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Federal Ministry
for Transport,
Innovation and Technology

Austrian Space Programme

>asap>

Projects - 1st and 2nd Call for Proposals

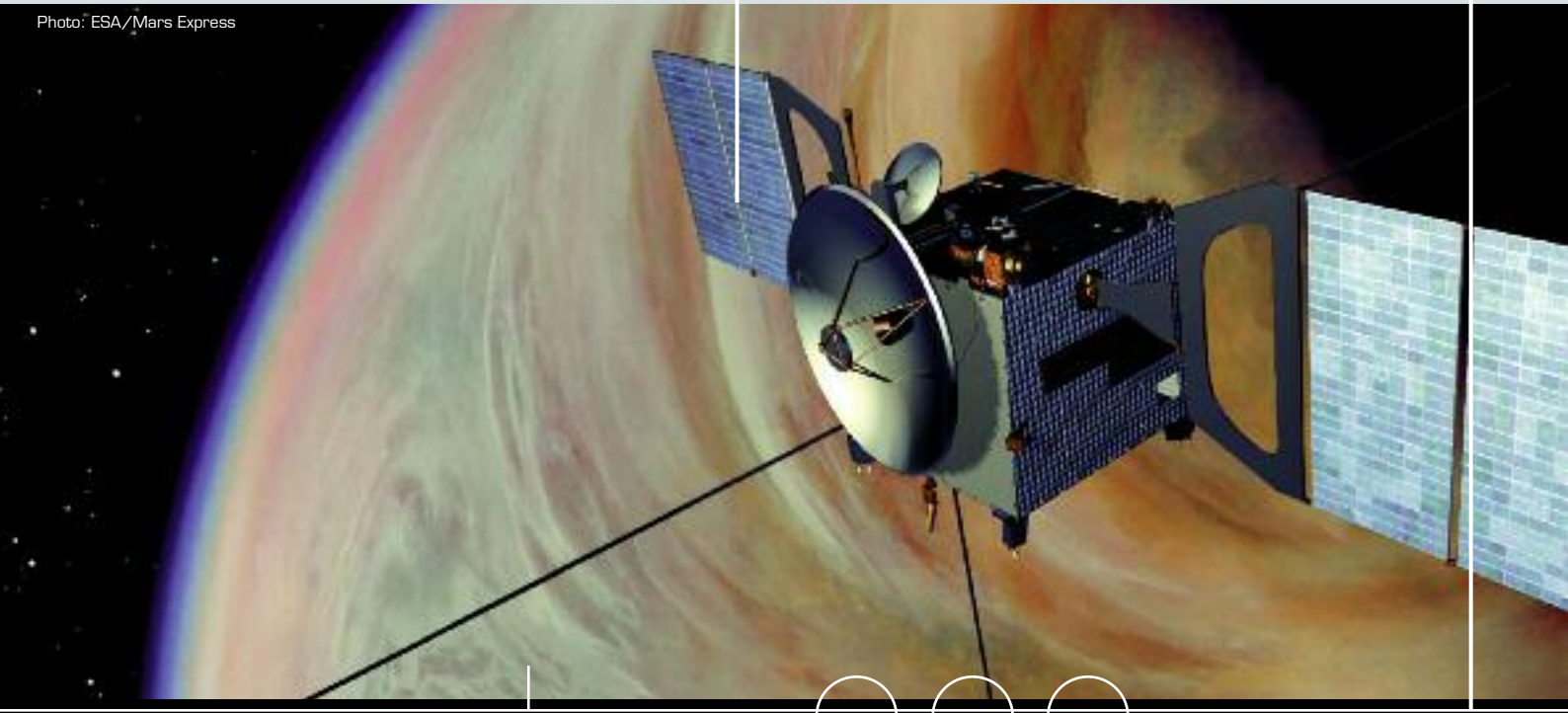


Photo: ESA/Mars Express

www.bmvit.gv.at

FFG

Preface

„The future cannot be predicted,
but futures can be invented."
Dennis Gabor, 1963

As vast as space is itself, as enormous are the possibilities to exploit it provided one has the right ideas. Space is of strategic importance throughout the world. Space leads to technological developments and innovations, contributes to growth and competitiveness, creates knowledge through scientific research. Space fascinates people, stimulates our creativity and fires our imagination. It offers a large variety of applications and is an area of increased international cooperation. Space benefits humanity.

In this sense, the Federal Ministry for Transport, Innovation and Technology supports Austrian ideas in space. Since 1987 Austria has participated in ESA programmes, since 2003 space activities have also taken place within the Sixth Framework Programme for Research & Technological Development.

In 2002, the Austrian Federal Ministry for Transport, Innovation and Technology established two Austrian space programmes, the Austrian Space Applications Programme (ASAP) and the Austrian Radionavigation Technology and Integrated Satnav Services and Products Testbed (ARTIST) to strengthen the Austrian capacity in space. In 2005 these two programmes have been merged to the Austrian Space Programme.

Today, due to this continuing effort space is a specialisation in the Austrian technology sphere.

This folder gives an overview of the results of the first two calls for proposals supported in the programmes ASAP and ARTIST from 2002 to 2004. Going through these pages you will see Austrian expertise in space in all its dimensions. Congratulations to this expertise!

Doris Bures
Federal Minister
Austrian Federal Ministry for Transport,
Innovation and Technology

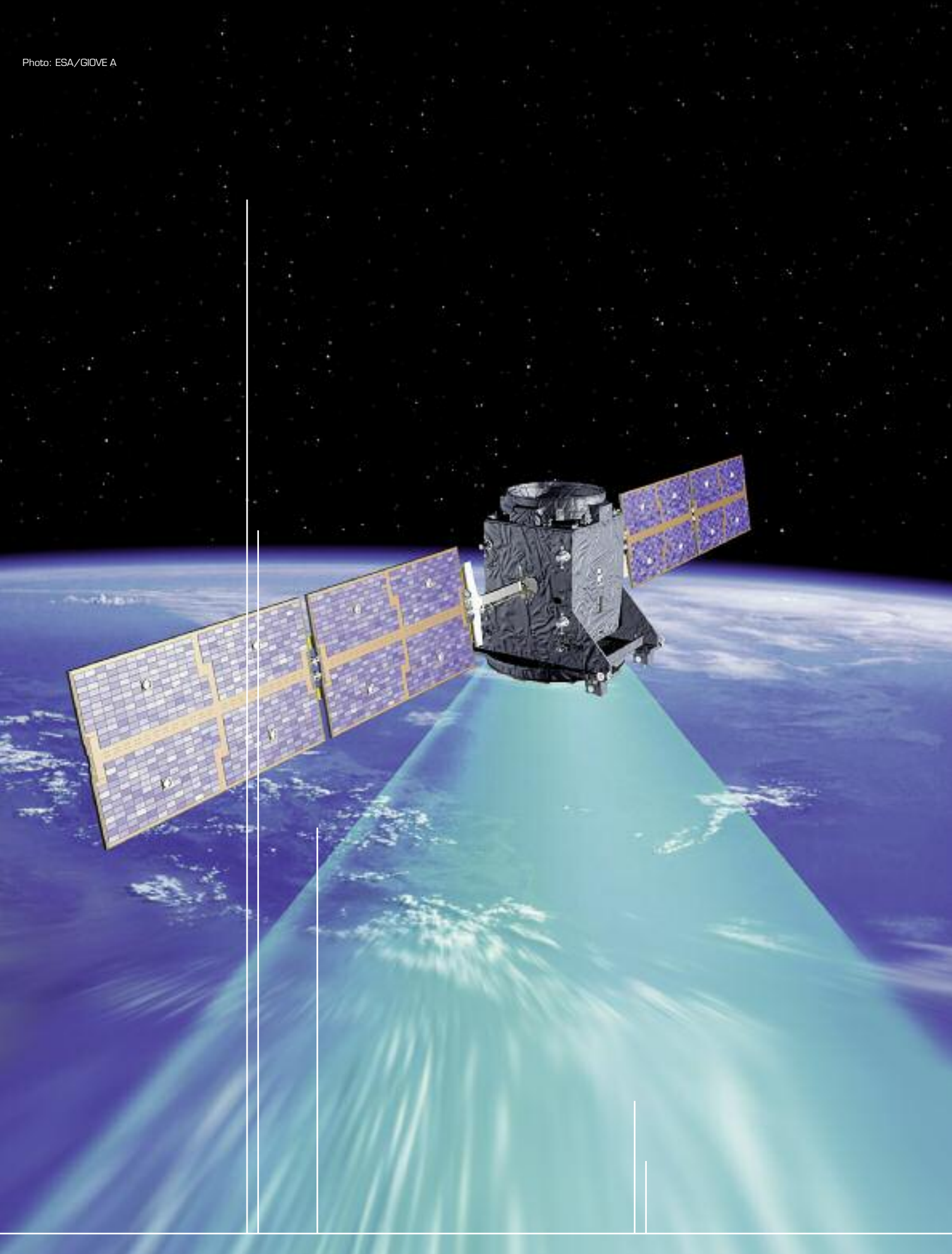


Photo: ESA/GIOVE A

Content

Austrian Space Programme

>asap>

Programme Description

Space is considered as an area of enormous strategic importance throughout the world. It is not only a major field of economic activity but also a strong driver for further support and development of scientific research. Space-based solutions enable governments to fulfil their responsibilities in building and maintaining the infrastructure necessary within today's mobile information and knowledge society.

The Austrian Federal Ministry for Transport, Innovation and Technology took the initiative to define a strategy ensuring that Austrian know-how is used as extensively as possible in the development and construction of future space systems. The strategy is designed to complement existing research and development initiatives in the field of space technologies and their applications. The „Austrian Space Plan 2000" aims at helping Austrian enterprises and scientific institutions to benefit from the innovative potential of space technology and from economic synergies. To achieve a sustainable increase of value in this field of advanced technology it is, above all, necessary to develop commercial products and services.

In order to realise its declared objectives, the „Austrian Space Plan 2000" supports Austria's participation in various programmes of the European Space Agency and the European Union and established the Austrian Space Programme.

In 2002 and 2004 an additional thematic focus was laid with two calls for proposals of ARTIST - the Austrian Radionavigation Technology and Integrated Satnav Services and Products Testbed. This testbed promoted research and development in the area of value added services based on satellite navigation.

Main Objectives
> Position Austrian players on the commercial market
> Support specialisation and networking
> Create technological content
> Improve scientific excellence

Approach
> Bottom-up
> Project-oriented
> Funding lead projects (cooperative projects)
> Competitive
> Applying Best Practice Code for Evaluation
> Internationally oriented
> Sustainable
> Complementing international activities

Programme Elements
> Science
> Technology
> International programmes
> Space technology transfer
> ARTIST



Programme Elements

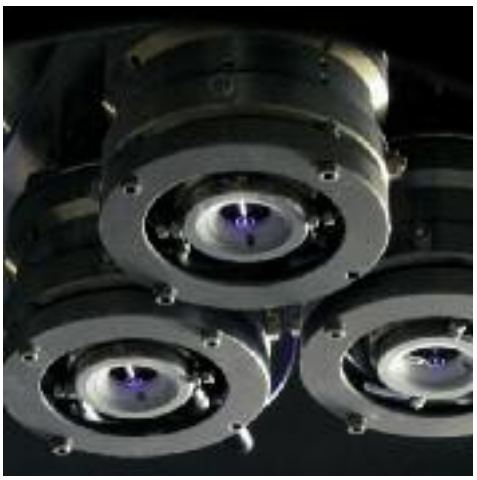
Science
This programme element strengthens Austrian competence in space science and research by supporting the participation of Austrian experts in international scientific programmes. It also promotes Austrian contributions to the European Space Agency's Science Programme.

Technology
This programme element aims at developing commercial products and services on the basis of shared funding PPP, thus complementing activities of European and international space programmes. It includes regulations of shared funding for project applicants comparable to those applied in similar ESA programmes and is subsidiary to various European and international space programmes.

International Programmes
This programme element supports bilateral and multilateral activities and enables the Austrian space community to take substantial steps towards becoming systems developers and producers, helping them to position themselves effectively on international markets.

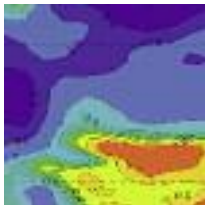
Space Technology Transfer
This programme element supports highly specialised activities in the field of space technology transfer in order to contribute more actively to the dissemination of technologies to other sectors and vice versa. These activities are coordinated with the corresponding ESA and EU activities.

ARTIST - Austrian Radionavigation Technology and Integrated Satnav Services and Products Testbed
ARTIST aimed at demonstrating technical feasibility, economic potential and legal framework conditions of value added location based services in the following thematic areas: fleet management, agriculture/forestry, tourism/leisure, personal navigation and search and rescue services.



Target Group

The Austrian Space Programme addresses Austrian and international scientists, scientific institutions, industrial enterprises and other companies, including SMEs located in Austria.

Earth Observation

AC GMES

CHAMPCLIM

GFPF

GOCE DAPC

Infra GEO

MEDUSA

Mountain Net

NEOS QUICK

PLEIADES

AC – GMES

Austrian Settlement and Alpine Environment Cluster for GMES

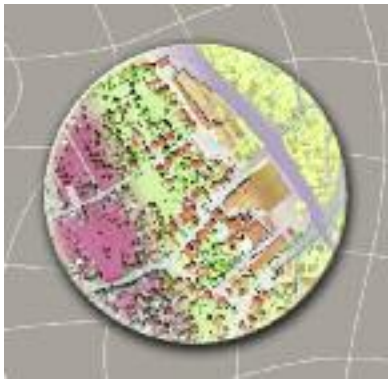
The Austrian Cluster for GMES (Global Monitoring of Environment and Security) combines the forces of industry, applied research, university institutes and user organisations to develop sustainable Earth Observation (EO) based services in the settlement and alpine environment context.

The cluster „Settlement" will develop an integrated product portfolio providing geo-information in the urban and settlement domain. Based on input data from satellites, laserscanning and in-situ measurements, information products on urban land cover, urban structure and urban function will be derived. These products serve as an input to sectoral spatial planning on municipal and State level and are developed for a test area in Upper Austria.

The cluster „Alpine Environment" covers three closely interrelated themes, namely land cover of rural landscapes, forests and water management. The project capitalises on the expertise of the individual partners and the amalgamation in a cluster will further strengthen these capabilities. In particular, services for the protection of forests and Nature 2000 sites, for the analysis of rural landscapes and model improvement for water resource management will be developed.

A supporting infrastructure activity will provide Settlement and Alpine Environment Cluster results to user organisations via Internet.

The Cluster for GMES comprises the leading Austrian EO application organisations and can be regarded as a major milestone towards a substantive and integrated Austrian contribution to GMES.



Infobox

01.05.2005 – 31.12.2006

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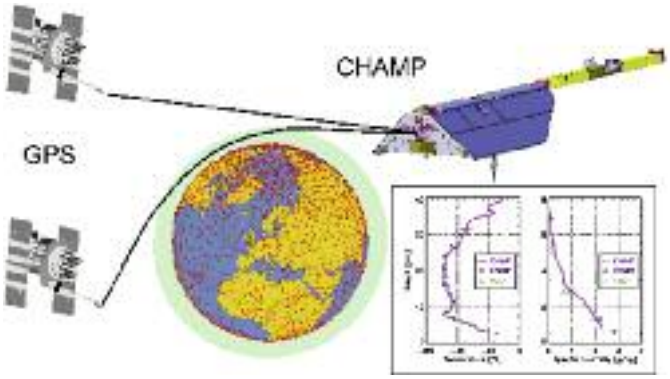
CHAMPCLIM

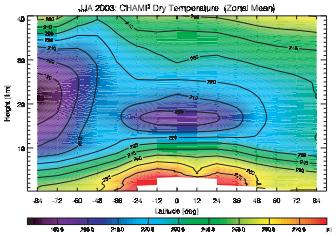
Climate Monitoring Based on the CHAMP/GPS Radio Occultation Experiment

The provision of accurate, longterm data to enhance the quality of climate observations is one of the high priorities formulated by the Intergovernmental Panel on Climate Change (IPCC). Such data are vital to improve the ability to understand and predict climate variability and change. Until now it has not been possible to determine trends in atmospheric temperature from satellite data with convincing accuracy. Radio occultation (RO) data using navigation signals as provided by the Global Positioning System (GPS) can overcome these problems due to their unique combination of high accuracy, longterm stability, global coverage, and allweather capability.

