POTENTIAL USE OF GBAS SATELLITE NAVIGATION SYSTEM FOR CIVIL AVIATION AT THE SLIAC AIRPORT

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The text describes GBAS system in basics. Also contains actual information of development and current situation in general. On the other hand informs about Sliac airport and its basic characteristics. Aim is to focus on FAS (Final Approach Segment) of precision approach provided by GBAS system. Description of FAS Data Block, which is transmitted to aircraft by VDB antenna. In this work design of FAS for runway 36 at the Sliac airport was created as well as the creation of FAS Data Block for runway 36 and runway 18.

K e y w o r d s: GBAS, approach, Sliac, design, creation

1 INTRODUCTION

Actual situation at the Sliac airport can be modified to more optimized way. New GNSS based systems are used in the aeronautical industry. After general information about Sliac airport, the GBAS satellite system is introduced. All of this information is related to potential use of GBAS system. Basic data about system and basic characteristics are introduced too. As the main part is presented design proposal for precision approach for runway 36 of the LZSL. It contains from Final Approach Segment description and definition. Basic navigational database is introduced as well as instrument approach chart.

2 SLIAC AIRPORT

Sliac airport is an international airport equipped with one runway, which is south to north oriented (36/18). It is used by civilian and military aviation. In 2010 was modernized and military has started to provide Air Traffic Services to GAT aviation. Approach procedures are published in AIP of SR, mainly an ILS precision approach for runway 36 is used by airplanes. This approach is a CAT I.

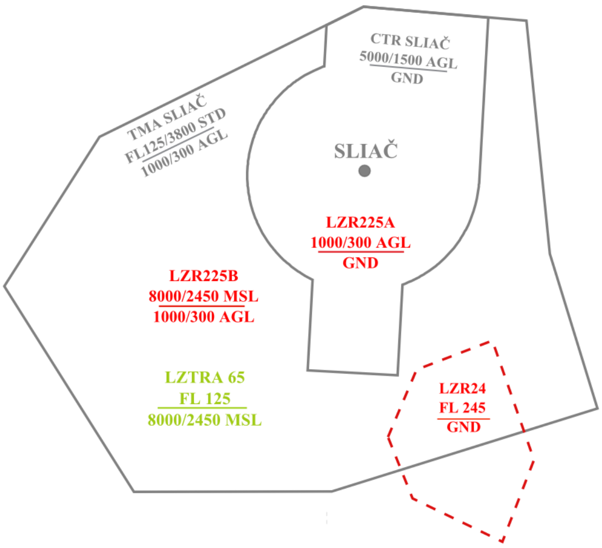

Fig.1 CTR and TMA Sliac

No precision approach for runway 18 is published, this situation significantly reduces airspace capacity, especially in case of procedural air traffic control. An analysis of actual situation shows problems occurrence in phases of departures and low flying flights. As a result of this situation appropriate authorities are discussing possibilities and designing new departure/approach procedures as well as relocation of radio communication devices to more suitable place.

3 GBAS SATELLITE SYSTEM

The Ground-Based Augmentation System to satellite navigation is an airport-based, local system. The Ground Based Augmentation System (GBAS) is intended primarily to support precision approach operations. It consists of a GBAS Ground Subsystem and a GBAS Aircraft Subsystem. One GBAS Ground Subsystem can support an unlimited number of aircraft units within its GBAS coverage volume.

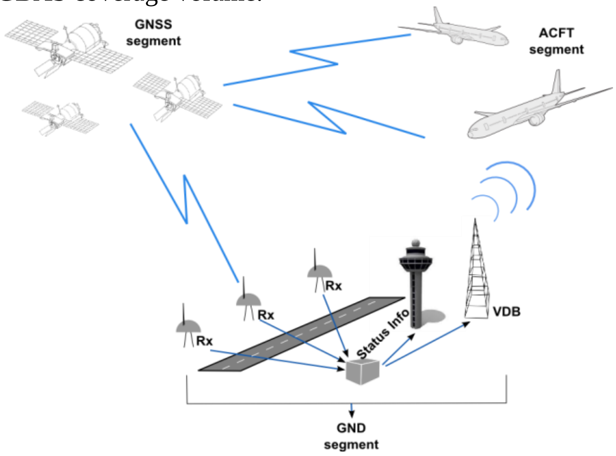

Fig.2 GBAS concept

The ground subsystem provides the aircraft with approach path data and, for each satellite in view, corrections and integrity information. The corrections enable the aircraft to determine its position relative to the approach path more accurately. The ground segment for GBAS includes multiple GNSS receivers which collect pseudoranges for all satellites in view and computes differential corrections and integrity related information. Then is broadcasted by VDB antenna to aircraft´s multi-mode receiver, which provides approach information at PFD (Primary Flight Display) for pilot. The broadcast information includes pseudorange corrections, integrity parameters and various locally relevant data such as Final Approach Segment (FAS) data, referenced to the World Geodetic System (WGS-84). The ground subsystem is composed of:

