

Civil Liability for Satellite-based Services

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I. – AIM OF THIS STUDY

What originally began as a special military technology¹ today helps many car-drivers to find their way in foreign cities or indeed in their home towns: they often use so-called *navis*, navigation systems which in most cases direct them quite easily and safely to their destination. And not only car-drivers benefit but many other types of transportation, too. The navigation systems make use of satellite-based information to establish the exact position of persons and objects around the globe. Many more uses of this modern technology have become possible or may be imagined. Its usefulness can hardly be denied. But likewise, situations may be envisaged where a failure or defect in the transmission of the satellite-based information causes loss. Such loss need not, but may reach disastrous proportions, for instance where the system's failure or defect causes an aircraft to crash into a densely inhabited area or causes a fully booked ocean cruiser to be sunk.

This article deals with the civil liability aspect in such scenarios. It specifically addresses the question of whether the present situation of civil liability for malfunction of satellite-based services is satisfactorily regulated and if so, whether, any improvement(s) should be envisaged. With respect to the factual situation in this field, the paper draws mainly on the example of the European satellite-based information system Galileo now being developed and which will be fully operational within the next few years.

II. – CHARACTERISTICS OF SYSTEMS PROVIDING SATELLITE-BASED SERVICES

1. The present systems

At present, two Global Navigation Satellite Systems (GNSS) are in operation: the United States' Global Positioning System (GPS), which was the first such

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¹ See Jonathan M. EPSTEIN, "Global Positioning System (GPS): Defining the Legal Issues of its Expanding Civil Use", 61 *Air Law & Commerce* (1995-1996), 243 *et seq.*, 248.

system, and the Russian Global Orbiting Navigation Satellite System (GLONASS).² There exist also complementary regional systems to GPS and GLONASS such as EGNOS in Europe (a precursor of Galileo), WAAS in the United States, MSAS in Japan or GAGAN in India which improve and augment the advantages and applications of the global systems regionally.³ However, in the coming years the European Union and China (COMPASS), and perhaps also India, will set up their own comparable global systems, the EU's to be called Galileo.⁴ The preparatory work on Galileo has already started. The organiser is the European Commission in co-operation with the European Space Agency (ESA) but private enterprises will be included in a form of public/private partnership. However, the Commission remains the *maître d'ouvrage* of the whole exercise.⁵ The European system is designed for civil purposes only. It intends to "be more advanced, more efficient and more reliable than the current US GPS monopoly."⁶ Although the Galileo system will be independent from the US GPS, an agreement between the EU and the US ensures the interoperability of the two systems.

It is not unlikely that countries or regions other than those already mentioned will also develop and establish further global systems in order to be independent from other nations with respect to this important technology.

2. Satellite navigation: how it works

Satellite navigation functions essentially as follows: a number of satellites – 30 in the case of Galileo – are placed into fixed orbits which they circle, constantly emitting signals indicating their position at any given time in an extremely precise way (using atomic clocks aboard the satellites). These signals can be received by any person possessing the necessary receiver (a

² GLONASS does not yet offer services for commercial purposes and is reported regularly to face problems with its satellites.

³ A recent account of GNSS activities may be found in the Note of the Secretariat on the Second Meeting of the International Committee on Global Navigation Satellite Systems (a subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space) of 10 December 2007 (UN-document A/AC.105/901).

⁴ See, on the European initiative, EUROPEAN COMMISSION/ESA, *Galileo. The European Programme for Global Navigation Services*, 2nd ed. (2005); see also: Communication from the Commission to the European Parliament and the Council: *Progressing Galileo: Re-profiling the European GNSS Programmes*, of 19 September 2007 (COM(2007) 534 final). After some difficulties the Galileo programme received the assent of the Council of Transport Ministers at the end of November 2007 ("Political go-ahead for Galileo").

⁵ Commission Communication (*Progressing Galileo ...*), *supra* note 4, 11.

⁶ EUROPEAN COMMISSION / ESA, *supra* note 4, 4, 8.

cheap and small instrument such as the *navi* which can recognise the signals and position of each satellite). By receiving the signals from at least four satellites the receiver can determine the position of persons or things in the air or on the ground exactly to the metre. The system needs further terrestrial up-link stations which contact and steer the satellites as well as a control centre to coordinate and control the entire system.⁷

3. The organisational framework of Galileo

Galileo will be set up and managed by the European Community itself, which at present it seems will even offer the different services which this ambitious infrastructure project will provide (see under IV below). Private enterprises will be involved in the manufacture and supply of hardware. Perhaps in later years they may take over the provision of the projected services.

The satellite navigation system makes use of highly advanced radio and space technology. Its installation requires substantial financial means. At present, the cost of Galileo is estimated at € 3.4 billion and will be borne by the EU and ESA.⁸

III. –PROJECTED AND POSSIBLE USES

Global navigation satellite systems are regarded as a core infrastructure offering a multitude of possible applications. The European Commission envisages that Galileo might be used in the following areas:⁹

- in all kinds of transport, in particular the navigation of ships, aircraft and cars;
- in the field of energy, for instance to monitor the electricity grid and to assist in exploring natural oil or gas resources;
- in the finance, banking and insurance sector for safer services;
- in agriculture and fishing for easier and more efficient performance and monitoring of these activities;
- in emergency situations where the position of a victim, a hospital and so on must be established;

⁷ *Ibidem*, 7 et seq.

⁸ See Commission Communication (*Progressing Galileo ...*), *supra* note 4, 3.

⁹ EUROPEAN COMMISSION / ESA, *supra* note 4, 15 et seq. The International Civil Aviation Organisation (ICAO) had already discussed the use of global navigation satellite systems and in particular of Galileo for civil aviation at its meeting in 2003 but remained somewhat reluctant.

- in environmental management (for instance in tracing polluters, etc.);
- in all kinds of land or water surveys;
- for recreational purposes, most obviously for pleasure flying or sailing.

Global navigation satellite systems can also play an important role in internal security by enabling the monitoring of suspects, the tracing of stolen objects (in particular cars), etc. For the future, one might also envisage a fully automated transport system combining satellite navigation and automatic driving so that manual driving becomes superfluous.

IV. – THE SERVICES ENVISAGED BY GALILEO

At present, the promoters of Galileo plan that the European satellite navigation system will offer different services, namely:¹⁰

- the Open Service (OS) which provides timing and positioning signals free of direct charge for users;
- the Safety of Life Service (SoL) for all means of transport where lives could be endangered if the Open Service fails;
- the Commercial Service (CS) providing (at extra charge) greater accuracy than the Open Service ;
- the Public Regulated Service (PRS) for the reserved use of State authorities such as the police, coastguard, customs, etc;
- the Search and Rescue Service (SAR) for situations in which search and rescue operations must be carried out.

All these services work on the basis that certain different radio signals are made available on which users can rely for their purposes.

V. – SITUATIONS THAT MAY GIVE RISE TO CIVIL LIABILITY

1. Loss scenarios

As indicated above, loss scenarios caused by failures of global navigation satellite systems, indeed sometimes catastrophic losses are quite easy to imagine. If, for instance, means of transport such as ships, aircraft or trains – whatever their (commercial or recreational) purpose – are navigated or steered

¹⁰ EUROPEAN COMMISSION/ESA, *supra* note 4, 22 *et seq.*; see also Commission Communication (*Progressing Galileo ...*), *supra* note 4, 5 *et seq.*

relying on such satellite-based information systems, then any systems malfunction may cause the loss of hundreds or even thousands of lives and of property due to collision or wreckage. If, e.g., an oil tanker is involved its wreckage may also cause tremendous damage to the environment and the coastline of several States.¹¹

However, catastrophic losses need not be the rule. Where satellite navigation is used in daily motor traffic, a system's failure causing a car's navigation system not to work properly will probably not result in instant accidents but only in traffic congestion and delay. Such failure is unlikely to cause immediate bodily harm; the loss will probably be of an economic nature. Taken singly, such losses may also be fairly limited. It is when taken together that the economic losses of all people involved may be considerable.

Damage to persons can also occur where the satellite-based positioning system is used in rescue operations and does not work, so that the ambulance, police, fire-brigade or whatever cannot provide assistance in good time. Damage to persons and to property can also follow from a system's failure where criminals would have been detected or caught had the system worked properly.

Death or bodily injury would be a less likely consequence of the failure of a global navigation satellite system with respect to the further uses at present envisaged by the promoters of Galileo (use in the financial sector, for prospecting, surveying, etc.). Yet economic loss could always ensue. Damage, again of an economic nature, may also result insofar as permanent failures or changes in the satellite navigation system impairs existing receivers which may become useless and unsaleable.

Damage caused by a satellite colliding with another object or crashing to earth may be left out of consideration here since such damage would not be due to the specific services provided by global navigation satellite systems. Moreover, such damage would already be covered by the 1972 *Convention on International Liability for Damage Caused by Space Objects*.¹² Under Article II of that Convention, the launching State would be strictly liable.

