LIABILITY FOR GLOBAL NAVIGATION SATELLITE SERVICES: A COMPARATIVE ANALYSIS OF GPS AND *GALILEO*

Frans G. von der Dunk[*]

I. INTRODUCTION: GLOBAL NAVIGATION SATELLITE SERVICES AND LIABILITY

The law relating to global navigation satellite systems, (GNSS) is a novel and complex subject. As a result, this paper addresses a considerable number of issues from a new, as of yet untested legal perspective. It will also address a number of altogether new issues which, from a legal perspective, have been dealt with often in other areas of law.

Global navigation satellite systems are being used for a very rapidly growing plethora of applications and, thus, also cause a rapidly growing plethora of legal issues to arise. These range from general institutional and jurisdictional ones, to such concrete aspects as certification, security, intellectual property rights and data protection. These issues, moreover, firstly, interplay with each other; secondly, do so at various levels (international/global, to some extent European, that is European Community, and national); and thirdly, do so in a number of respects across a number of economic sectors, transport and non-transport.

To address relevant legal issues, this paper will lay out the essence of a global navigation satellite system, how it basically operates at an abstract and non-technical level, and then will chart specific legal ramifications onto this analysis.

The first economic sector to acknowledge the potential benefits of global navigation satellite systems (timing, positioning and navigation-related services) was indeed a transport sec-

---

[*] Dr. Frans G. von der Dunk is Co-Director of the International Institute of Air and Space Law at Leiden University, The Netherlands. He has been involved in many GNSS - and *Galileo* - related study projects as Legal Advisor or Legal Task Manager, including the GALILEI Study Cluster which finalised its work in July 2003.

tor: aviation. In 1983 the International Civil Aviation Organisation (ICAO) established a Committee on Future Air Navigation Systems (FANS)[1] which *inter alia* was to identify possible benefits, risks and drawbacks of the use of global navigation satellite systems for aviation purposes, and came forward with recommendations for dealing with them properly.[2]

Concurrently, because of the high degree of safety-sensitivity in the aviation sector, it quickly became clear that one of the major issues would be that of liability: who pays for the damage in case an aircraft accident is ultimately caused by wrongful or absent navigation information at a critical point in flight operations?

For example, efforts have been made at least in writing to establish liability for such damage on the basis of the Convention on International Liability for Damage caused by Space Objects (Liability Convention)[3], as constituting "damage caused by [a] space object".[4] Others contended that air law would be the more appropriate place to establish liability – if any – as resting upon the providers of the relevant satellite signals, leading some to further conclude that indeed no such direct liability existed in the first place.[5]

---

[1] See e.g. *in extenso* BOAKYE DANQUAH KOFI HENAKU, THE LAW ON GLOBAL AIR NAVIGATION BY SATELLITE: AN ANALYSIS OF LEGAL ASPECTS OF THE ICAO CNS/ATM SYSTEM, (AST Law Monographs, Leiden 1998).

[2] Later, the FANS-concept evolved into the more encompassing one of Communication, Navigation and Surveillance/Air Traffic Management (CNS/ATM), and *inter alia* a Legal Technical Expert Panel (LTEP) was established to make sure all relevant legal aspects were considered. Also, efforts were made in the ICAO Standards and Recommended Practices (SARPs) to accommodate the possible usage of GNSS.

[3] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention].

[4] *Id.* at art. II. *See also* Henaku, *supra* note 1, at 221.

[5] *See* Michael Milde, *Air Navigation and Safety: Institutional and Legal Problems of the Global Navigation Satellite System*, IV TEMAS DE AVIACIÓN COMERCIAL Y DERECHO AERONÁUTICO Y ESPACIAL 134-5 (2000). It may be noted here, that under Art. 20(2) of the Convention for the Unification of Certain Rules Relating to International Transportation by Air, Oct. 12, 1929, 49 Stat. 3014, 137 L.N.T.S. 11 [hereinafter Warsaw Convention], "negligent pilotage or negligence in the handling of the aircraft or in navigation", did relieve the carrier of liability. Whereas, under Art. X of the Protocol to Amend the Convention for the Unification of Certain Rules Relating to International Carriage by Air Signed at Warsaw on Oct. 12, 1929, Oct. 28, 1955, 478 U.N.T.S. 371 [hereinafter Hague Protocol], this provision was not maintained.