- a reference station in charge of generating and transmitting the augmentation signal (VDB),
- at least one monitoring station (GMS), in charge of receiving the VDB signal, together with GNSS signal, and of monitoring GNSS and GBAS system´s performance.

The reference station is composed of:

- a redundant number of reference GNSS receivers,
- a data processing station,
- a VDB station for broadcasting correction and integrity messages in the VHF band to users.

4 FAS DESIGN FOR AIRPORT SLIAC

4.1 Final Approach Segment

The Final Approach Segment is defined by data prepared by the procedure designer. The complete description of the final approach track, the glide path, the alignment and all the other important parameters included, are provided by procedure designer. The Final Approach Segment (FAS) path is a line in space defined by Landing Threshold Point (LTP), Flight Path Alignment Point (FPAP), Threshold Crossing Height (TCH) and Glide Path Angle (GPA). Main information about Final Approach Segment is contained in FAS Data Block, also created by designer of precision approach.

4.2 FAS for runway 36

GBAS approach is nowadays certified for CAT I approach only. In future is assumed that CAT II or even CAT III will be certified for precision approach. Due to lack of practice, information and software issues the GBAS precision approach for runway 36 was created. All relevant information, as precise longitude and latitude positions, altitudes, IAS speeds was found in AIP of SR. But Final Approach Segment was designed in detail. As an example the ILS approach for runway 36 was used. Obstacle assessment surfaces of ILS and GBAS are same (OAS ILS = OAS GBAS). This relation was helpful in process of approach design. Also the PANS OPS OAS software was used as a sort of OAS GBAS verification.

4.3 GBAS approach chart for runway 36

With help of specific software and AIP of SR, the GLS RWY 36 instrument approach chart was created. This procedure is only a proposal of the instrument approach from west direction. Therefore three RNAV fixes were created. Initial Approach Fix called WALDI, Intermediate Fix (SL361) and the Final Approach Point (SL362).

