AVIGAL

Projection Description [General] Aviation with Galileo [in Schönhagen]

BBAA (www.bbaa.de)

TFH Wildau (www.tfh-wildau.de)

Schönhagen Airfield (www.edaz.de)

Summary

A landing approach system that functions without ground supported augmentation should be developed. The system should be suitable for general and regional aviation use and be capable of:

- making curved (3D) CAT I approaches over noise sensitive areas
- step approaches over obstacles
- defining and permitting narrower approach corridors than are possible using conventional methods

The following points are planned;

- evaluation of the suitability of the European GNSS system for this purpose
- the development of suitable navigation equipment for installation in aircraft
- the construction and temporary use of a test area at Schönhagen Airfield

The approach technique and apparatus should be available as soon as the European GNSS is in operation.

The equipment should be produced in the Berlin/Brandenburg area.

Motivation (Why AVIGAL Now?)

It is intended that Schönhagen Airfield will deal with some of the general aviation traffic for the new Berlin Brandenburg International Airport. Because of the position of Schönhagen Airfield it is not always possible to make straight landing approaches. It is desirable (as it is at other similar airports) that instrument supported CAT I landings should be made using the simplest means possible, despite the use of curved 3D approach paths.

A GNSS (Global Navigation Satellite System) can be used to do this.

The European Satellite Navigation System GALILEO, which should be up and

running by the year 2011, will be technically well suited for aerospace applications. To meet the need for an economic navigation approach system that is not dependent on complex ground supported equipment and can deal with curved 3D approaches an instrument that can be built into an aircraft must be developed, tested and licensed. This is particularly challenging as at present there is no functioning GNSS apart from the American GPS system and the Russian GLONASS system. Neither system is usable without ground based augmentation.

For the above reasons the AVIGAL project is already being put into operation at Schönhagen Airfield near Berlin Brandenburg International Airport (BBI). This project is being carried out with the help of various well-qualified partners

The aim of the AVIGAL project is to produce in the region an approach navigation system for general aviation use that is not dependent on ground augmentation. Such a system will be marketable worldwide and will also be a technically sophisticated and an obviously useful application of GALILEO. The project's aim of preparing, testing and putting into serial production should give a considerable boost to the aviation area BB as well the European GNSS system. To wait until the European GNSS system is up and running would mean leaving the field to international competitors.

Present Situation and Terms of Reference

Smaller airfields are in great need of a cost-efficient landing approach system. (In Germany alone there are 28 airports and 128 airfields.) Worldwide 75% of registered aircraft use GPS for route navigation. In Germany however only a few individual airports make use of GPS flight approach systems. In the new German states only Magdeburg airport uses a GPS overlay system. (This system is used as a supplement to conventional systems.) As a rule conventional instrument approach systems are only found at airports rather than airfields. To relieve major airports from general aviation traffic (unscheduled individual flights and aerial work) this traffic is to be diverted to suitable airfields. It is necessary that these airfields are equipped with instrument approach systems to ensure higher standards of safety and to ensure that these airfields can operate in poor weather. (Approximately 75% of all flights are made by general aviation aircraft with take-off weights of less than 14 tonnes.)

At present instrument landing systems are usually found at major airports. These systems are operated at considerable financial cost by major airlines. Satellite systems play a minor role as major airports are already equipped with alternative technology.

Without expensive ground stations neither GPS nor GLONASS (both national military systems) are permissible due to their limited accuracy and more importantly, because their signal integrity cannot be checked (inadequate security and reliability). Construction and licensing of such ground stations can cost tens of millions. The auxiliary European EGNOS system, which can be used to improve the accuracy and check the integrity of GPS, is not available worldwide and in Germany can only be used to an elevation accuracy of 5%, which makes its use extremely difficult. Eurofixx (a combination of GPS and LORAN-C) will not be usable if the LORAN-C transmitter

(e.g. the transmitter on Sylt) is turned off, which may well happen.

For these reasons it seems desirable to find a solution using the European Satellite Navigation System GALILEO which is under construction at present. This system should be extremely well suited to aviation needs but a fully functioning constellation of satellites will not be available before the year 2011. If the Berlin/Brandenburg solution is to be a success on the market it must be ready for use when GALILEO is introduced. Therefore development, testing, and certification must be carried out using alternative means.

The Solution and how to get there

Analysis of the Technical requirements, Comparison of Present and Planned Systems

Initially what must be done is to find the best way to produce a landing system based on GALILEO which best meets the demands of a CAT I system. If possible this should be done without ground based augmentation. (The GALILEO system is being designed with aviation applications in mind and because of its increased accuracy, availability, information integrity it should be highly suitable for aviation purposes.)

The results of this phase should essentially be a technical comparison between GALILEO and (D-)GPS/GLONASS and the formulation of relevant system scenarios for future on-board guidance systems.

Planning of Airfield Equipment for Test Operations, Design of Aircraft Technical Systems

GALILEO will not be available before 2010/2011. Therefore a process must be proposed that will allow the simulation and testing of a GALILEO based system using presently available systems (GPS, GLONASS).

As an alternative, similar to GATE, a satellite substitution system could be used, if it is possible to utilize ground based units and to use the results to calculate how the final system would behave.

In addition a design for a suitable low-priced on-board approach system must be produced.

Implementation of a Test Area that Will Simulate the Expected Conditions of the Selected Positioning System

The results of phase two are to be converted into a technical system.

Implementation of an On-Board System Prototype

A prototype on-board approach system suitable for the following test phase should be produced. The prototype should be based on commercially available systems.

Testing and Simulation Preparation for a Series Production On-Board System

At present the period of time planned for the tests will be six months. After testing is finished the system can be made commercially available to third parties. A suitable business model will be developed.

Evaluation of Testing/Documentation/IPR/Evaluation of Market Entry/Spin-offs

Project-accompanying evaluation with regard to the current market situation; documentation and discussion of the (intermediate) results by experts and users; investigation of the legal framework.

Schedule and Costs

- start — early 2007
- end of engineering planning — end of 2007
- construction — from early 2008
- beginning of test phase — approximately 2009

The cost of the project is estimated at about 2.2 million Euros.

Cooperating Businesses and Research Institutes

- BBAA
- TFH Wildau (University of Applied Sciences), Faculty of Engineering / Industrial Engineering (project management and coordination, scientific monitoring, evaluation)
- Schönhagen Airfield (user, technical aviation consultancy)
- Galileo Industries (technical support, know-how provider)
- Honeywell (hard- and software development)
- asitos GmbH (software development)
- Deutsche Flugsicherung (consulting)
- Forschungs- und Anwendungsverbund Verkehrssystemtechnik TSB/FAV, Berlin (dissemination, evaluation)
- Funkwerk AG, Dabendorf und Ulm (EuroTelematik)

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