

AIR-NET OF POLISH PERMANENT STATIONS RTK DGPS IN EUROPEAN CNS/ATM SYSTEM

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The dynamic development of aviation caused huge development of present techniques and technologies in navigation. Already since 1995, aircraft navigation has introduced GPS system receivers to be used as boosters, which added up to the supplement of classical navigation aids. However, NATO headquarters (STANAG 4550) have already exploited the majority of satellite radio navigation equipment between 2005 and 2007 (fig. 1 and fig. 2).

ECAC Roadmap of Navigation Applications and Infrastructure				
APPLICATIONS	2005 TO 2010	2010 TO 2015	2015 TO 2020	2020+
Conventional SIDs & STARs	VOR/DME/NDB			
B-RNAV SIDs & STARs (only above MSA/MFA/RVA)				
B-RNAV (En-Route)	GPS or GPS/SBAS or DME/DME or VOR/DME			
P-RNAV SIDs & STARs	Limited Application	GPS (+ Galileo after 2008) or		
P-RNAV (En-Route)		GPS/SBAS or DME/DME		
RNP-RNAV SIDs & STARs			GPS (+ Galileo) or	
RNP-RNAV (4D) (En-Route)			GPS/SBAS or DME/DME	
NPA - Conventional	VOR/DME/NDB			
NPA - P-RNAV & RNP-RNAV	GPS or GPS/SBAS or DME/DME			
APV - RNAV Baro-V-NAV & RNP-RNAV Baro VNAV		GPS (+ Galileo after 2008) or GPS/SBAS or DME/DME		
APV III -		GPS/SBAS		
CAT I/II/III Ops+ Guided TO - ILS		ILS (Reduced availability in support of CAT III Ops)		
CAT I/II/III Ops+ Guided TO - MLS			MLS	
CAT I Operations - GPS/SBAS + Galileo			SBAS	
CAT I Ops + Guided TO - GPS/GBAS			GBAS	
CAT II & III Operations - GPS/GBAS			GBAS	
INFRASTRUCTURE	2005 TO 2010	2010 TO 2015	2015 TO 2020	2020+
NDB		NDB		
VOR		VOR		
DME		DME		
GPS/GLONASS		GPS/GLONASS		
GPS/SBAS (EGNOS) + Galileo		EGNOS		
GALILEO (from 2008)		GALILEO		
GPS/GBAS + Galileo (CAT I - 2009, CAT III - 2015)				GBAS
MLS (Where Operationally and Economically viable)		MLS		
ILS		ILS		

