

A PRACTICAL APPLICATION OF EGNOS AND GALILEO : THE ADVANTIS PROJECT

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ABSTRACT

The paper presents a project currently undertaken by a consortium under contract with the Galileo Joint Undertaking, whose aim is twofold:

- to demonstrate the capacity to generate revenues for the EGNOS Operator, and later on, the Galileo Operating Company (GOC), and
- to provide a “Centralised, Integrity Guaranteed Localisation Service“, as an answer to the needs posed by applications based on satellite navigation, where *integrity* of the positioning and/or timing is essential.

The paper will provide some background about Galileo, describe the project, and outline some of the legal questions arising in its context.

INTRODUCTION

This is not what I would call an “academic paper”, performing a legal analysis of a certain space law topic. Rather, the paper aims to *inform* space lawyers about a project that tries to solve some everyday problems, using a practical application of space technology, namely satellite navigation.

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Of course it is important to tackle legal questions and analyse complex theoretical scenarios, but sometimes the lack of “real life” usefulness of these questions can be a bit frustrating... This paper will therefore not deal with the space treaties, but will in a more general way demonstrate how space technology can be used for the benefit of all mankind. It will do this by describing the “ADvantis Project”, which was the first contract awarded in February 2004 by the Galileo Joint Undertaking (GJU), set up by ESA and the EC to manage Europe’s global satellite navigation system, Galileo, to a consortium of 10 European companies. Of course I will also focus on some of the legal work carried out under that contract, in which I am involved. But first, a short overview of the Galileo programme and how it is managed will be given.

GALILEO

Just a little background information for those who are not familiar with Galileo: it is Europe’s global navigation satellite system, providing highly accurate, guaranteed global positioning service under civilian control. It is an initiative launched by the European Union (EU) and the European Space Agency (ESA), and will be *interoperable* with GPS and GLONASS. Thus, Galileo aims at complementarity, not competition. The coordinated use of both infrastructures offers greater precision and greater security (95% urban coverage vs 55% with GPS alone). Users will receive both GPS and Galileo signals on the same receiver.

Galileo is being introduced in 4 phases:

- (a) Definition phase (2000-2002, Phase A/B): Definition of the system requirements;
- (b) Development and Validation phase (2003-2005, Phase C/D): Consolidation of Mission Requirements; Development of satellites and ground-based components; Validation of the system "in orbit";
- (c) Deployment phase (2006-2007): Construction and launch of satellites; Installation of the complete ground segment, and
- (d) Commercial operation phase (from 2008).

ESA and the EU, through its European Commission (EC), are the key institutions managing the Galileo programme. They are involved in Galileo's *political* as well as *technical* definition.

ESA is the main player for the *Development and Validation* of the Galileo space and ground segments. Within ESA, Galileo is managed by the Programme Board for Navigation, "PB Nav". It is through this organ that ESA member states participate in Galileo, in accordance with a pre-determined distribution scheme.

The EU is in charge of the supervision and control of any *non-purely technical issues* related to Galileo – i.e. financial, budgetary, legal and organisational issues. At EU level, Galileo falls under the responsibility of "DG Tren" (Transport and Energy), which provides the EC financing for the development of Galileo. The EU also funds Galileo R&D through its 6th Framework Programme for Research and Development (6FPRD), managed by the Galileo Joint Undertaking.

The Galileo Joint Undertaking (GJU), set up in May 2003 by the EC and ESA, has a major role in the industrial and technical development of satellites, receivers,

integrity segments, ground segments, regional and local components. But it will also manage non-technical aspects, such as market definition and analyses, liability, service definition, standard and certification processes. Another major task is the selection of a Concession Holder (Operator). The GJU is based in Brussels, and has been operational since 1 September 2003.

ADVANTIS

"ADvantis" is the name of a project financed under the "First Call" of the 6th Framework Programme for Research and Development (6FPRD) for Galileo, under a contract awarded by the GJU in February 2004. This was, in fact, the very first contract signed by the GJU, spanning a 2-year period until February 2006. The project is carried out by a Consortium led by a Spanish company, GMV Sistemas, and consisting of 9 other companies in various European states, for one of which I worked (Aon Explorer).

ADvantis will define a centralised system, and associated business model, to provide final users with multiple, liability-critical, integrity guaranteed position services using single mobile equipment. The system is based on the enhanced service provided by EGNOS and Galileo. It is a "Centralised, Integrity Guaranteed Localisation Service", that provides an answer to the needs posed by applications based on satellite navigation where *integrity* of the positioning and/or timing is essential.

Objective

One of the most important objectives of the project is the development of a new integrity concept, and associated algorithm, for liability critical applications, the "ADvantis Integrity Concept".

