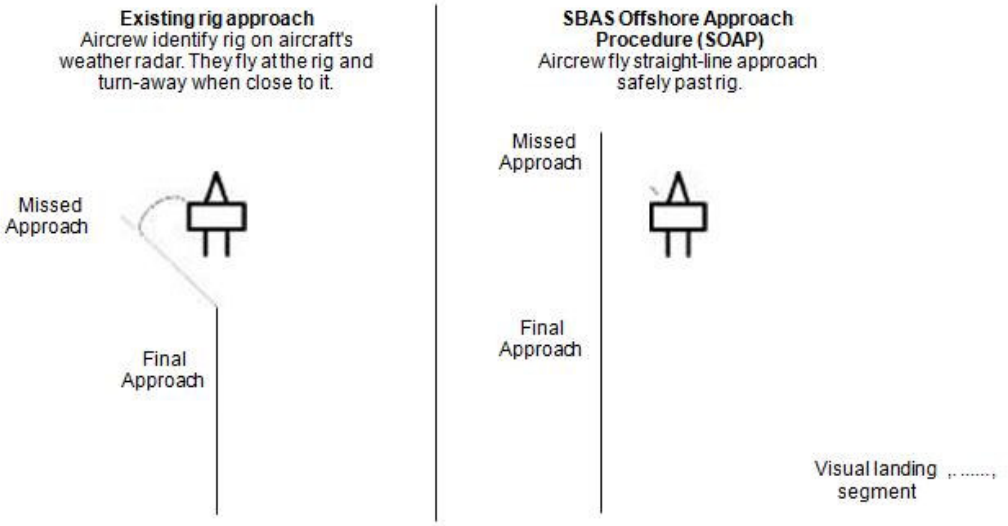
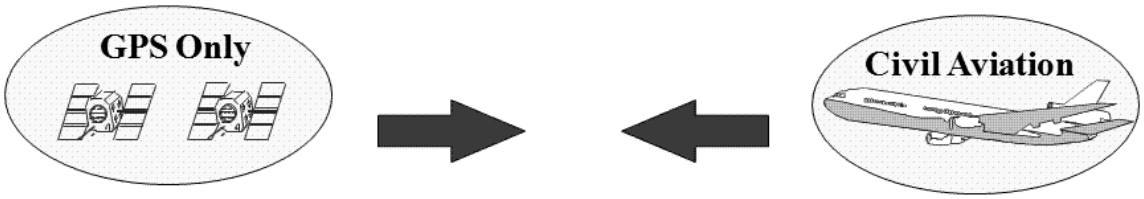


Figure 1-2: Examples of PINS and SOAP approaches



PERFORMANCE		CATEGORY I Requirements
H. 13 m V. 22m	ACCURACY (95%)	H 16.0 m V 4.0 m
99% (RAIM)	AVAILABILITY	99% to 99.990%
?	INTEGRITY	2.10^{-7}/ approach Time to alarm 6 s
?	CONTINUITY OF SERVICE	10^{-5} / approach (10^{-6} / 15 s)

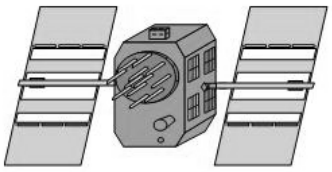
Accuracy: Difference between the measured position at any given time to the actual or true position

Integrity: Ability of a system to provide timely warnings to users or to shut itself down when it should not be used for navigation

