

GALILEO: A CORNERSTONE OF THE EUROPEAN SPACE EFFORT

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The current focus of the European space effort is Galileo, a more than 3 Billion Euro navigation satellite system that will allow any user to know his or her location with precision accuracy in any part of the world. In this respect, Galileo resembles largely the U.S. Global Positioning System (GPS) that already provide such information to its users worldwide. During the last months, the debate has heated up between the two sides of the Atlantic on the necessity for Europe to build such a system. In fact, these debates are older than their recent high profiles seem to indicate.

Program Roots: A Structured European Effort to Gain a Better Control on Strategic Information

The idea of European autonomy in the field of satellite navigation systems matured in the mid-90s. In 1995, the first phase of a large programme dubbed GNSS (Global Navigation Satellite System) was launched in *Europe (European Global Navigation Overlay System, or EGNOS/GNSS-1)* to draw on the performance provided by existing national systems (at the time the U.S. GPS and the Russian *Glonass*). Its initial function was to check the integrity of the data transmitted by the American and Russian satellites. This idea, managed by a tripartite entity composed by the European Space Agency, the European Commission and Eurocontrol, was designed to make sure that European users of the existing systems would be able to rely on those systems for their own use, and included a guarantee to detect any malfunction or defects in the systems. This first GNSS-1 system was based on the augmentation provided by specific payloads embarked on 3 geostationary satellites (two Inmarsat satellites and the ARTEMIS satellite) and is required to allow for the EGNOS program to be up and running in 2004¹.

Clearly, at the time the objective had already been defined to make Europe part of the precision location related activities with the ability to master this particular technology to the fullest extent². A number of studies had been published at the time demonstrating the extent to which those systems would become the backbone of a totally new activity with a wide array of possible uses in the market sector³. These perspectives clearly showed how important it was for Europe to be a major actor in this area, both for political reasons - depending upon a foreign MoD system for strategic applications was not without political significance if Europe was serious about becoming a major power - and for industrial and commercial reasons. From the start a second stage of GNSS was envisioned, GNSS-2, which was expected to provide Europe with a fully autonomous system based on a satellite constellation that would ultimately become Galileo. From the European perspective, the two principles behind the system proposed to support GNSS-2 were: 1) the satisfaction of the requirements in precision, availability and reliability compatible with life saving activities, and 2) ensuring that the management of the system would be administered by a completely independent civilian and multinational structure with a clear responsibility and liability for any service disruption.

After a number of differences of opinion between its Member States were reconciled, Europe confirmed this position through a High Level Group position expressed in 1997, while a European Commission document dated January 1998 defined all the action to be undertaken⁴. The document stated GNSS-2 would consist of a fully implemented EGNOS system starting in 2004 and would build on a the new Galileo space constellation composed of 30 satellites orbiting at 24,000 km and covering the entire surface of the earth with a network of ground control stations for a global estimated cost of between EURO 3,2 and 3,4 billion⁵. The global Galileo system would be deployed by 2008, which would require Europe to emit experimental signals by 2004 on the various frequency bands used. In order to maintain the frequency allocations granted during the difficult negotiations of the May 2000 International Telecommunication Union (ITU) World Radiocommunication Conference, it would be necessary to deploy the first operational satellite before February 13, 2006. For this reason a piggyback test bed payload is slated for launch in 2004. Until 2005, Galileo would be managed by a public/private entity for the so-called "Demonstration and Validation phase".

The structuring effort has been organized according to a "Targeted Action" launched by the commission in December 2000 under the auspices of the 5th Framework program. This specific action taken by the EC had of identifying the different necessary procedures necessary for implementation (defined by domains such as Local element definition, Interoperability, Frequency, standardization and certification, Pilot projects, and Legal and regulatory aspects) and, to involve industry in the program financing structure by defining in advance the role and the share of the satellite manufacturers, of the service suppliers and the system users. This EC action has materialized through several pilot projects now underway that deal with, for example, dangerous goods mobility (NAUPLIOS), infomobility safety critical application (INSTANT), railway operation system (GADEROS) or user tool for market analysis (POLARIS). In another domain, the European Commission has already made contacts with third states in order to develop the interests manifested by these countries to participate in the Galileo system in one form or another⁶.

The Context of the Galileo Development

Two structural features must be underscored for the Galileo program. First, as summarized above, the GNSS initiative has been managed from the start at the European level, involving the European Space Agency and the European Union. As such, Galileo is perceived as an important step by the European institutions themselves in building their relationships with the European Member States. In many respects, Galileo can be considered as a "premiere" as far as European institutional life is concerned. Even if the multi-dimensional nature and the complexity of political Europe is often underestimated in the United States, it has appeared as a main driving and structuring force behind the program. Another striking feature has to do with the civilian dimension of the project that clearly legitimises Galileo in the eyes of the Europeans, as it goes beyond the military-only controlled nature of the American GPS. In particular, current restriction of access to users worldwide⁷ has been perceived as a severe limitation in the free use of the GPS, as has the potential (even if improbable) voluntary disruption or degradation of the GPS signal.

