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GNSS THIRD PARTY LIABILITY:
THE EUROPEAN EXPERIENCE OF GALILEO

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Abstract

One of the key items discussed at the current stage within the Galileo Project is third party liability. The Public and the Private sector are debating, within the Public Private Partnership nature of the deal, how to best manage the risk of third parties claiming for damages arising from the Galileo System.

Galileo, the European Global Satellite Navigation System (GNSS), is a civil system designed to provide enhanced navigation and timing services to the users. The system's unique features (integrity, authentication, accuracy, precision, availability...) will change the user's perception and expectations towards satellite navigation services. Today GNSS services are exclusively offered by the military systems GPS and GLONASS, which provide only basic navigation and timing information with no guarantee of service or of performance.

Despite the undeniable value of satellite navigation services and despite the advanced features which will be offered by Galileo, GNSS is vulnerable to a number of possible intentional (jamming, spoofing, meaconing...) or unintentional (ionospheric interference, radiofrequency interferences, errors in the operations...) interferences. Such vulnerabilities may affect the ground segment, the space segment or the Signal in Space causing damages. Moreover the uncertainty of the legal regime under which third party claims may be brought, the global dimension of the project and the nature of the Signal in Space (SIS), which is freely broadcasted on air, raises some questions concerning the capacity of an entity to manage the risks arising thereof according to the prudent business test.

Through the analysis of the liability regime of other activities and the compensation mechanisms which are available in certain sectors, some considerations are drawn on the opportunity of establishing a liability regime for GNSS and on the opportunity of setting up an ad hoc compensation structure, which would guarantee trust in the system and adequate compensation to the plaintiffs.

Article

1. INTRODUCTION

A Global Navigation Satellite System (GNSS) is conceived as a core infrastructure, providing time and navigation information to the users. There are at present two GNSS in the world, the American Global Positioning System (GPS) and the Russian GLObal NAvigation Satellite System (GLONASS).

Both were developed as military systems. Currently, Europe is developing a civil Global Navigation Satellite System, GALILEO. Based on the information provided by the system, applications will be developed in domains ranging from transport to timing, surveying, science, search and rescue, law enforcement, environment or recreation. In other words, satellite navigation and its

applications imply services and downstream activities which carry strong social, safety and economical benefit.

GPS radionavigation signals are today freely broadcasted and received almost worldwide by anyone with a receiver. The signal provider has no control over the users or over the use that is made of the navigation signals. Signal providers have today no technical means to warn the users about abrupt signal degradations or error. Moreover, due to the military nature of the satellite positioning systems signal providers have at present no real political incentive to warn users.

An error in the positioning information, the unavailability of the signal or its misuse may have in some cases only minor effects on the users or may, in other cases, cause damages which may potentially be extremely severe. The global dimension of satellite navigation systems, the broad use of this technology, the different applications and the uncertainty of the legal regime suggest that the risk exposure to claims might be too high and difficult to mitigate.

Since the definition years of Galileo, liability and in particular third party liability in relation to the transmission of the signal in space, has represented an issue of primary concern for lawyers and decision makers.

2. THIRD PARTY LIABILITY

Third party liability is the obligation to repair damages arising by a faulty action or willful misconduct of a person (natural or legal). In other words, third party liability (also referred to as extra-contractual responsibility or tort liability¹) arises whenever there is the infringement of a right or of an interest (depending on the system of law) safeguarded by legislation or case law. The person claiming for third party liability has to **prove the damage, the fault** of the person causing the

¹ Torts are civil wrongs, other than breaches of contract, recognized by common law as grounds for a lawsuit.

damage and the causal relationship between the damage and the action of the faulty person.

Third party liability becomes a particularly sensitive issue with regard to Galileo. Indeed the system is composed of ground assets distributed throughout different countries, space assets orbiting around the Earth signal in space broadcasted worldwide.

3. THE CASE OF GALILEO

3.1 Program overview

Galileo will be a system of 30 satellites orbiting in Medium Earth Orbit (MEO²) and related ground stations to provide timing and positioning information to the users worldwide. The project is developed as a Public Private Partnership (PPP) by the European Commission (EC), the European Space Agency (ESA) and industry. The full constellation will be manufactured, by a private consortium on the basis of the technical design developed under ESA contracts.

The Galileo Joint Undertaking³ (GJU) is negotiating, on behalf of the EC and ESA, the implementation of the PPP contract, which will be signed by the GNSS Supervisory Authority (GSA)⁴ and the Galileo Operating Company (GOC). The contract will establish the terms and conditions under which the system will be operated during the 20 years of the concession period.