Standalone GPS and GLONASS Integrity is Not Guaranteed

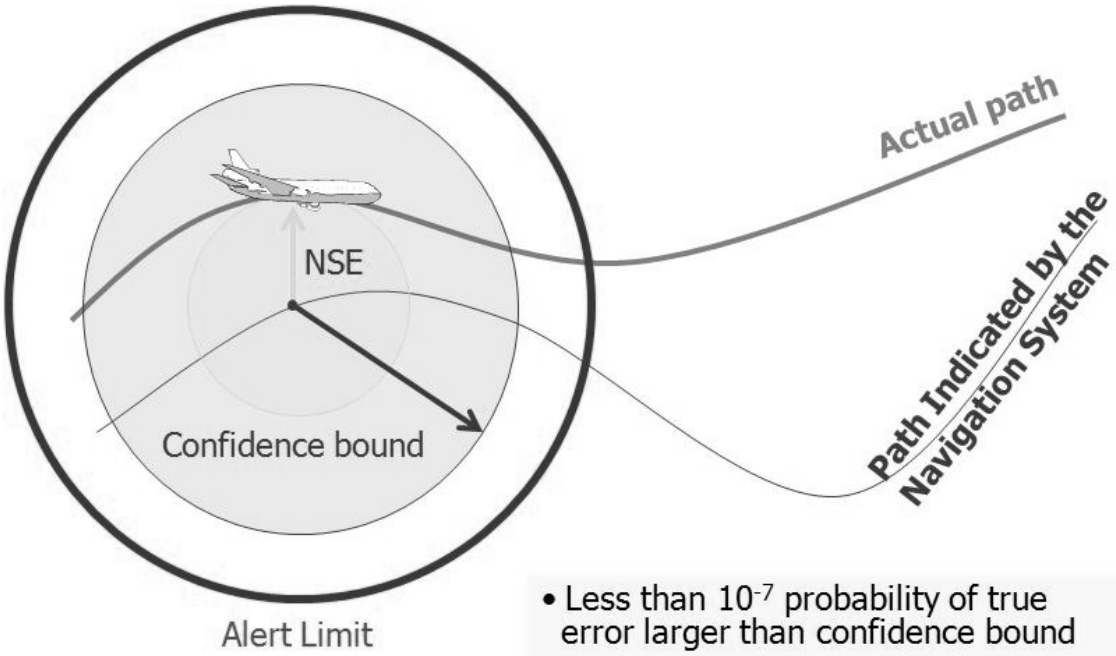
GPS/GLONASS Satellites:

- Time to alarm is from minutes to hours
- No indication of quality of service



Health Messages:

- GPS up to 2 hours late
- GLONASS up to 16 hours late



- Less than 10^{-7} probability of true error larger than confidence bound
- Time to alarm 6 s

Continuity: Ability of a system to perform its function without (unpredicted) interruptions during the intended operation.

Availability: Ability of a system to perform its function at initiation of intended operation. System availability is the percentage of time that accuracy, integrity and continuity requirements are met.

Availability and Continuity Must meet requirements

- Continuity:
  Less than 10^{-5} Chance of Aborting a Procedure Once it is Initiated.
- Availability:
  >99% for every phase of flight (SARPS).