¹¹ For similar loss scenarios, see also J.R. COPELAND, "Overview of System Architectural Implications of Third-Party Liability and Government Indemnification for GPS Augmentation", 47 *Navigation* (2000), 7 et seq., 13.

¹² United Nations Convention on International Liability for Damage Caused by Space Objects of 29 March 1972 (hereinafter: 1972 Liability Convention (Space Objects)).

2. Possible causes of loss

As we have already seen, global navigation satellite systems basically have three components, *i.e.* the satellites, the ground stations and the user's receiving instrument. The failure of either one of components may cause the entire system to fail to emit or receive the correct signals and to transform them into precise information as regards the position of a person or object. In turn, failure of the system will – probably inevitably – lead to defective services since these services depend on the proper functioning of the system. The system's failure may be due either to defective design of the relevant component or of the entire system; it may be due to defective manufacture or installation of one or more of the components; or it may result from faulty operation.

This sounds rather similar to product defects, where a distinction is also made between design defects, manufacturing defects and incorrect use are distinguished.¹³ But this parallel can be fully drawn only with respect to the receiver which the user usually buys from a private manufacturer. With respect to the satellites and in particular to the ground stations, their failure may be due to faulty design or manufacture of the hardware, for example of the atomic clocks, of the satellite itself or of its steering system and so on, but it might equally be caused by incorrect operation by the staff.

In addition to internal failures or defects, a further reason for the failure of an entire system must also be taken into account: its intentional misuse by third persons. It has been reported that in 2006, scientists at Cornell University deciphered the code of the European test satellite for the Galileo system (the satellite Giove-A),¹⁴ which would have enabled them to influence the satellite's operation. Other persons might do the same, for instance terrorists who after invading the system could then wilfully cause it to collapse and thereby wreak damage of the kinds mentioned above.

3. Evaluation of satellite navigation systems

The new technology of global navigation satellite systems has some inherent risks. These risks may be considerable and probably cannot be fully controlled even if all due care is exercised. Persons who rely on the GNSS technology – even indirectly, for instance as a passenger in an aircraft equipped with this technology – are exposed to these risks and there is little or no chance of their

¹³ See, e.g., in the United States: *Restatement Third, Torts: Products Liability*, § 2.

¹⁴ See Harenberg (Ed.), *Aktuell* 2008 (2008), 428.

avoiding these risks. The law in many countries generally reacts to this situation by introducing strict liability requiring the operator to pay compensation for the damage unless certain limited reasons exempt it from liability.

VI. – THE PRESENT LEGAL FRAMEWORK

1. General considerations

If we take a hypothetical case where a person has suffered damage or where the environment has been impaired through the malfunction of a global navigation satellite system, the question of liability and compensation will, in most cases, raise more or less difficult issues of private international law and international procedural law before the substantive law can be applied. This is because the persons who have suffered damage and the persons who could possibly be held liable are highly unlikely all to live in one and the same country. Loss scenarios of the kind envisaged will almost inevitably be characterised by an international dimension due to the global availability of the satellite navigation systems and the global effects of their malfunction.

An additional fact further complicates the situation, namely the complexity of global navigation satellite systems themselves. As indicated, a number of institutions, businesses and persons contribute to their functioning. Although State authorities at present dominate the GNSS, private manufacturers are also involved. In the event of damage caused by malfunction of the system any, or even all, of those involved may therefore be responsible for that malfunction. Thus, if a person who has suffered damage claims compensation it is necessary to determine the competent jurisdiction and the applicable law with respect to each possible defendant. And if a State – or in the case of the European Union, the Community – is to be held liable, the further question has to be decided of whether that State can be sued in a foreign court or whether it can invoke the defence of State immunity. All this exacerbates the complexity of the legal problems connected with the possibly disastrous malfunction of GNSS.

2. National compensation schemes

Apparently, most countries do not have specific regulations for compensation in the event of mass disasters, although some have provided for a public compensation fund to deal with such cases.¹⁵ Nonetheless, it is not rare for

¹⁵ See the comparative survey by M. FAURE in: M. Faure / T. Hartlief (Eds.), *Financial Compensation for Victims of Catastrophes – A Comparative Legal Approach* (2006), 415 et seq.

the respective State to provide for assistance on an *ad hoc* basis. The level of compensation under such schemes differs widely, however, from one country to another, depending on the financial support made available in the country involved. Generally, only part of the damage will be compensated.¹⁶ Such schemes and State interventions are likely to be called upon by victims should catastrophic damage be caused by GNSS malfunction. But at best only part of the damage will be covered and only some of the victims will receive compensation. As a consequence, the traditional liability rules in contract and tort remain important.

3. Contractual liability vs. tortious liability

The legal problems connected with compensation for damage through GNSS malfunction are further complicated by the fact that a damages claim may be based on either contractual or tortious liability or on both, and that the rules on private and procedural international law often vary for both. In most situations envisaged here there will be no contractual relationship between claimant and defendant. In that case, any liability can only be based on tort. Yet contractual liability may still play a role – albeit a limited one. Persons who have suffered damage through the malfunction of a global navigation satellite system may be able in part to claim compensation under a contract since the services rendered by systems such as Galileo will be partly provided on a contractual basis. Thus, for example, the special commercial services (CS) to be offered by Galileo for which certain fees must also be paid. In the event of these services proving defective, there may therefore be a claim in contract. A contractual damages claim may also be successfully brought by the buyer against the seller of a defective receiver, at least where the latter is the manufacturer. And finally, the system operator if itself liable may have a right of redress in contract against suppliers/manufacturers of defective components.

However, in general liability in contract is not likely to be of particular importance in the event of damage caused by the failure of a global navigation satellite system. Moreover, the widely recognised principle of party autonomy allows the parties to a contract to regulate their relationship with respect to jurisdiction and applicable law and also to a great extent with respect to the material contents of their contract. Tort liability or liability irrespective of any contractual relationship will be of much greater importance in the area under review and here, for obvious reasons, the parties generally cannot determine in advance which court shall decide and which law shall apply.

¹⁶ See FAURE, *supra* note 15, 418.

4. Relationship with existing international conventions

At present, there is no uniform global liability regime for damages caused by global navigation satellite systems in place under any international convention. However, if the malfunction of such systems causes, for instance, the loss of lives following an air crash or pollutes the environment through the foundering of a ship, international air¹⁷ or maritime conventions¹⁸ may come into play. In the worst scenario, that of a satellite systems failure causing an aircraft to crash into a nuclear power plant and triggering a nuclear incident, the nuclear conventions¹⁹ become applicable.

These conventions deal with the liability of the air carrier, of the ship-owner or the operator of a nuclear installation only. They do not deal with the liability of third persons who in turn may have caused the air crash, ship wreckage or nuclear incident. In part, they cover damage caused by the malfunction of a global navigation satellite system, in part they do not. The 1969 Brussels Convention (CLC), for instance, explicitly excludes the ship-owner's liability if "he proves that the damage was wholly caused by the negligence or other wrongful act of any Government or other authority responsible for the maintenance of lights or other navigational aids in the exercise of that function."²⁰ Damage caused by a State-run GNSS used as a "navigational aid" would therefore not fall under this Convention.

¹⁷ The (*Montreal*) Convention for the Unification of Certain Rules for International Carriage by Air of 28 May 1999; the 1972 Liability Convention (Space Objects).

¹⁸ The *International Convention on Civil Liability for Oil Pollution Damage (CLC)* of 29 November 1969 (hereinafter: 1969 Brussels Convention (CLC)) as amended by the 1992 Protocol; the *International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)* of 18 December 1971 (hereinafter: the 1971 Fund Convention); the *International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS)* of 3 May 1996 (hereinafter: 1996 HNS Convention); the *United Nations Convention on Civil Liability for Damage Caused during Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD)* of 10 October 1989; the *International Convention on Civil Liability for Bunker Oil Pollution Damage* of 23 March 2001 (Bunkers Convention).

¹⁹ The *Convention on Third Party Liability in the Field of Nuclear Energy* of 29 July 1960 (hereinafter: 1960 Paris Convention) with amending Protocols (in force in 15 States); the *Vienna Convention on Civil Liability for Nuclear Damage* of 21 May 1963 (hereinafter: 1963 Vienna Convention) with amending Protocols (in force in 35 States); the *Convention on Supplementary Compensation for Nuclear Damage* of 12 September 1997 (not yet in force).

²⁰ Art. III(2)(c) of this Convention. The 1996 HNS Convention contains the same provision (Art. 7(2)(c)).

On the other hand, the nuclear conventions channel liability exclusively onto the operator who is the only person that may be sued by victims.²¹ The nuclear conventions do not exclude nuclear damage caused by GNSS. Furthermore, these Conventions as well as further, additional instruments ensure that the person liable provides for appropriate insurance coverage and that further (public) funds are made available. Where these instruments are applicable and where they cover liability for damage even through GNSS failures there is no need for further protection of the victims. However, the scope of these conventions is limited insofar as only a limited number of countries have ratified them and by no means all cases are covered where the malfunction of a global navigation satellite system may possibly cause damage. It then becomes necessary to determine the competent court and the applicable law according to the various and diverse national, sometimes regional rules of private international and procedural law.