Fig. 1. Review of the ECAC Roadmap navigation strategy and implementation plan

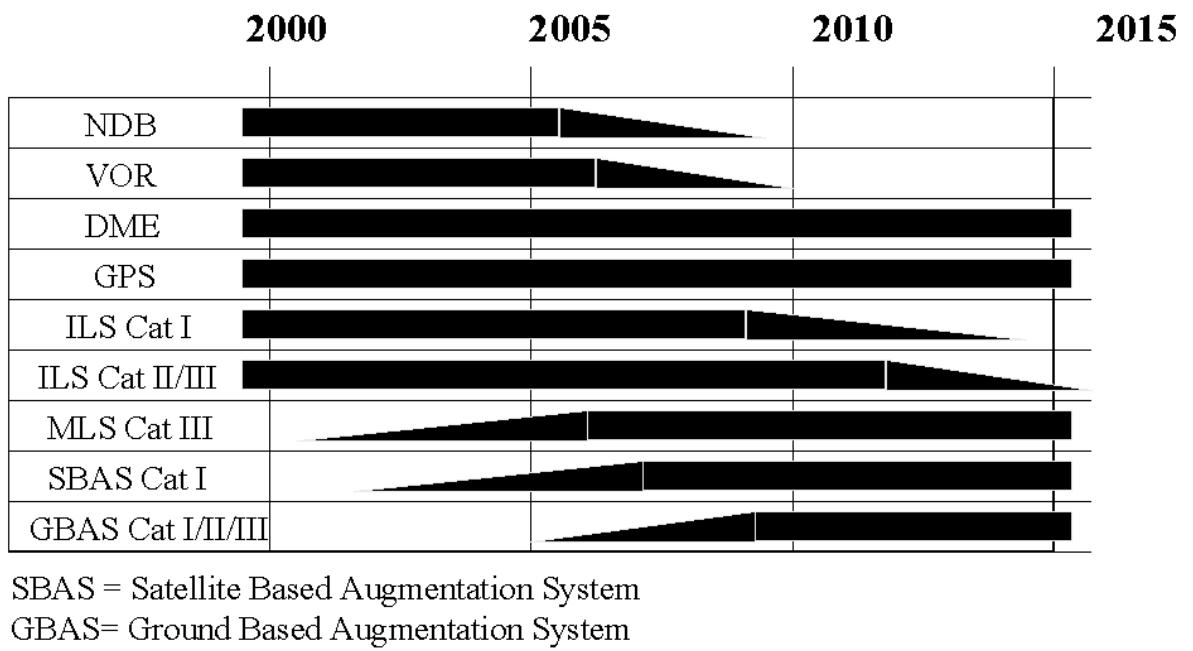


Fig. 2. Navigation strategy for ECAC

The present air navigation system equipment has to be replaced as it will form essential aid for air - navigation, enabling RNAV exercise flights (fig. 3).

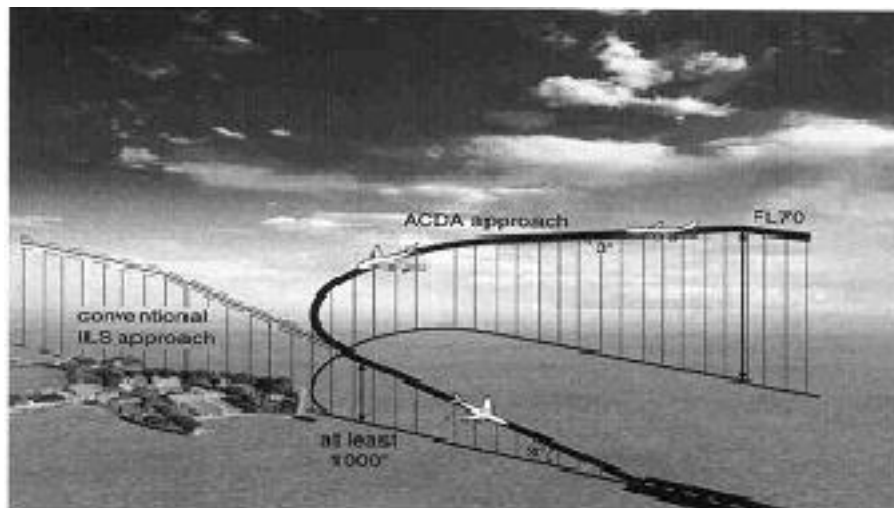


Fig. 3. Segment of approach procedure

Along with world trends as well as recommendations of international aviation organisations, every aircraft should be equipped with a satellite receiver set. Also the dependent supervision equipment - ADS (Automatic the Dependent Surveillance) depends on satellite technology (fig. 4).



Fig. 4. On – board approach equipment

This kind of information is received through COMSAT and sent to the operator's suitable air traffic centre. In turn, mainly in Sweden and in Germany airborne tests are made on the use of DGPS technique, on one of modules of automatic unit of ADS - B supervision (Automatic the Dependent Surveillance - Broadcast), which is the derivative of ADS. The deck receiver set GPS is to be used as basic source of information about time in this unit. ADS - B net was created and tested in Northern Europe in NEAN frame project (Northern European ADS -B Network). The countries received the ADS - B net enthusiastically, so in near future this navigation radars will be replaced by the ones traditionally used in air traffic control. Essential unit in created it becomes formations satellite technology and introduced to Global use particularly Navigation Satellite System defined as GNSS (Global Navigation Satellite System). The demand appeared on entirely new approach in connection with management the air traffic questions, with the aim of solution of problems connected with enlargement the capacity and transfer function and the skyway as well as existing the far-reaching European formations the ATM (fig. 5).