Since early 2002 the research satellite CHAMP, led by CHAMPCLIM project partner GFZ Potsdam, has continuously recorded GPS RO data, which provides the very first opportunity to create global RO based climatologies on a multiyear basis. The overall aim of CHAMPCLIM is to exploit CHAMP RO data in the best possible manner for their most challenging application, which is climate monitoring. The main objectives are 1) RO data and algorithms validation, 2) data processing advancements in order to optimize the climate utility, and 3) RO based monitoring of climate variability and change.



After successful processing advancement and validation work, monthly and seasonal temperature climatologies were created from spring 2002 to summer 2005. The results obtained show that the climatologies, though from a single satellite only, have the potential to improve even most modern operational climatologies, such as those from the European Centre ECMWF, demonstrating the climate utility of the RO data. CHAMPCLIM thus provides a pioneering first step to future multisatellite RO missions set to globally monitor climate change in the atmosphere with unprecedented quality.



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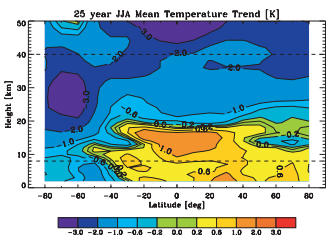
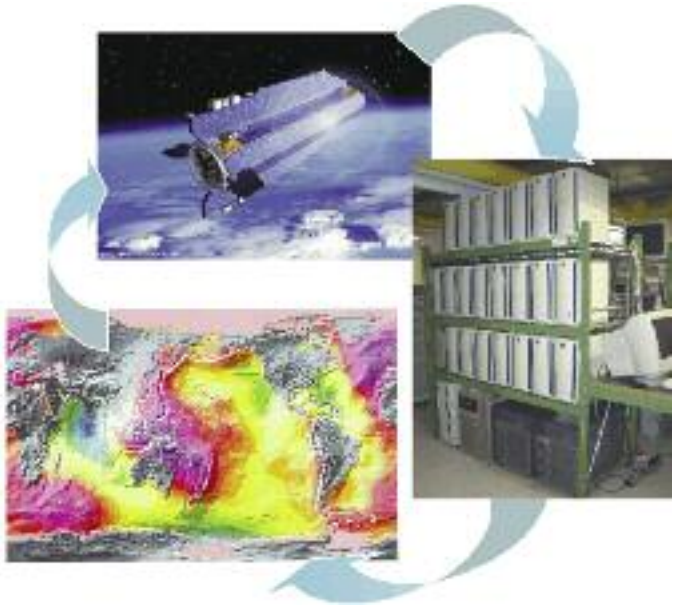


GFPF

Gravity Field Processing Facility

Based on the successful work performed in the project GOCE DAPC, the main objective of GFPF is the implementation and integration of a fully operable software system for the processing of an optimum Earth's gravity field model based on the data of ESA's satellite gravity mission GOCE (Gravity Field and Steady-State Ocean Circulation Explorer), combining orbit observations derived from GPS satellite-to-satellite tracking and the analysis of the GOCE gravity gradiometer data. This includes the development of all required algorithms, the software testing and integration and comprises two main software components: The Quick-Look Gravity Field Analysis is applied to compute very fast approximate gravity field solutions in parallel to the mission, in order to derive a fast diagnosis of the GOCE system performance. The Core Solver is based on parallel processing on a PC cluster and solves the large normal equation systems (70,000 unknowns) rigorously. These tasks are performed in conjunction with the ESA-project GOCE High-Level Processing Facility, performed by the European GOCE Gravity Field Consortium (EGG-C).

As a by-product of these software developments, Earth's gravity field solutions from the satellite mission CHAMP could be derived. Additionally, in the framework of GFPF the benefits of an incorporation of data from complementary satellite missions (CHAMP, GRACE), but also terrestrial and air-borne data, will be investigated.



Infobox

15.01.2005 – 31.03.2006

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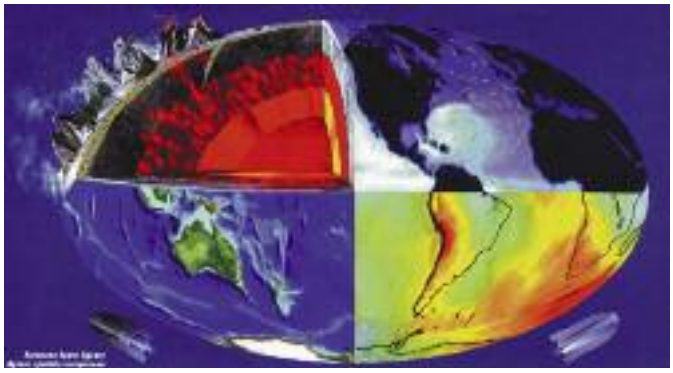
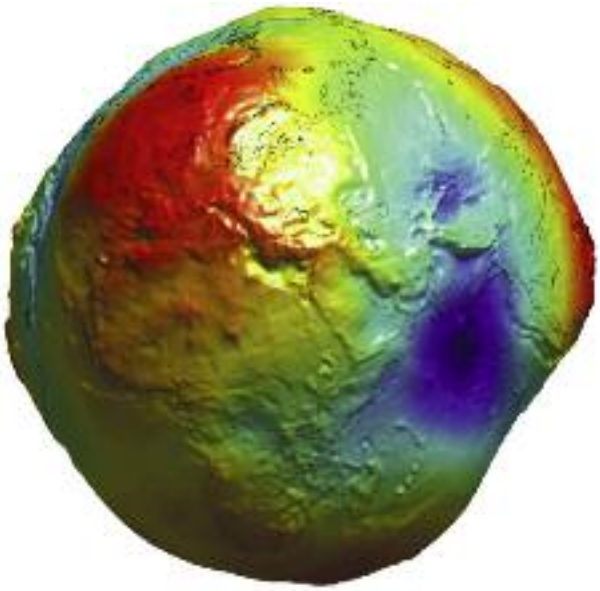
GOCE DAPC

GOCE Data Archiving and Processing Center

The satellite gravity mission GOCE (Gravity Field and Steady-State Ocean Circulation Explorer), the first core mission of ESA's Living Planet Programme, strives for a high-accuracy, high-resolution model of the Earth's gravity field.

The precise knowledge of the Earth's gravity field will have an impact on many branches of Earth science. It will be applied to improve the modelling of the Earth's interior, of geodynamic processes related to the lithosphere, and of the global ocean circulation, which plays a crucial role in climate regulation. In geodesy, it will provide a high-accuracy global height reference system, and it will improve the orbit prediction of satellites. The computation of an Earth's gravity field model, expressed in terms of about 70,000 parameters, from several 100 million observations, is a laborious numerical task and requires sophisticated processing algorithms. The scientific objective of the GOCE DAPC project was the design of an operational software system for the GOCE data processing and its installation as a first prototype, which is complemented by a data base design and archiving system concept for data retrieval. Two computation strategies have been followed: Applying parallel processing strategies on a PC cluster, the large normal equation systems are solved rigorously. Additionally, a fast iterative solver has been implemented for the purpose of quality assessment of the GOCE sensor system in the course of the mission.





Infobox

01.06.2003 – 31.03.2004

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InfraGEO

Earth Observation Mission Database

The aim of this activity is to develop a standard solution for a generic, comprehensive, central, long-term mission archive for Earth Observation missions.

The design driver for the generic product is to implement a re-usable core system, where mission specific features are configurable as far as possible. Further mission specific extensions necessary in the database schema and the interfaces can be added later by specific dedicated implementations.

The Earth Observation Mission Database is able to handle structured and unstructured parameter and configuration data and has a capacity of at least five Terabytes. It is designed as a central facility for data collection, data storage, data provision and allows secure exchange of data in a ground segment. It supports a considerable number of configurable XML and structured ASCII interfaces. The Mission DB is designed to operate autonomously.

Infobox

15.09.2004 – 30.09.2005

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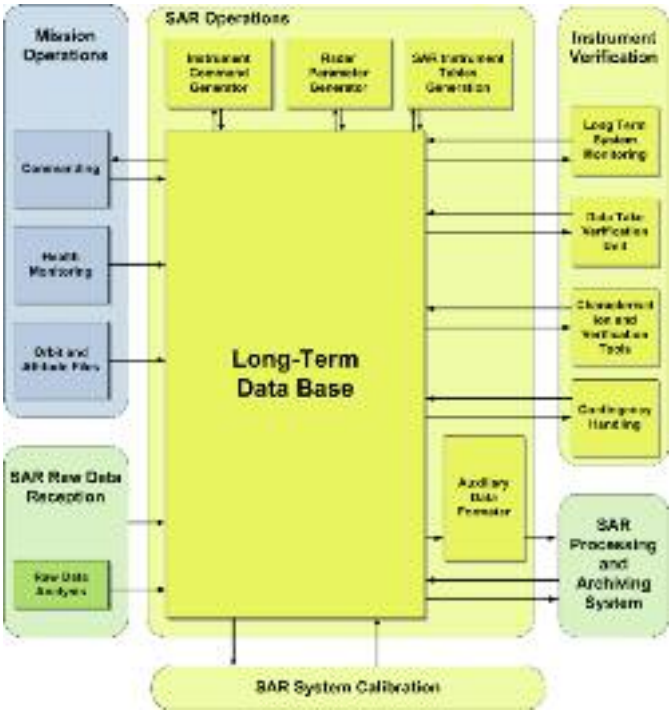

DLR is the first addressed customer to use this generic mission database for their TerraSAR-X Long-Term Database (LTDB).

TerraSAR-X is the first German Radar satellite for scientific and commercial applications. The launch date is scheduled for 2006.

The Long-Term Database is integrated into the Instrument Operations and Calibration Segment, one major part of the TerraSAR-X ground segment. The task of the Instrument Operations Section is to operate the SAR instrument in its different operational SAR modes.

All mission data relevant for SAR System performance are brought together and can be accessed by calibration, characterization, monitoring and verification tools. These tools thus enable to monitor and analyze the satellite's system and the instruments health and to provide a more complete picture of the whole SAR mission and its quality in shorter time. The figure provides an overview of the system context of the LTDB within the ground segment.

MEDUSA

Model Error Detection by Using Simulated Satellite Images

Errors arising from mathematical/computational restrictions (approximation of non-linear differential equations, the chaotic nature of weather, the spatial resolution of the model), from assumptions in the underlying physics and lack of observational data are responsible for occasional conspicuous deviations in numerical weather forecasting models, compared with the truth represented in meteorological satellite images. One way to make model output directly comparable to the satellite data are „simulated satellite images", i.e. hypothetical observations by the satellite sensor if the model-predicted three-dimensional distributions of temperature and moisture were perfectly correct. As numerical models are available from several institutions with differing model physics approaches (hence different strengths and weaknesses), the project MEDUSA aims at an objective quantitative decision tool to judge simulated imagery vis-à-vis reality, enabling a profound selection of the most appropriate forecast model for the day.

Two independent detection techniques were elaborated for erroneously forecasted propagation speeds of meteorological systems (namely: computation of shift vectors between truth and simulation, objective recognition of typical stripe-shaped patterns in difference images). Moreover, large average discrepancies within a segment (being defined as an area where both the real satellite image and the simulated counterpart show fairly homogeneous patterns) are detected automatically, alerting the forecaster on meteorological systems being underestimated / overestimated / absent in the numerical weather chart.

Infobox

01.03.2005 – 30.11. 2005

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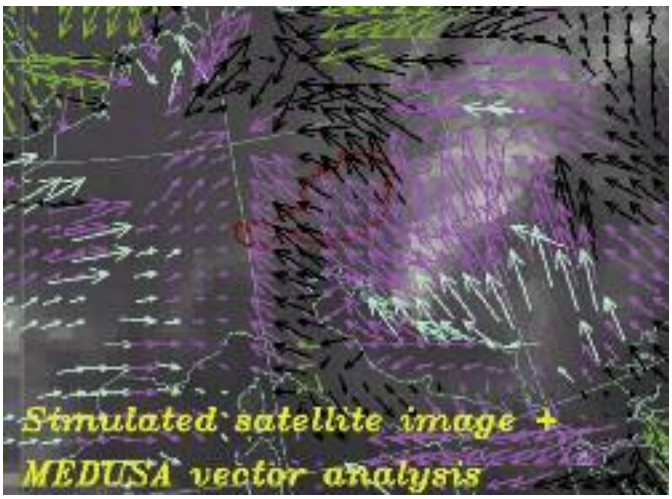
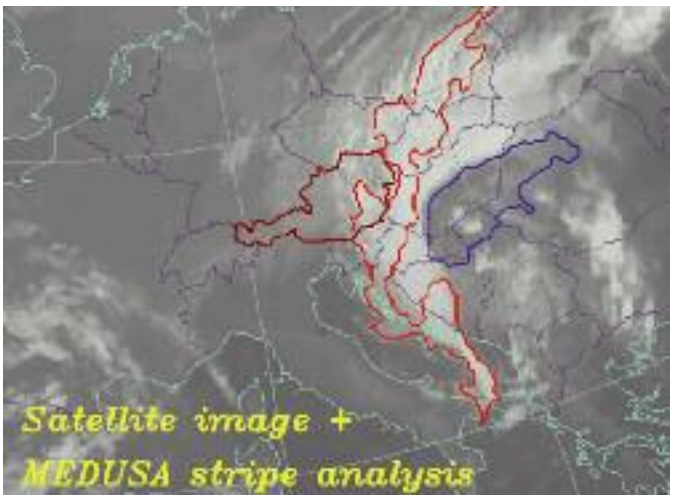
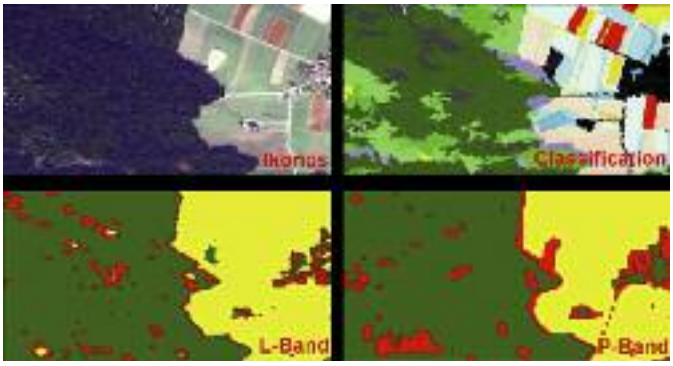




MountainNet

Management of Natural Resources in Alpine Regions by Advanced Remote Sensing Techniques



The international convention on the protection of the Alps concluded that the alpine environment is under imminent threat and demands comprehensive counter-measures. While the Alps represent one of the most sensitive ecosystems in Europe the pressure on them is far greater than on other parts of the environment.

In order to achieve the objectives of the Alpine Convention and national administrations it is not sufficient to monitor alpine subsystems only using conventional methods. To assess and monitor alpine landscape and hydrological parameters and thus to serve as the basis for planning actions, the project concentrates on methods and algorithms for

1. alpine land use and land cover based on SAR
2. alpine land use and land cover based on VHR optical data
3. hydrological applications in alpine regions based on SAR

The SAR related work is based on the polarimetric, interferometric, multi-frequency capability of E-SAR which enables the distinction of scattering centres in vegetation canopies. Moreover E-SAR can be seen as a prototype for the future TerraSAR system and, thus, allows the development of algorithms appropriate for this innovative sensor system.

The application of optical EO data to the assessment of alpine land use and land cover has become a standard method. With the emerging of systems providing data with a ground resolution of 1m per pixel and below (IKONOS, Quickbird) the potential for space borne applications in these fields has broadened, but the advantages of the new systems also bring along new challenges on the methodological side.

The main objective of the hydrology component is the development of retrieval algorithms to derive hydrological information from high resolution SAR images, in order to improve hydrological modelling and forecasting in mountain basins. The developments are aimed in particular on the future utilization of TerraSAR X-band data.