ADvantis aims at exploiting the quality guarantee that EGNOS and Galileo will provide, as opposed to GPS, making a reality those services that are only viable with this kind of guarantee, and to offer these and other services through the same equipment.

The objective is being realized in 2 parallel stages:

- the definition of the *system*, including user needs and system requirements, and
- the definition, design and implementation of a *prototype*, including a *demonstration* to validate the concept.

Value of integrity and “liability-critical” applications

GNSS applications have found typically two types of applications:

- Applications where GNSS answers the question *where am I?* or *where is it?* and
- Applications where GNSS answers the question *where was I?* or *where was it?*

It is within this first type of real-time applications that *Integrity* has become critical, because of safety of life considerations. In applications like aircraft navigation or air traffic control it is vital to know that each particular navigation data is within expected error limits, this is what integrity means. This is a clear field for which EGNOS and Galileo are enabling factors. However, the range of real-time safety critical applications within the overall scenario of GNSS applications and its market, although important for their impact, is rather small in economic figures.

The key question for ADvantis therefore is: for what other, non- safety-critical GNSS applications is the Integrity of GNSS-derived information critical?

- When the GNSS information is used to resolve *liability and legal* issues (the liability flows from a law or regulation, and the parties involved are a legal body and the individuals or organisations subject to it), or
- When it is used for *billing or commercial* issues (the liability flows from a commercial *contract* between two parties).

In both cases, besides having a GNSS service that meets certain availability and accuracy statistical requirements, it is necessary that each particular GNSS data lies within known error limits, so that it can be used as *evidence* to solve disputes, legal or economic. This is why we have called these applications “liability critical”.

Potential clients

The potential clients of the system are:

(1) Local Government

Public Authorities responsible for the mobility of individuals and goods within major European cities are increasingly concerned with problems such as economic inefficiency, congestion, pollution. There is an increasing interest for the application of traffic restrictive measures or Urban Congestion Charging Systems. A clear example is the London System introduced in 2003. Obviously, a system like Advantis that is even more efficient, that provides evidence in case of claims and that allows charging vehicles with a fee that could depend on the metropolitan zone they drive, the season, the day of the week, the time of the day and the travelled distance or even dependant on the time being within the zone, and that in addition to all this do not necessitate complex and expensive infrastructure, would enable efficient application of urban policies.

(2) Road Transport sector, e.g. road tolling companies, fleet operators

Road transport has undeniable socio-economic benefits, indeed the weight of the road transport sector within the economy is considerable, not only in quantitative terms (tons transported) but also in economic terms such as source of wealth, employment and in terms of support given to other economic activities. Nevertheless there are a number of problems such as congestion, delays, accidents, and pollution, which EGNOS and Galileo, in combination with a service such as ADvantis, could help tackle. An important issue nowadays is the interoperability among different tolling systems around the EU; for this, the Galileo system is the key. It can substantially improve road safety, guarantee the provision of better traffic information, help to achieve greater accuracy leading to time savings, reduction of economic losses, improvement of comfort, reduction of stress., and improve fleet management, to mention a few.

(3) Insurance Companies

ADvantis technology will be able to provide critical data to insurance companies such as precise positioning of the vehicle, location and driving behaviour in real-time. In return, companies or individuals subscribing to the ADvantis services could get cheaper insurance fares as well as augmented services such as precise navigation on "statistically safe" roads. This kind of service would also ensure safer trips, as the ADvantis system, following the vehicle in real-time, could detect an accident and send rescue teams automatically. The insurance companies would in turn find another benefit from the system, as claim procedures would be much simplified and would then cut their costs dramatically.

(4) Transport Regulators

There is a clear trend in the EU towards the harmonization of Transport Policy under a single EU legislation. The intended European Transport Policy for 2010 is identified and analysed in the "White Paper on European Transport Policy for 2010: Time to Decide"

From this policy two elements are of special relevance:

- Policy to increase safety of transport.
- Policy towards gradual charging for the use of infrastructure, towards more sophisticated and hence more equitable ways to charge.

This new Transport scenario opens, no doubt, the door for the use of EGNOS and Galileo and a system like Advantis as an enabler for achieving the mentioned objectives.

(5) Justice / Police

Society is showing a growing interest in legal measures leading to better protection of for instance mistreated women and children. Social pressure encourages governments to adopt measures to solve this problem. A legal zone restriction for an individual found guilty of mistreatment is usually established, and a major requirement that can be foreseen is the necessity that position data used to prosecute an offender can be used as legal evidence; that is where ADvantis can help. Probation Custody is another possible area for ADvantis. A system that could substantially reduce costs, improve security of citizens and improve quality of life of individuals out on probation is necessary. The offender would wear an ankle bracelet containing a GNSS receiver and communications terminal, the receiver will provide the position and the communications terminal will relay the position to a control centre, where the positions are logged. Using a GNSS based

system allows the financial burden of keeping offenders in prisons to be dramatically reduced.