Currently, there are two global navigation systems in existence: the U.S. Global Positioning System (GPS)[6] and the Russian GLONASS system[7]. The Russian constellation, for economic reasons, could not be replenished when consecutive satellites ended their operational life, therefore, the discussion on liability for global navigation satellite systems in the context of aviation has largely focused on GPS. In ICAO, for instance, many member states have expressed their hesitation to accept GPS as a structural component of air traffic services unless there would be some sort of international liability established for the provider(s) of system signals, specifically, the United States, preferably in the form of an international treaty.[8]

With the advent of *Galileo*, the third global navigation system due to be operational by 2008 or shortly thereafter[9], this discussion entered into a new phase, for two reasons. Firstly, the civil use of GPS in the context of safety-sensitive, highly-regulated and world-wide applications remains essentially confined to aviation. Other areas making substantive use of GPS are either not internationally and heavily regulated, such as maritime transport, or they concern non-professional areas such as private car-driving or yachting. By contrast, *Galileo* from the start was aimed at providing services to a number of other

---

[6] GPS is a 24-satellite constellation fully operational as of 1994. The system, developed for military purposes and operated under the *aegis* of the Department of Defense, in addition to a Precise Positioning Service (PPS) only available to the military, offers a Standard Positioning Service (SPS) available to civil users such as commercial aviation. U.S. President Clinton in 1996 offered such use for a period of at least ten years free of charge by means of The White House Office of Science and Technology Policy National Security Council, *Fact Sheet U.S. Global Positioning System Policy*, Mar. 29, 1996.

[7] GLONASS was launched as a 24-Satellite system quite similar to GPS by the former Soviet Union, and became operational as of 1995. Equally developed by the military (space) forces, the GLONASS system is ultimately controlled by the Russian Ministry of Defence, and emits both civil and military (encoded) signals. *See* Decree of the Government of the Russian Federation, Sobr. Zakonod. RF, 1995, No. 237. *See generally, e.g.*, Patrick Salin, *Regulatory Aspects of Future satellite Air Navigation Systems (FANS) on ICAO's 50th Birthday*, 44 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT 174-175 (1995).

[8] *See, e.g.*, Francis P. Schubert, *An International Convention on GNSS Liability: When Does Desirable Become Necessary?*, XXIV ANNALS OF AIR AND SPACE LAW 245 (1999); *See also* Milde, *supra* note 5, at 132.

[9] *See e.g., Transport and Telecommunications*, 2420th Council Mtg, Doc. 7282/02 (Presse 78), 19-21 (Mar. 25-26, 2002); Council Regulation 876/2002/EC on setting up the Galileo Joint Undertaking , 2002 O.J. (L 138/1).

transport applications such as high-speed trains or vessels as well as non-transport applications like time synchronisation, mobile phones, building, and banking. Secondly, in addition to free signals roughly similar to the free GPS Standard Positioning Signals (SPS) signals, *Galileo* will provide a few categories of signals namely services against payment for which it also will have to accept a certain liability.[10]

II. THE CONCEPT OF LIABILITY IN A GLOBAL NAVIGATION SATELLITE SYSTEM CONTEXT

When analysing liability for system signals and/or services that use those signals as crucial elements, on the one hand, global navigation systems do not and will not start operating in a legal or regulatory vacuum. On the other hand, most of existing law and regulation is non-global navigation satellite system-specific. In many cases, the advent of global navigation satellite systems on the scene merely adds another potential ultimate cause of damage to those already in existence such as traditional navigation errors, human errors, engine failure or *force majeure*, rather than leading to a fundamentally different, or separate legal paradigm.[11]

The legal environment within which GPS now and *Galileo* will soon operate actually comprises a wide range of separate and separately developed specific legal environments, none of which were developed principally with global navigation satellite systems in mind. Yet all of them potentially or actually impact upon global navigation satellite systems and its applications. This includes liability. Most of these environments are nationally defined. That is, they operate only within the territory of one particular state even if occasionally, as in air and space law, international regimes are superimposed. At the same

---

[10] *Cf.* already GALILEO Mission Requirements Document Issue 5, E.C./ESA, Rev. 1.1 (Mar. 27, 2003); GALILEO Mission High Level Definition, E.C./ESA, Sept. 23, 2002; or extensively the "Recommendations and Conclusions" arising from Task I, *Legal and Institutional Issues*, of the GALILEI Study Cluster, DD-120, v. 2.1, July 24, 2003 [hereinafter Recommendations and Conclusions]. *See further infra* section 6, focusing on this issue.

