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Galileo: the long road to European autonomy

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Galileo, the European program for positioning, navigation and timing (PNT), was launched by the European Union in 1999. Part of the European Global Navigation Satellite System (GNSS)[i], the future satellite constellation is meant to be a leading project for Europe, bringing strategic independence and political status to the continent, allowing Europeans to reap huge benefits from future services while maintaining an industrial and technological basis. The program has been crippled by a series of disputes and delays, however. More than ten years after the official launch of Galileo, the expected date for the Full Operational Capability (FOC) of the system keeps being pushed back. It is currently 2016.

Galileo illustrates the challenges met in the development of a European space policy and, more generally, the difficulties of the European building process: The program was to demonstrate the ambitions of the European Union as a major space actor. In doing so, it highlighted the need for a clear political direction (1); Galileo is a very ambitious industrial program. However, the 2004-2007 stalemate over the Galileo contracts attribution shed a cruel light on conflicting logics in Europe: liberals vs. interventionists, national vs. common interests, EU vs. ESA procurement rules (2); All the while, the development of downstream markets remained difficult to assess, which made private stakeholders reluctant to invest in the program (3); Finally, despite its original goal of complete independence, Galileo quickly became the focus of international negotiations. On the one hand, Galileo had to be compatible and interoperable with other systems -mainly the U.S. Global Positioning System (GPS)-, on the other, more partners were needed in the program –leading to talks with China, Israel, etc… (4).

Galileo is one of the most ambitious programs ever managed by the EU. As such, it illustrates the challenges and the opportunities offered by the development of a European Space Policy at the political, industrial, economic and international level.

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These four aspects are closely intertwined. Divergences between certain member states for example, have an impact both on governance and industrial issues. Similarly, the ongoing financing crisis can only be resolved by a political decision, with an impact on the industry and on the emergence of new downstream markets. The underlying goal of strategic autonomy is also a transverse issue: it was a key driver for the program, but also has implications on the choice of the launch provider or the degree of international cooperation.

Political issues: will the flagship remain afloat?

Galileo is often referred to as Europe's flagship program in space. It contributes to two major objectives of the 2007 European Space Policy (ESP): strengthening the foundation for space activities in Europe (access to space, maintenance of a technological and industrial base) and harvest the benefits of all space-derived services for markets and society. As such, Galileo constitutes a showcase for Europe, highlighting its new role as a space power and the superior level of European research and technology activities[ii]. Galileo also contributes to the broader economic, educational, social and environmental ambitions of the EU, laid down in the Europe 2020 strategy[iii].

Despite these potential assets, the Galileo program has met with a continuous string of problems. The opposition between certain member states and the difficult cohabitation of national and European logics were important factors. These political divergences have had consequences in three specific areas: governance, military uses and funding.

The governance of the program

According to the European Court of Auditors in 2009, the management of Galileo was inadequate at the beginning of the so-called Development and In-Orbit Validation (IOV) phase and until 2007. The program was managed at the time by the Galileo Joint Undertaking (GJU), a joint structure between the EU and ESA that did not have much authority[iv]. The Commission, still relatively new to space issues, did not play the role of a "strategic sponsor and supervisor" [v]. Last but not least, member states were constantly interfering in the management of the program.

Transport Commissioner Jacques Barrot probably saved the program in March 2007, when he advised the Council and the European Parliament to re-profile the Galileo program. It was decided that the Commission would now be in charge of management and funding. This would start with the on-going phase and continue with the next phases of the program, namely the Deployment and Exploitation phases. A Regulation of July 2008[vi] clarified the new governance structure: while the program is now under the political oversight of the Parliament and the Council, the Commission is the sole program manager. ESA and GSA (the new GNSS Supervisory Authority) are in charge of the

execution of the program, under EU delegation. This new institutional set-up denotes the political primacy of the EU in the program, and may constitute a more solid basis to manage its next phases.