A European Effort to Enroll the Industry

At the European level, such characteristics have been considered serious limitations in the free use of the GPS, especially as the European institutions had in mind the industrial and commercial applications from the start and desired to make them the primary justification for the program. Then again, two goals can be mentioned: first, to allow the European service industry to expand and second, to make this industry a crucial part of the building of a new European wide activity. Clearly, the fact that the DoD was controlling the GPS system, even after the White House decided in 1995 that any user would have access to the military quality service, has had a negative effect with an anticipated reluctance on the part of industry to invest massively at the European level in services depending on a DoD proprietary system.

Moreover, the massive legal presence of the U.S. firms on the GPS-related services market were viewed in any case as a strongly limiting factor for European industry. The figures at stake and their constant revisions were judged convincing enough to propose an autonomous system that would in return make the industries more willing to invest in it. In 1999 for example, a first market analysis reported by the Commission indicated:

The stakes are both economic and industrial. In particular, with a potential global market valued at EUR 40 thousand million between now and 2005, the challenge is to capture a fair share of the satellite navigation market as well as the jobs which flow from it. The current estimates are as follows: the development of the Galileo infrastructure would generate 20,000 jobs, while its operation would create 2,000 permanent jobs, not including opportunities in the field of applications⁹.

In a more recent communication, the Directorate general Energy and Transport from the European Commission announced that:

According to various studies that have been conducted, the equipment and services market resulting from the programme is estimated at around EURO 10 billion per annum, with the creation of over

100,000 highly-skilled jobs; conversely, if Europe misses out these new developments, many jobs would ultimately disappear in the electronics and aerospace sectors¹⁰.

Lastly and importantly as far as the desirability of the project for industry was to be considered, a study led by the private consultancy firm Pricewaterhouse Coopers and based on updated projections over a period of 20 years, indicated a cost/benefit ratio of 4:6, "which is higher than for any other infrastructure project in Europe," as noted by the EC¹¹.

As a result, the civilian and commercial aspects of GNSS and Galileo have been increasingly stressed, thereby confirming the implications of the tripartite EU-ESA-Eurocontrol body in the management of the program. Both this early involvement of the European institutions and the ambiguity of the public/private arrangement may explain the bulk of the troubles Galileo has had to face recently from the financing standpoint. The financial scheme (called *Public Private Partnership* or PPP) envisioned by the steering institutions quoted above was based on successive public and private financing phases, implying some degree of return on investment through the commercialisation of services by private entities.

At the cost of some adjustments, especially concerning the financial burden put on commercial entities, this system may have now found its balance. Public money would take the form of a European Commission payment of roughly one-third of the amount with private participation covering the other two-thirds. In spring 2001, 15 firms signed a memorandum of Understanding (MoU) aimed at achieving a combined private sector contribution of EURO 200 million for the "Development and Validation Phase," i.e. until 2005. A Galileo *Joint Undertaking* based on article 171 of the European Community Treaty was adopted by the Commission in June 2001 in order to create a single management and financing structure for the programme between 2002 and 2005. A few aspects of the arrangements were particularly carefully watched, among which included mechanisms to avoid conflicts of interests that were the condition for the private-sector participation. At the same time, as seen from the ESA, competitiveness must remain a key word for the undertaking.

Already, two main industrial groups have been formed and compete at the European level. One group, Galileo Industries, gathers British, French, Italian and Spanish firms around a core team composed by Alcatel Space, Alenia Spazio and Astrium. Another group, Thales Navigation, is built around the giant European electronic firm Thales, and is born from the successive mergers of mid-sized French specialized electronic firms¹². Budget decisions were made last March authorizing the building of a first payload and its launch in 2004 with an associated contract that may be signed later this year in December. For the time being, all the problems related to the Galileo budgeting calendar regarding the rest of the program are not solved yet. On its side, industry is still considering very cautiously the quite unusual nature of the early investments it has to make and is urging the European public entities to provide more insurance and more details on the future budgets as well as for the first four satellites and the rest of the space and ground segment.

The European Institutions/Member States Relationship Issue

The enrolment of Galileo in the "Aerospace" account of the 6th *Framework Programme*¹³ may have had the indirect effect of reinforcing the "civilian" only identification of Galileo. Today, Galileo could even be considered as an element of global aerospace expenditures, which are themselves confronted with competition from other transport budget items. As can be judged by what happened at the end of 2001, this particular position has had negative side effects for the program, implying a global, even if implicit, reassessment of the "sovereignty" or political dimension embedded in it. This reassessment has been highlighted by the hesitations noted in Laeken in December 2001, when the Transportation Ministers proved unable to agree on the amount of the public financing of Galileo, while its principle had been approved three months earlier in Edinburgh during the ESA Summit.