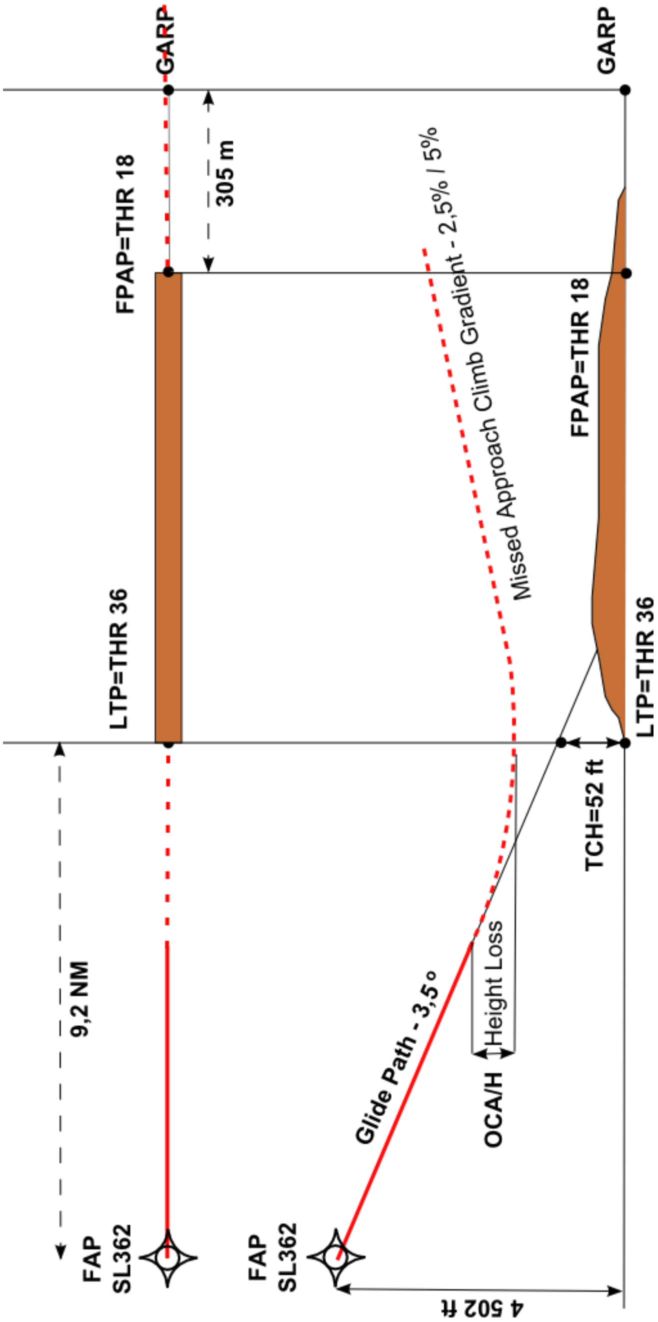

Fig.3 FAS for RWY 36

As was mentioned before ILS CAT I is similar to GBAS CAT I precision approach. Due this fact Glide Path Angle (GPA) is 3.5˚ and RDH 52 ft as is published in ILS approach for runway 36. Also there was need to recreate a missed approach procedure as well. OCA/H heights are published in approach chart, pilot is following runway heading (358˚) and climbing, after passing altitude of 2 600 ft pilot is commencing right turn direct to WALDI fix and climbing to 5 500 ft. New holding procedure was designed too. Holding pattern is created over fix WALDI and published in chart.

4.4. FAS Data Block

The integrity of the navigation database is a key element in an RNAV environment, that is an discrepancy between the publisher of procedures and the AIP of specific state. Any error by introduced by the data supplier must be detected, and the immediate alerts must by provided. That´s why a FAS Data Block is needed. It provides aircraft with suitable information and provides redundancy check and integrity related information. FAS Data Block elements are used to:

- define the three dimensional FAS,
- establish the location of the departure end of the runway,
- provide a high integrity cyclic redundancy check wrap of the elements of the FAS data, and;
- provide procedure identification parameters.

4.5 FAS Data Block for runway 36 and 18

With use of specific software precise positions of all needed points defining FAS were defined. The other relevant information was published in AIP of SR.

Data type	
Block Type	GBAS
Operation type	0
Service Provider Identifier	
Airport ID	LZSL
Runway Number	RW36
Runway Letter	0
Approach performance Designator	1
Route Indicator	Z
Reference Path Data Selector	12
Reference Path ID	G36A
LTP Latitude	483738.2612N
LTP Longitude	0190800.8530E
LTP Ellipsoidal Height	+03522
△FPAP Latitude	483855.9312N
△FPAP Longitude	0190804.8230E
Approach Treshold Crossing Height (TCH)	00052.0
Approach TCH Units Selector (meters or feet)	F
Glidepath Angle (GPA)	0350
Course width	105.00
△Length offset	0000
Final Approach Segment CRC	E104FC14

Fig.4 FAS Data Block RWY 36

With these data design of FAS Data Block for runway 36 was the easiest part of work. It includes all relevant information for aircraft segment of GBAS system. FAS Data Block for runway 18 was similar, only few things are changed due to opposite location of FAS´s defying points.