The military use of Galileo

Conversely, the possibility for EU member states to use Galileo's encrypted signal (the Public Regulated Service, PRS) for military purposes remains a contentious issue. While Galileo is presented as a civilian system under civilian control, its dual-use nature and the essential role it could play in supporting Common Security and Defence Policy missions (CSDP) are widely recognized. There are two conflicting interpretations in this regard. Some states, most notably the UK, consider that any decision on a military use of PRS is a CSDP matter and should therefore be decided by a unanimity vote. Other countries, in particular France, claim that a military use of the PRS is a matter of national sovereignty[vii]. Behind this dispute lies a deeper divergence on the status of Europe as an autonomous strategic player, especially vis-à-vis the United States. The Commission recently tackled this issue and proposed detailed rules of PRS access. The text "defines common criteria allowing PRS participants to select their users[viii] in a secure manner", but "the nature of PRS use is left to each member state to decide individually". [ix] This seems to reflect continental views.

The funding crisis

Back in 2000, the Commission estimated the total cost of the GNSS program at €3,3 billion, of which -thanks to the Private-Public Partnership scheme (PPP)- only €1,8 billion would be borne by the public sector. The cost was reassessed in 2007 to a new total of €5,5 billion, to be entirely borne by public funds[x].

The funding issue is very sensitive. The fact that the program is now completely covered by public money is berated by liberal economists (such as the British magazine *The Economist*), who see such investments as unsound and probably unproductive in the end. However, the European Parliament approved the full public funding of the program in April 2008. Since then, the Development and IOV phase has already met with new cost overruns. The Commission trimmed the number of satellites initially ordered from 30 to 22 in order to mitigate this,[xi] but the final completion of the program will depend on the resources made available in the next Multiannual Financial Framework (MFF) of the EU, starting in 2014[xii]. The European Parliament already announced that it wanted to include financial guarantees for Galileo for 2012-2013 in the 2011 budget. Similarly, the Commission proposed that Galileo be placed in a separate fund that could be fed directly by member states[xiii]. While the program's budget in future years remains problematic, these initiatives do show the political and strategic importance of Galileo to the EU.

The difficult emergence of a European space industry

One of the strategic motives underlying Galileo is the need to secure Europe's industrial independence for the production of both the space and ground segments and the rockets. Guaranteeing independent access to space is particularly important for Europe. As a consequence, only European companies were allowed to bid for the various Galileo contracts, and it was commonly understood that the satellites would be launched by a European launch services provider. However, the bidding process was complicated by two weaknesses of the European space industry: the persistence of national considerations and the lack of real competition.

Difficulties appeared during the bidding process for what was at the time the Galileo concession project. The European space industry was already an oligopolistic environment, probably not competitive enough to achieve results on time and within budget. The situation got even worse when the two initial bidding consortia[xiv] decided to merge and offer a single bid. Negotiations stopped for 6 months in 2005 while member states disagreed on the composition of the merged consortium, on the location of the system's activity center, the ground infrastructure and the headquarters[xv]. As said earlier, the concession option was finally dropped in favor of a fully public funded approach.

After the reorientation of the program in 2007-2008, a "competitive dialogue" procedure was launched under ESA management to select the contractors of the six newly-defined Galileo working packages[xvi]. Among the difficult issues was the selection of the contractor for the space segment, i.e. the selection of the satellite manufacturer. Astrium and Thales Alenia Space had already invested substantially in the Galileo program and they had won together the contract to built the four IOV satellites. Against all expectations however, the German firm OHB, tendering with the British SSTL, was chosen by the Commission in January 2010 to build the first 14 satellites of the Galileo constellation.

Another key package was the choice of a launch provider. As expected, the only European actor in this field, Arianespace, was selected by the Commission to launch the first 14 satellites. They are to be launched aboard Soyuz rockets from Kourou, with a possibility to use an Ariane 5 for the last 4 satellites. However, given the tight financial situation, some European governments have started to consider using a non-European launch provider to launch the second batch of satellites[xvii]. The U.S.-based company ILS already announced that it intends to offer a bid that would significantly reduce the costs for the EU[xviii].

As of December 2010, four out of six contracts for the Initial Operational Capability (IOC) have been awarded.

Developing downstream markets

Another reason for launching Galileo is the many social and economic benefits expected to derive from satellite navigation applications for the end-user. This is in line with the Europe 2020 strategy, that aims "to make the EU a smart, sustainable and inclusive economy"[xix].

A number of studies have been conducted to imagine possible new commercial uses for each of the five Galileo signals[xx]. The Commission launched a broad public consultation process in 2006 leading to the publication of a "Green Book on Satellite Navigation Applications". Meanwhile, the development of Galileo's commercial aspects is one of the main tasks of the GSA. In addition, several consulting firms such as Price Waterhouse Coopers published GNSS market forecasts[xxi].