5. Problems connected with the solutions in place

The following is a brief account of the solutions offered and the problems posed by the present state of affairs in regard of liability for damage caused by failures of satellite-based information systems. It is based on the assumption that State or European Community authorities run or will run these systems and bear the overall responsibility, that even the ground stations are or will be operated by State or Community authorities and officials, and that private enterprises are or will only be involved as manufacturers of specific components of the system.

(a) State immunity

(i) The legal basis

Where State authorities provide the services of the global navigation satellite systems it is questionable whether they can invoke the defence of State immunity when sued in foreign courts. Actually, two international conventions on State immunity – the 1972 Basle Convention and the 2004 UN Convention – provide general rules for this issue.²² However, the Basle

²¹ See Arts. 3, 9 of the 1960 Paris Convention; Art. IV of the 1963 Vienna Convention.

²² *European Convention on State Immunity* of 16 May 1972 (hereinafter: the 1972 Basle Convention); *United Nations Convention on Jurisdictional Immunities of States and Their Property* of 2 December 2004 (hereinafter: the 2004 UN Convention). But it should be noted that certain international conventions on specific matters also deal with the issue of state immunity and prevail over the two general Conventions on State immunity. Examples are again the nuclear conventions: see Art. 13(e) of the 1960 Paris Convention and Art. XIV of the 1963 Vienna Convention.

Convention is in force in a limited number of States only²³ and can hardly be taken to represent the current global solution, while the UN Convention is not yet in force at all. Therefore, as far as possible the international customary law on State immunity must be applied which is, however, more or less mirrored and thus to a great deal evidenced by the aforementioned Conventions.

(ii) Immunity of the European Community

A first question would be whether the European Community as such, as the organiser responsible for Galileo, is entitled to immunity like a single State in the courts of countries outside the European Union.²⁴ The view prevails that the Community – in parallel to international Organisations – enjoys immunity to the same extent as its Member States.²⁵ This understanding is, however, not yet reflected in the definition of the term “State” in Article 2(1)(b) of the 2004 UN Convention.

(iii) Immunity for sovereign acts

According to international customary law on State immunity which has also been adopted by the two aforementioned Conventions what is decisive is whether the State acted as a State (*acta jure imperii*) or as a private person (*acta jure gestionis*).²⁶ For acts of the latter kind the defence of State immunity is not available, whereas for the former it is. As far as immunity is granted, it extends not only to the respective State or, in the case of the European Union, to the European Community but also to State or Community agencies “performing acts in the exercise of sovereign authority.”²⁷

Given the prevailing view, the borderline between the two kinds of State activities must be determined according to the objective character of the

²³ This Convention is in force only in Austria, Belgium, Cyprus, Germany, Luxembourg, the Netherlands, Switzerland and the United Kingdom.

²⁴ Within the European Union, sovereign acts of the Community or its institutions and organs can be attacked in accordance with the provisions of the EC Treaty.

²⁵ See the contribution by B. SIMMA / Chr. VEDDER, in: Grabitz / Hilf (Eds.), *Das Recht der Europäischen Union* (looseleaf, October 2007), Art. 281 EGV No. 17 et seq., with many references. The same distinction can be found in international conventions on specific subjects. An example is the 1996 HNS Convention. Its Art. 4(6) prescribes that “(w)ith respect to ships owned by a State Party and used for commercial purposes, each State shall be subject to suit in the jurisdictions set forth in Art. 38 and shall waive all defences based on its status as a sovereign State.”

²⁶ See thereon I. BROWNIE, *Principles of Public International Law*, 6th ed. (2003), 335 et seq.; T. STEIN / Chr. VON BUTTLAR, *Völkerrecht*, 11th ed. (2005), No. 717 et seq.

²⁷ See the definition in Art. 2(2) of the 2004 UN Convention, ; in the same sense, Art. 27 of the 1972 Basle Convention.

activity.²⁸ It therefore depends on the nature of the transaction but also on the purpose for which a State-run infrastructure such as Galileo is used. As indicated, Galileo will serve different aims with various programmes. Hence, for each of these programmes the question of State immunity must be answered separately: in respect of the commercial service (CS) it is fairly certain that the Community cannot invoke immunity. As to the rescue service (SoL) and similar specialised services for use by the police, etc., on the other hand, it is rather likely although not certain that the Community would enjoy immunity in the courts of other countries if a system failure caused damage. This is because the provision of rescue services serves purposes the performance of which is generally and primarily in public hands, even though private organisations may also provide rescue services. Finally, as to the open service (OS), which benefits the public at large, it is uncertain whether or not immunity would be granted. Courts of different countries may decide differently on this matter.

(iv) Doubtful exclusion of damage claims from immunity

Both the 1972 Basle Convention and the 2004 UN Convention prescribe that a Contracting State cannot invoke immunity when sued for damage done to a person in another Contracting State if the damage is attributable to the (first) State and if the author of the damage was present in the (second) State when the damage was done.²⁹ It is questionable whether this rule already constitutes a rule of international customary law. In any event, its requirements will only rarely be met in the cases here under discussion.

(v) Evaluation

In sum, the current rules on State immunity are not free from uncertainties. Those who have suffered damage through the malfunction of a global navigation satellite system such as Galileo run considerable risk that the operating State or the operating Community or its respective agency cannot be made liable because of the State immunity defence.

²⁸ See, in this sense, the express definition of Art. 2(2) of the 2004 UN Convention; further, e.g., German Federal Constitutional Court (Bundesverfassungsgericht – BVerfG) *Entscheidungen* (BVerfGE) 16, 27; BVerfGE 46, 362; STEIN / VON BUTTLAR, *supra* note 26, No. 719. Specific Immunity Acts introduced by some States follow the same line: see, e.g., the United States *Foreign Sovereign Immunity Act* (Sect. 1603(d), where “commercial” acts are defined).

²⁹ 2004 UN Convention, Art. 12; 1972 Basle Convention, Art. 11.

(b) *International jurisdiction*

(i) Legal basis

As we have seen, the court competent to hear a damages claim must be determined separately with respect to each possible defendant. The applicable jurisdiction rules may then either be part of international instruments (international conventions but also EU Regulations) or they may be the autonomous national rules. However, the jurisdiction rules of international conventions in special fields can be left aside because these conventions do not yet cover liability for damage through satellite-based services. On the other hand, regionally harmonised jurisdiction rules may apply: this is the case in Europe where the EC Treaty provides for some special jurisdiction rules and where the Brussels I Regulation³⁰ together with its predecessor, the 1968 Brussels Convention³¹ and the 1988 Lugano Convention³² (both dealing with the same matters as Brussels I) establishes a general framework. This Brussels-Lugano regime does also provide rules on jurisdiction for proceedings for the compensation of damage, but these rules only bind the courts within the territorial scope of the Brussels-Lugano regime.

All the aforementioned instruments as well as national jurisdiction rules generally allow the claimant to sue the defendant in the defendant's forum. This is in accordance with the universally recognised maxim: *actor sequitur forum rei*. A competent court is therefore at least located at the place of the defendant's seat or domicile. This would mean that each member in the chain of supply of the satellite-based services can be, and often has to be, sued at its seat. However, this basic rule is further refined by additional jurisdiction rules.

³⁰ Council Regulation 44/2001/EC on Jurisdiction and the Enforcement of Judgments in Civil and Commercial Matters (the Brussels I Regulation). The Regulation is directly applicable in all EU Member States except Denmark. But the EU and Denmark agreed on a separate convention which made the Brussels I Regulation applicable to Denmark.

³¹ *Brussels Convention on Jurisdiction and the Enforcement of Judgments in Civil and Commercial Matters* of 6 October 1968.

³² *Lugano Convention on Jurisdiction and the Enforcement of Judgments in Civil and Commercial Matters* of 16 September 1988. This Convention is applicable in most of the EU Member States and also in Iceland, Norway and Switzerland. A revised version (Lugano II) which has been concluded between the EU and Denmark, Iceland, Norway and Switzerland will probably enter into force in 2009.

(ii) Jurisdiction for claims against the EU

There are specific jurisdiction rules for damages claims against the European Community even if the damage is done by its officials or agencies.³³ If such a claim is based on a contract which contains a jurisdiction clause conferring jurisdiction on the European Court of Justice, then according to Article 238 of the EC Treaty the ECJ is – exclusively³⁴ – competent. The proceedings must then be instituted in Luxembourg. Without such a jurisdiction clause the national provisions on jurisdiction apply (Article 240 of the EC Treaty). In the EU Member States, the Brussels I Regulation provides for jurisdiction in contract matters at the seat of the Community in Brussels³⁵ and at the place where the services were or should have been provided.³⁶ Galileo's commercial services (CS) will tend to be provided at the client's (and claimant's) seat or domicile where the signals will most likely be received for further use. Claimants may then choose between the different competent courts.

Courts in countries outside the Brussels-Lugano regime follow their own jurisdiction rules which for contract matters may also allow proceedings at the place of performance.

