

GNSS Center of Excellence for Safety Critical Applications, Simulation, Test & Certifications - GAUSS

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Abstract

A major advantage of the area in and around Braunschweig is its concentration of major research institutes and small to large enterprises dealing with different modes of transportation. For many years, aviation has been a particular focus. The research institutes have aircraft and helicopters equipped especially for research projects, as well as other laboratory equipment, allowing simulation and testing of air traffic application both virtually and on real aircraft. In addition, with the *Luffahrtbundesamt* (equivalent organization to FAA) and the *Bundesstelle für Flugunfalluntersuchung* (equivalent to NTSB) both located at the *Research Airport*, it enables direct contact with two key air-traffic safety authorities. The institutes of DLR and the Technical University of Braunschweig are very active in rail transportation applications. Cooperation with the market leader in rail automation – Siemens Rail Automation, also located in Braunschweig – and with other companies in the Braunschweig region means that safety-critical road applications and mobility research is available due to the activities of a number of institutes. Cooperation with Volkswagen (VW) and other companies in the region ensure access to the market leaders' know-how in this sector. Current European activities within framework of the Galileo project offer particularly good opportunities for the Research Airport to leverage its expertise and position itself internationally as a specialist in safety-critical transport applications – the centre is an initiative of Niedersachsen and the Ministry of Economic Affairs, Labour and Transport. Location and navigation plays a central role in all modes of transport – air, road and rail. The market is being revolutionized by the increasing integration of GNSS. The realization of the Galileo system will provide additional opportunities for the Research Airport: Galileo as a civil operated system offers service guarantees especially in the area of safety-critical applications in transportation. Notably standards, processes and authorizations related to the certification of safety-critical applications in the areas of air, road and rail transportation are still to be determined. GAUSS, located at the Research Airport Braunschweig, as an European centre of excellence for simulation, testing and certification of safety-critical applications can offer its expertise to validate the services guaranteed by the Galileo concessionaire.

Keywords: GNSS, Galileo, GAUSS

1. Initial Situation

Building a European positioning and satellite navigation system GALILEO includes extensive technological and economical chances.

Conservative estimations indicate that GALILEO, and applications and services based on GALILEO, will exhibit a potential economical business volume of more than EUR 10 billions and provide between 100.000 and 150.000 new jobs.¹ GALILEO is an essential element and a basic infra structure for the future of the European industry in the area of high technology.

In the future, the entire area of safety-critical applications will be seen as a fundamental element of GALILEO. The positioning in that area in an early stage

gives the possibility to generate a singular and regional cluster which will realize lasting proceeds in areas like technology, economy and employment politics.

The profile of the research airport of Braunschweig and its immediate environment demonstrate a special concentration of overall transportation competence, especially within the safety-critical area. This focused competence exhibits a unique selling point within the European context which should be used as the GALILEO center for safety-critical applications (GAUSS) in order to establish the location.

The establishment of the location as a European competence center can be seen as an essential element within the policy of innovations and technology in Lower Saxony which primarily attends to the development of the business-friendly and applied infra structure. Essentially, it concentrates on fields of technology with already existing adequate strengths.

¹ Compare European Space Agency (2002): GALILEO, The European program for worldwide service of navigation.

2. Objectives

Safety-critical applications of GALILEO will basically arise from every field of application which goes back to information about positioning, velocity and time.

Primarily - independent from the carrier - this will be about the area of traffic.

Every safety-critical system and service in the future will need a certified accreditation to be applied. This will be determined by partially not yet existing norms and standards. The intended application center GAUSS has the following agenda:

1. Active collaboration developing norms and standards at European level and - consequential – taking a leading position;
2. Taking a European leading position in admission of end devices and services by the conclusion of an exclusive contract with the Galileo concessionaire;
3. Assembling a simulation and testing environment in collaboration with further partners which is standby before entirely operational availability of Galileo and which guarantees the possibility of a financial flow back, the supply and marketing.
4. Assembling and extending a networked “innovative milieu” which leads to a permanent enlargement of the scientific-technical infra structure, forces the development and realization of successful innovations, and adds new – mostly highly qualified – jobs around the nucleus of GAUSS by increasing the technological and economic attractiveness of the location.