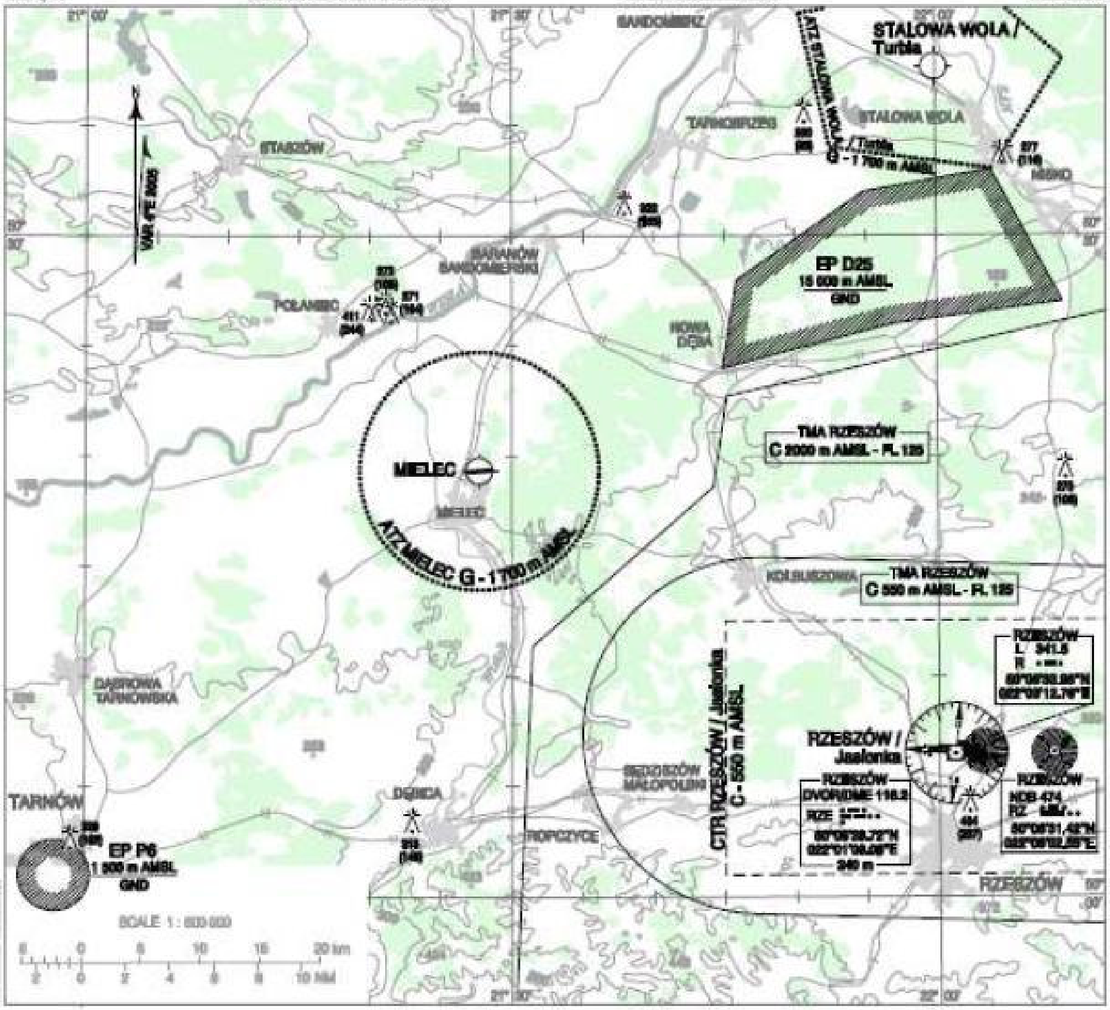
	Lateral Accuracy 95%	Vertical Accuracy 95% (1)(3)	Integrity (2)	Time to Alert (3)	Continuity (4)	Availability (5)
En-Route	2 NM (6)	N/A	$1\text{-}10^{-7}$/h	5 min	$1\text{-}10^{-4}$/h to $1\text{-}10^{-8}$/h	0.99 to 0.99999
ER, Terminal	0.4 NM	N/A	$1\text{-}10^{-7}$/h	15 s	$1\text{-}10^{-4}$/h to $1\text{-}10^{-8}$/h	0.99 to 0.99999
Initial and Intermediate Approach, NPA, SID	220 m	N/A	$1\text{-}10^{-7}$/h	10 s	$1\text{-}10^{-4}$/h to $1\text{-}10^{-8}$/h	0.99 to 0.99999
APV-I	16.0 m	20 m	$1\text{-}2\text{x}10^{-7}$/h per approach	10 s	$1\text{-}8\text{x}10^{-6}$ in any 15 s	0.99 to 0.99999
APV-II	16.0 m	8.0 m	$1\text{-}2\text{x}10^{-7}$/h per approach	6 s	$1\text{-}8\text{x}10^{-6}$ in any 15 s	0.99 to 0.99999
PA- CATI (8)	16.0 m	6.0 m to 4.0 m (7)	$1\text{-}2\text{x}10^{-7}$/h per approach	6 s	$1\text{-}8\text{x}10^{-6}$ in any 15 s	0.99 to 0.99999

VISUAL OPERATION CHART

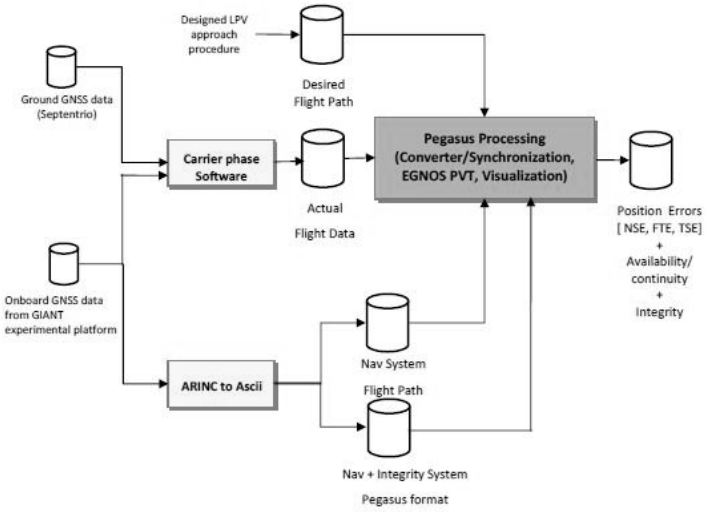
AERODROME ELEV 167 m
HEIGHTS RELATED TO AD ELEV