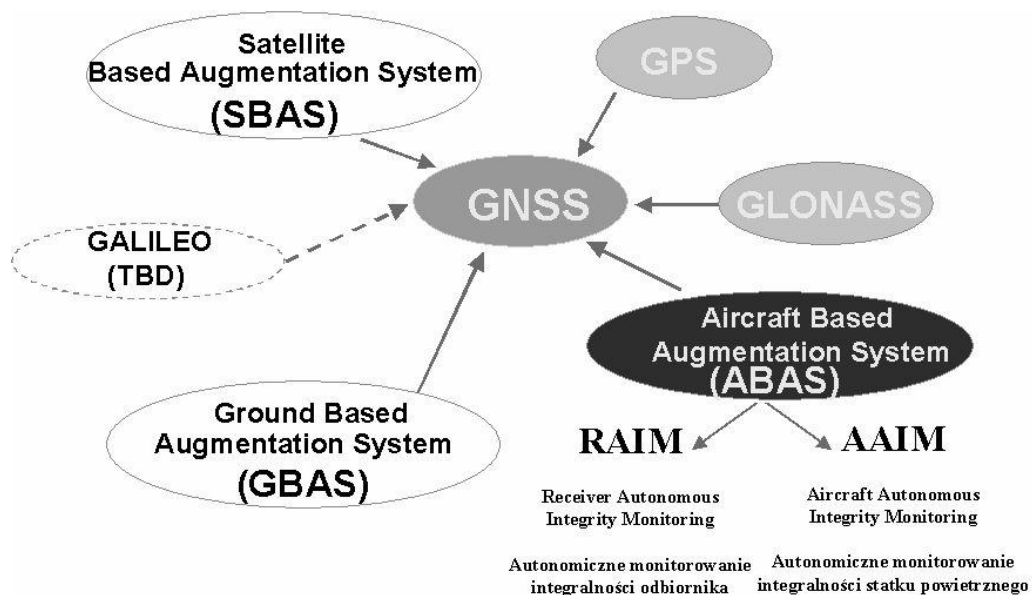


Fig. 5. ICAO GNSS

Therefore document "THE AIR TRAFFIC MANAGEMENT STRATEGY FOR THE YEARS 2000+" was worked out with the aim to create a uniform aerospace for Europe. Presented strategy delivers also precise hands and presents effective centres enabling us to deal all problems and effectively cope with challenges by European ATM in XXI century. Then on the base of THE AIR TRAFFIC MANAGEMENT STRATEGY FOR THE YEARS 2000+" it is possible to realise regional undertakings. For European countries the programme of standardisation CNS /ATM carries the name "European Convergence and Implementation Plan 2004 - 2008". In support to this document every country was obliged to study and to realise the state programme of standardisation CNS /ATM and harmonisation of workings named "Local Convergence and Implementation Plan". Poland also participates in this programme and meets or corrects received requirements. Problems connected with GNSS have been treated recently as a priority Global Navigation Satellite System, contained in "ANNEX 10 TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION". In received international solutions it is mentioned, that initiation of global formation ATM/CNS should take into account present techniques and technologies in wide range and simultaneously build it will make possible the modernisation of formations in the future. This formation was foreseen in CNS according to the aim ATM in support about component units: GNSS, ASDLS, GEO, VDL, FMS, SSR, PSR, MCC, METEO, Mod S, GES, MLS, LAAS, WAAS, EGNOS, GALILEO, ATN, RMS, SMGCS, ACC. Changes in our country began also with creating bases under Polish formation ATM/CNS (fig. 6) and the net of permanent air-stations RTK DGPS.