Galileo will be the first European infrastructure, as the Community funds allocated to finance its development phase

² Medium Earth Orbit MEO is a region of space situated at 20.200 Km altitude between Low Earth Orbit LEO (900/1000 Km) and Geostationary Orbit GEO (35.000 Km)

³ Council Regulation (EC) No 876/2002 of 21 May 2002 setting up the Galileo Joint Undertaking. *OJ L 138, 28.5.2002, p. 1-8.*

⁴ This European Agency was set up by: Council Regulation (EC) No 1321/2004 of 12 July 2004 on the establishment of structures for the management of the European satellite radionavigation programmes. *OJ L 246, 20.7.2004, p. 1-2.*

were mainly provided by Directorate General Energy and Transport (DG TREN) within the Trans-European Transport Networks. The GSA will be the owner of all the tangible and intangible assets of the project, it will be the entity responsible of ensuring that the interest of the public sector is safeguarded and it will be the regulatory authority for the European radionavigation (Galileo) and augmentation (EGNOS) systems. The GOC will be granted the exclusive right to deploy operate and exploit the system in accordance with the PPP contractual requirements.

3.2 Sources of Third Party Liability

Third party liabilities in the Galileo Project may arise from different sources in respect of the specific phases of the project. In particular a distinction could be made between the period before Full Operational Capacity (FOC) and the period therefrom.

In the pre-FOC phase, third party liability is mostly expected to arise with regard to the assets, while from FOC on the biggest risk exposure is foreseen from the signal transmission.

Signal In Space (SIS) related damages are those presenting the highest uncertainties in terms of risk exposure and required coverage. It is assumed here that the SIS will not fall under the definition of "space object" and therefore will not be disciplined by international space law. Indeed the question whether SIS falls or not under the definition of "space object" is an interesting question, however, it appears rather theoretical. According to the 1972 Liability Convention⁵ art 1 a space object includes component parts as well as its launch vehicle and parts thereof. It seems that this concept defines tangible assets and it doesn't seem to extend also to the intangible ones such as the signals in space. Indeed, it is likely that States at the time

⁵ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and other Celestial Bodies, 27 January 1967, 610 UNTS 205 entered into force on 10 October 1967. See in particular art VI and VII.

of ratification of the Treaties didn't have in mind such a wide interpretation of space object.

3.2.1 Assets

Third party liability may arise with regard to the ground segment, the space segment and the Signal In Space.

Ground segment: third party liability for damage to goods or people will fall under the applicable law of the territory in which the damage occurs. The risk in relation to the infrastructure can be mitigated through common third party insurance policies. Special legal regimes might be negotiated with the hosting Country; but it is unlikely that the GSA or the Commission would be able to negotiate, on behalf of the operator, an extraterritoriality regime with special immunities from the national legislation. It would however be recommendable to locate to the best extent possible all elements of the ground segment in territories under EU or ESA member States' jurisdiction.

Space segment: there are mainly two phases of risk concerning the space segment where damages could be caused to third parties: the launch risk and the in orbit risk. Responsibility related to the space segment is regulated by international law and in particular by the 1967 Outer Space Treaty and the 1972 Liability Convention⁶.

The Treaties establish a regime of international responsibility of the launching State⁷ for activities conducted in outer space. A launching State is held strictly liable for damages caused by elements of the space segment on the surface of the Earth or to aircraft flight. Should the damage occur in outer space, the plaintiff may recover his

⁶ Convention on International Liability for Damage caused by Space Objects, 29 March 1972, 961 UNTS 187. See in particular art II and III.

⁷ According to article III of the OST Treaty, the "launching State" can be defined as a "State that launches or procures the launch...and from whose territory or facility an object is launched ...".

damage only if he proves the fault of the launching State.

For the launch phase, risk mitigation tools, such as satellite insurance, contingencies, Launch Risk Guarantees (LRG) and spare satellites will be put in place to alleviate the risk exposure. Possible outstanding liabilities will fall under State's responsibility in accordance with international law and specific launching agreements. During the In Orbit phase, liability to third parties shall be covered by the launching State (in the event that his fault is proven) and eventually if provided under particular agreements by insurance or contingencies allocated by the private entities.

In relation to the assets a relevant source of third party liability may be represented by product liability as defined by the EC Directive 85/374⁸. Product liability refers to an area of law ruling the responsibility of manufacturers, distributors, suppliers and retailers according to which, producers are strictly liable (there is no need to prove the fault) for damages caused by their defective products. Product liability is a risk commonly faced by manufacturers which usually insure the risk through dedicated insurance.

3.2.2 Operations

Signal transmission: is believed to be the most relevant font of third party claims. The Galileo system will provide navigation services with features which will significantly improve the reliance on GNSS. According to the different services, Galileo will provide integrity, authentication, guarantee and continuous availability of service therefore increasing the reliability of the technology and the confidence in its use. However, satellite navigation systems are vulnerable systems which are subject to a number of possible intentional (jamming, spoofing, meaconing...) or unintentional (ionospheric interference,

radiofrequency interferences, errors in the operations...) interferences. Such vulnerabilities may cause disruptions or errors in the signals which may easily result in damages suffered by third parties.

In principle there is no difference between services in the nature of third party damages suffered because of SIS malfunctioning. However it may be opportune to briefly recall the different services, which Galileo will provide, to better understand some of the future operator's specific concerns.

