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GALILEO

GUIDING YOUR WAY
GALILEO



GALILEO

◦ HIGH-TECH MADE IN EUROPE

■ ■ Innovation is the key to foster Europe's economic success. Satellite based radio navigation has been identified as one of the key drivers for innovation of the twenty-first century. In few years time, so called "Location Based Services" will be offered via a small GALILEO chip integrated in mobile phones allowing for local service providers to point customers to restaurants, hotels, movie theaters, hospitals or parking lots. Aircraft will be equipped with GALILEO receivers making air travel safer, faster, cheaper and also more environmentally friendly. GALILEO will also help to make the world safer by complementing and reinforcing existing systems i.e. predicting floods and earthquakes or contributing to successful relief operations.

GALILEO is a key project and at the same time a great challenge for European space industry and, moreover, a perfect example for the benefits, space technology offers to the people on Earth. Due to the expected long life cycle and the constantly needed upgrades of the system, GALILEO serves also as an important signal to the next generations of engineers interested in working in the space industry.

The huge interest expressed by many non-European countries in wanting to participate in this European project, proves that GALILEO is undoubtedly one of today's most exciting high-tech projects worldwide.



A handwritten signature in white ink on a dark blue background. The signature is cursive and reads "G. Stamerjohanns".

Günther Stamerjohanns

CEO Galileo Industries



GALILEO INDUSTRIES

° A EUROPEAN COMPANY

The European company Galileo Industries has been established in 2000 as a joint venture of leading European space companies to act as the industrial prime to develop and deliver the GALILEO infrastructure, which will consist of 30 satellites and ground based infrastructure spread around the world.

Galileo Industries is headquartered in Ottobrunn near Munich, Germany, with a subsidiary located in Rome, Italy. The company is responsible for three main activities being prime management, system engineering and procurement. There is no place else in Europe where satellite-based navigation know-how is as concentrated as it is within Galileo Industries.

■ ■ SIX STRONG SHAREHOLDERS

Galileo Industries is owned by Alcatel Alenia Space SAS of France, Alcatel Alenia Space SpA of Italy, EADS Astrium GmbH of Germany, EADS Astrium Ltd of United Kingdom, Galileo Sistemas y Servicios of Spain, a consortium of seven Spanish companies, and Thales.

■ ■ PHASES OF THE PROJECT

Since the very beginning, Galileo Industries has been deeply involved in GALILEO including the GSTB V1 project, awarded in May 2002, which basically simulates the future GALILEO ground infrastructure. In July 2003, Galileo Industries has been awarded by ESA the contract to develop and build the GALILEO test satellite named GIOVE B. This satellite scheduled for launch in mid 2006 will secure the GALILEO frequencies and perform in-orbit testing of critical payload elements.



° IOV PHASE

End 2005, Galileo Industries has finalized the negotiations with its customer ESA (European Space Agency) for the so called IOV (In-Orbit Validation) phase which comprises four satellites and the relevant ground infrastructure. This phase, which is equally financed by ESA and the European Commission, has started in 1st quarter 2005 and will last until 2008. Galileo Industries is determined to deliver to ESA a fully operational system in the planned cost- and time frame.

° FOC PHASE

Since Galileo Industries aims at becoming also the prime contractor for the so called FOC phase (Full Operational Capability), scheduled for 2008 until 2010, during which a PPP (Public Private Partnership) concession company will order the remaining 26 satellites, the main objective is to have delivered a state-of-the-art product to ESA by 2008. By doing so, Galileo Industries will be in a good position to remain the supplier for the FOC phase which is expected to be finalized by end of this decade.

BENEFITS OF GALILEO FOR EUROPE

◦ POLITICAL AND ECONOMIC REASONS

In the 1980's, the EU identified the political and economic need for an European-owned satellite based radio navigation system named GALILEO. However, in contrast to the US American "GPS" and the Russian "Glonass" system, GALILEO will be designed around the needs of civilian users:

- GALILEO will be a civil-controlled system
- The availability of the GALILEO commercial signal will be guaranteed allowing for reliable and sound business cases based on satellite navigation technology
- The GALILEO system will offer an integrity signal

With an overall investment of € 3.7 billion GALILEO is one of the biggest and most ambitious projects undertaken in European space industry. According to a PricewaterhouseCoopers study, GALILEO shows a benefit/cost ratio of 4.6, the highest of all infrastructure projects in Europe.