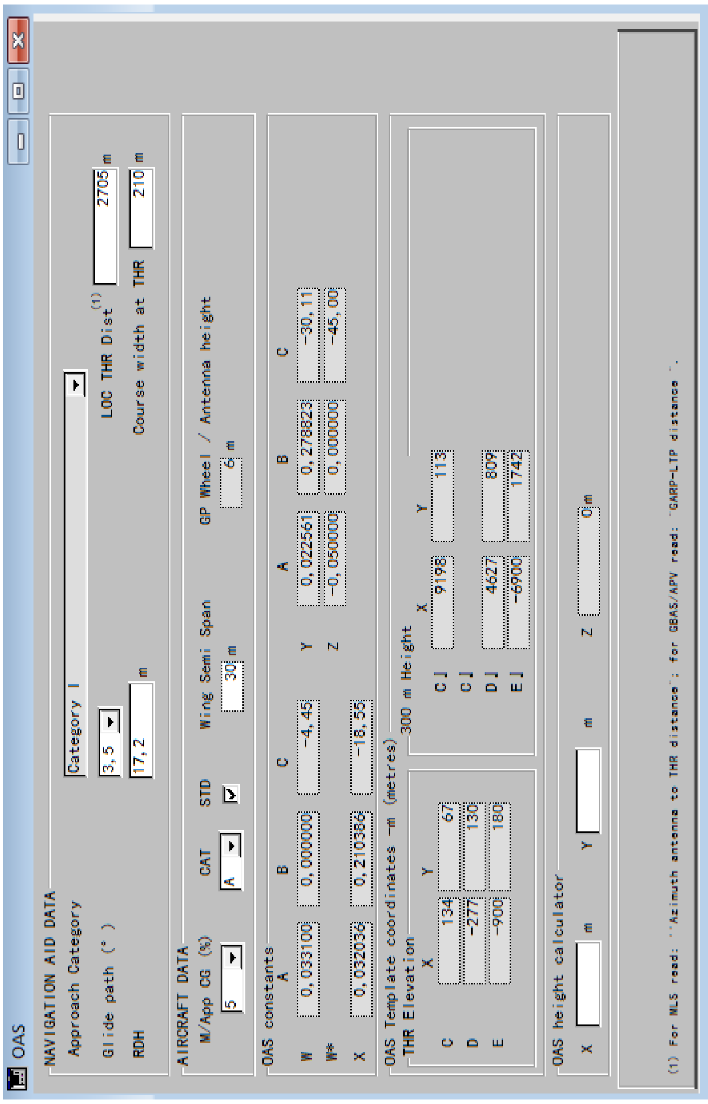

Fig.5 PANS OPS OAS Software Output

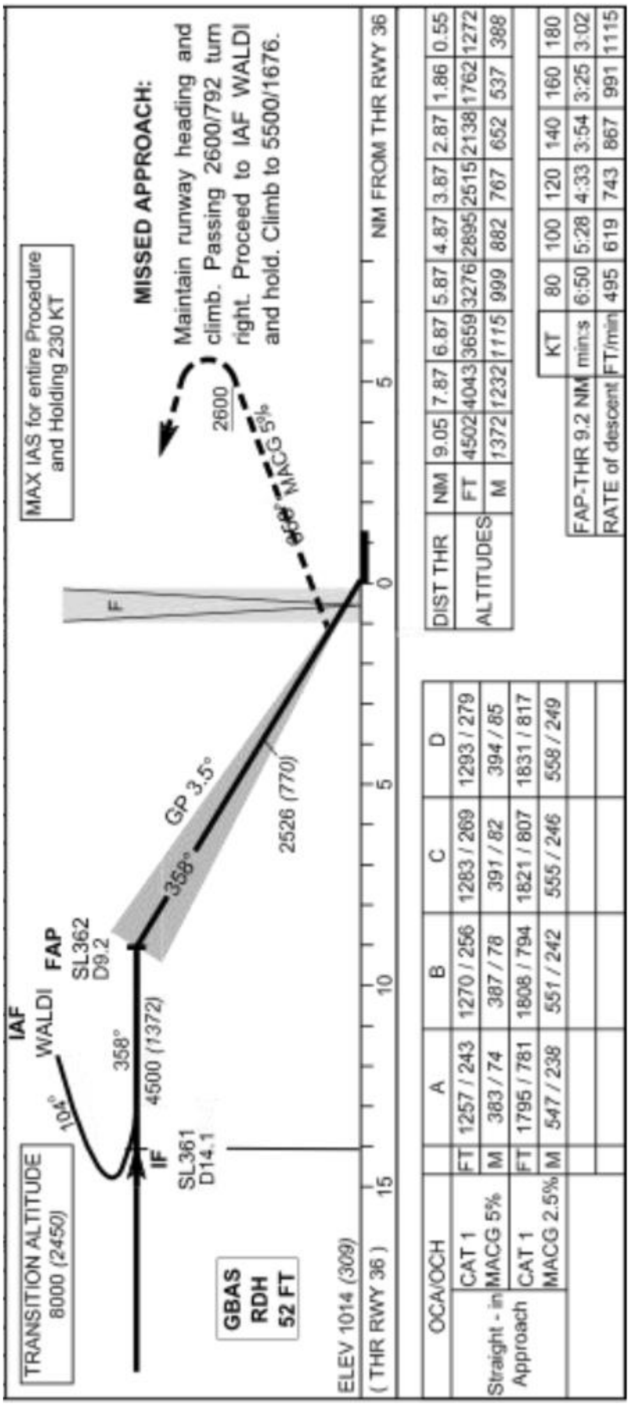

Fig.6 Approach Description RWY 36

5 CONCLUSION

I hope, that the information provided as above will help to introduce new technologies in instrument approach procedures. Benefits of approach with use of GNSS are clearly confirmed by manufacturers, airports, airlines and authorities. It is obvious that in our airspace is place to start new project, which can increase effectiveness, safety and quality services provided.

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