Special jurisdiction rules apply, too, for tortious damages claims against the EU. According to Articles 235 and 288(2) of the EC Treaty, the European Court (the Court of First Instance) is competent to decide on such claims if the damage was caused through the exercise of the Community's powers and violated a right of the claimant.³⁷ Again, the Court's jurisdiction is exclusive.³⁸ And again, courts in countries outside the Brussels-Lugano regime would apply their own jurisdiction rules on tort claims (see further under *iv* below).

(iii) Jurisdiction for contract claims

For all other contract claims (except the claims against the EU discussed above) the general jurisdiction rules apply. Within the Brussels-Lugano

³³ See thereto the contribution by U. KARPENSTEIN, in: Grabitz / Hilf (Eds.), *supra* note 25, Art. 238 EGV No. 8 *et seq.*

³⁴ *Ibidem*, Art. 238 EGV No. 13.

³⁵ This follows from Arts. 2 and 60 of the Brussels I Regulation. Brussels is also to be regarded as the regular seat of EU agencies which perform the activities of the EU.

³⁶ Art. 5 No. 1, second indent of the Brussels I Regulation.

³⁷ Art. 288(2) of the EC Treaty does not mention the requirement that a right of the claimant must have been infringed but the ECJ has constantly interpreted the provision in this sense: see, e.g., ECJ [1992] ECR I-2533 (C-55/90, *Cato*).

³⁸ See, e.g., ECJ [1979] ECR 623 (Case 101/1978, *Granaria*).

regime, the courts of the country where the defendant is domiciled (*i.e.* at the seat of the service provider)³⁹ or where the services were or should have been rendered are competent, provided that these places are located in Member States of the Brussels-Lugano regime.⁴⁰ The claimant may choose between the different courts. Outside the Brussels-Lugano regime, the national procedural laws generally allow proceedings at the defendant's seat and often also at the place of performance or at a place with which even fewer links exist.⁴¹ Again, the claimant may choose between the competent courts.

(iv) Jurisdiction for tort claims

Also with respect to tort claims the Brussels-Lugano regime allows the victim a choice of forum: the victim is entitled to sue either in the courts of the country where the defendant is domiciled⁴² or of the country where the harmful event occurred⁴³ or threatened to occur.⁴⁴ The place where the harmful event occurred includes both the place where the tortfeasor/operator acted and where the victim suffered the harm.⁴⁵ If these places are located in different countries (which however must be Member States of the Brussels-Lugano regime), the claimant may also choose between the courts of these countries.⁴⁶

Outside the Brussels-Lugano regime, the national rules on jurisdiction for tort claims vary considerably from country to country. The respective rules in the United States, Russia and India may suffice here as examples. In the United States, the jurisdiction of civil courts falls within the competence of the single states. They accept international jurisdiction in tort cases generally, if the

³⁹ See Art. 2 of the Brussels I Regulation, Art. 2 of the Brussels Convention and Art. 2 of the Lugano Convention.

⁴⁰ Art. 5 No. 1, second indent of the Brussels I Regulation. Under Art. 5 No. 1 of the Brussels Convention and Art. 5 No. 1 of the Lugano Convention, the place of performance still has to be determined according to the applicable law; for further discussion, see the contribution by P. MANKOWSKI, in: Magnus / Mankowski (Eds.), *Brussels I Regulation* (2007), Art. 5 No. 128 *et seq.*

⁴¹ See, in particular, the so-called long-arm statutes of several US states.

⁴² Art. 2 of the Brussels I Regulation and the Brussels and Lugano Conventions.

⁴³ Art. 5 No. 3 of the Brussels I Regulation and the Brussels and Lugano Conventions.

⁴⁴ Only in Art. 5 No. 3 of the Brussels I Regulation.

⁴⁵ See ECJ [1976] ECR 1735 (C 21/76, *Handelswerkerij G.J. Bier v. Mines d'Alsace de Potasse*).

⁴⁶ See *idem*. In the exceptional case of a claimant suffering damage in different (member) States, it is likely that the so-called Shevill doctrine would apply. According to this doctrine, the claimant can claim compensation in tort in each State only to the extent to which damage in the respective State ensued. Compensation for all damage suffered can only be claimed at the defendant's domicile (see ECJ [1995] ECR I-415 (C-68/93, *Shevill v. Press Alliance SA*)).

defendant has acted in the country of the forum,⁴⁷ but also if there occurred intentional or reasonably foreseeable effects of damaging conduct committed outside the forum State.⁴⁸ Thus, relatively transient connections can suffice to found the international tort jurisdiction of US courts. Instead, the claimant can always sue the defendant at the latter's domicile. In Russia, the claimant is entitled to choose among the courts either at the defendant's domicile, or at the place where the tort was committed, or at the place where the damage was suffered.⁴⁹ In India, the defendant can be sued in the courts of its residence but also at the courts of the place where the tort was committed.⁵⁰

(v) Evaluation

The survey shows that the determination of the competent court is not without its complications. On the one hand, claimants very often have an option as to where to sue the defendant: either at the latter's domicile or at the place where the damaging conduct was committed or at the place where the damage was suffered, if these places are not all located in the same State. On the other hand, in cases of damage caused by the malfunction of global navigation satellite systems it will often be difficult to locate the place of damaging conduct in a certain country, either because the precise cause of the malfunction may remain unclear or, if the malfunction of a satellite is the cause, there simply is no place of conduct in a certain State.

Nonetheless, the present legal situation as a rule allows claimants to go forum shopping which is accepted in the interest of the victims. But in the event of a combination of disastrous damage and the defendant(s) limited access to funds, the possibility of forum shopping might adversely affect all the victims' interests because a race to the courts in each country where damage was suffered would be more than likely, with the first claimant probably served best in terms of full compensation. On the other hand, it would be difficult for the possible defendants, in particular the service providers, to foresee and guard against the situation of being sued in many different countries. This would also multiply the litigation costs for the defendant(s) and

⁴⁷ See *World-Wide Volkswagen Corp. v. Woodson*, 444 US 286, 100 S. Ct. 559 (1980); *Restatement Second, Conflict of Laws*, § 27.

⁴⁸ See, e.g., *Kaiser Aetna v. I.C. Deal*, 86 Cal. Ap. 3d 896; 150 Cal. Rptr. 615 (1978); *Moon Carrier v. Reliance Insurance Col.*, 153 N.J. Super. 312, 379 A. 2d (1977); see further *Restatement Second, Conflict of Laws*, § 37.

⁴⁹ See Art. 247 of the Code of Arbitrage (the Code of procedure for commercial cases).

⁵⁰ Secs. 19 and 20 of the Code of Civil Procedure; see further PARAS DIWAN, *Private International Law*, 3rd ed. (1993), 569 s.

reduce the available funds. A “procedural channelling” concentrating all actions arising from one incident in one court – as is known for instance in international nuclear law conventions⁵¹ – could be an alternative.

(c) *Determination of the applicable law*

(i) General considerations

Not only the determination of the competent court(s) poses problems; in addition, once the competent court is seised of the case it must determine the applicable law if the dispute has a foreign element which in the cases under review tends to be the rule rather than the exception, given the global effects of global navigation satellite systems and their malfunction.

Like the jurisdiction rules, so also the choice-of-law rules for the determination of the applicable law require a distinction to be made between contract and tort claims. Although there are no conventions at a global level which unify the choice-of-law rules for these matters, there do exist some relevant regional instruments of unification: in the field of contracts – less important here –, the 1980 Rome Convention⁵² and its successor, the 2008 Rome I Regulation,⁵³ as well as the 1994 Mexico Convention⁵⁴ and, in the field of tort law, the Rome II Regulation.⁵⁵ Outside the scope of these instruments, the various and rather diverse national conflicts rules have to be applied.

(ii) Conflicts rules for contracts

Both international instruments⁵⁶ and national conflicts rules⁵⁷ generally allow the parties to an international contract to choose the applicable law. In

⁵¹ See Art. 13 of the 1960 Paris Convention; Art. XIV of the 1963 Vienna Convention.

⁵² *Convention on the Law Applicable to Contractual Obligations* of 19 June 1980.

⁵³ *Regulation (EC) No. 593/2008 of the European Parliament and of the Council on the law applicable to contractual obligations* of 17 May 2008. For the full text of the Regulation, see *Unif. L. Rev. / Rev. dr. unif.* (2008), 830. The Rome I Regulation will enter into force on 17 December 2009.

⁵⁴ *Inter-American Convention on the Law Applicable to International Contracts* of 17 March 1994. As yet, this Convention is in force only in Mexico and Venezuela.

⁵⁵ *Regulation (EC) No. 864/2007 of the European Parliament and of the Council on the law applicable to non-contractual obligations* of 11 July 2007. The Rome II Regulation enters into force in the EU Member States (except Denmark) on 11 January 2009.

⁵⁶ Art. 3 of the 1980 Rome Convention and Art. 3 of the Rome I Regulation; Arts. 7 and 8 of the 1994 Mexico Convention.