Despite these early efforts, the assessment of future downstream markets remained unclear. Based on a cost share of 1/3 public and 2/3 private, the PPP model didn't sufficiently take into account the difficult evaluation of the profits private actors could expect[xxii]. This led to the failure of the concession scheme. Besides, third countries who have also recognized the growing potential of GNSS are possible future competitors. The U.S. and Russia, followed by China, India and Japan are not only deploying their own systems, but also actively boosting the development of applications based on them[xxiii].

Developing end-user applications is therefore a crucial factor for the success of the program. In June 2010, the Commission released an Action Plan on GNSS Applications in June 2010[xxiv]. This document identifies six priority applications[xxv] and contains a list of precise actions that can be implemented rapidly. The general philosophy of Galileo's commercial policy is that while the market has to be based on private demand, public actors – the Commission and the GSA – must create the adequate conditions for the development of such a demand. In line with this objective, the EU is trying on the one hand to boost innovation (through prizes and networks) and on the other hand to emphasize communication and visibility (through outreach events).

Cooperation in the context of strategic autonomy

Finally, Galileo was also launched to establish a European independence in the strategic field of GNSS, allowing to reduce its reliance on the U.S. GPS system.

The early years of the program were devoted to convincing a very reluctant U.S. administration of the legitimacy of the European project, indeed of the security benefits that would come from having two complementary systems. A cooperation agreement was signed in July 2004. Agreements to ensure at least the compatibility and at best the interoperability of Galileo with other GNSS systems were also sought with other countries, such as Russia (signed

in 2006) and Japan: an agreement was signed in February 2010 between the EU and JAXA to secure radiofrequency compatibility between the QZSS-1 satellite and Galileo[xxvi].

Meanwhile, non-European partners to the Galileo program were also sought to minimize both the technological and financial risks of the program. Cooperation agreements were signed with China (in 2004) and Israel (in 2005), and both countries joined the GJU. However, the agreement with China proved to be unsustainable in view of Beijing's demands in terms of technology transfers. European authorities have come to see that such cooperation agreements run against the goal of strategic autonomy. Indeed, relations with China and Israel were damaged when the GJU was wound up, and other ongoing discussions with non-European countries were closed down[xxvii].

Perspectives of further cooperation with China seem extremely far off at the moment. Indeed, a conflict with China on the attribution of radiofrequences between Galileo and Beidou is ongoing to this day. While several coordination meetings took place, the issue will be solved at the political level, as shown by the letter sent by the President of the Commission Manuel Barroso to Premier Wen Jiabao in July 2009[xxviii].

At the end of the day, program-level cooperation may only possible with European countries. Norway recently joined the Galileo program and pledged to contribute €70 million[xxix].

Conclusion

Galileo was launched by the EU to fulfill three strategic objectives: ensure Europe's political and strategic autonomy in the field of PNT, derive economic benefits through GNSS applications and boost the industrial base and R&T capacities in Europe.

After the failure of the concession scheme and the redefinition of the program in 2007 and 2008, Galileo received a new impetus. The governance structure is now firmly established, with a role attributed to each stakeholder and a clear leadership exercised by the Commission. The procurement process is also well advanced, with four out of six working packages attributed. The four IOV satellites built by EADS and Thales Alenia Space will be launched in 2011 aboard Soyuz rockets; the first 14 operational satellites will be manufactured by OHB. Starting in 2012, ten of them will be launched from Kourou on Soyuz launchers. Other issues remain open, however. The most important is the funding problem, as the additional public funds allocated to Galileo in 2008 will probably not be sufficient. While new funds might be allocated by the next MFF as of 2014, a solution must be found to finance Galileo until then. Finally, the enduring conflict with China over signal overlap and the uncertainty surrounding the future downstream markets are still looming.

Galileo is certainly the most complex program ever managed by the EU from a

technological, political and legal point of view. While this may explain some of the delays and cost overruns encountered by the program in the last few years, the structural constraints of the European Space Policy also account for a great share of the difficulties. Grouping several member states with different expectations, political and industrial interests under a common European banner is always a source of tensions. Attributing the leadership of the program to the Commission might help to overcome these obstacles.