Infobox

01.09.2003 – 30.11.2005

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NEOS-QUICK

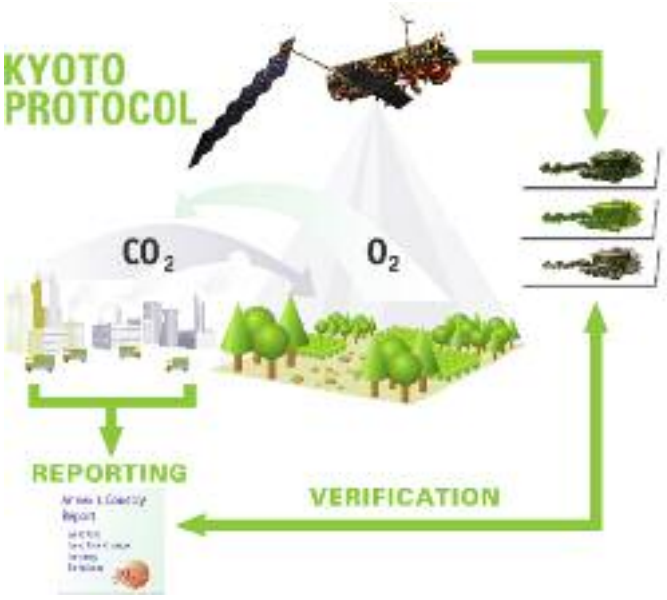
Testing of Novel Earth Observation Systems for Supporting Quality Control Activities required by Kyoto Protocol

The Kyoto Protocol, an international and legally binding agreement to reduce greenhouse gases emissions world wide, became effective on 16 February 2005.

The project NEOS-QUICK responded to the need for improved Earth Observation based services for Kyoto reporting. It was aligned with activities performed under Europe's Global Monitoring for Environment and Security (GMES) programme.

The objective of NEOS-QUICK was to develop novel Earth Observation applications for the mapping of Land Use, Land Use Change and Forestry (LULUCF) parameters as specified by the reporting standards of the Kyoto Protocol.

NEOS-QUICK combined the forces from Austrian public entities, industry and research to develop such products. Public organisations responsible for Kyoto reporting including the Federal Environment Agency (Umweltbundesamt) and the Austrian Federal Office and Research Centre for Forests (Bundesamt und Forschungszentrum für Wald) as well as the State of Vorarlberg (Land Vorarlberg) and the regional forest enterprise Stand Montafon participated in the project.



Kyoto Protocol compliant project results comprise Earth Observation derived land cover and forest extent maps, as well as information on forest change, crown cover, species, vegetation height, above ground biomass, and carbon stock.

Within the project, a close collaboration with the German TerraSAR team was established. Furthermore the project contributed to strengthen the capacity of Austrian Earth Observation service providers to provide sustainable space based solutions for satisfying Kyoto reporting obligations.

Infobox

01.02.2004 – 31.05.2005

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PLEO

Pleiades On-board Management Unit

The French Pleiades Earth Observation Satellite Constellation is a project of the French government, performed in cooperation with Austria, Belgium, Italy, Spain and Sweden. It represents the continuation of the successful SPOT (Système Pour l´Observation de la Terre) series of satellites.

The main control computer of the Pleiades satellites is the On-board Management Unit (OBMU) which will be supplied by Saab Ericsson Space and Austrian Aerospace. Based on a long-term cooperation strategy, Austrian Aerospace will supply major parts of the I/O (input/output) system of the OBMU. This subsystem handles discrete signals carrying telemetry-, telecommand- as well as equipment status information and translates these data into the spacecraft´s data bus format.

The output of this activity is spaceborne electronic modules carrying high-reliability, customer tailored integrated circuits capable of withstanding the harsh space environment with high radiation rates, extreme mechanical stress and the absence of atmosphere. As satellites, once launched, cannot be repaired, exhaustive testing is necessary. The respective demanding test equipment is a further result of the present project.

This activity enables Austrian Aerospace to participate in the core team of a satellite manufacturing consortium and to secure its position in many future missions. It aims at the development of advanced technologies making future on-board computers more competitive and it broadens the company´s relation to other industries in the dominating nations of Europe´s space business.

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03.11.2003 – 22.12.2005

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GPS Receiver

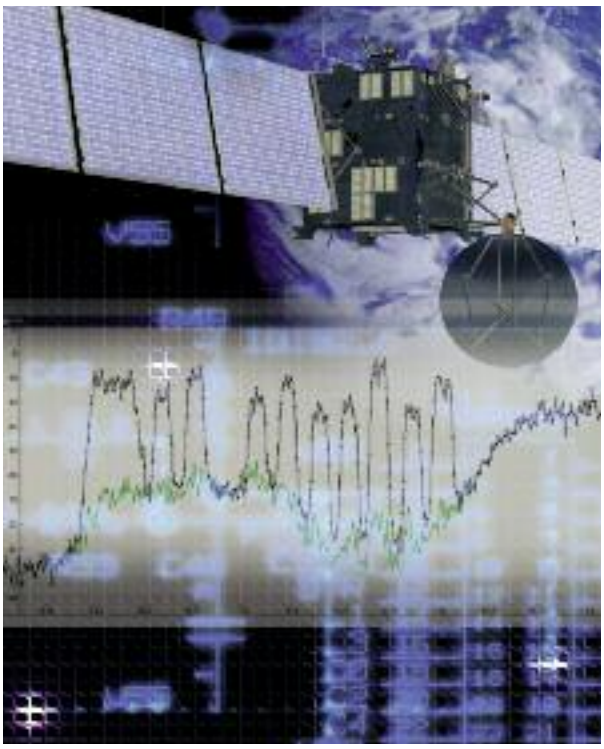
NetMSI

QUANTUM

SSPP

CASIMO

Carrier Signal Monitoring



Siemens Space Business has already developed a product, called SIECAMS (Siemens Carrier Monitoring System) for the monitoring of the signal spectrum transmitted via satellites, which has been in use at some major satellite operators. The product uses commercially available measurement equipment, that limits measurement speed and accuracy which in turn reduces equipment costs significantly.

During slice 1 of the Austrian Space Programme Joanneum Research and Siemens jointly developed a very powerful and cost efficient DSP based monitoring equipment which interacts with the Siemens Satellite Monitoring System SIECAMS. This was the key for a successful bid for the European Satellite Provider Hellassat who used this system for the provision and monitoring of Radio/TV Broadcast services at the Olympic Games in Athens in 2004.

The proposed project targets for the second slice of the Austrian Space Programme is a seamless enhancement of the system based on and driven by customer requirements concerning DSP based monitoring of satellite signals, especially among other signals DVB-RCS. Most of the big satellite providers in the world have developed from pure transponder capacity providers into complete service providers (e.g. : Intelsat – the worlds biggest satellite provider who also uses the Siemens System SIECAMS for monitoring).

The new generation of multimedia satellite systems will offer bi-directional services via satellite and will enable satellite providers to offer their customers additional services, like Internet access, video broadcasting, etc. With this increase of satellite channels, the needs of the customers will dramatically change within the next 2-3 years. It will be crucial to obtain more measurement results as fast as possible, with increased accuracy and additional information about the signals. The realization of this project will enable the satellite operators to supply their customers with sustained quality of service and enhanced security against interceptors, based on continuous, fast, and reliable monitoring of their signals.

One main goal associated with this topic is to offer a low-cost measurement system for small satellite providers on the one hand and a high performance monitoring system based on COTS products to provide automatic carrier detection capabilities including enhanced analyses and in-band interference detection on the other.

Infobox

30.03.2005 – 24.03.2006

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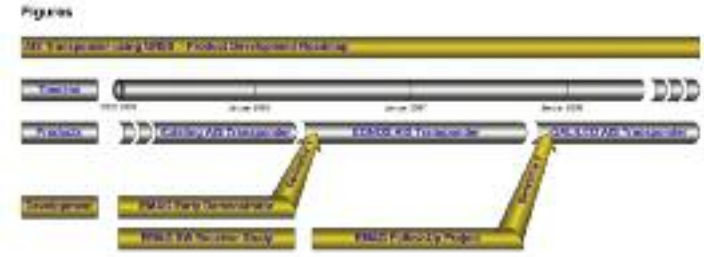
EMAG

Feasibility study for an experimental platform for multi-modal applications of Galileo

To achieve added value for satellite navigation by inferring from the Galileo project, it is necessary that interested companies and research institutes can get familiar with the elements and services of Galileo. This can be realized by a symbiosis of specific test equipment to be developed and a dedicated test environment. Therefore, the DLR (Deutsches Zentrum für Luft- und Raumfahrt) in Germany authorized a consortium to set up the test environment GATE (Galileo Test Environment). Among others, one of the GATE intentions is to be available to all interested international parties.

The project EMAG includes technical and economical basic research and analysis regarding the feasibility to develop an experimental platform based on a software receiver for multi-modal applications of Galileo. Therefore, it is the objective to develop a detailed concept for a later realization. In a next step, the proper development of the experimental platform could be carried out. The platform could be made available for interested companies, organizations and research institutes in Austria to provide the possibility to deepen the knowledge about Galileo. Interested parties would be able to use the platform for extensive investigations in combination with GATE.

In addition, a functional demonstrator based on an integration of AIS (Automatic Identification System), GPS (Global Positioning System), and EGNOS (European Geostationary Navigation Overlay Service) will be developed. Therefore, a combined GPS/EGNOS receiver will be used and integrated with a Nauticast AIS transponder. The EGNOS-improved GPS position solutions and an integrity message will be provided to the transponder in real-time. The transponder will be capable to broadcast the position of the ship including a quality indicator (integrity flag) for the position solution to other ships and to the control facilities on shore.



Infobox

Running project, 2005 – 2006

Coordinator:
TeleConsult Austria GmbH, Austria
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Partners:
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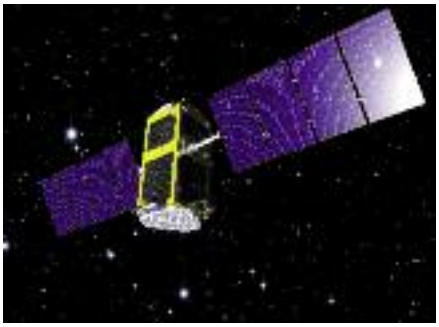
ASGS

Advanced Signal Generation Study



In preparation of the up-coming European Galileo Navigation programme Austrian Aerospace has been involved especially in the development of the navigation signal generator, that represents the core unit of the Galileo satellites.

In 2005/2006 two Galileo experimental satellites will be launched, which will carry the NSGU (Navigation Signal Generation Unit). The navigation signals transmitted by these satellites are in conformance with the so-called Signal-In-Space (SIS) specification which defines the signal structure. However, its specification has undergone continuous further evolution, defined in the international „Signal Force Working Group".

The aim of this study is to investigate all new requirements of the Galileo Signal-In-Space, to discuss appropriate implementation possibilities into the Advanced Signal Generator, to design programmable electronic components (Field Programmable Gate Arrays, FPGAs), and carry out the respective tests.

In order to keep track of the latest findings of the Signal Task Force, Joanneum Research (JR) representing Austria acts as a partner to Austrian Aerospace (AAE). Another partner is Saab Ericsson Space, which is also a team member in the NSGU development.

After having performed extensive systems engineering work an FPGA will be designed using VHDL (Very High-Speed Integrated Circuit Hardware Description Language). For the validation of the generated signals test equipment hardware and signal simulation environment will be built.

Infobox

01.04.2005 – 23.12.2005

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GeGS TTMS

Generic Ground Station Telemetry, Telecommand & Monitoring System

The aim of the project GeGS-TTMS is the provision of a generic uplink interface supporting different base-band equipments. Usually such interfaces are proprietary and unilaterally optimised for one specific uplink equipment. Therefore there was the need to develop a generic interface which is capable of communicating with different kinds of ground station infrastructure applications. Furthermore another part of this project was the accountability for a monitoring and control component of this interface in order to check the bit patterns which are transferred out of the Mission Control System (MCS) via the Telemetry and Telecommand System (TMTCS) up to the base-band equipment (e.g. IFMS).

A well-designed, generic uplink interface was to be created, which is based on state-of-the art software and interface technologies. A message based interface that uses TCP/IP as physical interface was envisaged. The already established interface between TCDS and IFMS (used for telemetry data) serves as a reference approach. A proper set of messages are defined that not only allows conveying commanding data units but also to exchange status and keep-alive messages which are required to maintain a state model of the uplink system and to convey relevant status information to the ground station's management system. A RISC-based Universal Communicator turned out to be the best approach to develop this interface.

Finally a specific Test Automation Procedure including Spacecraft Simulators (SSFE) and Space Link Extensions (SLE) was carried out to simulate the whole Ground Station infrastructure by testing the generic interface and obtaining the relevant results.

Infobox

01.03.2005 – 31.12.2005

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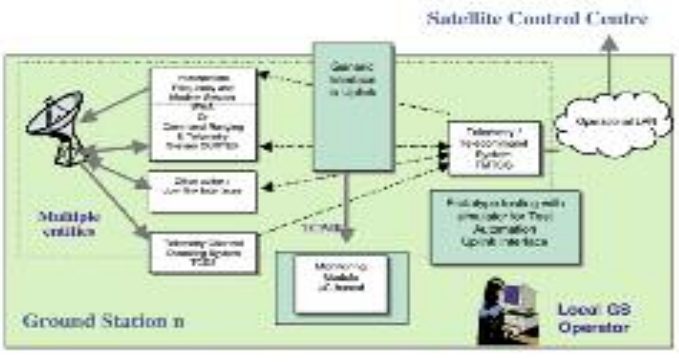
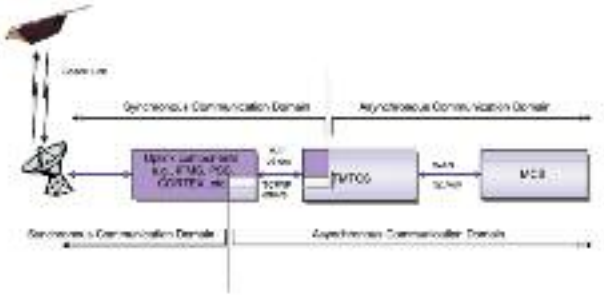


New Topics for the Ground Station Software Infrastructure



Individual split between synchronous and asynchronous communication domains of individual different uplink components

GPS Receiver

Global Positioning System Receiver Software Modules

The project aims at designing and developing software modules for a navigation receiver for space applications complements and at developing the so-called Innovative Global Navigation Satellite System (GNSS) Receiver. This is performed by the Austrian Aerospace which is under contract of the European Space Agency (ESA). The mentioned activity focuses on the development of the Navigation Receiver Hardware Modules and the basic receiver software in a modular way in order to make it easier to adapt the system to different mission requirements. Thus, the next logical step to achieve a marketable product is to enhance the basic receiver software, which is a very specific development for space applications, based on know-how already available at Austrian Aerospace.

The basic function common to GNSS receivers is processing of the spread spectrum signals emitted by GNSS satellites. This step is required in order to reduce the data volume, since there is an ample bandwidth of GNSS signals.

In its basic configuration the instrument also performs real-time navigation, using the signals received through the zenith antenna. The instrument uses the navigation results to control its operation. It exploits the received navigation messages and timing information in order to monitor the movement of the GNSS constellation as well as its own movement (or state vector), and autonomously decides which satellites to acquire, to track or to release.

The software modules developed in this ASAP contract will be integrated into the target hardware and verified within the Innovative GNSS Receiver acceptance test campaign.