⁵⁷ See, e.g., for Russia: Art. 1254 of the Civil Code of the Russian Federation.

the absence of any choice, different solutions are provided. The Rome Convention and the Rome I Regulation provide for the law at the

place of the party which renders the characteristic performance.⁵⁸ Under the Mexico Convention, “the contract shall be governed by the law of the State with which it has the closest ties.”⁵⁹ The closest ties must be determined taking into account all objective and subjective elements of the contract and the general principles of international commercial law.⁶⁰

National conflicts rules determine the objectively applicable contract law partly also by redress to the seat of the characteristically performing party,⁶¹ partly by applying a multi-factor approach which groups and weighs all relevant contacts,⁶² and partly by taking the law of the place of performance⁶³ or of the place where the contract was concluded.⁶⁴

(iii) Conflicts rules for tort claims

At a regional level, the Rome II Regulation designates “the law of the country in which the damage occurs” as generally applicable to international torts⁶⁵ but also recognises more specific rules on product liability⁶⁶ and environmental damage.

At the level of national conflicts rules, again a broad variety of solutions exists. A widely accepted general principle designates the law of the country where the incident occurred (*lex loci delicti*). But the place of the tort may be either where the tortfeasor acted⁶⁷ or where the victim suffered damage. In some countries, the tort must be actionable both in the country where it was

⁵⁸ Art. 4 of the Rome Convention and Art. 4 of the Rome I Regulation.

⁵⁹ Art. 9 of the Mexico Convention.

⁶⁰ Art. 9 of the Mexico Convention.

⁶¹ *E.g.*, in Russian law: Art. 1255 of the Civil Code of the Russian Federation.

⁶² *E.g.*, the law of the single US states: see, *e.g.*, Art. 3537 of the Civil Code of Louisiana (which codified this approach).

⁶³ See, *e.g.*, Art. 834(2) of the Vietnamese Civil Code of 1996.

⁶⁴ See, as examples which represent many others: Art. 19 of the Egyptian Civil Code; Art. 7 of the Japanese *Horei*.

⁶⁵ Art. 4 of the Rome II Regulation (with the exception that the law of the common habitual residence and a more closely connected law take precedence).

⁶⁶ Art. 5 of the Rome II Regulation (mainly the law of the country where the product was marketed).

⁶⁷ See, *e.g.*, China: § 146(1) of the General Principles of Civil Law; further YOUNG, *IPRax* (1993), 343 *et seq.*; XU GUOJIAN, *International Comparative Law Quarterly* (1991), 684 *et seq.*; also, in Russia: Art. 1219(1) of the Civil Code of the Russian Federation (both with certain exceptions).

committed and in the country where the suit was brought.⁶⁸ In the United States in particular, what is decisive is with which country the tort and the parties are most closely connected.⁶⁹ This has to be determined by weighing all the relevant factors, in particular the place of the injury, the place of the tortious act, domicile, residence, nationality, place of business,⁷⁰ but also other factors such as the relevant policies of the forum, justified expectations of the parties, etc.⁷¹

(iv) Evaluation

In the event of damage caused by the malfunction of global navigation satellite systems it will often, though not always, be necessary to designate the applicable law according to the rules of private international law. With few exceptions of limited harmonisation, this law is mainly national law and varies from country to country. Even the brief survey presented above shows a fairly wide variety of conflicts rules for cases dealing with such damage. First, the conflicts rules for contract and tort claims differ. Second, even though the starting point for international tort claims is often the *lex loci delicti* principle, there are many variations and exceptions to that rule. It is clear that in the same cases, the different conflicts solutions do not lead to the same law but produce differing results and thus promote forum shopping. Not infrequently, the question of which law will ultimately govern a given case is quite unpredictable since many national laws grant the courts broad discretion to designate the applicable law. In the event of international or even global mass disasters of the kind envisaged here, the present system of private international law provides an inappropriate response to the challenge that like cases should be treated alike.

(d) *Diverse substantive laws*

(i) General considerations

Leaving aside the few conventions which, in certain specific situations, may already cover damage caused by global navigation satellite

⁶⁸ See, e.g., India (which still follows the former English rule of double actionability): e.g., *The Kotah Transport Ltd. v. The Jhalawas Bus Service Ltd.*, 1960 Raj.224; further PARAS DIWAN, *supra* note 50, 551 ss., 570.

⁶⁹ See, e.g., *Babcock v. Jackson*, 191 N.E. 2d 279 (N.Y. 1963); *Reich v. Purcell*, 432 P. 2d 727 (Cal. 1967); further M. ROSENBERG / P. HAY / R.J. WEINTRAUB, *Conflict of Law. Cases and Materials*, 10th ed. (1996), 520 et seq.; E. SCOLES / P. HAY, *Conflict of Laws*, 2nd ed. (1994, Suppl. 1995), 570 et seq.; also *Restatement Second, Conflict of Laws*, § 145(1).

⁷⁰ See *Restatement Second, Conflict of Laws*, § 145(2).

⁷¹ See *Restatement Second, Conflict of Laws*, § 6(2).

systems,⁷² national contract and tort law has to be applied to claims concerning such damage. It is neither possible nor necessary here to give a full comparative account of the national contract and tort laws. A few remarks may suffice.

(ii) Claims in contract

A damages claim in contract generally requires a breach of contract, a damage and causation between both. Differences between national laws exist as to the requirement of fault; while some systems require fault, others provide for strict liability with certain excuses.⁷³ With respect to contracts for services, the fault principle may prevail. Sometimes, national law even expressly implies a contract term that the service provider “will carry out the service with reasonable care and skill,”⁷⁴ thereby adopting a fault standard.⁷⁵ In contract, there is a tendency to place the burden of proof on the debtor who must prove that he acted with reasonable care and skill.⁷⁶ Major differences between the legal systems exist with respect to the extent of damages in contract, although the principle of full compensation is generally the common starting point.⁷⁷

(iii) Claims in tort

The general tort law is most frequently based on four requirements: damage (partly limited to certain protected interests such as life, body, property, etc.); wrongfulness (breach of a duty); fault and causation. Generally the claimant bears the burden of proof of all these elements. If these requirements are met, then full compensation (*restitutio in integrum*) is owed. However, the single elements are not everywhere understood in the same way nor are they applied in a uniform sense.⁷⁸

⁷² See text under VI(3) *supra*.

⁷³ See the comparative observations by B.S. MARKESINIS / H. UNBERATH / A. JOHNSTON, *The German Law of Contract*, 2nd ed. (2006), 444 *et seq.*

⁷⁴ See Sec. 13 (English) of the *Sale and Supply of Goods Act* 1982.

⁷⁵ MARKESINIS / UNBERATH / JOHNSTON, *supra* note 73, 445 *et seq.*

⁷⁶ See thereon the contribution by U. MAGNUS / H.-W. MICKLITZ, in: Magnus / Micklitz, *Liability for the Safety of Services* (2006), 517.

⁷⁷ See the comparative observations by MARKESINIS / UNBERATH / JOHNSTON, *supra* note 73, 479 *et seq.*

⁷⁸ See the broad comparative studies on the single elements: Koziol (Ed.), *Unification of Tort Law – Wrongfulness* (1998); Spier (Ed.), *Unification of Tort Law – Causation* (2000); Magnus (Ed.), *Unification of Tort Law – Damages* (2001); Widmer (Ed.), *Unification of Tort Law – Fault* (2005).

Generally, this basic liability scheme is supplemented by strict liability statutes or precedents which dispense with fault in cases of specific activities which are unusually dangerous or place unreasonable risks on possible victims. Under strict liability, only very few grounds of exoneration are recognised.⁷⁹ The rather widely accepted example of strict product liability,⁸⁰ however, may be already on the retreat in some parts of the world.⁸¹ In some countries, the courts are given a degree of discretion, in others they are not permitted to extend strict liability statutes by way of analogy.⁸² To some extent, those statutes provide for maximum amounts in damages. Rather far-reaching variations between the different legal systems concern the compensable heads of damage under tort law,⁸³ in particular with respect to environmental damage. Some countries, especially the United States, even allow for punitive damages.

With respect to damage caused by the malfunction of a global navigation satellite system, most countries are likely to require fault for the provider's liability. Principles of strict product liability would, however, cover cases where defects of the hardware were the cause of damage.

(iv) Evaluation

The national solutions concerning liability for damage caused by satellite-based service activities such as those here under review vary considerably. This will lead to differences in the level of compensation. Depending on the applicable substantive law, some victims will receive less (or no) damages than others for similar losses.

(e) Recognition of judgments

A further aspect deserves a brief mention, namely the recognition and enforcement of judgments which have been rendered on claims for the compensation

⁷⁹ See the comparative survey by B.A. KOCH / H. KOZIOL, in: Koch / Koziol (Eds.), *Unification of Tort Law – Strict Liability* (2002), 395 et seq.

⁸⁰ In this sense, with respect to the European Directive on Product Liability of 1985: ECJ [2001] ECR I-3569 (C-203/99, *Henning Veedfald ./. Århus Amtskommune*) no. 15; ECJ, NJW 2006, 1409 (C-402/03, *Skov Æg ./. Bilka Lavprisvarehus A/S; Bilka Lavprisvarehus A/S ./. Jette Mikkelsen, Michael Due Nielsen*) Rz. 19.