Open Service (OS): is basic timing and navigation information freely broadcasted to any user with a capable receiver. No contract is needed for service provision. Any service provider can use the OS and develop applications; the GOC will have no control over such applications. The frequency signal is close to that of GPS and the user of mass market receiver won't be able to tell whether the information received is coming from Galileo or not.

Safety of Life (SoL): is timing and navigation data plus integrity⁹ information. Integrity will warn the user on the reliability of the computed position and authentication¹⁰ will prove that the signal received and trusted is truly coming from Galileo. The signal will not be encrypted and it will be mostly used in safety critical domains (aviation, maritime, rail). Certification is also foreseen for specific user's communities and in particular in aviation and in maritime.

⁹ Integrity is a measure of the trust which can be placed in the correctness of the information provided by the total system. The integrity message will warn the user when the system should not be trusted for the intended operation.

¹⁰ Authentication is a process by which a system verifies that the origin of the information is truly the one claimed by the source and that the information has not been modified. It can be achieved in different ways; one of which is electronic signature. In Galileo, Authentication is foreseen by the Mission Requirement Document (MRD) 6 as an encrypted electronic signature proving that the integrity message received is truly coming from a Galileo satellite.

⁸ Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products. *OJ L 210, 7.8.1985, p. 29–33.*

Commercial Service (CS): is timing and navigation data with value added services provided to commercial users against a payment. This service will be provided only to users requesting and paying for the service.

Public Regulated Service (PRS): provides timing and navigation information with encrypted value added services to the EU MS Governments that buy the service. This service will be restricted to selected users under States supervision subject to governmental authorities' decision for defense and civil protection.

Search and Rescue Service (SAR): is not part of the navigation payload, but it will provide positioning information to locate people in distress. SAR will operate within the COSPAS-SARSAT¹¹ framework according to which States bear no responsibility in relation to SAR services.

Due to the civil nature of the European radionavigation and augmentation system, to its user approach and to the fact that the system is a public infrastructure, it could be argued that the actors involved in Galileo may have towards the users a duty of care¹² of particularly high standards. The proof of the existence of such duty may sensibly increase the chances for a claim by a third party to be recognized valid. Two services in particular may be perceived as particularly critical: the OS and the SoL. Concerning the OS the main concerns address the following considerations: there is no contract for service provision by which special clauses could mitigate the liability exposure, the number of

¹¹ COSPAS-SARSAT is a programme developed through the cooperation of the US, France, Russia and Canada for the search and rescue of people in distress. The USA contributed with the programme SARSAT, France with SARGOS and since 1978 the Soviet Union provided COSPAS, while Canada provided the transponders. On the 1 July 1988 the four Countries have signed the COSPAS-SARSAT intergovernmental agreement to guarantee the continuity of the programme. Today 37 States are part to this agreement.

¹² Duty of care is a requirement that a person acts towards others with the attention, prudence and cautious that a reasonable person in the same circumstances would use.

users is unknown, there is no control over the use or misuse of the signal and moreover the OS doesn't generate any revenue which could repay potential liability claims. The Private sector fears to face, in relation to this service, claims of relative small magnitude but very large in number. The Safety of Life is also seen by the operator as a particularly critical service because it will mainly be used in safety critical operation where possible failures may lead to catastrophic scenarios of personal injury or loss of life.

Moreover it is still unclear whether the Signal In Space could be considered (just like electricity, art 2) as a product under the aforementioned product liability Directive. If this was the case, a faulty signal would give raise to the strict liability of the "producer" of the signal. The producer is defined in the Directive as the manufacturer of a finished product, the producer of any raw material or the manufacturer of any component part and any person who by putting his name, trade mark or other feature on the product presents itself as the producer¹³. Thus, the GSA, the GOC and the service providers may possibly

¹³ Council Directive 85/374/EEC of 25 July 1985 Art.3: "1. 'Producer' means the manufacturer of a finished product, the producer of any raw material or the manufacturer of a component part and any person who, by putting his name, trade mark or other distinguishing feature on the product presents himself as its producer.

2. Without prejudice to the liability of the producer, any person who imports into the Community a product for sale, hire, leasing or any form of distribution in the course of his business shall be deemed to be a producer within the meaning of this Directive and shall be responsible as a producer.

3. Where the producer of the product cannot be identified, each supplier of the product shall be treated as its producer unless he informs the injured person, within a reasonable time, of the identity of the producer or of the person who supplied him with the product. The same shall apply, in the case of an imported product, if this product does not indicate the identity of the importer referred to in paragraph 2, even if the name of the producer is indicated".

all be held liable for product liability for faults of the SIS.

3.3 SIS third party liability management

Based on the aforementioned considerations, it is feared that signal malfunctioning might result worldwide in a considerable number of claims. Given the number of domains served, the uncertainties of the legal environment and the absence of internationally agreed financial caps, it is difficult to estimate what would be the magnitude of the risk and therefore the appropriate coverage.