Identified services

After studying the potential applications and users needs, seven sets of potential services were identified by the Consortium on which the further study would concentrate:

1. Commercial Fleet Management Service
2. Dangerous Transports Service
3. Charge Systems Service
4. Surveillance Service
5. Velocity Control Service
6. Statistical Data Service
7. Generic Service.

ADvantis Club

In order to realise this new service, the idea is to set up an "ADvantis Club", linking single terminal equipped mobile agents with multiple clients, i.e. companies and organisations that exploit localisation data to offer multiple services.

This "ADvantis Club" will serve as a revenue collector for the EGNOS and Galileo Operator, generated from contracts established with ADvantis Customers. ADvantis can thus become a major enabler that justifies the commercial feasibility of Galileo.

The company exploiting the ADvantis service is expected to have two main types of customers:

- *Mobile Agents*: individuals, car owners, or fleet managers who want to have access to the services provided by third companies/organisations, and
- *Clients*: the third companies or organisations that use the localisation data of the car owners or individuals. They will be ready to pay for these data as an efficient

way (not requiring dedicated infrastructure) to either charge on the use of the provided service or for monitoring and control purposes.

System architecture

The provision of ADvantis services will require certain supporting infrastructure involving the following elements:

- *GCLSI*, Global Centre of Localisation Services with Integrity Guarantee, where localisation data of all different units is centralized and where integrity and privacy of this data is ensured. This is the *only physical asset* of the company providing the ADvantis service.
- *OBU*, On Board Unit, that will implement EGNOS and Galileo receivers together with specific data processing and communications capabilities as required by the ADvantis services.
- *Communication links* will be based on external service providers (GPRS/UMTS, for the link GCLSI-OBUs, and internet/dedicated lines for the link GCLSI-ADvantis Clients).

Trials

The two key concepts of the system, data concentration and ADvantis Integrity, will be validated by the implementation of an ADvantis *prototype* and the execution of a relevant set of *trials*, the results of which will be analysed in a public workshop in December 2005. The prototype will bring real experience in a number of aspects, and will demonstrate the (commercial) feasibility of the potential applications.

The following applications were selected for the trials:

- (1) Integrated Urban Traffic Management (as part of the Charge Systems Service)
- (2) Legal Zone Restriction for individuals (as part of the Surveillance Service).

(1) Integrated urban traffic management

The aim of this trial is to demonstrate the technological feasibility of managing traffic issues with ADvantis.

Some of the charging options that can be realized are:

- Real-time congestion charging, the tax varies with the congestion levels found in the restricted area at that time.
- Time based charging, the charge levied is proportional to the amount of the time spent inside the area covered by the charging schema.
- Distance based charging, the charge is directly related to the distance travelled within or along the specified area.
- Cordon pricing, a charge is applied just for entering the restricted zone.
- Area licensing, a charge made for the permit needed to enter a restricted area during specified times of day which generally can be used as many times as desired during the duration.

The user can choose between two payment modalities:

- Go to any control point and pay the quote every time he enters the restricted area or parks in a restricted area, or
- Contract ADvantis services. Payment is automatically charged every month. The system automatically detects when the user enters and exits the area, computing the parking time, or the time that the vehicle has been in the restricted area, and the associated fee.

(2) Legal zone restriction for individuals

This trial will use GNSS technology to assess the reliability and suitability of a guaranteed location service for this novel application, which has large social benefits. If proven successful, the exploitation potential is very high. Due to the clear legal implications, this service must be able to guarantee the integrity of the positioning.

The system could check that a particular “user” does not leave the assigned restricted area. This approach can be applied to people in prison. It might be possible to release on parole some prisoners under the condition of not leaving a defined area. The prisoner should assume the commitment of “wearing” a personal receiver. This can improve re-insertion perspectives for offenders.

The system can also assure that a certain individual does not access a particular restricted area. When an individual is found guilty of mistreatment, the court usually defines an area around the victim’s house where access is not allowed. When the individual enters the restricted zone, an alarm is generated and transmitted to the Police station nearest to the position. Automatic warning messages can be sent to the nearest station, and there will be manual or automatic mechanisms to ask for the position of the user at any time.

LEGAL ISSUES

The development of ADvantis applications will of course occur in a regulated environment and will pose legal questions.

In general, it is important to keep in mind the following considerations which may influence legal issues:

- Distinction between European law and National law. No harmonised internal market exists for most of the applications, and as a consequence, the national laws of

25 EU Member States would need to be analysed. It may be wise to set up an EU-wide network of national law experts to analyse all 25 EU legislations. Moreover, similar harmonisation initiatives within the WTO or OECD may be required to be able to include countries outside the EU in the service area.