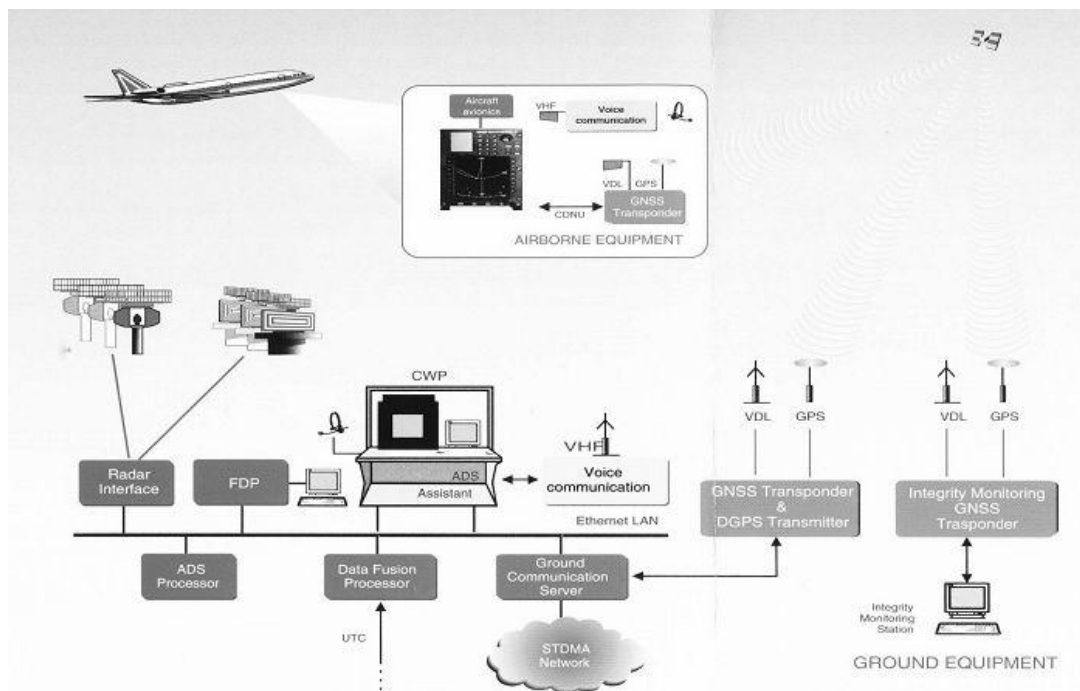


Fig. 6. European CNS/ATM system

The concept of formation DGPS was worked out for needs of aviation in support about normative documents. The coordination also uniform, global system, world formation of time UTC is the additional advantage, which makes possible services exercise on terrain between the armed services in different states, services in all over the world the peaceful missions, the assurance of safety in the communication routes, etc. Proposed air-formation RTK DGPS realises arrangement C3I (Command, Control, Communications, Intelligence - control, argumentation, transport, and interview - recognition). We would like to emphasise that arrangement C3I in Polish formation treats to gathering of function related to accumulations,

working out and spread of information, indispensable to correct of aviation. It will be required that the Polish formation RTK DGPS from this time also would consist of different types of joint mobile operating centres. Future Polish air - net of permanent reference stations presents the general structural pattern of Polish air - formation RTK DGPS – POLPOS (fig. 7).



Fig. 7. Polish air - net of permanent reference stations

We are going to prepare an experiment connected with exercise of landing approach on new airport Chelm-Deputyce Królewskie that is also the permanent satellite station of The State School of Higher Education (fig. 8 and fig. 9).