Being Galileo a Public Private Partnership, it is also within the interest of the Public sector to agree with the private counterpart means to operate the system under an adequate coverage which could ensure a sound risk management. Both, the private and the public sector, agree on the need to operate the system under an adequate coverage which a prudent business delivering the signal in space would seek. The assessment of such adequate coverage is particularly difficult in a project like Galileo mainly due to the following circumstances:

- absence of a dedicated legal regime applicable to the signal in space;
- lack of previous experiences;
- non existence of comparable businesses.

4. CHALLENGES FOR GALILEO IN THE ASSESSMENT OF THE ADEQUATE COVERAGE

4.1 The absence of a dedicated legal regime for the SIS

4.1.1 Regulatory initiatives within the aviation domain

For the time being there is no dedicated juridical regime which disciplines the provision of radionavigation signals, however this does not mean that there is no liability regime applicable to the SIS. On the contrary the provision and the use of radionavigation

signals falls under a variety of legal frameworks depending on the legislation of the territory in which it is used and according to the specific application domain.

The only attempt to discipline GNSS was made within the aviation domain, but yet no satisfactory solution has been provided, in particular with regard to third party liability. The initiative of the aviation sector was twofold. On one side Member States expressed their concern in relation to the use of GNSS under Article 28 of the Convention on International Civil Aviation¹⁴ (hereinafter referred to as the Chicago Convention). On the other side the civil aviation, which strongly relies on CNS/ATM¹⁵ and in particular on satellite navigation (mainly provided by the Global Positioning System GPS in the absence of any service or performance guarantee), wanted to bring clarity on the responsibilities for signal provision of the different actors. GNSS services are namely provided by primary signal providers, augmentation signal providers, States, Air Traffic Control (ATC), air carriers, aircraft operators and equipment manufacturers. The International Civil Aviation Organization (ICAO) aims to avoid that the variety of national and international

¹⁴ See the Convention on International Civil Aviation of 1944 (Chicago Convention). In particular under article 28, *Air navigation facilities and standard systems*: "Each contracting State undertakes, so far as it may find practicable, to: (a) Provide, in its territory, airports, radio services, meteorological services and other air navigation facilities to facilitate international air navigation, in accordance with the standards and practices recommended or established from time to time, pursuant to this Convention; (b) Adopt and put into operation the appropriate standard systems of communications procedure, codes, markings, signals, lighting and other operational practices and rules which may be recommended or established from time to time, pursuant to this Convention; (c) Collaborate in international measures to secure the publication of aeronautical maps and charts in accordance with standards which may be recommended or established from time to time, pursuant to this Convention".

¹⁵ CNS/ATM, Communications, Navigation, Surveillance/Air Traffic Management.

laws, the different liability regimes and the legal nature of the providers (public, for which special protection might apply or private, which are fully exposed to the risk of claims) limit the determination of liability and reparation of the damage.

According to article 28 of the Chicago Convention, conventional navigation aids are implemented and maintained under States' responsibility. GNSS, as navigation aid, falls under art 28 of the Chicago Convention and consequently States are responsible for the safety of radionavigation services within their jurisdiction¹⁶. States can delegate to other States the responsibility of air traffic service provision within their territory (Annex 11 to the Chicago Convention), but such delegation is only limited to technical and operational aspects, while safety remains a responsibility of domestic competence.

ICAO concluded that CNS/ATM systems operations and liability issues, in particular, are mostly disciplined by national laws.

According to the Study Group's analysis of various States' national laws, GNSS was likely believed to be governed by the National liability regime of the place where the air traffic control (ATC) agencies¹⁷ are located and that ATC liability is a fault based liability regime based on negligence (proof of fault of action or omission of the ATC in its duty of care) or gross negligence (in case of States).

4.1.2 International Convention

In the attempt to overcome the above mentioned liability related uncertainties, the majority of ICAO contracting States, as reflected by the adoption of Resolution A 32/2018, were in favor of establishing a

¹⁶ Article 28 of the Chicago Convention disciplines only relations among States and it doesn't give cause of action to private persons to claim compensation for damage.

¹⁷ ICAO AFI Planning and Implementation Regional Group 13th Meeting: *Institutional Aspects of CNS/ATM systems*. Sal, Cape Verde, 25-29 June 2001APIRG/13-WP/25.

¹⁸ 32nd Session of the ICAO Assembly adopted Resolution AS-32/20: *Development and elaboration of an appropriate long term legal framework to govern the*

GNSS International Convention to be applied to all activities employing satellites and ground based equipment, technologies and systems.

A "Draft Convention on the Rights and Obligations of States relating to Global Navigation Satellite Systems for Air Navigation Purposes" was presented at the 10th meeting of ICAO Secretary Group. The document stated some general principles and a description of their objectives addressing the importance of safety, performance requirements and certification. The Convention was seen as the most efficient legal instrument to guarantee worldwide a common approach to liability management. The establishment of a single jurisdiction, or the possibility to recur to arbitration, was proposed in order to ensure certainty of applicable law, procedural effectiveness and equal treatment between Governmental and non-Governmental service providers.