Achieving the aims:

- Systematic grouping of application activities from all application areas (incl. research and development)
- Structural, organizational and legal integration of the relevant commercial partners and businesses
- Structuring of system-oriented processes of research, development and accreditation in coordination with the partners
- Developing an integrated, comprehensive service sector

3. State-of-the-art

The safety-critical positioning today is an important component for the secure functioning of traffic systems:

- In rail traffic, no norms or standards exist yet in order to verify the applicability of vehicle-fixed, satellite-based positioning systems for safety-relevant applications.
- In road traffic, safety-relevant positioning is not yet possible. However, in the future it will become necessary when driver or driver assistant systems affect more than one vehicle.

- In aviation, GPS-based systems for the navigation of airplanes exist today. In the future, applications for aerial surveillance and ground positioning will be added. The admission of these systems calls for complex diagnostic programs to meet the set development standards for hard- and software.

4. Certification of devices, services and applications

GAUSS will be the first active institution for all manufacturers which have to certify single components like receivers, systems, algorithms and services.

Autonomy of GAUSS and the refinancing is carried out through these services.

Flowchart of the certification process:

1. Order to certify devices, services or application by manufacturer
2. Organizational processing by GAUSS (sub-orders to members or validate partners) → financial proceed
3. Enabling concessionaire and client
4. Direct negotiations between concessionaire and client

5. GAUSS as network

GAUSS will perform and offer services both inwards and outwards, which induce a technological and/or financial added value and strengthen the structure of the network.

Internal services:

- Determination of the strategic adjustment of GAUSS
- Definition of quality standards and building regulations
- Further development of the network resources
- Sales support for members
- Arrangement of resources and infra structure
- Order processing and project management

Market-oriented services by order:

- Certification
- Offer of information (education, special events, etc.)
- Studies
- Simulations
- Technology management
- Consulting services (business case, F&E support, etc.)

6. Technological capability / competence

Around the nucleus of the research airport an outstanding spanning carrier F&E-area exists which, in this combination, is unique.

Besides the extensive mechanistic equipment including experimental vehicles for all traffic areas (wind channels, research plane etc.) as well as a differentiated simulation and testing infra structure (driving simulator, rail simulator etc.) there is a unique combination of businesses and research establishments to find, which give the area a unique selling point:

- Grand research establishments (e.g. DLR)
- Academic institutes of the TU Braunschweig (e.g. Institute for vehicle technology, Institute for road safety and automation, center for aerospace)
- Federal authorities (e.g. Luftfahrtbundesamt, Physikalisch-Technische Bundesanstalt)
- Technology-oriented SMEs (e.g. Aerodata AG, Oecon GmbH)
- Distinguished location and corporate offices of mobility compliant global players (Volkswagen AG, Siemens AG, Robert Bosch GmbH) respectively.

7. Structure and organization of GAUSS

GAUSS is managed as a membership corporation with corresponding boards. The following elements are intended:

1. Executive board (max. 5 members – strategic leadership)
2. Advisory board (max. 10 members – professional consulting of executive board and office)
3. Office (organization of office, management of business processes)
4. General meeting (decision board of the members)

Companies / Institutions which account for the extension and fortification of the competence of the membership corporation can become members of GAUSS. The degree of the commitment defines the particular benefit and degree of influence. Three gradual types of memberships are intended:

1. Basis membership (membership on information level)
2. Cooperative membership (membership on know-how level)
3. Strategic membership (membership on strategic level)

The Galileo Project Agency (GAPA Corporation) as an organizational and operative unit will stand for the intended center and will dog with the realization.

8. Technological and employment political chances

Because of the manifold activities of GAUSS lasting development potentials for the area of Braunschweig and Lower Saxony as well as technological and employment potentials will result:

- Extension of an internationally leading cluster in the entire area of safety-critical applications of the GALILEO systems
- Taking a European leading position setting norms and standards as well as their application / realization in terms of certificates
- Generating a lasting regional growth pool which attracts further suppliers and specialized service provider (business model) and thus induces additional employment (employment extensions in companies at the location and attracting new industrial developments) around the nucleus. From a today's view the employment effects should proceed quite dynamically because the engagement will primarily start with comparatively employment-extensive SMEs at the location. Additionally, the employment effects at the beginning of an innovation process are comparatively distinctive.
- Advancement of the implicit, competition-relevant knowledge between the network partners of the value-added chain (both horizontal and vertical) in order to develop innovative application possibilities – especially for SMEs.