⁸¹ In the United States, design defects and warnings defects are mainly subject to negligence standards: see *Restatement Third, Torts: Products Liability* (1998), § 2.

⁸² KOCH / KOZIOL, *supra* note 79, 395 et seq.

⁸³ See the comparative survey by U. MAGNUS, in: Magnus (Ed.), *Unification of Tort Law – Damages* (2001), 185 et seq.

of damage caused by the malfunction of global navigation satellite systems. It is an aspect of considerable practical importance. If such judgments cannot be recognised and enforced in other countries, in particular countries where the defendant's assets may be located, then the whole exercise of instituting proceedings and obtaining a judgment would be frustrated.

At present, no global instrument regulates the international recognition and enforcement of judgments in a general way. However, some specialised conventions, such as the nuclear conventions,⁸⁴ do deal with this aspect and provide for recognition and enforcement of judgments in the Contracting States. Furthermore, a number of bilateral treaties address the matter and some States still recognise foreign judgments only on this basis.⁸⁵ But as a rule, this issue must be dealt with according to national and, at times, regional regulations applicable in the country where recognition and enforcement is sought.

At a regional level, the Brussels I Regulation provides for the recognition and enforcement of judgments handed down in the EU Member States. Judgments rendered in one Member State must be recognised and enforced in all other Member States except on a very few grounds such as considerations of *ordre public* or failure of service.⁸⁶ To the extent that the Lugano Convention applies, it contains almost identical rules and serves the same purpose as the Brussels I Regulation.

At the national level, a variety of solutions are encountered. Generally, the judgment must be final and conclusive and rendered by a competent court, and it must not offend the *ordre public*. Not infrequently, however, reciprocity is also required,⁸⁷ and on occasion also any conflict with internal law hinders recognition.⁸⁸ Frequently, the defendant is further required to have been given proper notice of the suit and the opportunity to be heard.⁸⁹

This short survey again reveals a considerable variety of solutions which may lead to judgments to be neither recognised nor enforced in the countries

⁸⁴ Art. 13(e) of the 1960 Paris Convention; Art. XII of the 1963 Vienna Convention.

⁸⁵ This had been the prior Russian practice.

⁸⁶ See Arts. 34, 35, 45 of the Brussels I Regulation. Again, Denmark is not bound by these provisions of the Regulation but by the respective rules of the Brussels Convention.

⁸⁷ See, e.g., for China: Arts. 266 and 268 of the Civil Procedure Law of the People's Republic of China and thereon: JING-PING, in: Paley (Ed.), *International Recognition and Enforcement of Money Judgments* (1994), No. 403.001 *et seq.*; probably also for Russia: Supreme Court of the Russian Federation, 7 June 2002, *IPRax* (2003), 356 *et seq.* (German translation).

⁸⁸ E.g., in India: see Sec. 13 of the Code of Civil Procedure; for further discussion, see C. SARKAR, *The Law of Civil Procedure*, 10th ed. (2004), 159 *et seq.*

⁸⁹ An example is the United States: see *Restatement Second, Conflict of Laws*, § 98.

where they were not rendered. In the case of global activities with global effects, this is an unfortunate outcome.

VII. – SHORTCOMINGS OF THE PRESENT SOLUTION AND THEIR CONSEQUENCES

It must be stated at the outset that services based on global navigation satellite systems – despite their great and undeniable advantages – have a certain potential to cause tremendous damage, in the worst cases. Potential victims should be properly protected against this risk. The present legal framework allows a certain protection of potential victims but the current solution also shows some significant shortcomings:

- The main operators of global navigation satellite systems are and will be States or the European Union. To some extent, they can invoke the defence of State immunity so that they cannot be sued in foreign courts. This is a disadvantage for potential victims outside the operator's State.
- In principle, the international jurisdiction must be determined separately for each claimant with respect to each possible defendant and there will usually be more than one forum where a suit can be brought. The victim can generally choose between the different fora. At first glance, this may appear as an advantage for victims since they are often granted the opportunity to sue at the place where the damage was sustained, which may be their home country. But in the event of international mass disasters it leads to litigation in many different States, thereby multiplying the litigation costs for the defendant(s) and reducing the assets available for compensation. Moreover, a just and fair distribution of all assets among all victims cannot be safeguarded. The first claimants have the best chances of full compensation. A further disadvantage is the fact that the rules on international jurisdiction and their application are not everywhere clear beyond any doubt. Time and money are needed to ascertain their contents and even then claimants may run a certain risk to have approached the wrong court.
- At present it will often, if not always, be necessary to determine the applicable law according to national or regional conflicts rules when damage is caused by a GNSS malfunction. Due to the different solutions on offer this step may be complicated and may again cost time and money when a victim prepares a claim. Moreover, because

courts are frequently accorded a certain discretion in determining the applicable law, the outcome is often unpredictable. The diversity of national or regional conflicts rules has the further consequence that courts of different countries apply different laws to like cases, thereby again furthering forum shopping.

- The ultimate success of a claim depends on the contents of the applicable substantive law. Here, the national solutions for compensation of damage through GNSS malfunction vary widely. Often no claim will lie when the claimant is unable to prove fault on the part of the defendant. Great differences exist also as to the recoverable heads of damage and the level of compensation. Not infrequently, like cases of damage are treated completely differently in different countries. For victims it may become a kind of lottery whether the applicable national law is favourable or unfavourable to them.
- The recognition and enforcement of judgments on the compensation of damage through GNSS malfunction in other countries is not always secured. In a considerable number of cases such judgments will not be recognised in other countries. The party favoured by the judgment cannot rely on it in the foreign country where, for instance, the other party may have assets.

In sum, the present rules on State immunity, international jurisdiction, applicable law, substantive liability and compensation as well as on recognition and enforcement of judgments do not altogether exclude victims from compensation in the event of damage caused through global navigation satellite systems. But the problems and complexity of these rules make it difficult and in some instances impossible for victims of such damage to receive fair compensation and for defendants to make provision in advance for the situation in which they become liable.

Are these shortcomings serious enough to demand a change in the traditional rules of private international and procedural law according to which liability and compensation for damage in international cases are generally dealt with? The answer depends to some extent on how serious the risks of damage through GNSS malfunction are. For certain risks, the traditional rules have already been replaced by uniform conventions, in particular for the risk of damage through oil pollution at sea, through nuclear installations, during flight, etc. At present, the potential damage through GNSS malfunction can be assessed only in a hypothetical fashion. But as stated at the outset, given the global impact of global navigation satellite systems there

is a potential of extremely high damage which comes close to those risks for which international conventions have been concluded. The likelihood of such risk actually coming to pass may be questioned, but in case of doubt one should follow the precautionary principle and take reasonable steps of precaution in particular where the risk may not materialise very often but if it does, may cause tremendous damage.

Consequently, also with regard to protection against damage through GNSS malfunction, a global solution should be sought. It is therefore advocated here that a global convention on civil liability for damage caused by global navigation satellite systems should be concluded.

VIII. – POSSIBLE PROPOSALS

1. General considerations

An international convention as envisaged here need not break entirely new ground. As already mentioned, there are examples that could serve as models. The most prominent and apt of these models is the international liability regime for nuclear damage. This regime was likewise established in order to facilitate a new technology in, as was then thought, the common interest and to safeguard against its immense inherent risks. Insofar as it avoids the shortcomings referred to earlier it could be copied.

Below, this article discusses possible solutions for the different procedural and substantive aspects addressed above.

2. State immunity

A possible Convention on GNSS liability should exclude the defence of State immunity. As far as commercial activities of States are concerned, this exclusion already follows from international customary law, but in the field here under review the immunity defence should also be excluded – as is the case with the nuclear conventions⁹⁰ or with the 1972 Space Objects Convention⁹¹ – insofar as victims claim damage caused through State activities which do not qualify as commercial or whose qualification is uncertain. Where States or bodies such as the European Union establish

⁹⁰ See Art. 13(e) of the 1960 Paris Convention; Art. XIV of the 1963 Vienna Convention.

⁹¹ *Supra* note 12. This Convention does not explicitly exclude the defence of State immunity but allows claims against States and intergovernmental organisations (such as the EU) by providing certain procedures for such claims.

worldwide services, thereby transcending the boundaries of their sovereign territory, there is no convincing reason why they should be exempted from an otherwise applicable jurisdiction in foreign countries even if these States or bodies act in the global common interest.

3. International jurisdiction

The proposed instrument should also regulate international jurisdiction. It should – again after the model of the nuclear conventions⁹² but also of other conventions⁹³ – prescribe exclusive jurisdiction at the seat of the operator of the global navigation satellite system which caused the damage. This would allow a procedural channelling of all claims in connection with such damage. The litigation could be concentrated at one single court. Also, the eventual distribution of the defendant's available assets could be handled by one court. The equal treatment of victims or, as the case may be, of classes of victims could be safeguarded. These advantages outweigh the disadvantage that the exclusive jurisdiction of the court at the defendant's seat will usually force victims to sue in a foreign court. This disadvantage could be minimised if GNSS operators were obliged to name a claims bureau in each Contracting State of the proposed Convention.