The Convention specifically addressed liability arising from GNSS related damages (system and sub-system technology components or services). Liability was proposed to be strict up to a limit and fault based thereafter (in line with the 1999 Montreal Convention) with joint liability in case of damage being caused by more than one provider. Adequate risk coverage was mandated under the Convention, which also envisaged the possibility of establishing a dedicated compensation fund¹⁹. No possibility to recur to sovereign immunity protection was envisaged, but it was foreseen the exclusion of fault liability in case of Force Majeure events.

The project of the International Convention was abandoned as consensus on the content of this document was not unanimous, ICAO's

implementation of GNSS implementation. The resolution recognizes the need for a long term legal framework instructs the ICAO Council and Secretariat to ensure the follow up of the recommendations of the World Wide CNS/ATM System Implementation Conference, especially on institutional issues and questions on liability and invites to present proposals for such a framework.

¹⁹ A35-WP/125, LE/11, Appendix C: *Proposal relating to main elements for inclusion in a draft convention*.

Legal and Technical experts²⁰ recognized the International Convention as being a difficult and long solution to achieve. Moreover the experience in the implementation of CNS/ATM was estimated to be insufficient to allow and the drafting of an international convention was considered premature.

4.1.3 Contractual Framework

A more flexible approach compared to that of the International Convention was presented to the Council at the 33rd ICAO's Assembly by the Study Group. The proposal envisaged to present a Draft Contractual Framework relating to the provision of GNSS Services.

The Contractual Framework contained mandatory elements such as compliance with SARPs and with the 1998 Charter on the Rights and Obligations of States Relating to GNSS Services, the establishment of fault based liability regime, compulsory risk coverage, mandatory recourse to arbitration and recognition of equal treatment between State organizations and private entities.

The Contractual Framework Agreement proposal is twofold as it reflects both public and private law elements. The first addresses obligations between Governments: in particular certification, liability, jurisdiction and the creation of a GNSS Authority addressing the relations between system operators and service providers²¹. The second concerns contractual arrangements among stakeholders, which define responsibilities in the chain of implementation, operation, provision and use of GNSS²². In particular

²⁰ Resolution A32/20 established a Secretariat Study Group to ensure the follow up of the recommendations of the Rio Conference and a Panel of Legal and Technical experts on GNSS.

²¹ The GNSS entity shall be entrusted with the tasks of defining specifications of GNSS signal and services, drafting, negotiating and implementing service level agreements, defining the process for responsibility allocation, managing a compensation GNSS fund and defining the applicable risk coverage requirements.

²² According to the proposed framework, contracting parties shall ensure that GNSS system operators and service providers provide adequate insurance or other risk coverage to compensate

these arrangements define the relationship between and the obligations of Air Traffic Service (ATS) providers and GNSS signal providers, augmentation signal providers and potentially other parties.

The Draft Contractual Framework which is today currently under discussion fails to address an issue of paramount importance: third party liability in case of GNSS related damages. However it does address explicitly the issue of contractual liability in the event of loss or damage related to a failure, malfunctioning or improper use²³ of GNSS. Liability would be based on fault and it would apply to each subject to the extent that it has contributed to the occurrence of the damage²⁴. Failure to perform obligations shall be governed by the liability regime applicable to the activity for which the signal is utilized and public parties should be subject to the same rules as private parties by submitting themselves to arbitration. The proposed framework

4.2 Lack of previous experiences

A commonly used method to assess what would be reasonable liability coverage for a certain business is that of benchmarking against other similar businesses. However, Galileo is a complex and unique business and no real analogy can be found in the market. Despite the difference in the philosophy under which the two satellite systems were developed and the resulting consequences, it could, however, be worth exploring how the United States' face the risk of liability claims in relation to the NAVSTAR Global Positioning System (GPS)²⁵.

liabilities that might arise out of their non performance and shall establish a compensation fund to compensate shortfalls in the recovery of damages from the liable entity

²³ The meaning of "improper use" is not specified, but it might be interpreted also negligence.

²⁴ The framework agreement to establish a liability framework based on fault for human errors and strict liability for technical errors.

²⁵ The following section reflects the content of the article by Brandon E. EHRHART: "A technological dream turned legal nightmare:

The US Government generally enjoys sovereign immunity²⁶, a doctrine preventing the initiation of suits by private parties against the Federal Government. Despite to its immunity, the US has, in some specific cases, expressly waived this protection. In particular the US can be sued mainly for a tortuous act of a federal employee causing damage or for claims arising out of contracts to which the federal government is a party.

GPS is controlled and operated by the US Federal Government, therefore - in the absence of specific waivers - GPS operations are covered by sovereign immunity.