Infobox

01.06.2003 – 14.08.2006

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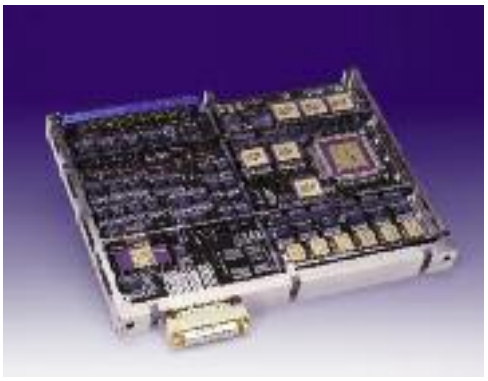

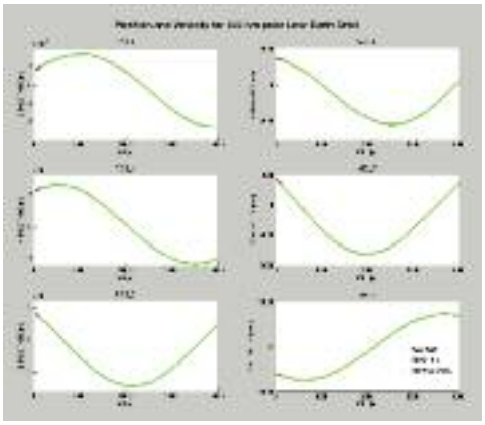

NetMSI

New Technologies for the Multimedia Satellite Infrastructure

After several years of stagnant growth, the satellite communications sector in Europe now sees promising opportunities of expansion in the years ahead. These expectations mainly derive from (i) ongoing developments in terrestrial telecommunications, in particular the emerging transformation of the terrestrial infrastructure into all-IP networks, and (ii) successful sector-internal technology developments, such as the introduction of DVB-RCS (Digital Video Broadcast – Return Channel via Satellite) networks.

The objective of this project was to contribute to the development of key enabling technologies to support these promising opportunities. According to the various relevant areas of expertise of the involved project partners, these contributions cover different fields, as follows:

- Improved IP Encapsulation: A novel encapsulation method for the MF-TDMA return link of DVB-RCS systems was specified. This method, which was optimised for IP traffic, significantly outperforms the standard methods currently employed in DVB-RCS systems.
- Emerging Protocols for Communication Control in Multimedia Satellite Systems: A previously developed novel communication control protocol for multimedia satellite networks (termed Sat-SIP, or Session Initiation Protocol for satellite networks) was extended for enhanced operational effectiveness.
- Performance Evaluation of Satellite UMTS Networks: A powerful network simulator for third generation satellite networks (developed for ESA) was extended to facilitate a detailed analysis of congestion control techniques.
- Satellite Ground Station Test Automation: Separation of different levels of abstraction by using a common approach for the simulation tools for testing new ground station Telemetry and Telecommand equipment.

Infobox

15.03.2004 – 30.09.2004

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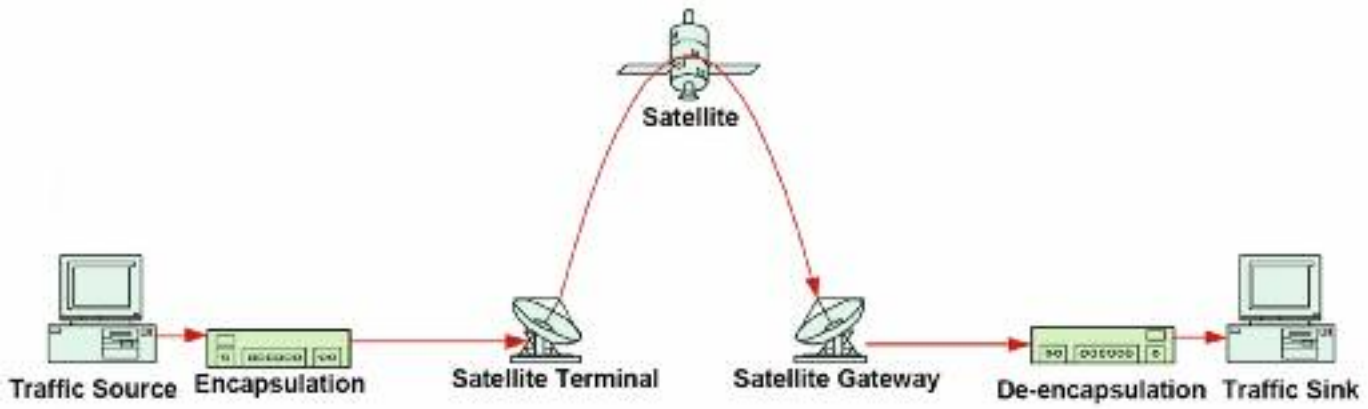
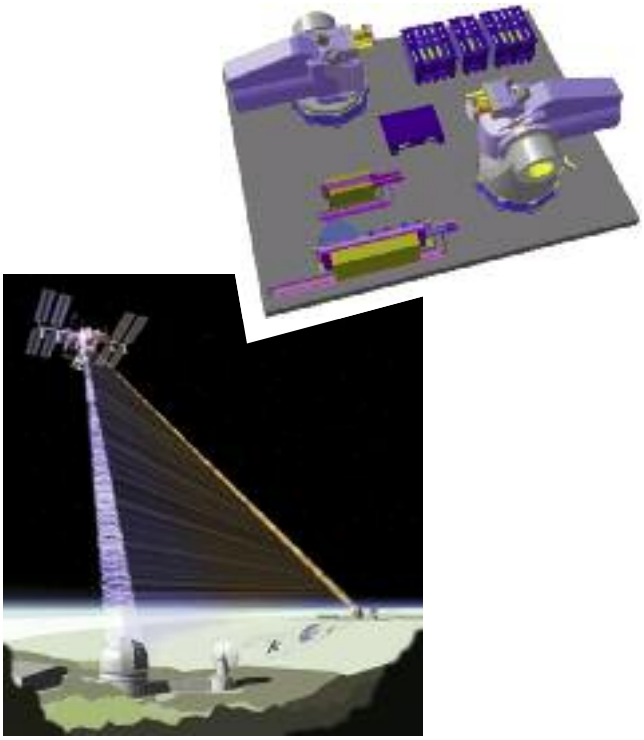


QUANTUM

Quantum Entanglement in Space Experiments



Quantum physics has changed our understanding of the fundamental principles of nature. Its predictions, although intriguing and counterintuitive in their philosophical consequences, have been verified extensively and have thus established quantum theory as the most successful theory of modern science. **Quantum entanglement** (Erwin Schroedinger 1935) is one fundamental feature of quantum physics. It describes the situation, in which separate particles have only joint but no individual properties, independent from the distance from each other. This counterintuitive behaviour has led to a series of fascinating experiments.

Besides its importance for fundamental physics, quantum entanglement has become a basic building block in the novel field of quantum information-processing. It is at the heart of **quantum cryptography**, the unconditional secure distribution of cryptographic keys and it is also a necessary ingredient in quantum communication applications such as quantum state teleportation and quantum computer.

We intend to place a source of entangled photons on a LEO (low earth orbit) platform such as the international Space Station (ISS). Global quantum key distribution can then be realized by combining separate quantum communication links to two (or more) ground stations, establishing an individual quantum key, when it passes over. When both keys are established, the system on the satellite has access to both separate keys. By sending a logical combination of the keys (e.g. bitwise XOR) to one of the ground stations, a symmetric unconditional secure key is established. Furthermore the two photons are each sent through telescopes towards two separate ground stations simultaneously at a distance of about 1400km from each other, where the photons will be received and finally measured. A world record in distance!

Satellite based distribution of quantum entanglement will eventually allow to establish a worldwide network for quantum communication and will help to prove the foundation on physics and the basic principles of a new upcoming technology.

Infobox

01.03.2006 – 30.06.2007

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SSPP

High-end Spaceborne Signal Processing Platform

Infobox

01.05.2005 – 30.04.2006

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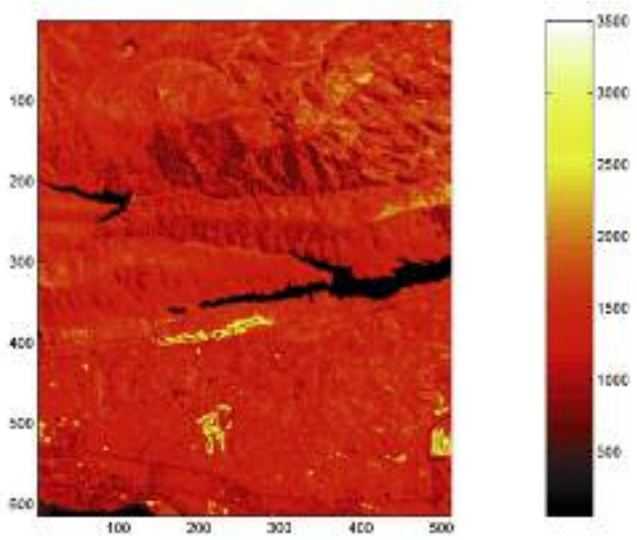
Due to the up-coming obsolescence of European space qualified signal processors and the growing demand on processing power new signal processing concepts for space applications are required.

The objective of the activity is to evaluate the feasibility and pinpoint the critical areas of new, high-performance signal processing concepts, which are necessary to fulfil future space mission requirements in the area of science, earth observation, and telecom applications. Thus the architecture of a highly flexible (configurable, programmable) spaceborne digital signal processing module with exceptional performance in terms of data throughput and interface capabilities will be established. This is the first step of an initiative towards the development of flight representative hardware. Novel methodologies for the design of integrated electronics (ASICs, FPGAs) are required to achieve good radiation tolerance and high data throughput simultaneously.



In view of the challenging and interesting objectives of this activity Austrian Aerospace has won the interest of Alcatel Space (F) to contribute to this study. Alcatel Space – as one of the few international prime companies – will contribute by providing their insight of future application requirements and critically commenting the established processor architecture.

The output of the study will be the detailed specification of the hardware architecture, substantiated by trade-offs, performance analyses, VHDL-prototyping and simulations.

Space Technology

DHS

FEEP

FEEP Cluster

HPS

SOFC Single Cell

SMART-1

DHS

Data Handling Systems for Satellites

The function of Data Handling Systems on satellites is the collection of housekeeping data for transmission to the ground (Telemetry Link) to allow the monitoring of the spacecraft status and the commanding of different spacecraft functions from the ground (Telecommand Link).

Austrian Aerospace has recently started to cooperate with its parent company Saab Ericsson Space (SE) in this field of space engineering and to build Data Handling Systems together with SE. In order to keep track of the latest technological trends a common bilateral development programme was launched.

This programme encompasses a market survey phase in the course of which the latest technical solutions in terms of hard- and software are investigated. The usability of new electronic components and processes has been studied. Additionally, a more flexible mechanical concept for the accommodation of electronic modules has been designed and functional electronic building blocks have been created in order to provide adequate solutions for the most different applications.

As an output of the project two breadboards carrying general I/O building blocks have been manufactured and as testing is of greatest importance in the space business a generic test bench has been built as well, which allows comfortable and comprehensive tests of future Data Handling Systems.

The present study is carried out in cooperation with Saab Ericsson Space, which provides technology transfer and receives inputs from Austrian Aerospace for various power supply and test aspects of the equipment. The study will secure and increase the competitivity of Austrian Aerospace´s contribution to Data Handling Systems in the frame of the European space infrastructure.

Infobox

01.03.2004 – 31.10.2005

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FEEP

Austrian FEEP Technology

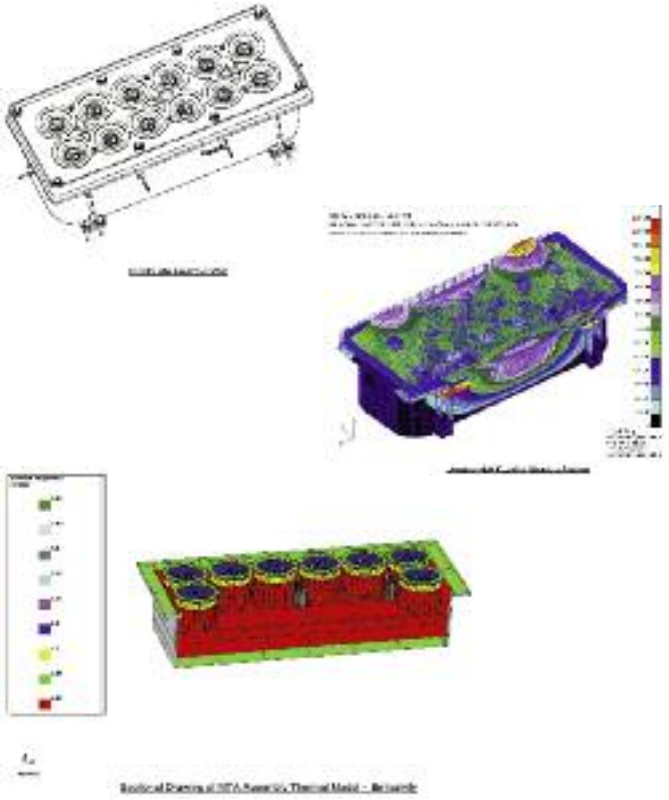
The Austrian FEEP (Field-Emission-Electric-Propulsion) Technology for space application derived from the charge control units developed for former space projects by ARC Seibersdorf research has been further developed since the Austrian FEEP Cooperation was founded. It has reached a technical status which promises to be very attractive for upcoming projects within the ESA Earth Observation- and Scientific Programme as well as the developing commercial market.

FEEPs are actually the only available technology which can provide the requested fine attitude control, station keeping and drag free operation for the ESA Programmes like GOCE, LISA; GAIA, etc. where very accurately controlled thrusts between 1 µN and 100 µN are required.

Major aims of the development work were the

- Design and analysis of a FEEP Thruster Package, able to fulfil the requirements of a dedicated spacecraft mission – in this specific case the requirements and applicable documents of the GOCE Mission (Gravity Field and Steady-State Ocean Circulation Mission, part of ESA's Earth Observation Programme) have been taken as the baseline.
- Manufacturing of a breadboard to perform thermal testing to compare the hardware-behaviour with detailed analysis results.
- Specification of the interface to a necessary control electronics to run the whole subsystem using high voltage up to 12 KV.
- Development of a facility for the filling and/or wetting of In-FEEP Emitters, allowing a controlled, highly reproducible, time and cost saving manufacture of the required emitters.
- Study of possible miniaturisation and clustering technologies to reduce volume and weight compared with the actual designed technology.

The defined work packages have been successfully fulfilled, nevertheless some key requirements could not be reached, specifically the thermal housekeeping together with the power budget need further developments.



Infobox

01.09.2002 – 31.12.2004

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FEEP Cluster

Generic FEEP Cluster Qualification

Field emission electric propulsion (FEEP) is a technology that enables missions that require ultra-precise attitude and orbit control, such as scientific satellites measuring gravitational waves (LISA) or detect extra-terrestrial planets using telescope interferometers in space (DARWIN). Ion sources developed at ARC Seiberdorf research are a key element for such thrusters. The goal of this research task is to demonstrate the long operating capabilities required for such missions that may exceed several thousands of hours as well as to build a cluster of several emitters that can still be operated by a single high voltage power supply. This cluster has to comply with increasing thrust demands by the satellites.

After the design and construction of the cluster prototype, the thruster will undergo a 5000 h endurance test. These results will then be compared to the analysis of a lifetime prediction model to extrapolate the test data to the overall mission durability required. In support of the qualification, a unique µN thrust balance will be designed and built that enables to directly measure the tiny forces and the thrust noise generated by the cluster. Our partner MAGNA Steyr will transfer our cluster design to a flight representative design taking thermal and structural issues into account. After qualification, an Austrian FEEP thruster will be available to support some of the most challenging future European science satellites and enable new insights into our universe.