GALILEO, GPS and Glonass will most likely be compatible and interoperable systems, as the combination of these systems will offer better availability and higher levels of accuracy. The European Commission and ESA attach great importance to the complementary and interoperable relationship between GALILEO and GPS in order to provide improved and safer services to the users worldwide.

GALILEO will offer considerable advantages in many sectors of the economy. In road and rail transport, for example, it will make it possible to predict and manage journey times, or, thanks to automated vehicle guidance systems, help reduce traffic jams and cut the number of road accidents. However, although transport by road, rail, air and sea is the example most frequently quoted, satellite based radio navigation is also increasingly of benefit to fisheries and agriculture, oil prospecting, defense and civil protection activities, building and public works, etc. In the field of telecommunications, allied with other new technologies such as GSM or UMTS, GALILEO will increase the potential to provide positioning information as well as to provide combined services at a very high level.

By developing the GALILEO system, European industry acquires and widens important know-how in satellite based radio navigation, one of the identified key technologies of the twenty-first century. Moreover, European industry will have the opportunity to develop countless applications evolving from this technology and hence, position itself as a world-wide market leader. Controlling and operating an independent satellite based radio navigation system, which allows for the development of applications vital to the running of the society of tomorrow is crucial for the European Union. The global dimension of GALILEO is underlined by international agreements – either in preparation or already signed - with countries like China, India, Israel, USA, Russia, Australia, South Korea, Argentina, Japan, etc.

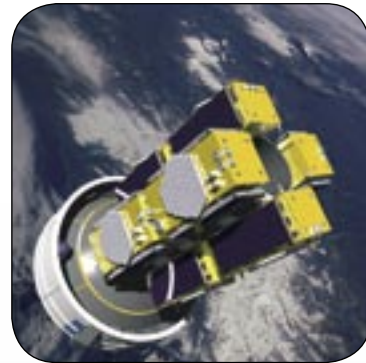


THE GALILEO SYSTEM

° FIGURES AND FACTS TO THE EUROPEAN RADIO NAVIGATION SYSTEM

■ ■ TECHNICAL DATA

Galileo provides accuracy between 5-10 metres 99.5% of the time (equivalent to 23 hrs 53 min per day)



LAUNCHERS

- The Ariane 5 launcher is capable to carry up to 8 satellites
- The Soyuz launcher can place 2 satellites into orbit at once
- The launchers inject the satellites directly into a Medium Earth Orbit (MEO)

GROUND INFRASTRUCTURE

- 5 TT&C stations communicating with the satellites
- 9 Up-link Stations (ULS) communicating with the navigation payload of the satellites
- ~ 40 Galileo Sensor Stations (GSS) to receive signals for determination of integrity and clock synchronization
- 2 Ground Control Centres (GCC)
- Additional local ground segments for regionally enhanced integrity, accuracy, availability and continuity for specific applications

SPACE SEGMENT

- 30 Satellites (27 operational / 3 in-orbit spares)
- Altitude: ~ 23,000 km
- Orbiting Time: 14 hrs 5 min
- 3 orbital planes (9+1 satellites for each plane), 56° inclination
- Satellite design life: ~ 12 years
- Satellite mass: 680 kg
- Satellite dimension (m): 2.7 x 1.2 x 1.1
- Satellite power: 1.6 kW
- Continuous signal transmission on 3 frequencies for ranging purpose:
 - E5 Signal Carrier frequency
1191.795 MHz with an assigned bandwidth of 92.07 MHz
 - E6 Signal Carrier frequency
1278.750 MHz with an assigned bandwidth of 40.92 MHz
 - L1 Signal Carrier frequency
1575.420 MHz with an assigned bandwidth of 40.92 MHz
- Regular ground contact to update navigation data (every 100 min)
- Integrity data is updated every second via the satellite constellation

THE GALILEO SYSTEM

° SERVICES OFFERED BY THE EUROPEAN RADIO NAVIGATION SYSTEM



■ ■ GALILEO OFFERS FIVE SERVICES

OPEN SERVICE (OS)