Another take on the Galileo story so far –allowing this paper to end on a more optimistic note-, would be to state that the many difficulties met in the first decade of the program have been useful lessons for the EU. A number of evolutions have had to be devised to accommodate the management of this flagship program. In this regard, Galileo is a beneficial experience not only for space policy, but for the European building process as a whole.

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[i] The European GNSS program is composed of two separate elements: the PNT system Galileo, and the GPS-based augmentation system EGNOS, which entered into service on 1 October 2009. This paper will focus exclusively on Galileo.

[ii] Assemblée Nationale, « Rapport d'Information N. 2142 sur l'état du programme Galileo », enregistré à la Présidence de l'Assemblée nationale le 8 décembre 2009.

[iii] The general contribution of space to the Europe 2020 strategy was highlighted in the 7th Space Council Resolution "Global challenges: taking full benefit of European space systems," from 25 November 2010.

[iv] The GJU was the dedicated structure set up by ESA and the Commission to manage the development and validation phase of Galileo. It operated from September 2003 until the end of 2006. In 2007, its functions were transferred to the GNSS Supervisory Authority (GSA).

[v] European Court of Auditors. « The Management of the Galileo programme's development and validation phase. » Special Report No 7. 2009.

[vi] European Parliament and Council of the EU. « Regulation Nr. 683/2008 on the further implementation of the European satellite navigation programmes (EGNOS and Galileo), » 24 July 2008.

[vii] Assemblée Nationale, op.cit..

[viii] PRS participants include the member states, the Council, the Commission and EU agencies. PRS users are the natural or legal persons duly authorized by the PRS participants.

[ix] European Commission. « Proposal for a Decision of the European Parliament and of the Council on the detailed rules for access to the public regulated services offered by the global navigation satellite system established under the Galileo programme. » COM(2010) 550 final, 8 October 2010.

[x] European Court of Auditors, op.cit.

[xi] de Selding, Peter B. « European Commission To Trim Initial Order of Galileo Satellites, » Space News, 16 October 2009.

[xii] « Galileo Program Recalibrates Schedule, Budget, Open Signal ICD, » Inside GNSS, 3 November 2009.

[xiii] de Selding, Peter B. « Galileo May Need 'Too Big to Fail' Label To Overcome Financial Hurdles. » Space News, 27 October 2010.

[xiv] Those were Eurely (Vinci, Alcatel, Finmeccanica) and Inavsat (EADS, Thales, Inmarsat)

[xv] European Court of Auditors, op.cit.

[xvi] The six working packages are : system support, ground mission segment, ground control segment, space segment, launcher, operations

[xvii] de Selding, Peter B. « Galileo May Need 'Too Big to Fail' Label, » op. cit.

[xviii] de Selding, Peter B. « ILS to Bid on 18 Galileo Launches, Touts Saving. » Space News, 17 March 2010.

[xix] European Commission. « Communication. Europe 2020 A strategy for smart, sustainable and inclusive growth. » COM(2010) 2020, 3 March 2010.

[xx] The five signals are the open service, the commercial service, the safety of life service, the public regulated service and the search and rescue service.

[xxi] Nardon, Laurence. « Galileo and the Issue of Public Funding. », in: Schrogl et.al. (Eds.) Yearbook on Space Policy 2007/2008. Vienna: Springer, 2009.

[xxii] European Court of Auditors, op.cit.

[xxiii] European Commission. « Communication. Action Plan on Global Navigation Satellite System (GNSS) Applications. » COM(2010) 308 final, 14 June 2010.

[xxiv] Ibid.

[xxv] The six priority applications are handsets and mobile phones, road transport, aviation, maritime transport and fisheries, precision agriculture and environment protection, civil protection and surveillance.

[xxvi] ICG. « Current and planned global and regional navigation satellite systems and satellite-based augmentation systems. » ST/SPACE/50, 2010.

[xxvii] These included Brazil, Mexico, Chile, Canada, Argentina and Australia.

[xxviii] Assemblée Nationale. « Rapport d'Information N. 2142 sur l'état du programme Galileo. » Enregistré à la Présidence de l'Assemblée nationale le 8 décembre 2009. Annex 2.

[xxix] de Selding, Peter B. « Norway Pledges 70M Euros as it Joints Galileo Program. » Space News, 22 September 2010.