Infobox

01.03.2005 – 31.08.2006

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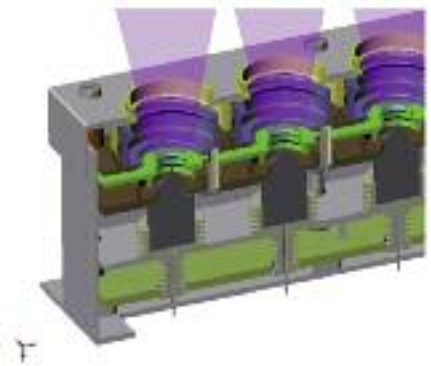
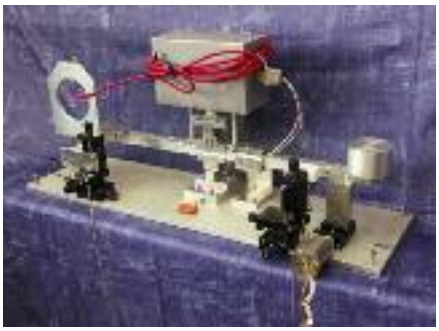
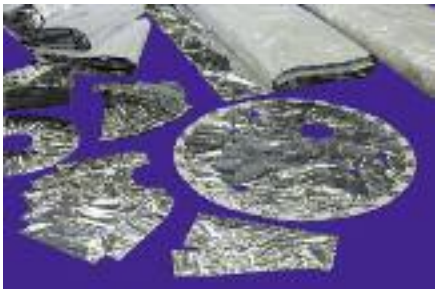




HPS

High Performance Superinsulation for Long Term Vacuum Stability



Multilayer insulation is the leading-edge technology to thermally insulate high temperature gradients under vacuum conditions. We extended our activities into the field of insulation systems for cryogenic application in 1993. Such insulation systems are to be developed for liquid gas systems according to technical requirements.

Within this project we want to perform a research and development programme concerning specific thermal insulation for use in vacuum insulated double wall steel tank systems for storage of liquid gas as Helium or Hydrogen. Such tank systems shall be used e.g. in medical applications or hydrogen propelled cars. Hydrogen propelled cars may become important for the deployment of sustainable energy sources.

Using the experience from space business and from former cryogenic programmes at AAE the spacer material has been identified as the crucial material for application in automotive tank systems because of important effects of the spacer for the thermal performance, flammability of insulation and influence to degradation of vacuum.

We want to cooperate with the European Space Agency (ESTEC) to carry out data base research for materials and achieve testresults for similar applications. A close partnership with the Technical University in Vienna, Institut für allgemeine Physik, Prof. Rudolf Dobrozemsky has been established to investigate vacuum technology and the outgasing of materials. And finally the University / research institute Forschungszentrum Karlsruhe, Dr. Holger Neumann shall perform tests of different multilayer insulation compositions with different types of spacer materials.

Further tests are planned for oxygen-compatibility. The final goal of this programme is the generic qualification of insulation which can be adapted for use in future technical applications.

Planning:	Phase I	Investigation/development of materials and tests
	Phase II	Selection of materials versus tests
	Phase III	Performance of tests

Infobox

01.04.2005 – 30.09.2006

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SOFC SINGLE CELL

Single Cell Test Stand for Solid Oxide Fuel Cells

Future Mars mission plans of the ESA and the NASA include a Mars sample return mission as well as a manned Mars mission. Such advanced missions will require significantly more surface power than current Mars missions. It is thus essential to design suitable on-board power systems that provide mission elements with sufficient amounts of electrical power. Solid Oxide Fuel Cells (SOFC) are among potential options for this application. SOFCs are capable to run on different fuels including hydrogen, carbon monoxide and methane. Carbon monoxide is particularly attractive for Mars applications as this fuel type can directly be produced on Mars. Experimental data of SOFCs running on concentrated carbon monoxide are not available in literature. The aim of this project was thus to investigate SOFCs fuelled with carbon monoxide in order to generate performance data which can subsequently be used for design studies of such power systems. The experiments were carried out by means of SOFC single cell testing on a test facility specifically designed and implemented for this purpose. It was shown that the electrochemical oxidation of carbon monoxide within a SOFC proceeds fast enough to generate power at adequate efficiency levels. The results demonstrated the principle feasibility of designing SOFC systems operated with concentrated carbon monoxide for power generation on Mars.

Infobox

01.03.2004 – 30.06.2005

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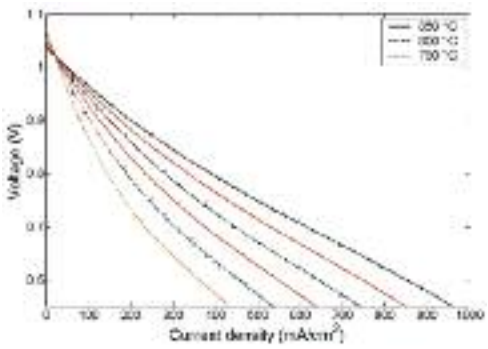
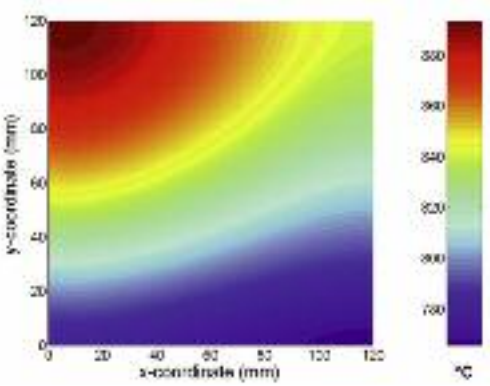
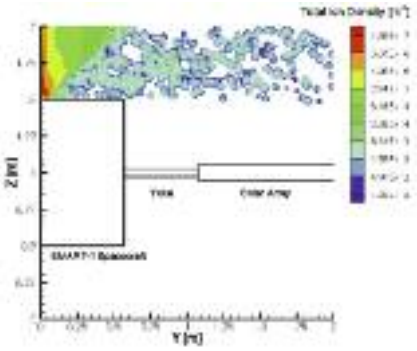


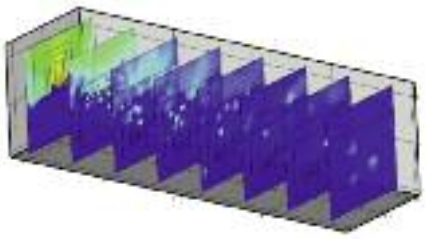


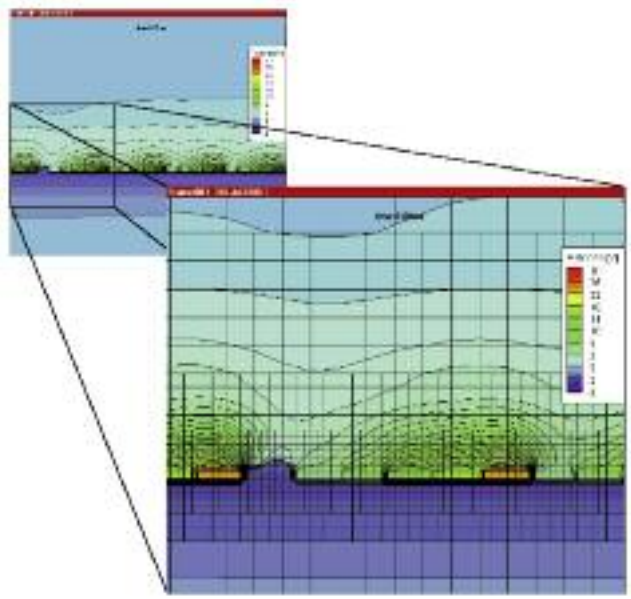
SMART-1 EPDP

Co-Investigator on Electric Propulsion Diagnostic Package (EPDP) for European SMART-1 Satellite

SMART-1, launched in fall 2003, is Europe's first moon satellite. It shall demonstrate Solar-Electric Propulsion using a PPS-1350 hall thruster. One of the main mission investigations is the characterization of the thruster's charge-exchange ion environment. Two instruments support this analysis: EPDP, consisting of a Langmuir probe, RPA analyser and a solar cell sample, and SPEDE, consisting of two current collection spheres supported by two short booms. ARC Seibersdorf research developed a Particle-In-Cell plasma simulation to support and predict the thruster's induced plasma environment around SMART-1. This is very important as this contamination can cause spacecraft charging, surface sparking, and torques due to asymmetric ion backflow or solar cell degradation caused by sputtering. During the flight of SMART-1, an unexpected cyclic variation of the floating potential of the thruster cathode and the spacecraft itself was detected. Our tool was able to explain this variation with the interactions of the thruster plume and the solar array. The software SMARTPIC, verified with flight data, will be a valuable tool for spacecraft and mission designers for future electric propulsion missions such as BepiColombo to avoid floating potential variations and to optimize the orientation of the thruster with the rest of the spacecraft.







Infobox

01.03.2004 – 31.12.2005

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Human Spaceflight, Microgravity and Exploration

MATROSHKA

RADIS – Austria

Matroshka Austria

Cosmic radiation exposure during extravehicular activities onboard ISS

The ESA Matroshka experiment was launched to the International Space Station (ISS) with a Russian Progress freighter on January 29, 2004. The cooperation of 15 laboratories around the world makes it the most extensive research effort in radiation dosimetry ever performed in space. The facility is aimed to simulate an astronaut's body during an extravehicular activity.

Matroshka basically consists of a human phantom torso attached to a base structure and covered with a protective carbon fibre container which acts as a space suit simulation. The phantom is divided into 33 tissue-equivalent polyurethane slices of specific density for tissue and organs. Natural bones are embedded. Channels and cut-outs enable the accommodation of active and passive radiation monitors as well as temperature and pressure sensors. In total, the phantom houses seven active instruments and over 6000 passive detectors of which the Atomic Institute of the Austrian Universities provides more than 1000 thermoluminescence dosimeter crystals for dose measurements with high spatial resolution and estimation of the biological effectiveness of the radiation field.

Matroshka was mounted outside the Russian Segment on February 26, 2004, and recovered on August 18, 2005. During that 18-month exposure period, the integrated radiation detectors measured distributions of particle fluence, energy spectra and accumulated doses within the anthropomorphic phantom body, particularly in identified radiosensitive organs and tissues. The results are expected to contribute essentially to reliable radiation risk estimations of future astronaut crews.

Infobox

01.10.2003 – 30.04.2006

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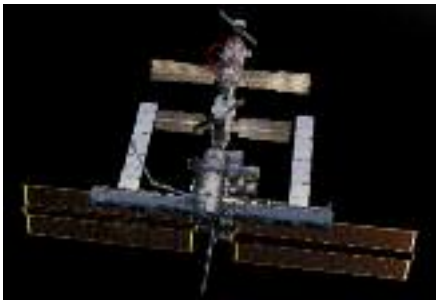

RADIS Austria

Radiation dose distribution within the Matroshka human phantom torso onboard ISS

The cosmic radiation environment is significantly different from that found terrestrially. Cosmic rays primarily consist of high-energy charged particles originating from galactic and solar sources. Some of these particles inflict greater biological damage than that resulting from terrestrial radiation hazards. Particle and energy spectra are attenuated in interaction processes within the human body. The reliable assessment of health risks to astronaut crews is pivotal in the design of future expeditions into interplanetary space and requires knowledge of absorbed radiation doses in critical radiosensitive organs and tissues.

Within the further utilization of the ESA Matroshka facility onboard the Russian Segment of the International Space Station the dose profile in the anthropomorphic phantom body shall be investigated. Different active and passive detector systems from 16 participating international laboratories are distributed at the surface and inside the phantom. The Atomic Institute of the Austrian Universities provides roughly 1000 small thermoluminescence dosimeter crystals for dose measurements with high spatial resolution and estimation of the biological effectiveness of the radiation field by means of the worldwide unique high-temperature ratio method. In two phases, Matroshka shall be exposed inside and outside the spacecraft hull. The results are also expected to improve the dosimetric metrology in mixed radiation fields and are directly applicable to radiotherapy and aircrew radiation monitoring.

Infobox

01.09.2005 – 31.08.2008

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Space Science

COSIMA

FIRST-PACS

SPICE

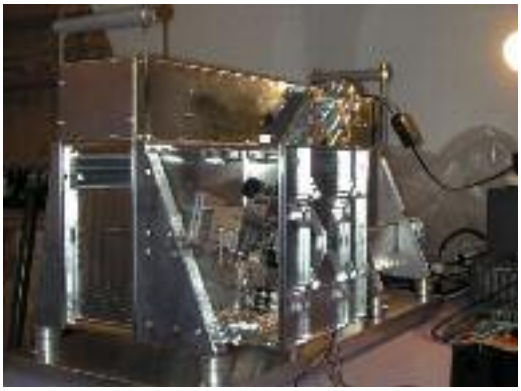
STEREO

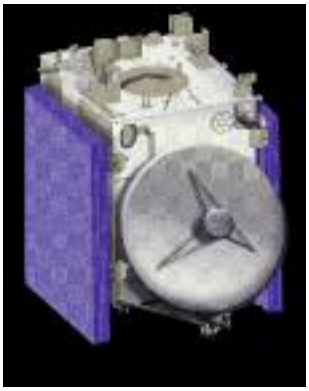
TMIS.plus

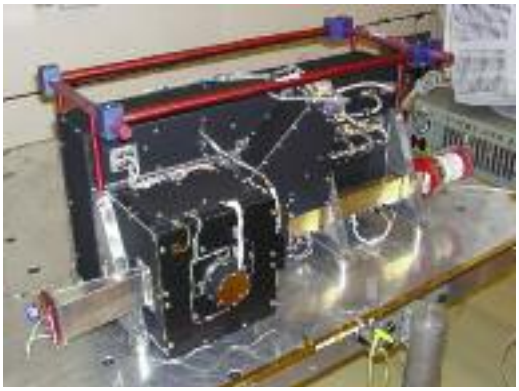
VEX MAG

COSIMA V

Ion Emitters for COSIMA / ROSETTA V







ARC Seibersdorf research GmbH was selected to develop and produce ion emitters for the experiment COSIMA (Cometary Secondary Ion Mass Analyser). Scope of this experiment is to analyse cometary matter e. g. to find out what molecules existed shortly after the „big bang". There may be molecules, composed of hydrogen, carbon and oxygen, which might build blocks of amino acids, the basic molecules of life.

The name „Rosetta" derives from the famous stone document found by Napoleon's troops, which enabled scientists to decipher the Egyptian hieroglyphics.

THE EXPERIMENT
A **T**ime-**O**f-**F**light (TOF) mass spectrometer was chosen for this mission, to provide high mass resolution (that enables us to discern between atoms and molecules) without losing any material (all target atoms hitting the collector of the TOF are counted).

To use a high resolution mass spectrometer of TOF design requires a monoisotopic ion gun with chopper and buncher facilities. This ion gun produces a beam of In 115 ions (monoistopic). We achieved a first TOF – SIMS Spectrum in space (PI: Dr. Jochen Kissel). For parallel tests to the already launched experiment additional ion sources are required.

Lander
After having approached the comet Churyumov-Gerasimenko the Rosetta orbiter will dispatch a robotic lander for the first controlled touchdown on a comet nucleus. The spacecraft itself will circle around the comet in a cylindrical path and collect and analyse particles in the vicinity of the comet.

Final Results
Approach to the comet is scheduled for the period from January to May 2014. This imposes another problem on spacecrafts: All systems have to stay alive and work again after they have not been used for several years. This means that all experiments will be exposed to cosmic rays for a very long time.

Infobox

01.01.2005 – 30.06.2006

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HERSCHEL/PACS

The Austrian Participation in the ESA-Cornerstone Mission HERSCHEL: On-board Data Reduction and Compression

The Herschel Space Observatory (formerly know as FIRST, the Far Infra-Red Space Telescope), a cornerstone of ESA's Space Horizon 2000 programme, will for the first time facilitate the investigation of the far infrared and submillimetre radio regime of the electromagnetic spectrum, which is not accessible from the ground. In this wavelength range the primary research goals will be in the fields of stellar evolution, development of planetary systems, interstellar matter and the origin of galaxies.

Austria participates in the development of PACS (Photodetector Array Camera and Spectrometer), one of the three HERSCHEL instruments, with sophisticated on-board software for HERSCHEL/PACS, as well as in the Instrument Control Centre. Univ.Prof.Dr. Franz Kerschbaum represents the Institute for Astronomy of the University of Vienna as co-investigator in the PACS instrument consortium.

PACS is designed to perform on-board data reduction in order to overcome the limitations of ground contact and telemetry. The tuneable reduction steps range from simple data rejection by various criteria to ramp fitting and integration. A set of algorithms for backend lossless compression and dedicated data has been developed with special emphasis on the high detector readout rate and possible transient effects within the processed data.