Under Article 28 of the Chicago Convention, the US Government does not assume any responsibility for the provision of radionavigation signals outside its jurisdiction arguing that decision and authorization to use navigation services pertains to each National State. Therefore, there is no responsibility of the US as signal provider. This might erroneously lead to the assumption that inside its National territory the US would then take responsibility for GPS-related damages, but reality shows to be different.

As previously mentioned, expressed waivers to the US sovereign immunity doctrine allow people suffering damage (also GPS-related) to sue the Government under one of the following Acts, namely: the Foreign Claims

potential liability of the United States under the Federal Court Claims Act for Operating the Global Positioning System". *Vanderbilt Journal of transnational law*, Vol. 33, Number 2, March 2000.

²⁶ Sovereign immunity is a doctrine which precludes law suits against the sovereign without its consent. The doctrine is based on the inherent nature of power and on its spirit of preservation which dates back to the time when it was believed that the King could do no wrong as his sovereignty arose from a divine right. It was therefore believed that no legal right could apply against the authority that makes the law on which the right depends. In earlier days the sovereign immunity doctrine was relaxed through the admission of waivers, as it is believed that nobody is above the rules, not even the State.

Act²⁷ (FCA) the Suits in Admiralty Act²⁸ (SAA) and the Federal Tort Claims Act²⁹ (FTCA). According to the first two Acts a right to compensation is recognized respectively to inhabitants of foreign countries for personal injury, death or property damage caused by non combat activities of US personal overseas (FCA) and for torts committed in navigable waters controlled by the United States (SAA). The Federal Torts Claims Act allows plaintiffs to directly pursue the US before Federal Court for damages arising from negligence resulting from Government employees' acts or contracts to which the Federal Government is a party, therefore most GPS related claims would be brought under the Federal Tort Claims Act.

Specific exceptions such as the discretionary function exception³⁰ and the foreign country exception³¹ limit the scope of the waivers to sovereign immunity and would be the most relevant exceptions as far as GPS related operations are concerned. The question therefore is whether GPS operations could fall within the scope of one of these exceptions.

²⁷ Foreign Claims Act, 10 U.S.C. § 2734-2736. It is a US Federal Law of 1942 providing for compensation to non US citizens for personal injury, death or property damage arising from non combat activities of the US military personnel overseas.

²⁸ Suits in Admiralty Act, 46 U.S.C. app §§ 741 - 752.

²⁹ Federal Tort Claim Act, 28 U.S.C. 2680(h).

³⁰ The United States are immune for any claim based upon an act or omission of an employee of the Government, exercising due care, in the execution of a statute or regulation, whether or not such statute or regulation be valid, or based upon the exercise of or performance or the failure to exercise or perform a discretionary function or duty on the part of the Federal agency or an employee of the Government, whether or not the discretion involved be abused. 28 U.S.C. 2680(a).

³¹ The foreign country exception to the FTCA's waiver of sovereign immunity for claims "arising in a foreign country," bars claims based on any injury suffered in a foreign country, regardless of where the tortuous act or omission occurred. 28 U.S.C. § 2680(k).

According to the discretionary function exception, the US - which would be liable under the FTCA - is not liable to compensate claims if the act causing the damage involved an element of judgment or choice by the employee. With regard to GPS, most fixed regulations and procedures rule the operations leaving little room to employee's judgment, which would determine the inapplicability of the exception.

However, the source of the negligent decision is also an element which determinates the applicability of the discretionary function. If the challenged activity results to be a function uniquely undertaken by the Government, the discretionary function would then probably apply. GPS is provided to civilian users, but it is still primary a military system under the Government control, thus it should be considered a unique Government function.

The foreign country exception, immunizes the US - which would be liable under the FTCA - for "any claim arising in a foreign country"; therefore it appears that the US is immune for suits outside its borders.

To determine the applicability of this exception, courts focus on where the damage arises: this is to say the site of the negligent act, rather than where the damage is suffered. As most likely GPS liability would result from an error in the uploading of the ephemeris data from the Colorado Master Control Station (MCS)³² to the satellites, one could say that the site of negligence is Colorado State in the US territory. The foreign country exception would then not apply, unless the Court would see the damage as being originated in outer space as the Signals in Space are broadcasted by the satellites. From a legal perspective outer space could be seen similar to Antarctica (both regulated by international law and both having no Government) for which the US court recognized the applicability of the foreign

³² The GPS master control station is located at Falcon Air Force Base in Colorado Springs, Colorado.

country exception in case law *Smith vs United States*³³.

The US is so far reluctant to waive its sovereign immunity for damage resulting from negligence in GPS operations; therefore GPS does not really provide a benchmark for Galileo. Indeed, for GPS limits of Standard Positioning Service (SPS) performance and limits of condition of use of the receivers are set in the "user manual"; producers don't take responsibility for consequences resulting from the use of their products specifying that radionavigation devices do not substitute traditional navigational methods.

However it should be noted that the applicability of the FTCA exceptions are generally extremely controversial and however always dependent on the courts judgment. Therefore, despite to the opposition of the US and unless the Congress would add another exception to the FTCA for GPS activities and operations, there might be the legal ground for US citizens to sue the Government.