[11] *Cf. also* Milde, *supra* note 5, at 134.

time, a global navigation satellite system is inherently global, and both GPS and *Galileo* address global markets.

In view of such complexity, it is helpful to briefly consider the concept of liability which is a term used in numerous national and international legal regimes.[12] In each case, however, it may be differently interpreted and applied with the consequence that, at the international level, quite often a large measure of confusion has arisen as to the scope, meaning and consequences in law of liability. Generally, "liability" is defined as a "condition of being responsible for a possible or actual loss, penalty, evil, expense or burden", and as "the state of being bound or obliged in law or justice to do, pay, or make good something".[13] In the context of *Galileo*, this definition has been elaborated as: "the accountability of a person or legal entity to compensate damage caused to another person or legal entity, in accordance with specified legal principles and rules and based upon specified sources of law."[14] Thus, liability depends upon a specific legal regime, which itself determines the boundaries of the particular liability regime at issue regarding where it applies, which persons or legal entities are involved, what type of liability is provided for, and how compensation is being dealt with.

From the perspective of seeing which liability regimes do or might apply to a GNSS and how they would apply, the fundamental threefold distinction between contractual liability, non-

---

[12] *Cf. eg.*, the authors *Liability and Responsibility in Space Law: Misconception or Misconstruction?*, PROCEEDINGS OF THE THIRTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE 363-71 (1992).

[13] BLACK'S LAW DICTIONARY 823 (5th ed. 1979); WEST'S LAW & COMMERCIAL DICTIONARY IN FIVE LANGUAGES: DEFINITIONS OF THE LEGAL AND COMMERCIAL TERMS AND PHRASES OF AMERICAN, ENGLISH AND CIVIL LAW JURISDICTIONS Vol. II, p. 47 (1983), referring to, respectively, Union Oil Co. of California v. Basalt Rock Co., 30 Cal. App.2d 317, 319 - 20 (1939), and Fidelity Coal Co. v. Diamond, 310 Ill. App. 387 (1941) [hereinafter WEST'S LAW & COMMERCIAL DICTIONARY].

[14] Recommendations and Conclusions, *supra* note 10, at 101. See also, Cooperation Agreement on a Civil Global Navigation Satellite System (GNSS) – Galileo Between the European Community and its Member States and the People's Republic of China, art. 2(i), Doc. Council of the EU 13324/03 (Oct. 30, 2003) (defines liability as: "the legal accountability of a person or legal entity to compensate for damage caused to another person or legal entity in accordance with specific legal principles and rules. This obligation may be prescribed in an agreement (contractual liability) or in a legal norm (non-contractual liability).").

contractual liability and product liability should also be noted. The key issue distinguishing the three types of liability focuses on the legal relationship between the claimant and the defendant.

"Contractual liability," for purposes of this paper, is defined as "the liability which arises from a contract or agreement," and thus fundamentally deals with liability as between parties to a contract regarding activities undertaken in relation to damage suffered in the context of the contract and its subject matter.[15] Contractual liability is essentially a term coming from national law, and, by way of common denominator is explicit, formalised and already in existence at the time the relevant accident leading to damage occurs. Hence, for the purpose of analysis here, it coincides in a principled sense with inter-party liability as it is often discussed on the public international level, where international treaties between states would essentially take the place of contracts. From a legal point of view, dealing with contractual liability is a matter of the freedom of parties to contract between themselves. This freedom may only be restricted by overriding public interests in contracts being generally fair, if indeed such public interests are expressed through law or other legally binding documents.