Since the first integration of the software into the target hardware (an integrated and radiation tolerant digital signal processor based on the TSC21020E architecture) mid-2002 and the acceptance and delivery of the software to the consortium in spring 2003, a whole lot of tests in all diversity have been conducted and the software has been improved to respond to the evolution of the detectors. This process of iteration has not been finished yet. The FM will be delivered to ESA in early 2006.

Infobox

Running project, 2004 – 2007

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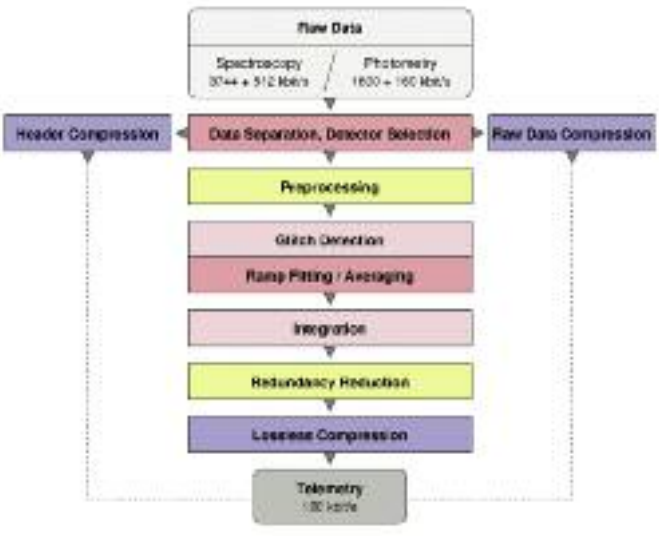
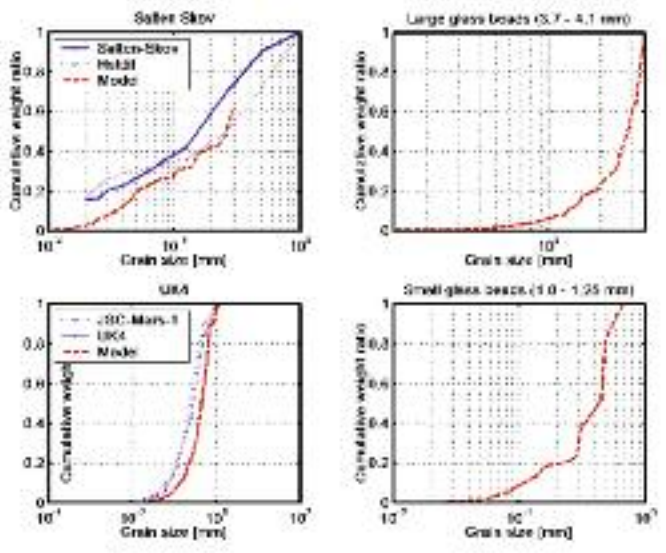


SPICE

Experiment SPICE: Material Strength and Cohesion of Martian Soil



Since the exploration of the planet Mars is currently in the focus of all major space agencies, the understanding of the physical properties of Martian soil has become an issue of interest. The aim of the SPICE project was firstly to develop sensors and techniques suitable for in-situ measurements of soil strength on a surface platform on Mars. A second goal was the establishment of a soil model for dry granular materials which can typically be found on Mars.

For this project a penetrometer test facility was established at the „Planetary Surface Laboratory" of the Space Research Institute in Graz, which allows to perform soil strength measurements for a variety of Martian analogue materials. The same materials were tested with standard soil-engineering methods and the results were used to develop a finite element soil model, which was then calibrated with the results from the laboratory test facility.

Additional soil parameters can be derived directly from the penetrometry data, such as grain size distribution or density to peak force relations.

As a spin off, the technologies and tools developed within this project will be investigated for their usability in terrestrial engineering applications.

Infobox

01.07.2003 – 31.07.2005

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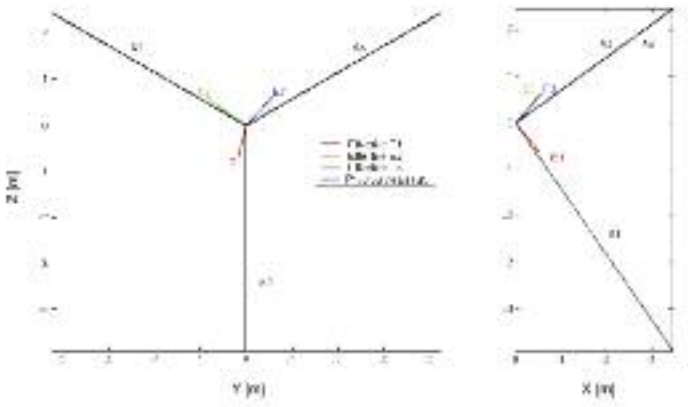
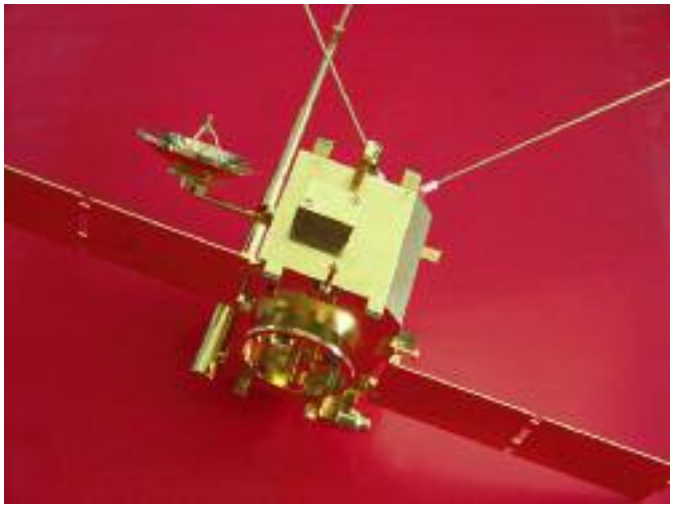
STEREO-WAVES antennas

Reception properties in the quasi-static frequency range

The project is dedicated to analyze the antennas of the WAVES instrument onboard the two STEREO spacecraft. The STEREO mission will be launched in April 2006. Its target is to investigate the plasma environment of the Sun with its complex, sometimes even hazardous consequences for the Earth. On each spacecraft three monopoles are mounted to receive electromagnetic waves. For the purpose of accurate data evaluation, especially geometric triangulation, an accurate knowledge of the antenna reception properties, represented by the so-called effective length vector, is essential.

The objective of this project is the determination of these vectors and of the antenna impedances by means of two different techniques: First, rheometry is based on electrolytic tank measurements of a 1:20 scale model of the spacecraft and the antennas yielding the effective length vectors in the quasi-static frequency range where the wave length is much greater than the dimension of the antenna system. Rheometry facilitates modelling of the antennas-spacecraft system in great detail, and the measurement set-up is rather disturbance-free in contrast to high-frequency measurements. Second, numerical computer simulations are used in order to study the antenna properties over a wide frequency range. The main advantage of the numerical method is flexibility with regard to the representation of spacecraft parts, which can easily be altered to test their influence on antenna properties. Furthermore, computer simulations enable us to estimate an upper frequency limit below which the quasi-static results are valid. The data evaluation of the WAVES experiment will be improved substantially by our analysis, in particular the direction finding and source localization for the observed radio signals are only possible with the results of this project.





Infobox

15.02.2005 – 15.08.2006

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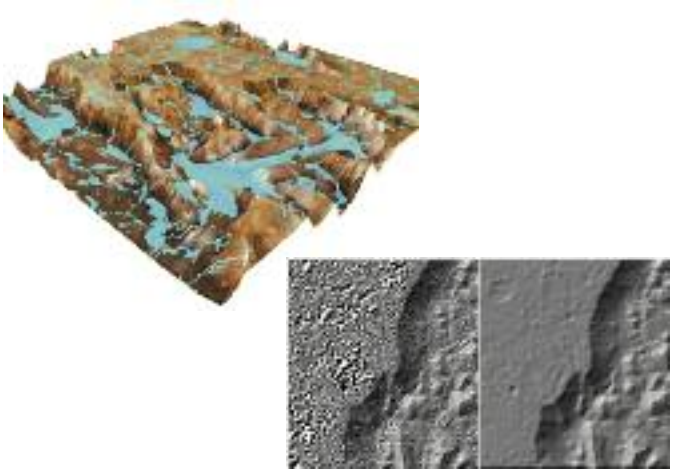
TMIS

Topographic Mars Information System

One of the instruments on board of the European Mars Express spacecraft is the HRSC (High Resolution Stereo Camera). The project group is headed by Prof. Neukum, Berlin. IPF of the Vienna University of Technology, who is one of the Co-investigators, developed the topographic information system TMIS – a relational spatial data catalogue – for managing, archiving and distributing the captured images.

This catalogue is the core for data distribution to the international group of Co-Investigators. A second phase, called TMIS.plus, covers additional topics. IPF with its expertise in terrain modeling, also concentrates on research for enhancing the quality of the terrain models derived from the images by multi-view matching. Due to the properties of the Mars surface the matching procedure delivers poor results in many areas. Within TMIS.plus an algorithm has been developed which can significantly improve the quality through statistical analysis and by data fusion, thus removing disturbing noise without affecting relevant surface features. A further area deals with hydrological analysis for detecting former potential rivers, lakes and oceans. Though based on the present state of the Mars, the analysis provides valuable objective information for geologists and planetologists.

The European Mars Express mission has become a great success and especially the HRSC delivers excellent images. Therefore, an extension of TMIS.plus is planned so that in near future detailed knowledge about the surface of the entire Mars might not only influence our personal image of the neighboring planet, it certainly also deepens our knowledge concerning the history of our planetary system. But most importantly, the results of TMIS and the know-how acquired in the course of the project can easily be transferred to Earth-related research, investigations, and applications.



Infobox

TMIS: 07.2000 – 12.2003
TMIS.plus: 01.2004 – 06.2006

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VEX-MAG

Venus Express Magnetometer

Venus Express (VEX) is the first mission of the European Space Agency (ESA) to Venus. It aims at a global investigation of the Venusian atmosphere and plasma environment and addresses several important aspects of the geology and surface physics. Its payload comprises seven scientific instruments with heritage from Mars Express and Rosetta. IWF Graz is one of the Principal Investigator institutes and participates in the mission by providing the fluxgate magnetometer VEX-MAG together with the TU Braunschweig and the Imperial College London.

VEX-MAG is a space qualified magnetometer with two fluxgate sensors to measure the magnetic field magnitude and its direction. It consists of two sensors, one electronics box (including sensor electronics, data processing unit, and power supply) and a one meter long boom made from carbon fibre. One sensor is located on the tip of the boom and the other one is mounted on the surface of the satellite. This configuration of two sensors allows the separation of spacecraft disturbances from the natural ambient magnetic field. The flight model including the magnetometer boom was built in record time of less than two years. Among the many scientific objectives of the magnetic field observation, the definition of Venus' plasma boundary and the study of the solar wind interaction with the Venusian atmosphere are of major interest. In addition, the magnetic field data provide important information to other instruments aboard Venus Express, for example the particle spectrometer ASPERA, for any combined studies of the Venus plasma environment.

Important mission dates are: launch – 26 Oct. 2006; VEX-MAG commissioning and boom deployment – 5 Nov. 2005, arrival at Venus – April 2006; duration of nominal mission – 500 Earth days.

Infobox

01.07.2003 – 31.05.2006

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Satellite Navigation Applications

Fleet – Management
COALA.NT
C-TOP
EMOGES
EPRIS
FLEET
GRAS
HERMES
MEDNAV
PISA
RONCALLI

Agriculture and Forestry
EASE
EMMFOR
GO.FOREST
HOLMES

Tourism and Leisure
JOE
MOBILE CITY EXPLORER
TINYGHOST

Personal Navigation
PONTES
SATSKI

Search and Rescue Services
GO.HIKING
GUSTAV

Fleet – Management

COALA.NT

C-TOP

EMOGES

EPRIS

FLEET

GRAS

HERMES

MEDNAV

PISA

RONCALLI

COALA.NT

Conflict Avoiding Low Cost Application by using New Technologies

Safety of railway operation is provided by procedures and regulations on main lines as well as on branch lines. Operation and technical safety are usually based on interlockings as central operational components and an outdoor-equipment, which supplies the appropriate information for the interlocking on the one hand and on the other hand signalizes the travel permission to the engine driver. Such safety systems are expensive due to the quality and safety requirements and are therefore being totally or partly replaced by specific operational procedures on routes with small traffic volume. For such branches, which have a small traffic volume and frequently are not even equipped with interlockings, the economical benefit of the application of sophisticated high-end-technology usually cannot be demonstrated, the application of ETCS (European Train Control System) is not probable as well.

COALA NT's task is to prevent and detect on-line conflicts through the application of GNSS, which result from the temporally and locally simultaneous use of lines by several train movements. Nowadays the conflict detection often is done statically in the operational part of fleet management systems or in control centers. The clue idea of COALA.NT is to stronger involve the engine driver in the decisions of the operational traffic management. COALA NT is a bi-directional, detection-based, innovative information system for operators and engine drivers on railroad lines with small traffic volume.

The information system primarily has the following tasks:
- Indication of the current driving permissions given by the operator of the control centre
- Indication of track occupancy and vacancy messages
- In-time indication of a conflict, which could result from a potential human failure (e.g. driving on non-released sections)

Infobox

01.04.2003 – 31.03.2004

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C-TOP

Carinthian Traffic Optimizer

Location awareness of buses, trains, and private transport-companies is one of the essential factors in the optimization of traffic in Austria. While GPS in the first step and Galileo in the second step deliver vehicle positions with accuracies down to some 10 meters, GSM and other satellite-based means of communication are used to ‚deliver' these positions to a central geographic data-base. Each vehicle is identified by its unique code and thus information on status and position can be gathered either on requests initiated by a central authority or automatically triggered on defined events (arrival at station, accident, ...).

Besides optimizing routes and the number of vehicles per route and time, prediction of the estimated time of arrival will result in increased customer satisfaction, which will be only one of the benefits among many others. Finally, displaying locations of selected vehicles on digital maps on the internet will result in interesting turn-key solutions for private transport companies. This project will bring up a platform, which combines the highly specialized knowledge of two Austrian companies, that both have been well established for more than 10 years in the field of GIS and GPS. While MapExplorer provides digital maps in web-based solutions, COMMUNICATION & NAVIGATION (C&N) is a manufacturer and integrator of GPS-based applications.

Infobox

01.08.2003 – 31.10.2004

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C&N COMMUNICATION & NAVIGATION
INDIVIDUAL GPS TECHNOLOGY

EMOGES

Evaluation of Positioning Technologies for Monitoring Dangerous Goods Transports on the Austrian high-ranking Road Network

Experience with large-scale accidents in road tunnels in the past years (e.g. Tauern tunnel, Mont Blanc tunnel 1999) has confirmed the weak points in management of dangerous goods transports and the high risk related to these transports on the critical sections of the Trans European Road Network.

A consistent monitoring of dangerous goods transports on all sections of the road network is the only method to obtain a sufficient data quantity to guarantee the safety of motorists and all abutters on those critical road sections.

Since the functionality of conventional and future satellite navigation systems cannot be guaranteed on all sections of the Austrian high-ranking road network (e.g. in tunnel shadings) it is necessary to use complementary technologies for these areas to provide a seamless monitoring system of dangerous goods on the whole road infrastructure.

As a result of the technology evaluation based on user needs a system architecture was created and implemented that carries out automatically the handshake-procedure at the crossover point between out-door-positioning (using GPS) and in-door-positioning (using an acceleration sensor) and the whole communication with the tunnel control centre. For that purpose a functional model of an on-board-unit (laptop) including all relevant software solutions as well as a virtual tunnel centre to track the hazardous goods transport during its tunnel passage was implemented. The evaluation of the test run of the system showed a high grade of usability in hazardous goods monitoring systems, but also that the accuracy of the position is highly dependent on the quality of the used acceleration sensor.

Finally, the feasibility study concerning the usability of video image processing showed, that this technology is merely appropriate for the use in hazardous goods monitoring systems in tunnels.