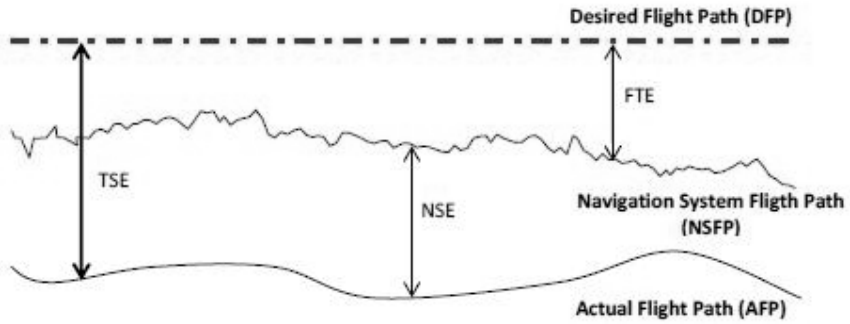
INFORMATION 118.100

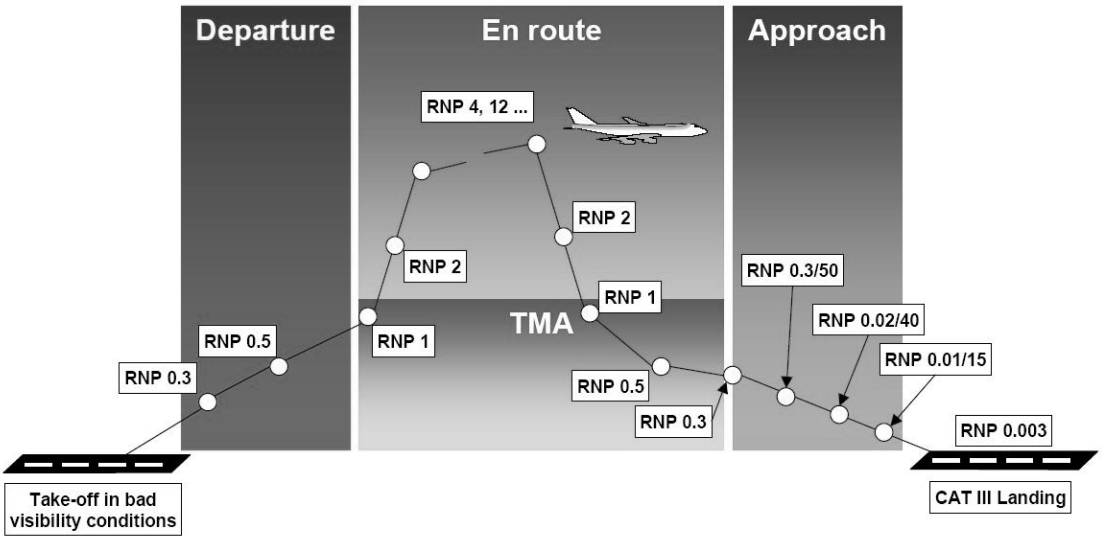
MIELEC



Corrections: Obstacles.


Designed LPV approach procedure
Desired Flight Path
Ground GNSS data (Septentrio)
Carrier phase Software
Actual Flight Data
Pegasus Processing (Converter/Synchronization, EGNOS PVT, Visualization)
Position Errors [NSE, FTE, TSE] + Availability/ continuity + Integrity
Onboard GNSS data from GIANT experimental platform
ARINC to Ascii
Nav System Flight Path
Nav + Integrity System Pegasus format


Desired Flight Path (DFP)
FTE
TSE
NSE
Navigation System Fligth Path (NSFP)
Actual Flight Path (AFP)


Departure
En route
Approach
RNP 4, 12 ...
RNP 2
RNP 2
RNP 1
TMA
RNP 0.5
RNP 0.3
RNP 1
RNP 0.5
RNP 0.3
RNP 0.3/50
RNP 0.02/40
RNP 0.01/15
RNP 0.003
Take-off in bad visibility conditions
CAT III Landing