- Service for the mass market
- Provided on 3 frequencies
- Free of charge
- World-wide coverage

COMMERCIAL SERVICE (CS)

- Same basic performance as open service
- Added value by additional information in the data-stream
- Access is restricted by service provider via encryption for commercial exploitation of the service

SAFETY OF LIFE SERVICE (SOL)

- Same basic performance as open service
- Additional provision of integrity information
- Free of direct user charges
- Access restricted to specific user groups via encryption

PUBLIC REGULATED SERVICE (PRS)

- Guaranteeing the continuity of public applications for European and/or national security
- Controlled by EU and Member State governments
- Encrypted ranging codes and navigation message
- Access restricted to users authorised by EU Member States

SEARCH AND RESCUE (SAR)

- Global broadcast of alert messages received from distress emitting beacons
- Enhances the performances of international Search and Rescue systems such as COSPAS-SARSAT

APPLICATIONS

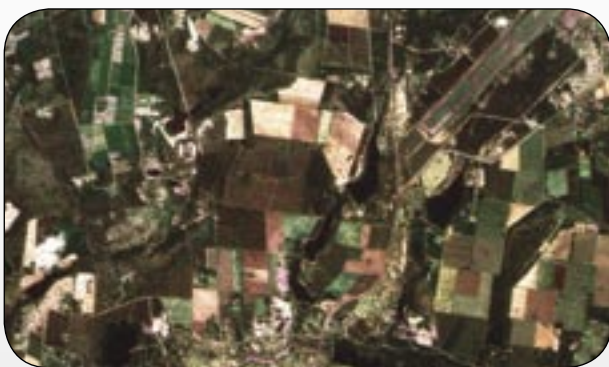
° SAFE, RELIABLE, BENEFICIAL, ASPACE, MULTIFUNCTIONAL

■ ■ AGRICULTURE

Precise aircraft positioning enables the pilot to spray the herbicides, insecticides or fertilizers in the right places and in the correct quantities. GALILEO receivers on harvesters will lead to more automated systems and higher accuracy, drawing on the data stored in databases. GALILEO could replace the traditional but imprecise, expensive and time-consuming measuring techniques, which use wheels and tapes.

■ ■ ENVIRONMENT

The GALILEO navigation signals can be efficiently used for accurately determining atmospheric profiles over wide areas. Continuous measurement of atmospheric parameters will provide valuable data for weather forecasting and for climate monitoring. The GALILEO system will also help in studies of the sea and oceans. It can help to predict the movement of the ice and flood water as well as earthquakes. The study of fish stocks, marine surveys and data collection, help the management of fisheries to increase yields and improve sustainability. Oil transportation and the transport of dangerous goods will be managed using this new infrastructure, with the advantage of dramatically reducing the risks to the environment.



■ ■ LEISURE

Travelers would all like to make seamless journeys whether they are first on public transport or in their car and then expect to transfer to another means of transportation. A



traveler using a GALILEO receiver will receive a constant supply of information to enable him to determine the location and find the best route available. The regular data from GALILEO processed by value-added service providers e.g. integrating available travel information - services, congestion, events, incidents, etc. - can be instantly downloaded to travelers.

■ ■ LOCATION BASED SERVICES

Location Based Services (LBS) are gaining much importance for all kind of human activities ranging from tourist navigation to support of rescue teams in disaster management. Service providers could point customers to restaurants, movie theatres, parking lots or hospitals.

° TELECOMMUNICATION

Knowing one's position can be sometimes useless if it cannot be communicated. Telecommunication is indispensable for the majority of satellite navigation applications. Reciprocally, satellite navigation techniques will become indispensable for the telecommunications community, to increase the level of communications and the efficiency of their networks. The integration of GALILEO chips in mobile phones will generate a multitude of combined uses in positioning, real-time traffic information, respondents to distress calls and many others. GALILEO will provide high-precision timing and frequency information without the need to invest in expensive atomic clocks.