Infobox

02.03.2003 – 30.09.2004

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EPRIS

Evaluation of positioning technologies for the provision of value added services within River Information Services

Inland waterways as a commonly used transport mode are a main objective of traffic policy in Europe. The provision of River Information Services (RIS) to support traffic and transport management will foster safe, predictable, and efficient transport on the European inland waterway network comparable or even better than rail or road transport.

The system concept of RIS is based on an exact positioning of the vessel with frequent updates (every 2 sec.) and the monitoring of relevant vessel data. Traffic management on inland waterways therefore postulates high requirements on accuracy and integrity of positioning services. Based on this information, different services can be provided whereby the actual traffic situation is displayed on digital navigation charts on board and on shore. The application for navigation purposes requires a position accuracy of 3 meters (95%).

Conventional navigation services like NAVSTAR GPS are neither able to deliver such high position accuracy nor the required integrity information as sole means of navigation on a pan-European basis. Therefore EPRIS contains testing of conventional and future planned positioning technologies in the RIS environment to identify a „best practice"-method which is able to fulfil commercial requirements (transport management) as well as nautical and administrative requirements – navigation requirements (traffic management) related to RIS. Focus has been laid on new services (e.g. EGNOS, GALILEO) in order to consider these kinds of services in the migration paths under elaboration for the 2nd generation of River Information Services.

Infobox

03.2003 – 12.2005

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FLEET

Fleet Logistics Service Enhancement with Egnos & Galileo Satellite Technology

In the project FLEET a travel time information service based on vehicle-generated data (Floating Car Data) was developed and demonstrated for the Vienna region for the use in Traffic Telematics Systems.

By integration of a taxi fleet (radio taxi 31300) comprising a certain amount of (approx. 800) taxis, the driving patterns of taxis, which were registered by the control system of the taxi fleet, were transmitted to a data server for travel time calculations. The travel times of all road segments in the testing area, calculated in real-time, were archived in a database developed by arsenal research, Transport Technologies, and were combined with typical time series corresponding with the traffic state. They formed the basis for developing algorithms to interpret and forecast travel-times which were compared and verified with up-to-date traffic information by a radio station (Krone Hit R@dio). To ensure the optimum economic commercialisation of the project, an institution specialised on eco-scientific know-how (HiTec Marketing) made an accompanying study.

The cost effective travel time information, obtained without having to install additional expensive road infrastructure, can be used for fleet management, for travel-time information services (e.g. by producing a traffic-state image), and as a medium-term planning tool for administration. Based on the standardised interface between the FLEET system and the taxi radio system, travel-time calculation and representation of the current travel state via Floating Car Evaluator is interoperable and can be integrated in 45 other central units of the taxi radio system, which are operational in 38 cities of the European Union. A rapid implementation of the developed system is therefore possible for other cities in Europe.

Infobox

01.02.2003 – 31.08.2004

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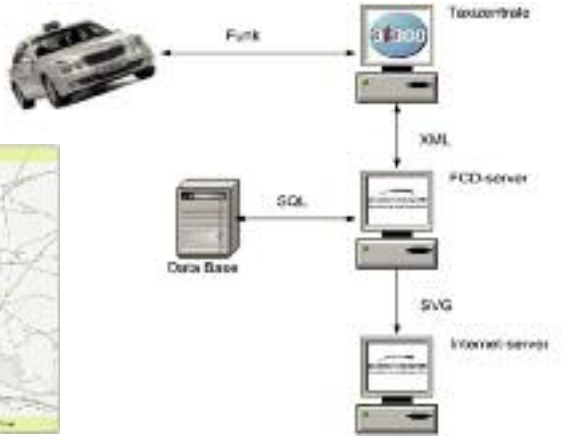

GRAS

Galileo Road Application Simulator

GRAS is a simulation and verification tool to support satellite positioning and navigation technology and to particularly demonstrate the expected Galileo system and service characteristics at selected Points of Interest (POI) in the urban area.

The objective of GRAS is to show quality improvements in terms of positioning accuracy of the future European Satellite Navigation System Galileo by simulating the Signals in Space (SIS) using the POLARIS tool and verifying the results by the ground truth verification tool GeoTracker. In order to develop the Galileo Road Application Simulator, satellite visibility was simulated in the POLARIS tool under different space, ground and user segment constellations, i.e. GPS only, Galileo only and combined GPS and Galileo visibility at selected urban POIs representing different shading scenarios. The plausibility test of the simulation enabled the verification of the simulation results and showed the true satellite visibility under real conditions in urban areas. The functionality of the developed Galileo Road Application Simulator integrated all results and consists of the following components:

- A navigation bar for selecting the preferred urban Point of Interest.
- The graphical design of the user position on the map as simulated with state-of-the-art simulation software available for PDA's.
- The illustration of the user position in the orthographic picture with integrated visibility mask.
- The illustration of the user position in a three-dimensional angular perspective with highlighting the visible horizon.
- User's view illustrated by 360 º panoramic photo of the real urban environment.
- The display of the simulation results of the satellite positioning accuracy and availability at the Point of Interest.
- A link providing the summary project description, partners and data as well as software used.

The GRAS tool is available on CD-Rom that can be used without any additional installations of plug-ins or other software, therefore enabling a user-friendly and platform-independent usage.

Infobox

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HERMES

Digital drivers book integration into organization specific processes

The project aimed at designing, developing and testing a digital driver's book including dedicated analysis software. Special attention was paid to ease integration into organisation specific processes. Easy data collection, analysis, and transferability were among the main project goals.

A combination of mobile device (PDA personal digital assistance) and GPS sensor was used to collect geographical information in the vehicle. The data was compiled, freed of errors and systematically stored. Different ways to input the data into the company network are provided: wireless, cable, storage card. No special software is required by the organisation since standard browsers can be used to access the information and analysis from every internet connected computer is possible.

A dedicated study evaluated the potential productivity gain of the system. In a pilot project executed at the Austrian Ministry of Finance all relevant processes were analysed and compared with their conventional counterpart without the new system. The increase of productivity can reach 70%, dependent on the specific task. The payback period of the investment into the system is – depending on the systems coverage and intensity of use – between 12 and 36 months.

Infobox

01.06.2003 – 01.04.2004

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MEDNAV

Management of Emergency Devices Based on Navigation Technologies

If the resuscitation with defibrillation shocks starts within five minutes, the patient has a high chance to survive a sudden cardiac arrest. For that purpose an Automated External Defibrillator (AED) is used, which is a small portable device that is easy to handle. The goal of the MEDNAV-Project is to determine the exact present position of AEDs and forward this information in real-time to Emergency Dispatch Centres in order to minimize the time between sudden cardiac arrest and resuscitation.

An additional positioning unit was developed to determine the actual position of the AED. The unit can be mounted externally to the AED or alternatively transported together with the AED in the backpack. The outdoor position of the AED is determined via GPS. Indoors or at places with weak GPS-signals the positioning is taken over by wireless- or Bluetooth-LAN. The unit is also able to detect an acoustic signal from the AED indicating that the device has been activated. Furthermore an acceleration sensor is integrated in the positioning unit to detect any movement of the AED. Via GPRS the positioning information is transferred to a central MEDNAV-server where a specifically developed software processes and stores the data. This software handles the communication with the positioning unit, calculates position information based on indoor environments and allows a remote configuration of the unit via SMS (Short Messaging Service). All data is stored in a central database. A Geographical Information System visualizes the position on a vector map or satellite picture of Vienna.

The system is applicable for the following purposes:
- Patient transport ambulance and „First Responder"
- Risk patients
- AED in enterprises and public locations

Infobox

16.06.2003 – 15.09.2004

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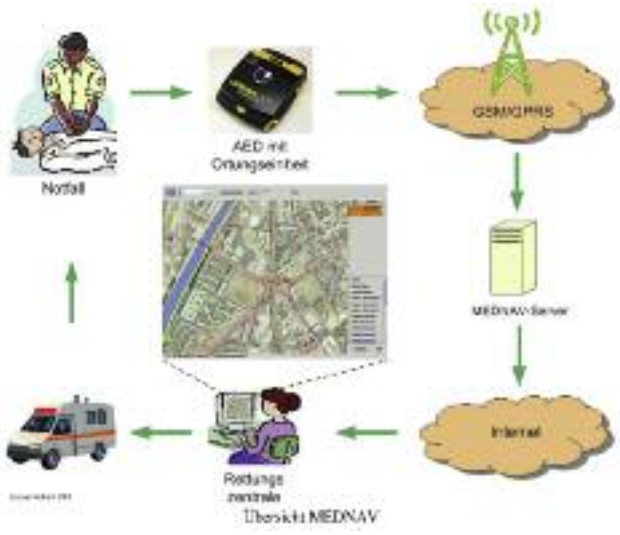


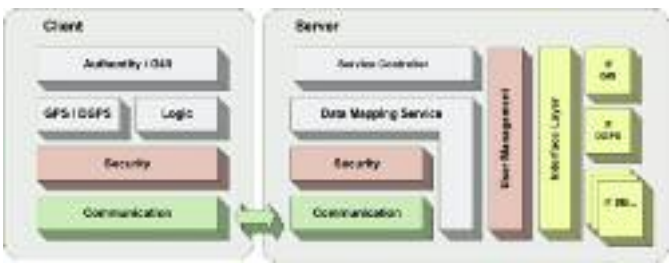
PISA

Position Information System for Time- and Location-based Analysis

The amount of road segments which needs to be maintained and cleared increases steadily. This poses new challenges for snow crews and road maintenance companies in their daily work.

Within the scope of the project PISA a system will be developed which registers vehicles' movements by utilizing GPS technology. At the same time, data about actual weather and road conditions (e.g. rainfall, ground temperature) are collected. Both are stored in a central database, which is connected to a geo-information system. Based on this automatic documentation, up-to-date information about the roads' condition for statistic evaluation and analysis purposes is constantly available. The data can also be used as preservation of evidence in case of legal procedures. Moreover, drivers acquire an assistance system which documents their service.

The system to be developed consists of a client/server architecture, by which the client determines the current position, reads further state data and encrypts and transmits both to a server. The positioning is handled by a GPS or the Galileo system; differential GPS enables scalable accuracy.



The server receives and decodes encrypted data from the client and forwards it to the proper services. These can record the data, visualize the information on a map or send data back to the client using GSM-based radio technologies.

Test drives with two or three vehicles will be conducted during the pilot project. Each vehicle will be equipped with a terminal, which is connected to other sensors (snow plug, scatter unit, temperature measurement, etc.). This allows transmitting up-to-date vehicle data, which will be evaluated by a server. The result should be an automatic driver's logbook as well as a visualization of the vehicles' positions in a web-based GIS application.

Infobox

Running project, 2005-2006

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RONCALLI

Real time traffic information

The RONCALLI principle is based on linking centrally available information with current vehicle data. Key components from RONCALLI are GPS-positioning (later Galileo) and traffic relevant information from a central server which communicates with a mobile device (PDA) over a GPRS connection. The permanent availability of positioning signals from satellites and efficient mobile radio connections form the central theme of the project. In order to present the most up to date information, RONCALLI receives constant updates of accident spots, sensitive zones (around schools), road conditions, and speed limit information (Intelligent Speed Adaptation).

In the frame of the project RONCALLI, this information brought together from a myriad of sources will be specially processed for each individual participant according to their current situation and made accessible via a standard traffic safety service device. Special value is placed on aspects of road safety, customer friendliness, and information reliability.

By the successful implementation of RONCALLI, the consortium has proven that road safety information can be made available in real time to each participant and that this does not necessitate the development of special hardware, rather existing standard business equipment can be used. RONCALLI provides a leading contribution to road safety in Austria which represents an increase in value for the consumer as well as for the entire economy.

Infobox

01.03.2003 – 31.07.2004

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Agriculture and Forestry

EASE

EMMFOR

GO.FOREST

HOLMES

EASE

Enhancing Agriculture by Satellite Navigation Systems

The project comprises two demonstrations: (1) determination and registration of funded agricultural areas and (2) precise farming applied to the disposition and the management of growing areas.

The first task aims at developing a demonstration system applicable for farmers as well as the adherent inspection organisations. The person in charge measures on site using a satellite-based system like DGPS (differential GPS) or GPS/EGNOS. To bridge GPS gaps caused by obstruction, additional sensors must be installed. The appropriate data and their respective attributes (e.g. inclination) are stored. The measurement data will be transferred to a Geographical Information System (GIS) on a desktop PC and submitted to INVEKOS (an integrated administration and inspection system).

In order to transmit GPS correction data (in the sense of DGPS or EGNOS), a communication link has been installed that enables interaction between the mobile unit and the PC.

The second task covers the use of satellite-based navigation techniques with special emphasis on planning for fruit-growing. The mobile unit for determining the areas as described above may also be used for a precise surveying of areas to be restructured. The key is a multi-purpose GIS (interoperable with INVEKOS) to manage, store, analyse, and display the data. Beyond that, the interaction and data exchange with existing optimisation programmes may determine strategies for optimal sowing.

Infobox

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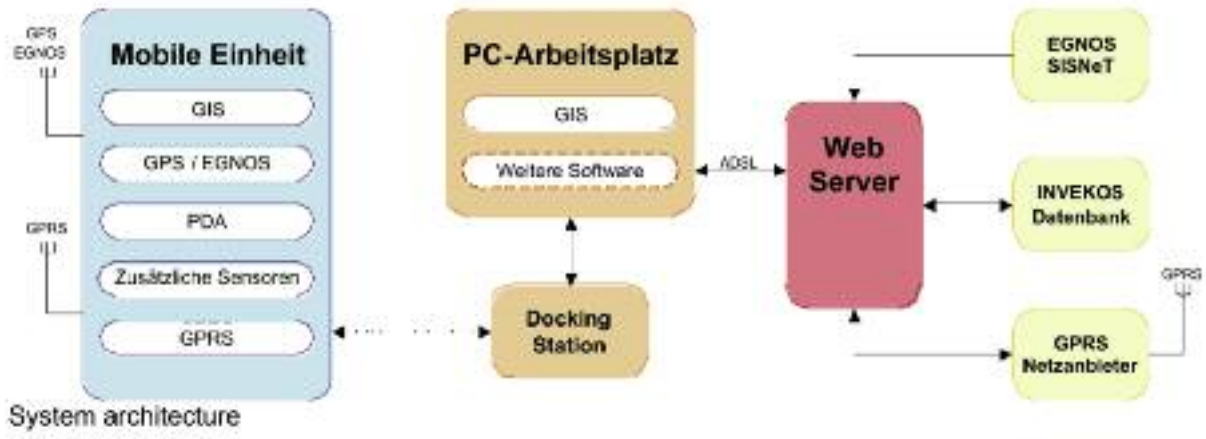


System architecture

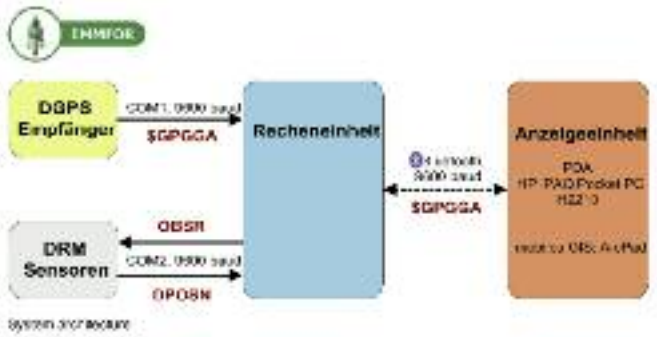
EMMFOR

Application of modern methods for forest inventories

Compared to GPS, the use of DGPS (differential GPS), especially the combined use of GPS, EGNOS and further GALILEO, allows a more precise relocation of the sample points. Additional total stations and autonomous sensors (e.g. magnetometer, gyros, barometer and acceleration sensors) guide to the sample points even in topographically difficult locations. The project aimed at demonstrating advantages and the easy handling of the DGPS method combined with conventional ground based surveying techniques. Once successfully measured, geographical coordinates of sample plots or certain ground marks can be reused.

Employing high resolution satellite imagery in addition to traditional methods adds further advancements to the satellite navigation component: The high repetition rates, the large aerial coverage, the high geometric accuracy, and the spectral information content bear the potential for rapid, precise, more frequent forest assessments covering larger areas and a broader thematic scope than conventional forest inventories. Earth observation data are analysed along with traditional data in Geographic Information Systems (GIS) to achieve maximum value of these various types of information.