The proposed instrument should also secure its general priority over the provisions of the EC Treaty on the jurisdiction of the European Court of Justice and of the Court of First Instance, but could leave untouched those provisions in relation to entirely internal EU cases.

4. Applicable law

An international convention on GNSS liability should further explicitly determine the applicable law for matters covered but not expressly regulated by that instrument. In general, this should be the law at the seat of the system operator. Again, the nuclear conventions provide an example for such a solution.⁹⁴ In designating the applicable law, the instrument would avoid the difficulties and diversities to which differing national choice-of-law rules lead.

⁹² See Art. 13(a) of the 1960 Paris Convention; Art. XI(1) of the 1963 Vienna Convention.

⁹³ Other liability conventions also deal with the issue of jurisdiction but prescribe that exclusive jurisdiction lies in all States affected by pollution damage: see Art. IX of the 1969 Brussels Convention (CLC); Art. 9 of the 2001 Bunkers Convention.

⁹⁴ See Art. 14(b) of the 1960 Paris Convention; Arts. I(e) and VIII of the 1963 Vienna Convention.

5. Substantive law

(i) General considerations

The central contents of an international instrument on GNSS liability should be the material provisions on liability and compensation. Here, not only the nuclear conventions but also further liability conventions such as the 1972 Space Objects Convention, the 1969 CLC Convention (as amended by several Protocols), the 1996 HNS Convention or the 1999 Montreal Convention⁹⁵ form the background and fund from which general principles can be derived. They can and should be used for present purposes. A short account of the relevant problems and possible solutions is given below, although further in-depth considerations remain necessary.

(ii) Definition of the material scope of a possible convention

A first necessary step is the definition of the material scope of application of the proposed convention. The instrument should apply to any damage caused by the malfunction of a global navigation satellite system. The global navigation satellite system is to be understood as described above. It should include also those services which make local or regional use of such global systems. Whether the system is operated by a public body or a private enterprise should not matter. The definition further requires that malfunction of the system was the cause of damage. The malfunction may be due to a design defect, a manufacturing defect or the incorrect operation of the system or of one of its components except the receiving device. The latter is neither operated nor controlled by the operator of the global navigation satellite system. If the receiver does not work and causes damage, the user must approach the seller or manufacturer of the device. Here, the product liability rules provide the appropriate and existing remedy.

(iii) Definition of the operator

A further issue to be addressed in a future instrument is the definition of the operator of the system who could be made responsible (as to channelling onto the operator see below). The operator should be the person or entity bearing the overall responsibility for establishing and managing the system. In the case of Galileo this is the European Union. For GPS, it is at present the United

⁹⁵ See, for a survey of international conventions relevant for GNSS activities, F.G. VAN DER DUNK, "The European Equation: GNSS = Multimodality + Liability", in: *Liber Amicorum Böckstiegel* (2001), 231 et seq.

States and for GLONASS, the Russian Federation.⁹⁶ It is not required that the operator own all satellite or ground components of the system nor need it have built up or run all these components. It suffices – but this is also a prerequisite – that the operator has central control.

Where global navigation satellite systems are run co-operatively by two or more States or entities (such as the European Union), each entity functions as operator unless one of them is the leading operator with over-all responsibility.

(iv) *Strict liability*

Many international liability conventions prescribe strict liability of the person responsible.⁹⁷ Strict liability is the appropriate reaction of international but also of national law⁹⁸ to specifically dangerous activities which create either high risks or risks for many people or risks to which potential victims are – often necessarily – exposed and which they are neither able to control nor to avoid or where proof of negligence of the risk creator is difficult if not impossible. Where liability is strict, the victim need not prove fault, in particular negligence of the person liable. It suffices – but again, it is also necessary – that the victim proves causation between its damage and the damaging activity.

The risks of global navigation satellite systems may be considerable. Although the introduction of this technology is highly desirable because of its advantages, it is likewise desirable that potential victims be adequately protected against the inherent risks. This aim requires the introduction of strict liability for GNSS.

(v) *Exoneration*

Even the strictest liability regimes admit certain grounds of exoneration. The operator is generally exempted from liability if war (including civil war) or an exceptional natural disaster caused the damage.⁹⁹ Also, the victim's

⁹⁶ In space law, the traditional approach holds States liable for any damage cause by space activities; see, in particular, Art. II of the 1972 Liability Convention (Space Objects): the “launching State shall be absolutely liable”; see thereto also VAN DER DUNK, *supra* note 95, 231 *et seq.*, 235.

⁹⁷ See, e.g., Art. II of the 1972 Liability Convention (Space Objects); Art. 3 of the 1960 Paris Convention; Art. IV of the 1963 Vienna Convention; Art. III of the 1969 Brussels Convention (CLC); Art. 3 of the 2001 Bunkers Convention.

⁹⁸ See thereto Koch / Koziol, *supra* note 79, 395 *et seq.*

⁹⁹ This is the solution under, e.g., Art. 9 of the 1960 Paris Convention, Art. IV(3) of the 1963 Vienna Convention and Art. III(2)(a) of the 1969 Brussels Convention (CLC).

intentional or negligent conduct may lead to an appropriate reduction of its claim.¹⁰⁰ And finally, the act or omission of a third party with intent to cause damage exonerates the person actually liable.¹⁰¹

A future instrument on GNSS liability should also recognise these grounds of exoneration. The system operator should be exempted from liability if the cause of damage were war or a comparable incident, a natural disaster or the conduct of a third person with the intent to cause damage. For all these exemption grounds it should be further required that they could neither have been foreseen nor avoided. Intentional or negligent conduct of the victim should reduce or exclude the latter's claim.

(vi) Channelling of liability onto the operator

One of the central questions is whether civil liability should be channelled onto the operator of the global navigation satellite system so that victims can sue the operator (in the sense just defined) alone, even if other persons involved in providing the system's services have caused the actual damage. Such channelling is an essential feature of liability under the nuclear conventions.¹⁰² To a certain extent, also the oil pollution damage conventions channel liability onto the shipowner in that they exclude liability of the shipowner's servants or agents.¹⁰³ There are two main advantages of such channelling: the first is that victims can always, and need only, sue the operator; they need not identify who in the complicated network of the service system is the correct defendant; they run no risk suing the wrong person. The second reason is that only the operator must take out full insurance for all potential damage while sub-suppliers, subcontractors, etc. need insure at most only their share (in the event of a recourse action by the operator). This allows a certain concentration of insurance capacity in the interest both of the victims and of all those involved in the supply of the system services.¹⁰⁴

¹⁰⁰ See Art. IV(2) of the 1963 Vienna Convention; Art. III(3) of the 1969 Brussels Convention (CLC).

¹⁰¹ See Art. III(2)(b) of the 1969 Brussels Convention (CLC), .

¹⁰² See Arts. 3, 6 of the 1960 Paris Convention, Art. II of the 1963 Vienna Convention.

¹⁰³ See, e.g., Art. III(4) of the 1969 Brussels Convention (CLC).

¹⁰⁴ See the arguments for channelling stated in the Exposé des Motifs of the 1960 Paris Convention (as revised and approved by the OECD Council on 16 November 1982), No. 15; see also C. STOIBER / A. BAER / N. PELZER / W. TONHAUSER, *Handbook on Nuclear Law* (2003), 112.

On the other hand, it is argued that channelling reduces the incentive of all those persons who, besides the operator, may also have been involved in causing the damage or even have caused it all by themselves to take appropriate care to avoid damage.¹⁰⁵ This argument is only valid however if the operator were to have no recourse against those third persons. Clearly, therefore, such recourse should be possible.

A future instrument on GNSS liability should channel liability onto the operator. The reasons given for the introduction of channelling under the nuclear conventions also apply here. GNSS technology and nuclear technology also have some features in common which allow a parallel. They resemble each other insofar as many sub-suppliers, subcontractors, etc. are involved in achieving the "end product", making it difficult if not impossible for victims of damage caused by these technologies to identify the single responsible cause and person. Furthermore, the damage caused by either of these technologies almost inevitably transcends the boundaries of a single State and its compensation may reach astronomic amounts.

(vii) Heads of damage

A further, central point would be the circumscription of the recoverable damage. In this respect, the law of the international liability conventions has developed over the years. In particular, the costs of preventive measures and environmental damage has become recoverable.¹⁰⁶ Meanwhile, the following heads of damage are recognised and are regarded as recoverable by or on behalf of the victim:

- loss of life and personal injury,
- loss of or damage to property,
- economic loss as the result of these infringements,
- costs of measures to reinstate the environment,
- costs of preventive measures to reasonably mitigate damage after an incident,
- any other economic loss if permitted by the applicable national law.¹⁰⁷

¹⁰⁵ See M. FAURE, "Economic Analysis" (of strict liability) in: Koch / Koziol (Eds.), *supra* note 79, 386.