In many respects, this "non-decision" has brought out a somewhat frail political support for the program on the part of the Member States, much beyond the usual bureaucratic resistances manifested by financially careful ministries towards a more than 3 billion Euro program. High profile personalities, rather than states representatives, have had to press the importance of a positive vote for Galileo and to underscore the damage that could have been caused by Europe's hesitations. Carl Bildt, the former Swedish Prime Minister, has blamed "the inability of successive Swedish and Belgian

presidencies of the European Union to resolve fully the issues around the Galileo Project", explaining that "the urgent need to begin dialogue with the U.S. on this issue, has highlighted Europe's lack of coherent policy and an effective decision making structure." As an addition to this severe judgement, Loyola de Palacio, European Transport and Energy Commissioner, declared at the time that "what we are lacking is a decision by the Governments of the European Union. The problem is not one of cost, but of [politics]."¹⁴

This need for a "political transcription" of the utility of Galileo for Europe has been somewhat confirmed by the mild position adopted by countries usually judged as the warmest supporters of Galileo. Member States, and more particularly the Ministries of defense, have adopted quite a low profile, appearing more as spectators rather than as primary actors. They were hardly in a position to directly support Galileo, judged as it was a civilian program from A to Z, i.e. both at its inception and in its main ultimate goals. Again, the military expressed its point of view in a very measured approach. In particular, the then French Ministry of Defence, Alain Richard, when interviewed by the *International Herald Tribune* in January 2002, indicated that "he saw no compelling military case for Europe to launch its own fleet of satellites to match the GPS network already in space," according to the IHT¹⁵. Besides expressing a traditional military posture which insists on the operational character of GPS¹⁶, this position has also revealed how far a European programme can be perceived as drifting away from concrete national considerations, with, as a consequence, a particular difficulty in transforming the idea of "European sovereignty" into an effective driving force in the national contexts.

European military choices are always made in the context of very tight national defence budgets. Space expenditures have never ranked very high on their priority list, except in the case of strictly controlled programs related to national sovereignty like the reconnaissance satellite program Helios, for example. But precisely, the link traditionally made between the notion of sovereignty and the Nation-State concept is obviously put into question by projects such as Galileo. This programme requires a great deal of political work to enlarge the sovereignty idea. At the same time, it requires an equal amount of effort to make the military and civilian technologies and (last but not least) the uses and procedures to converge. It must be noted that the Commission in its latest communications takes care not to put aside the military dimension of Galileo:

And last but not least, Galileo will underpin the common European defence policy that the Member States have decided to establish. There is no question here of coming into conflict with the United States which is and will remain our ally, but simply a question of putting an end to a situation of dependence. If the EU finds it necessary to undertake a security mission that the US does not consider to be in its interest, it will be impotent unless it has the satellite navigation technology that is now indispensable. Although designed primarily for civilian applications, Galileo will also give the EU a military capability.¹⁷

Obviously, attaining balance on this subject is a delicate matter in the European institutional context. By posing the question of the military use of Galileo at the end of 2001, the United States connected directly the project to the traditional Achilles' Heel of the European construction process. Reflecting either a subtle diplomatic manoeuvre or real preoccupations, the message sent to the Europeans by the Deputy secretary of Defense, Paul Wolfowitz, in a letter dated December 1st, 2001, citing potential interference problems caused by Galileo to the GPS system and worries about the secure military use of the system in the context of a European framework, has been devastating enough to break the European consensus at the Laeken Summit mentioned above.

Significantly, the strongest reactions to what was considered as American pressure to sink the project came from the European institutions. For example, Antonio Rodota, the Head of the European Space Agency affirmed that he was convinced the United States was aiming at destabilizing Galileo in order to keep a monopoly on satellite navigation activity worldwide. On her side, Loyola de Palacio exhorted the governments to keep their objectives clearly defined so they will be able to set definitively the technical characteristics of the Galileo signal when the next World Radiocommunication Conference takes place in 2003.