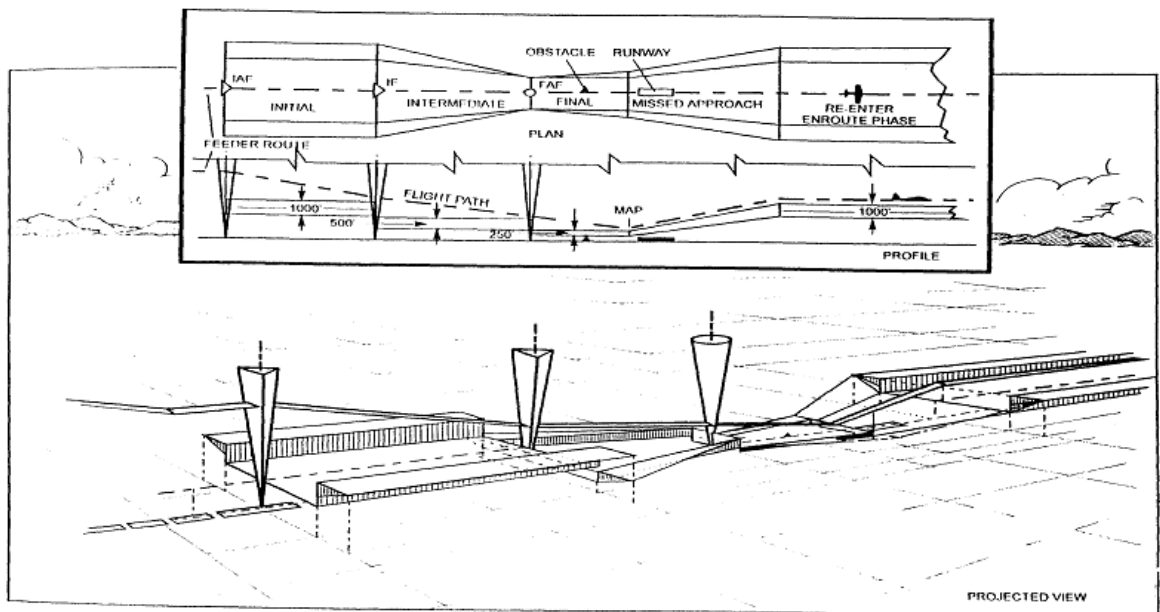


Fig. 8. Segment of approach procedure.

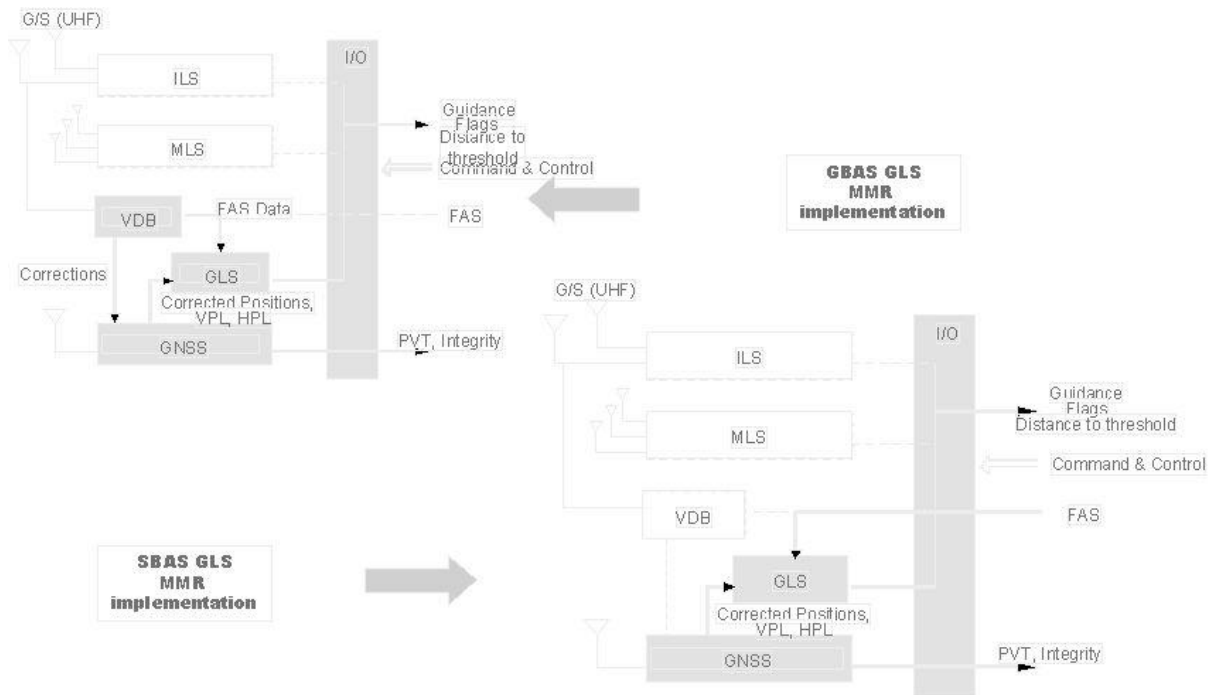


Fig. 9. On – board infrastructure

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