4.3 Non existence of comparable businesses

In the previous section, through the analysis of the sources of third party liability within the Galileo Project, many arguments seemed to confirm that Galileo presents a unique risk profile. The complexity of its organizational structure, the number of actors involved and the technological challenge of the development of a radionavigation system, are all elements which contribute to adding difficulties to the exercise of shaping a defined risk profile.

³³ Moreover this position was enforced by the famous case law, 507 U.S. 197 (1993), *Smith v. United State* where no waivers of sovereign immunity were accepted regarding a claim for damage occurred in Antarctica. Antarctica (territory with no government) was considered as a foreign country and the same principle could be considered applicable to GNSS if the negligent act is viewed as arising in "outer space".

Notwithstanding the appreciation of the unique risks of the Galileo Programme, it should be also noted that there are other businesses which are exposed to extremely high and unforeseeable risks, but which anyhow engage in dangerous activities even when they are not in the position to fully undertake their operational risk. It is possible from a comparative analysis of the liability management strategies adopted in other sectors to draw some considerations which could inspire the definition of effective measures for risk management.

5. LIABILITY REGIMES IN OTHER DOMAINS

5.1 Civil aviation

Third party liability in the aviation sector is regulated under an international convention which aims at compensating liability for damages caused by air planes to persons or property on the surface of another contracting State. The Protocol to amend the Convention on damage caused by foreign aircraft to third parties on the surface³⁴, signed at Montreal in 1978 (Montreal convention) only applies to international flights, while third party damages caused by a national aircraft are ruled by the national legislation.

For damages to goods and/or for loss of life or personal injury caused by an aircraft in flight, by persons or things falling therefrom, liability is limited and channeled to the aircraft owner and operator. The Operator has the obligation to maintain valid insurance or another guarantee up to its liability limits.

Should the total amount of claims exceed the limit of liability, claims are reduced in proportion to their respective amounts. Claims may be brought only in front of the courts of the contracting State where the

³⁴ The Convention on Damage caused by Foreign Aircraft to Third Parties on the Surface was signed at Rome on 7 October 1952.

damage occurred (subject to agreement by the parties also before any other court of contracting States) or it can be submitted to arbitration. Under certain circumstances the operator cannot limit his liability.

No provision foresees a Government step-in for outstanding liabilities.

5.2 Oil Pollution damages

Transportation of oil by sea is a dangerous activity as it may cause very severe environmental damage. This activity is regulated at international level through Conventions The 1992 Protocol on Civil Liability and the 1992 Fund Convention establish a regime and a mechanism to compensate third parties oil pollution damages on the following principles and mechanisms:

- strict and limited liability of the shipowner
- compulsory insurance³⁵ regime linked to the ship tonnage
- clauses of exclusion of liability
- clauses of exclusion of limitation of liability
- International fund to compensate claims exceeding the shipowners limit
- Funding of the international fund by contributions of any person who has received amounts in excess of 150.000 tonnes of crude oil

The Fund established as an intergovernmental organization (super partes) is recognized in each contracting State as a legal person and provides compensation in case: 1) no liability for damage aroused under the Liability Convention, 2) of financial incapability of the liable owner of the ship to meet its obligations, 3) the damage exceeds the owner's liability.

³⁵ A major part of the ships has entered Protection and Indemnity Associations, called P&I Clubs which provide insurance on mutual basis. Liability is limited under international conventions or national laws and the insurance cover is limited to the limitation amount applicable to the ship.

Claims are accepted if they are based on real expenses, if there is a link between the expense and the incident and the expense was made for reasonable purposes

The Fund receives two types of contributions: those to the General Fund - which cover both administrative expenses and claims for compensation which do not exceed 4 million SDR per incident - and those to the Major Claims Fund to cover payments for incidents in excess of the amount payable by the General Fund. Should the claims exceed the aggregate amount of compensation, the amount available shall be distributed so that the portion between the claim and the amount of compensation is the same for all claimants.

In 2003 a Supplementary Fund was established to raise the limits available for compensation.

5.3 Nuclear damages

Before 1997, the liability regime for nuclear damage was embodied into two instruments: the IAEA Vienna Convention (which was adopted on 21 May 1963 and entered into force on 12 November 1997) and the OECD Paris Convention on Third Party Liability in the Field of Nuclear Energy of 1960 in force in 1963 and then bolstered by the Brussels Supplementary Convention. In 1992 a Joint Protocol adopted in 1988 entered into force to coordinate the two conventions.

In principle the liability of the operator is supplemented by the international liability of the licensing State and by a third tier of compensation provided by an international fund.

The Conventions foresee compensation for damages caused by nuclear accidents (within the installation or during the carriage or storage) on the territory of any of the contracting States.

The Conventions provide the minimum threshold of the operator's liability. Liability is strict and channeled to the operator of the

nuclear installation (or of the carrier under defined circumstances).