The Member States Active Role in the Security Issues

As far as the U.S. security preoccupations were concerned, they were indeed shared by some European Ministries of Defense that insisted the military security aspects would obviously have to be taken into account in the management of the European system. In fact, in full compliance with those security requirements at the member States level, the structure of the service brought by Galileo is based on the existence of several types of services. One of these, the Public Regulated Service (PRS), will rely on a highly secured and precise signal devoted to an array of governmental activities, including, but not limited to, military applications. Other emergency civil security uses or police uses will also be strictly monitored and secured as it is decided at the European level that Galileo would have to provide maximum reliability and security for these kinds of uses. This means that Galileo will not be organized the same way the GPS is, i.e. by nature (along a military uses/civilian uses line), but rather by performance, (according to the precision and the reliability required by type of user). This allows it to include the military uses in a wider category of public only uses, with military standards as minimum requirements, and to allow a control and management structure to be managed directly at the European level. This response to the U.S. authorities was hoped to be sufficient to allay their fears in the security management domain. Moreover, the technical possibility seems to have been successfully demonstrated that the Galileo signal would not interfere with GPS. Moreover, the choice of frequencies close to those used by the GPS (so called L5 -EA5 - and L1 bands) has even proven to be a prerequisite in the eyes of the ministries of Defense of the member States who insisted at the European level on the fact that Galileo would have to be interoperable with the U.S. system. Currently, it is estimated that the cost associated with the development of this particular signal would cost 150 EURO millions over 8 years.

Galileo as a Reinforced European Program?

The U.S. questions have thus revealed how much Galileo remains a complex program combining technical and organisational innovations with hopefully economic, but also political benefits for Europe. In some sense, the difficulties brought about by the Wolfowitz letter, followed by the decisive political move in March 2002 of a definitive common decision in favour of the program made by the same ministries that were undecided three months earlier, seem to have cemented the program. Considering the potential military utility of Galileo, the current argument made in the U.S. over the usefulness of expenses that could otherwise be devoted to "filling the military gap" as some U.S. officials put it, may now appear quite incoherent on this side of the Atlantic. In fact, in the European context, the acquisition of such high tech systems is rather seen as reinforcing the ability of the European military to cooperate with the United States in coalition warfare or even to take care of more minor military situations, and then make Europe more responsible for assuming its own share of the burden.

Given this position, the uneasy relationship that has developed about Galileo these last months over the Atlantic may likely be attributed primarily to commercial and economic motivations related to the potential emergence of a genuine European activity. More than that, the sensitivity remains very high in the European Union about a program that symbolizes the efforts made in Brussels to show Europe as a responsible partner and actor, with the ultimate objective being to make it amount to more than the sum of its Member States government decisions.

Footnotes

¹ A first simplified EGNOS version was tested in February 2000.

² It must be noted that some other concurrent effort were already underway in this area of the so-called "augmentation system" like in Japan with the MTSAT (Multifunctional Satellite) Augmentation System or in the US also with the parallel development of the WASS (Wide Area Augmentation System) for civil aviation use in liaison with Canada.

³ One of the most important study was conducted by the U.S. GPS Council in March 1995 that estimated the GPS spin-off at a figure of \$8.5 billion for the year 2000. Some other studies, such as the one conducted around the same time by the private firm Frost and Sullivan, were putting the emphasis on the integration of GPS techniques in "information technologies", thereby opening the perspective of larger future activities for this applications.

⁴ European Commission Communication COM (1998) 29, Towards a Trans-European Positioning and Navigation Network, 21 January 1998.

⁵ "This is equivalent to the cost of building 150 km of semi-urban motorway or a main tunnel for the future high-speed rail link between Lyon and Turin - assuming that the tunnel only has one track" as remarked by the European commission in a recent information note.

⁶ For example, most important to the EC was the setting up of a GNSS working group in May 2001 with Mediterranean partner countries. Similar contacts have been made with Canada, Norway, Israel, Czech republic, Ukraine, Japan, Australia and African authorities. Last but not least, Galileo information seminars were organized with China and South Korea. Commission Staff Working Paper, *Progress Report on the Galileo Programme*, December 5, 2001.

⁷ Especially with the reinforcement of the GPS user segment control (via the setting of different categories of equipment for example).

⁸ As a Rand Corporation Report noted in 1995 : "The relative breadth with which U.S. GPS inventions are protected around the world provide a competitive advantage to U.S. companies." Giving an example, the Rand Report remarked also that "while Japan has conducted R&D and has exploited GPS internationally, it has not protected its GPS inventions as broadly". *The Global Positioning System, Assessing national Policies*,

⁹ Rand Corporation, Santa Monica, 1995, p.117.

Communication for the Commission, February 10, 1999: *Galileo - Involving Europe in a New Generation of Satellite Navigation Services*.

¹⁰ *Galileo, The European Project on Radio Navigation by Satellite*, 26 March 2002, European Commission, Directorate general Energy and Transport.

¹¹ Idem.

¹² This last group received the first ESA order for a Galileo compatible receiver.

¹³ The FP6 that will start in 2003.

¹⁴ Carl Bildt and Loyola de Palacio, as quoted in *Satellite News*, January 21, 2002.

¹⁵ *International Herald Tribune*, 31 January 2002, p.4.

¹⁶ This position was later contradicted by a declaration unambiguously supportive of Galileo emanating from the French Ministry of Foreign Affairs.

¹⁷ European Commission, Directorate-General Energy and Transport, Op. Cit., March 26, 2002.