Important overall improvements and added value in terms of efficiency, accuracy, and information quality resulted from the innovative approach of EMMFOR. The involvement of the users from the very beginning of the project guaranteed the development of a prototype service, which is actually based on the requirements and the financial capabilities of forest management actors.



Infobox

01.09.2003 – 31.08.2004

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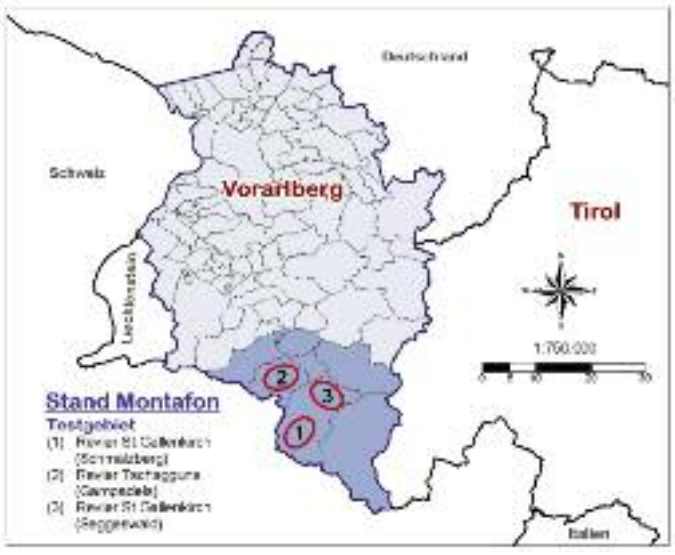


go.forest/mobile

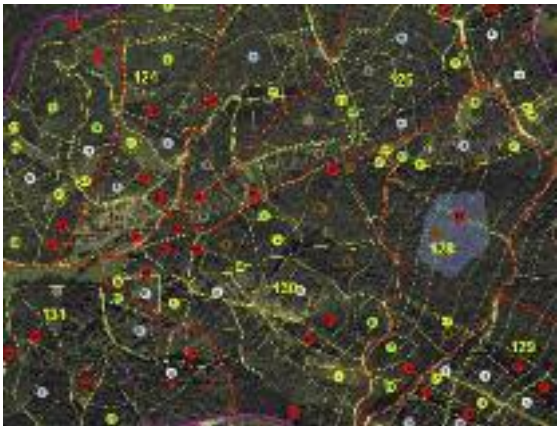
Independent mobile SatNav device as supplement for a web-based Forestry Management- and Information System

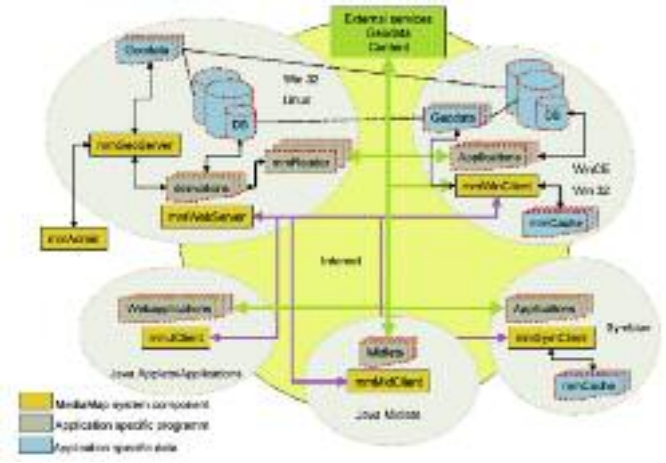
Forestry in middle Europe, notedly in moutainous regions, requires significant efforts to remain competitive to Scandinavian or northeast European timber production. In Scandinavia timber logistics are highly developed. In Austria the small-sized structure of landparcels, high harvesting costs and considerable legal restraints due to nature protection are the most obvious handicaps of forestry in alpine regions.

Selling timber, forest enterprises are generally too small to face the much bigger sawmills or pulpmills on the buyers' side. They therefore start multiple cooperations with neighbouring forest owners in order to get better prices. On the other hand forest enterprises have to rely on very specialized contractors for timber harvesting, timber transport and silviculture measures. The main idea of go.forest is to create a web-GIS-platform which enables horizontal and vertical cooperation and implementation of complex workflows in a user friendly way.

As a continuous principle the actual state, all planned measures, and all executed measures have to be geocoded. Thus spatial patterns become visible instantly. A central data base in combination with a highly sophisticated user management will control availability of data and functions due to the defined user roles. Mobile SatNav devices for forest rangers, harvesting contractors and hauliers will provide proper coordination data along the whole workflow of timber production.

Forest areas in mountainous regions cannot rely on a complete coverage by GSM signals. Remote systems therefore have to be designed for both online and offline capabilities.





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HOLMES

GNSS based forest logistic management

Covering forest logistics enhanced by satellite-based navigation, the project aimed at developing a closed logistic system for wood industry based on satellite navigation technologies; optimisation of the dispositional and administrative tasks was the objective. The service incorporates the most advanced applications of satellite navigation, Geographical Information Systems (GIS) in combination with wireless communication links. The added value chain developed within the project consists of four main parts: maintenance of forest specific local maps, data acquisition of storage places and stock, satellite-based guidance of vehicles to the storage places, and automatic order and delivery preparation. The main task within the project was the development of a navigation system for data acquisition and guidance of vehicles primary based on Global Navigation Satellite Systems (GNSS) like GPS/GLONASS/EGNOS and the future GALILEO. In case of loss of the satellite signal dead reckoning and data of autonomous sensors bridge these outages even in topographically difficult locations. The innovative advantages of the project are the reduced amount of mobile data, the less complicated documentation of the whole wood harvest process, and the visualisation and georeference of the added value supply chain so that an efficient disposal and guidance of trucks is enabled. Thereby the efficiency and accuracy are improved and the costs decrease.

Infobox

01.09.2003 – 31.10.2004

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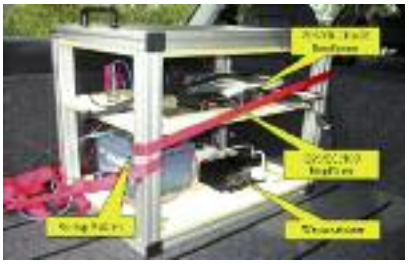

Tourism and Leisure

JOE

MOBILE CITY EXPLORER

TINYGHOST

JOE

JOE – New Possibilities for Intelligent Infotainment

The objective of JOE is to create new possibilities for intelligent infotainment in the area of recreation and tourism by using satellite-navigation based devices. Precisely it deals with animating single persons or groups (people travelling in groups, city tourists, incentive tourists, family vacationers). JOE provides the up to now unique chance for an intelligent, active approach to infotainment including elements of local culture, nature and sights. In addition JOE enables each participant to experience satellite navigation in an intuitive and hands-on way.

JOE covers the conception, development and testing of an open IT-system architecture for satellite navigation based outdoor games – regardless of the type of target group, the game area, transport mode, season or the contents to convey.The players get equipped with mobile terminals that comprise of a GPS-receiver and a GPRS-modem. The game director, keeping permanent contact to the groups via the central server, can flexibly take influence on the game process. The players´ objectives are chosen from a large pool by the director, who can change the process during the game whenever it makes sense to do so. Possible game elements are: simple orientation, exploring the game area with the aim of answering questions concerning local points of interest, games with interaction between the participating players or groups of players and many more.

The core result of the project JOE is the realisation of the system architecture and the demonstration and evaluation of three prototype games using it.

Further Information: www.joe-infotainment.com

Infobox

01.05.2005 – 30.04.2006

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MCE

Mobile City Explorer

The project aimes at developing and demonstrating a pilot system of an intelligent mobile GPS/GALILEO-based travel assistant, which both guides tourists to interesting routes and provides them with information on the sights they see or photograph. The Mobile City Explorer also acts as a multimedia travel diary and thus spares the traveller the onerous task of documenting, cataloguing and editing photos and travel experiences. Users can thus fully concentrate on experiencing and exploring the special features of their environment instead of reading the map or searching for addresses.

R&D activities focus on developing a pilot system of an innovative GPS/GALILEO based value added service for urban tourism, which has a large market potential, demonstrates the benefit of location-based services for the tourism sector and has been tested under real-world conditions.

The pilot system consists of a cameraphone, a GPS/GALILEO receiver and a server for mobile services. Central innovative features of the project include image based object detection, which allows tourist objects captured by the cameraphone to be automatically identified, and the electronic travel guide, which creates thematic routes tailored to the user's interests, supplies targeted information, and reacts adaptively to user movements. A multimedia geo-server provides the tourist with a map of his/her location determined by GPS/GALILEO, enhanced with multimedia tourist information.

The integration platform serves as a central basis for mobile services and is responsible for communication between the systems and components connected as well as for central data storage. The system uses standardised technologies, protocols and interfaces, which enable simple porting and integration of mobile network operators and content partners.

Infobox

01.06.2005 – 31.07.2006

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TinyGHOST

Tiny GPS Hosted Sports Timer

Automated satellite-based time-measurement for professional motor sports, skiing, and public sports events. The project further includes integrated tracking services for search and rescue and tracking of wild-life animals.

While „GPS" for most applications in the world refers to „tracking" and „navigating", another interesting aspect of satellite-based signals is „timing". This project targets at amending time measurement at sports events in general and specifically motor sports and skiing.

Measuring time seems an easy and simple thing to do. Watching sports on TV, we get to know about the many ways to achieve results. Using photoelectric barriers, connecting start and finish by cables, counting units of measure and subtracting two values are always the first basic approaches to most different forms of chronometry. But the traditional way in some cases requires significant efforts for reliable, quick and accurate information. Some events necessitate up to twenty specialists to measure, transmit, score, and finally publish the results.

In contrast TinyGHOST facilitates a solution in a highly automated fashion requiring only a minimum of personal capacity, infrastructure and a fraction of the time to make it run in new environments.

Providing user-friendly intserfaces, establishing quick data-transmission links, building most reliable hardware based on satellite technology and finally simplifying the usage of the complete system are key issues to guarantee a successful product for a broad range of applications. Flexibility and mobility of the equipment requires small, self-contained units including special GPS-modules optimized for highly accurate timing, a high-speed processor for calculating algorithms, GSM for data-transmission and high energy batteries for extended endurance under severe conditions and tough environments.

Infobox

01.05.2005 – 31.07.2006

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Personal Navigation

PONTES

SATSKI

PONTES

Positioning and navigation of visually impaired pedestrians in an urban environment

For outdoor applicability in an urban environment, an overall concept of navigation is adapted to the special needs of blind and visually impaired pedestrians. The development aims at a prototype of a navigation system which covers the total spectrum of specific components. This comprises an appropriate modeling and mapping of the navigational environment, a complete acquisition and efficient storage of relevant geodata, effective routing algorithms generating lists of maneuvers, accurate positioning methods, a reliable map matching of the trajectory for route checking, an adequate generation of guidance instructions, and suitable man-machine communication devices.

Initial specification of the geodata, especially thematic ones, is performed by the assistance of blind persons. This is to gsuarantee that the system is able to compensate parts of the user's handicap by imitating spatial cognition and reasoning of the visually impaired human being. In the same sense the routing algorithm will compute the safest route from the starting point to the desired destination, rather than the shortest or fastest. Position determination uses an integrated concept of satellite-based positioning (GPS or DGPS) and dead reckoning (compass, step detection) accomplished by a position processing software using Kalman filtering. Dead reckoning bridges GPS data gaps typically occurring in an urban environment. In opposition to sighted pedestrians, the visually impaired is strictly stuck to a line-based movement. Therefore the map-matching procedure transforms the position to a location relative to the elements of the modelled path on the digital map. Along this route, the user is acoustically supplied with adequate maneuver instructions including warnings of obstacles and off-route situations.

Infobox

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SATSKI

Sensor-based GPS as a tool to analyse the performance of professional ski racers

During the last few years alpine ski racing has evolved into a high performance sport with extremely small time differences between the racers, where sometimes just one hundredth of a second decides over winning or losing. Before the contest it is extremely important to analyse the test runs of the athletes under consideration of the slope and the material in order to optimise the results in the race. A major analyse method therefore is the determination of the line of a ski racer, and also of velocities and accelerations along the trajectory. Currently, the Austrian Ski Federation uses simple time measurements and videotapes to analyse the trajectory. With these methods only parts of the wanted parameters can be detected with just low accuracy. Adequate measurement instruments for determining those parameters with satisfying accuracy are missing. In the future modern technologies based on satellite positioning and navigation can change this. Therefore the objective is an analysis tool that provides the Austrian Ski Federation with the possibility to increase the performance of its racers, but also to study the physical robustness of the human body, and take counteractive measures if necessary.

The first phase of the project will elaborate detailed user requirements for an analysis tool. The second phase will mainly deal with the determination of the parameters defined in the previous phase. The measurement system will be based on GPS and autonomous sensors. The adequate choice of the hardware concerning weight and dimension, and also the mounting of the mobile equipment onto the skier will play an important role. Finally, it will be possible to analyse the extracted measurement data in terms of fastest times, highest velocities and accelerations, etc. TeleConsult Austria will be responsible both for the choice of the hardware and the development of the software.

Infobox

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Search and Rescue Services

GO.HIKING

GUSTAV

go.hiking

Web-based Service Platform for Monitoring and Maintenance of Alpine Hiking Infrastructure, Search&Rescue Spatial Knowledge Base and Info-Desk for Hikers

SatNav devices have been available for mountaineers for a long time. If someone plans a hiking tour, they will look for web-maps showing the region of interest, they want to investigate, the actual state of trails or paths, degree of difficulty, height differences, duration, public transport information, local weather forecast, etc. The most critical content within this list is the state of paths; the rest is somehow linked to commercials. go.hiking will concentrate on the state of paths, on hiking infrastructure. In general, hiking trails, paths and mountaineering infrastructure are maintained by non-profit organisations (alpine clubs, etc). They check the trails, the bridges, gutters, guard-rails, sign-posts, safety ropes, and marks.

To obtain geo-referenced data on the objects including their properties, the path-guards will enhance their workflow using mobile SatNav/GIS-devices and digi-cams. Additionally, in order to get up to date information of the state of paths, the feedback of mountaineers from their tour experiences is of course welcome. An attractive hiking portal should encourage people to post their notices after a tour.

go.hiking is a prototype of a web-based platform serving the following three different user groups. The platform is meant to create synergy effects between all three user groups:

- Path guides can react quickly on notices of damage, prioritise their maintenance measures and thus reduce risk for moutaineers; their mostly unpayed work will profit by enhanced efficiency.
- Mountaineers will benefit from geo-referenced content and maps, they will take advantage by the exchange of geo-coded information.
- Mountain search&rescue organisations as a separate user group can maintain and share their special experience and know-how by geo-coding their local knowledge.

Infobox

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GUSTAV

Mobile Documentation and Online-Management of Catastrophic Events

The aim of GUSTAV is to develop a prototypical system – splatform as a basic information server used in case of natural catastrophically events. New tools will be created and tested. GUSTAV focuses on information about events and their consequential actions. By the use of GPS accuracy and reliability of given information, especial in spatial dimensions, should be warranted. The following proceedings of catastrophic management are supported by GUSTAV:

Registration on the spot	Event declaration, damage declaration
Local support	Current information: • about the event • about attributes
Event handling	Subsequent invoices respectively local information queries as a basic for: • analysis and reconstruction • commission of damage

The following technical components are used by GUSTAV:

- A server to provide and store data, to validate event based notices, to allocate information in a cartographical environment and to integrate different web services
- Client components via portable terminal, cartography – user profiles, use of existing expert – knowledge
- Communication via GPS as well as checking and verification of alternative communication tools in case of natural catastrophically events
- Spatial location by the use of GPS for event documentation (detection of the event, detection of damage, measuring points) and user information (fire brigades, police, civil service)
- Legal restrictions
- Cost effectiveness and potential of realisation
- Alternatives of communications
- Adoption and external information sources

Infobox

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