Insurance, reinsurance and other financial security is aimed at covering the damages in relation to bodily injury, loss of life, loss of any property (other than the nuclear installation itself) and any property used in connection. States are free through their national legislation to agree on the amount of coverage which they would require from the operators of the installations over their territory. The State throughout which radioactive substances are transported, may request the responsible operator to raise its coverage protection (within the maximum amount).

5.4 Lessons learned

Having briefly presented some of the solutions which were found in other sectors presenting a high risk profile, a strong public interest and an international dimension, some observations can be made. Risks in these sectors are generally secured through different coverage means such as insurances, bank guarantees, internal reserves, industries pooling schemes and compensation funds. States require the private entity uncharged of the operations to maintain compulsory insurance coverage and in some activities additional financial security is provided through international compensation funds. This choice is generally made when there are large numbers of actors which share the same interest on the basis of a risk they all contribute to create.

Funds represent a solid guarantee for compensation, however on the long term they might fail to create a real incentive for the operators for take due care in the course of their activity. The same problem is faced by strict liability regimes coupled with quasi-unrestricted rights to liability limitation. To avoid such risks, international conventions often foresee provisions by which, under certain circumstances, operator's liability limitation is excluded and he is fully exposed to the risks. Where liability regimes are in place, chances of a risk to become uninsurable are usually reduced. Fault-based solutions tend to promote uninsurability as the risk is

hardly sizable and it is dependent on a very wide variety of factors. Precedents show that where the insurance market is not in the position to provide coverage, because perhaps the damage is too difficult to size, the contracting parties might prefer regimes of strict liability.

A typical example of this kind of choice is that of the strict and limited liability of the shipowner in case of oil pollution. Oil pollution typically causes environmental damage, which is difficult to define and to fully compensate and in this case States have chosen a regime of strict and limited liability. Damages to be insured may be both tangible and intangible and the intangible risks are those which are often more difficult to size. A solution, in these cases, was found through pool schemes for which a necessary precondition is to have a mutual risk which is shared among a large number of parties. If on one hand liability caps can help to promote insurability (as the risk to be insured becomes quantifiable) they may also lead to unfair compensation of the victims and to the violation of the "polluter pays" principle.

It can be observed that generally States don't assume liability for damages arising from activities undertaken by the private sector and even dangerous activities which are of strong public interest are generally no exception. The nuclear domain represents the only case where public funds are foreseen to cover outstanding liabilities, but liability is channeled to the operator of the nuclear installation that is required to maintain insurance. The State has the obligation to ensure the payment of claims and an international fund is available to further mitigate the risk.

International conventions are very well recognized legal instruments, however the process required to reach an agreement is extremely complex and time consuming. Typically States sit at international negotiation tables in reaction to a catastrophic event (e.g. SOLAS convention in the maritime domain after the Titanic accident), but it is unusual to have an international convention regulating an activity which is still not completely proved. Indeed none of the Conventions analyzed was

drafted before the starting of the activity. The establishment of such legal instruments is only achieved after years of experience which showed that there was the need to regulate the activity in order to specifically answer problems that were identified from the experience.

If an international liability regime was to be considered for Galileo and if an international fund was to be established for compensating damages related to the transmission of the signal in space - provided that an agreement could be found - the time frame would not allow the Galileo concession contract to fall under this scheme. Moreover it is difficult to envisage upfront the content and shape of a potential international Convention for Galileo.

An intermediary step could be that of establishing a dedicated compensation fund at European level under an EU Regulation. This would not be a totally new initiative, as the precedent of the European Union Solidarity Fund shows. The Fund, established through Regulation 2012/2002 of 11 November 2002, aimed at providing up to 1 billion euros in case of for Major Natural Disasters. A Regulation at European level may pave the way towards a future wide international liability regime and compensation mechanism.

6. CONCLUSIONS

Satellite navigation provides worldwide undeniable benefits worldwide. The Galileo operator will make available the open signal free of charge and this service will have the advantage to stimulate technological development through numerous applications. Galileo services will assist the mass market users as well as decision makers in the implementation of common policies and will be of key importance for the public sector as well as for the private sector. However GNSS is a vulnerable and complex system which is exposed, under a multitude of juridical regimes, to a great number of risks. As it was done in a number of other sectors, it doesn't seem unreasonable to envisage legislative actions to establish a common legal

framework and possibly a compensation mechanism which would recognize to GNSS a fundamental role and would safeguard its continuity over time. The establishment of an international fund for radionavigation could be a way forward for sharing the burden of compensation among all the actors while ensuring better reward to the plaintiffs. The long timeframe required for International Conventions to be adopted seems to be inappropriate to satisfy the near time needs of the Galileo Project. This constraint could be overcome through the adoption of an EU Regulation establishing a common dedicated liability regime and perhaps a compensation fund. Although geographically very limited for a system that is global, this option may deserve careful consideration as it could represent a good starting point to trigger initiatives with a wider international scope.

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