APPLICATIONS

◦ SAFE, RELIABLE, BENEFICIAL, APACE, MULTIFUNCTIONAL

◦ 3D-POSITIONING

3D-positioning is crucial for wireless measurement of position and velocity of moving targets. A typical example for this kind of application is large construction sites (tall buildings, bridges) where several construction elements have to be put together with hardly any tolerance.

■ SAFETY, SEARCH AND RESCUE

One of the main purposes of the GALILEO infrastructure is to increase safety. By complementing and reinforcing current systems, GALILEO will greatly contribute to diminishing risks and to the saving of many lives.



◦ ROAD SAFETY

Thanks to the guarantee of service continuity and increased availability in urban areas, GALILEO will provide new possibilities to motorists and public authorities in the fields of navigation and guidance systems, traffic information and accidents providing essential information to the nearest rescue station, fleet management and understanding of the causes of accidents.

◦ EMERGENCY AND INCIDENT HANDLING

Rapid response to emergencies is a critical requirement, on the one hand for saving lives but also for the maintenance of efficient traffic flow. Automatic crash sensors and positioning systems can communicate directly with emergency dispatch centres and require no action on the part of the driver. GALILEO will enhance the capabilities of independent tracking systems significantly. During an accident, an on-board terminal will transmit not only the accurate location of the vehicle, but also information on vehicle contents, including the kind of material being carried. Additional lives will be saved thanks to GALILEO.

◦ TRAIN SAFETY

Ensuring high-level safety for railway networks is a priority. GALILEO will constitute a complementary source of positioning information. Especially regional secondary lines will benefit from increased safety.

◦ AIR TRAFFIC SAFETY

GALILEO will allow for precise four dimensional navigation from gate to gate in all phases of flight without switching from one navigation system to another, as is the case today. It will allow for better approach procedures at airports and aircraft will rely on GALILEO signals for highly critical applications like collision avoidance systems.

◦ MARITIME SAFETY

GALILEO will improve the position accuracy and hence, improve the SAR capabilities. Traffic flow can be optimized whilst improving the safety for all ships and shores. Even precise manoeuvres of large vessels in harbors can be guided by GALILEO.

◦ INFRASTRUCTURE MONITORING

GALILEO receivers on and around bridges, skyscrapers and historical monuments, for example, can provide a significant means for structural monitoring. GALILEO can also be used in predicting natural events such as landslips or rock-falls, and measuring the levels of rivers and lakes. During power outage or other failures, the critical infrastructure can be identified immediately.

APPLICATIONS

° SAFE, RELIABLE, BENEFICIAL, APACE, MULTIFUNCTIONAL

° CIVIL PROTECTION

Crisis and emergency situations require a coordinated effort by several teams. GALILEO will be a valuable tool in such situations. Its high reliability and independence from a substantial ground infrastructure are of paramount importance for public authorities.

■ ■ TIME CRITICAL NETWORKS

The advantage of the use of GALILEO in this field is not only derived from the high accuracy obtained by a GALILEO receiver in time determination, but mainly by its interoperability characteristics, which makes the GALILEO time scale accurately steered and synchronized with the widely used UTC (Coordinated Universal Time) time scale. Power plants and networks for example will use the common time reference system not only for time stamping, but also as a common reference for all system monitoring and control.

■ ■ TRAFFIC MANAGEMENT AND TRANSPORT

Transport applications are the user category par excellence that will benefit greatly from the existence of the GALILEO system. GALILEO will provide an answer to current mobility and transport problems throughout the world and will make for improvements in safety and comfort.



° ROAD

The road sector is a major potential market for GALILEO applications. Satellite navigation receivers are now commonly installed in new cars as a key tool for providing new services to people on the move: electronic charging, real-time traffic information, emergency calls, route guidance, fleet management and Advanced Driving Assistance Systems (ADAS).

° RAIL

GALILEO will be able to offer numerous rail transport applications, ranging from traffic, wagon and cargo control and monitoring to train signaling, track survey and passenger information services. In particular, GALILEO will make it possible to reduce distances between trains and therefore increase train frequency. In addition, it will make it easier to locate the entire rail fleet. Some examples of practical uses of GALILEO are train control, fleet management and goods tracking, passenger information and rail track survey.