- Distinction between Common law and Civil law. Although both are basically different, a certain convergence can be observed, and aspects of both can be found in EU legislation. Moreover, both systems contain elements that may be important for the target applications: the flexibility of Common law and the legal certainty of Civil law. It is important to keep this convergence in mind, as it will also influence future EU/ national law-making.

- Trend to protect the weakest party: There is a clear trend in national law to favour protection of third parties in good faith, and this applies also to EC developments.

Below are a few examples of legal disciplines relevant for ADvantis.

GNSS-dedicated law

Regarding the current legal and regulatory framework for GNSS service provision, there is as yet little specific GNSS-dedicated law, although of course there is a lot of relevant law both at the international level, EC level and national level. In addition, it may well be that in the future some kind of global GNSS regulatory framework (GNSS Convention) will be set up, and that will have consequences for ADvantis. It is thus important to follow the developments in this area closely, even though they are sometimes seen as "too remote" by the system designers.

Transport law

One legal area that will be on the forefront is transport law, in particular EC Transport

Policy contained in the abovementioned White Paper. Several Directives are also directly relevant for ADvantis, such as Directive 99/62/EC (1999) laying down rules defining the conditions under which user charges ("Eurovignette") and tolls may be applied, and the proposed EFC Directive (Electronic Fee Collection). As yet, no dedicated legal and regulatory framework for the road transport sector exists. In the near future, however, regulation may be expected to develop along a few lines. From this perspective the TEN's-concept (Trans-European networks), certification of relevant hardware, and licensing are likely to be dealt with in the near future.

Telecommunications law

With respect to the telecommunications sector, Galileo-specific regulation will likely develop framing the use of Galileo signals and services by value-added service providers and end-users. Thus, EC law will work towards achieving a more harmonised legal and regulatory environment in such areas as licensing and certification. Again, it is necessary that legal developments are closely monitored.

Contract law

The freedom to contract principally leaves ADvantis at liberty to negotiate deals on liability or any other contractual obligations as it sees fit with its customers, the value-added service providers. But it should follow the developments regarding the Galileo Concession currently being negotiated, in particular as they may result in absolute or relative requirements downstream in the contracts with ADvantis that ADvantis in turn may wish to deal with in appropriate manner in its contracts with its customers.

Despite the basic freedom of contract, a number of issues important for contracts between ADvantis and its customers

should find their way into the contracts by means of service guarantees, clauses allocating responsibility for violations of the law, and liability for damage.

Some legal issues to be addressed are:

Privacy and data protection

EC law is extensive, and harmonisation is well on the way. Member states do not offer the same level of protection of the rights and freedoms of individuals, notably the right to privacy, which may prevent the transfer of personal data from the territory of a member state to that of another member state or a non-member state. Therefore it is important to analyse the current regulatory framework regarding data privacy. Several important EC Directives exist in this area, such as Directive 95/46/EC which requires Member States to ensure the rights and freedoms of natural persons with regard to the processing of personal data, and in particular their right to privacy, in order to ensure the free flow of personal data in the Community. Directive 97/66/EC translated the principles of the former into specific rules for the telecommunications sector.

Applicable criminal law

Criminal law is not (yet) harmonised between EU states, and national law rules with little restrictions under EC law.

Human rights

Some 'harmonisation' is achieved in the framework of the ECHR, but it has only limited capacity to handle cases, various hurdles must be taken before a claim can be brought, and thus national legislation still plays a very important role.

Liability Issues

Contractual liability, non-contractual liability, product liability, they all play a role for ADvantis. The operator may be committed to respect a certain level of service, either contractually or non-contractually (for instance when he is

bound by a law or regulation), and by offering guarantees, he promises to deliver services of a certain performance and to accept contractual liabilities up to a certain level in case of failure to meet those guarantees. Liability arrangements handle cases where, in spite of the integrity guarantees, end-users, consumers or third party-victims suffer damage. In the absence so far of applicable international or EC law, one should yet again look at the national law-level. But there as well, little if anything has been provided in terms of law with a clear focus on satellite navigation integrity issues.

Non-contractual liability may play a role in the field of service provision, and so may product liability as a special version thereof, focused on products. No European legal regime exists dealing with this type of liability. As a consequence, again, analysis of the national regimes of the 25 EU member states would be due.

As to product liability, it is not very clear whether the service to be provided by ADvantis may be considered as a product, but, under the EC Directive on Product Liability, it will be difficult to entirely discard the possibility of courts considering the entire service package as a product, and hence holding ADvantis liable also under product liability.

Of course, liability for economic loss and liability for accidents, in particular third-party damage need to be addressed.

CONCLUSION

I hope that the above has given some insight into how space lawyers can use their skills to help realise an application of space technology of benefit to all mankind.

For information on ADvantis, please visit www.galileo-advantis.com