¹⁰⁶ See, in particular, Art. 1(f) of the 1997 *Convention on Supplementary Compensation for Nuclear Damage* (although this Convention is not yet in force).

¹⁰⁷ See *idem*: the Convention even allows compensation of an economic loss resulting from a significantly impaired environment (Art. 1(f)(v)).

An instrument on GNSS liability should provide for the recoverability of these heads of damage as well. However, it is advocated here that the instrument should avoid any reference to national law but should instead regulate the recoverability of pure economic loss itself.

(viii) Limitation in amount and time

Many of the international liability conventions and in particular the nuclear conventions¹⁰⁸ limit the liability of the person liable to a maximum amount per incident. They further fix the time within which victims must bring an action for damages. An instrument on GNSS liability should likewise provide for such limits. Here, the nuclear conventions could give some guidance. With regard to the limit in amount, it could be argued that this is unnecessary given that at present only States are engaged in GNSS technology and their liability should be unlimited since in the event of mass disasters they have to step in anyhow in one form or another. An international GNSS liability convention would, however, also cover the liability of private system operators who may eventually manage such systems in the future. For these operators, the reasons apply that support a limit in amount, *i.e.* to protect them against excessive liability for which no insurance coverage is available.¹⁰⁹

(ix) Proof

Proof is partly a matter of substantive law, partly of procedural law. The burden of proof is mainly regarded as substantive law, whereas rules and principles of evidence belong to the law of procedure. The latter is generally not unified by international conventions and need therefore not be regulated by a GNSS liability convention. But as in other liability conventions, the burden of proof should be expressly regulated.¹¹⁰ In a future instrument on GNSS liability victims should bear the burden of proving their damage and its causation by the malfunction of a global navigation satellite system. The operator should bear the burden of establishing a ground of exoneration. Also, any contributory negligence should be pleaded and proven by the operator.

¹⁰⁸ Art. 7 of the 1960 Paris Convention; Art. V of the 1963 Vienna Convention.

¹⁰⁹ For these reasons see, in nuclear law, STOIBER / BAER / PELZER / TONHAUSER, *supra* note 104, 113.

¹¹⁰ See, *e.g.*, Art. III (2) and (3) of the 1969 Brussels Convention (CLC); Art. IV(2) of the 1963 Vienna Convention.

(x) *Obligation to take insurance*

The nuclear conventions and the maritime liability conventions on oil pollution and on carriage of hazardous substances provide as a specific feature that the operator or shipowner – the master of the dangerous source – is obliged to take out insurance or other financial security for its possible liability before engaging in the dangerous activity.¹¹¹ In part, a fund solution has been introduced. Instead of, or in addition to, insurance the shipowner must contribute a certain amount to a fund. The amount depends on the likely risk. The fund then indemnifies victims to whom the shipowner has become liable.¹¹² This compulsory insurance, fund solution or other security excludes the otherwise serious risk that a liable operator or shipowner cannot satisfy the claims up to the amount to which liability is incurred.

A GNSS liability convention should also contain instruments which safeguard that the liable system operator is able to satisfy all claims up to the prescribed maximum limit of liability. As long as only States or the European Union are system operators such a solution might appear superfluous. But again, the proposed convention also has to provide for cases where private enterprises become system operators. In those cases, such safeguarding is more than appropriate. The experience¹¹³ with the Oil Pollution Damage Fund may serve as an encouragement to establish a similar global fund for the compensation of damage caused by GNSS activities. The resources of the fund would have to be paid for by the system operators.

As a rule, the existing liability conventions grant victims a direct right of claim against the respective insurance, fund or other financial guarantor.¹¹⁴

(xi) *Recourse*

The proposed convention should not exclude any right of recourse which the operator may have under the applicable law against any third person. The

¹¹¹ Compare Art. 10 of the 1960 Paris Convention; Art. VII of the 1963 Vienna Convention; Art. 7 of the 2001 Bunkers Convention.

¹¹² See Art. V of the 1969 Brussels Convention (CLC) in connection with the 1971 Fund Convention; Arts. 9 and 13 *et seq.* of the 1996 HNS Convention.

¹¹³ As to this experience, see R. RENGGER, "Recht und Praxis der Haftung und Entschädigung für Ölverschmutzungsschäden auf See", in: Koch / Willingmann (Eds.), *Großschäden – Complex Damages* (1998), 151 *et seq.*

¹¹⁴ See Art. 6(1) of the 1960 Paris Convention and Art. II(7) of the 1963 Vienna Convention (however, both Conventions reserve a direct claim only if the applicable national law provides for such a right); Arts. V and VI of the 1969 Brussels Convention (CLC); Art. 14 of the 1996 HNS Convention.

channelling excludes direct claims of victims against third persons who without the channelling may also or alone be responsible for the GNSS damage. There is no reason to relieve such persons wholly from liability. Hence, the future convention should be without prejudice to eventual recourse claims by the system operator against such persons.¹¹⁵

(xii) Relationship with other conventions

A future instrument would also have to solve the relationship with other already existing or future conventions. In the event of a conflict between the future instrument and another convention, the general solution should be that specialised conventions – like for instance the nuclear conventions – should prevail to the extent that they were also applicable. Whether a conflict existed would first have to be clarified by interpretation. For instance, a conflict of a possible GNSS liability convention with the 1972 Space Objects Convention has probably to be denied. The better view is that the latter convention (Article II: “damage caused by ... space object on the surface of the Earth or to aircraft in flight”) covers only cases where damage is caused by space objects in their corporeal capacity by hitting an aircraft or persons or objects on the ground and does not cover cases where signals emitted by space objects cause damage.¹¹⁶

6. Recognition of judgments

As shown above, it is often not certain whether a judgment rendered in one country will be recognised in another. It is therefore a considerable advantage of practical importance where international conventions – such as the nuclear conventions¹¹⁷ – provide that judgments on matters covered by them must generally be recognised and enforced in all Contracting States and that recognition and enforcement can be denied for very few reasons only (denial

¹¹⁵ This is also the general solution under the international liability conventions: see, e.g., Art. 3(6) of the 1969 Brussels Convention (CLC); Art. 6(f) of the 1960 Paris Convention (with some limitations).

¹¹⁶ In this sense EPSTEIN, *supra* note 1, 243 et seq., 269 et seq. with further references ; B. HURWITZ, *State Liability for Outer Space Activities in Accordance with the 1972 Convention on International Liability for Damage Caused by Space Objects* (1992), 18 et seq.; but *contra*, e.g., P.D. LARSEN, “Legal Liability for Global Navigation Satellite Systems”, in: *Proceedings of the Thirty-Sixth Colloquium on the Law of Outer Space* (1993), 69 et seq.

¹¹⁷ Art. 13(d) of the 1960 Paris Convention; Art. XII of the 1963 Vienna Convention. Similar rules are provided for by the *Convention on Civil Liability for Oil Pollution Damage* (Art. X) and the 1996 HNS Convention (Art. 40).

of the right to be heard and public policy).¹¹⁸ The same solution is desirable for an international GNSS liability convention.

7. Further procedural issues

Some further procedural aspects should be considered for an international GNSS liability instrument. Again, they can only be mentioned briefly here. To facilitate victims' access to compensation thought should be given to obliging system providers to establish or at least to name a Claims Bureau in each Contracting State. As long as States or the European Union are the only GNSS operators a department of their diplomatic representation in each Contracting State could perform this function. For future private operators it might suffice if they named a lawyers' office in each Contracting State of the proposed convention as their Claims Bureau.

A further issue is the question whether any form of mediation should be made mandatory before victims can go to court. If so, it is questionable whether a global mediation centre for claims arising from GNSS activities should be established to deal with these cases. Should a fund solution be instituted an – independent – mediation centre could be established at the place where the fund organisation was located.

VIII. – CONCLUSIONS AND RECOMMENDATION

Global challenges require global answers. The highly advanced technology of global navigation satellite systems is an activity with positive as well as negative global effects. The risks engendered by this technology are considerable. The present legal framework does not provide an adequate response to this challenge. It is complicated, burdened with uncertainties and may leave victims without compensation without just reason. To amend these shortcomings, to provide safeguards against the risks of this new technology and also to facilitate its acceptance, an international Convention on Civil Liability for Damage Caused by Global Navigation Satellite Systems should be negotiated. This Convention should be modelled on the conventions on liability for nuclear damage. Such an instrument should primarily meet the following requirements: it should provide for strict liability of the operator of the system whose malfunction caused the damage in question; it should further channel liability onto the operator, define the notion of damage as including also environmental damage and costs of preventive measures, limit

¹¹⁸ See, as an example, Art. 12(1) (a)-(c) of the 1963 Vienna Convention.

liability in amount and time and ensure that operators of global navigation satellite services have sufficient insurance or other coverage in the amount of their maximum liability. The Convention should also deal with the accompanying procedural aspects such as State immunity, jurisdiction, as well as recognition and enforcement of judgments.

The proposed Convention would provide an adequate global response to the global challenge that is posed by Galileo and its companions.