° AIR

Refining and improving satellite navigation through GALILEO will assist pilots in all flight phases: the taxiing on the ground, to take-off, en-route flying, and landing in all weather conditions. Some examples of practical uses of GALILEO are commercial air transport, surface movement and guidance control, freight tracking in the air and leisure. GALILEO will be a major asset in coping with the continuous increase in the number of flights worldwide.

° MARITIME

GALILEO will be a fundamental tool for bringing innovation and progress in navigation and many other marine activities such as fishing, oceanography as well as oil and gas exploitation. Satellite navigation serves all maritime applications. Some examples of practical uses of GALILEO are maritime navigation, survey and marine engineering, science, SAR and commercial maritime applications.

BENEFITS OF SATELLITE NAVIGATION

◦ ECONOMIC AND TECHNOLOGICAL GROWTH

SATELLITE NAVIGATION IS A FUTURE-ORIENTED TECHNOLOGY

The complete GALILEO system is scheduled to be fully operational by the end of this decade and will enable any user to calculate his position anywhere and anytime on Earth to within a few meters. Due to its civilian nature, GALILEO will safeguard and promote strategic growth for industry and service related businesses. The system provides a huge range of benefits from the precise synchronization of telecommunications systems, power supply networks and electronic banking transactions, to car navigation and the integrated management of air, maritime, rail and road transport. It can calculate the precise location of an emergency and can contribute to improvements in agriculture, ecology, and communication for phone users.

SATELLITE NAVIGATION AND TELECOMMUNICATION ARE A WINNING COMBINATION

Modern telecommunication has brought immense flexibility to our lives. In the future, mobile phones with new UMTS transmission technology will provide internet access from anywhere in the world. Mobile phones and other commercially available devices will become complete navigation systems thanks to GALILEO. What car drivers already have at their disposal today - positioning, local information and guidance on routes - will be available to everyone, anywhere and anytime. Additional costs of equipping mobile phones with the relevant chip are minimal and the advantages immense. Navigation and telecommunications technologies are merging to ensure that the cost to the individual user of navigation technology is virtually negligible.

SATELLITE NAVIGATION FULFILS POLITICAL EXPECTATIONS AND GOALS

A European navigation system will strengthen political and economic unity in Europe and fortify European independence. The future-oriented navigation technology offers Europe a very strong product for the global marketplace. Navigation, providing positioning, local information and guidance, fulfils political goals by guaranteeing mobility, innovation and environmental quality. Mobility is a pre-

condition for successful commerce and an independent Europe. Fostering innovation secures the future - an important political goal. GALILEO opens the potential for almost unlimited innovation. European navigation technology and the range of services it provides, strengthen EU independence in the face of global competition.

SATELLITE NAVIGATION IMPROVES THE QUALITY OF EVERYDAY LIFE

Positioning, local information and route guidance increase personal safety and improve the quality of everyday life. For example, with a hand-set the size of a matchbox, no one on an overland trip or journey into unfamiliar surroundings needs ever get lost again. Emergency services will no longer waste precious time, on which the difference between life and death can depend, searching for the right spot.

SATELLITE NAVIGATION CONTRIBUTES TO THE PRESERVATION OF A HEALTHY ENVIRONMENT

The condition of vegetation can be continuously tracked on large areas of terrain, as well as at specific sites. Global mapping can determine potential sites for legitimate human intervention in existing biotopes. Navigation technology is especially useful for oil and gas exploration, mining and deep-sea fishing. It thus not only optimizes yields but, when coupled with other data, also provides vital information about how much exploitation the ecology of a particular region can withstand and where ecological balance is endangered by human activity.

SATELLITE NAVIGATION DOES NOT MEAN "SURVEILLANCE"

Satellite based positioning is not an active but a passive system: no one can be tracked-down by carrying an activated receiver. That is only the case once one forwards received information to third parties. Consequently, satellite based radio navigation technology does not allow for permanent surveillance.

SITES AND SHAREHOLDERS OF GALILEO INDUSTRIES

° A EUROPEAN COMPANY

■ ■ SITE OTTOBRUNN



■ ■ SITE ROME



■ ■ SHAREHOLDERS OF GALILEO INDUSTRIES



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