In view of the above definition of "contractual liability" non-contractual liability would then be liability for damage occurring outside a contractual relationship. This occurs where the person or entity suffering the damage is not formally or contractually related to the person or entity causing it, and is likely unaware of the possibility of damage occurring nor is able to take precautionary measures against it.[16] Thus, it equates at this level of abstraction with the tort liability[17] of national legal

---

[15] BLACK'S LAW DICTIONARY, *supra* note 13, at 295, and WEST'S LAW & COMMERCIAL DICTIONARY, *supra* note 13, at Vol. I, p. 339, which define "contractual obligation" as "the obligation which arises from a contract or agreement." *See also* Recommendations and Conclusions, *supra* note 10, at 102.

[16] Recommendations and Conclusions, *supra* note 10, at 102.

[17] "Tort" is defined as, "a private or civil wrong or injury, other than breach of contract, for which the court will provide a remedy in the form of an action for damages". BLACK'S LAW DICTIONARY, *supra* note 13, at 1334; WEST'S LAW & COMMERCIAL DICTIONARY, *supra* note 13, at Vol. II, p. 660.

systems, respectively the third-party liability known in international law. Its common denominator would thus be that the legal relationship is implicit, not formalised and solely based on the fact that one party is the proven cause of the damage sustained by the other party.

As a consequence, protecting the interests of third parties through non-contractual liability regimes is a public matter, to be taken care of preferably by legislative means, since by definition entities cannot protect their interests by contract or otherwise. Hence, this is also the type of liability which a public legislative document on the international level is most often concerned with, although exceptions exist, such as most notably the Warsaw system on contractual liability in international air transport.[18] On the national level, this equates with the need for, preferably, a clear written law or statute, or in common law countries at least clear jurisprudence and customary law.

"Product liability" is defined as, "the legal liability of manufacturers and sellers to compensate buyers, users, and even bystanders, for damages or injuries suffered because of defects in goods purchased".[19] Thus, as also dealt with in the context of *Galileo*,[20] it is of a different nature; not imposing liability upon someone for activities undertaken and damage suffered as a consequence, but imposing it upon someone having manufactured and/or sold a product by which, in the course of using it, damage has been caused. In a sense this constitutes an indirect form of liability, as the occurrence which triggers liability claims may take place long after the manufacturer or seller – the entity to be held liable – has had any involvement with the product. The relevant legal relationship here is effectively created through the product concerned. Also, product liability, even if elements may have found their way into contracts for the sale of the product in the last resort is a matter of general public interests being preserved through the enunciation of explicit law.

---

[18] *See* further *supra* note 5, *infra* note 48, and accompanying text.

[19] BLACK'S LAW DICTIONARY, *supra* note 13, at 1089, and WEST'S LAW & COMMERCIAL DICTIONARY, *supra* note 13, at Vol. II, p. 358.

[20] *See also* Recommendations and Conclusions, *supra* note 10, at 102.

III. GPS AND THE LEGAL/FUNCTIONAL MODEL

This section applies liability to the context of global navigation systems, particularly GPS as it is the first fully operational version.

To properly apply current liability concepts to GPS it is helpful to refer to the Legal/Functional Model (Model) for a global navigation satellite system and its activities which was developed for the European Commission.[21] It is based upon the fundamental categories of players and their ensuing legal relationships. In view of the definition of liability provided above, this Model should help in answering the salient overarching – but rather broad – question on liability issues in the context of GPS. That is, which legal entities would be held liable to compensate for damage caused to another legal entity in the context of GPS activities?

As a generic concept based upon the existence of the currently operational systems, GPS and GLONASS, the Model presumes three essential categories of satellite navigation functions are discernable. They are:

1. basic or primary signal provision,[22] which could hardly be labelled a "service provision" since existing basically of the provision only of signals-in-space carrying basic data;

2. augmented or secondary signal provision,[23] which sometimes could be, and is, labelled "service provision", since more than just the signal-in-space carrying basic data is provided; and

3. value-added service provision.

This threefold categorisation of activities leads to a fourfold functional categorisation of key actors in the context of a global navigation satellite system with three fundamental categories of legal relationships involved. (Figure 1, Appendix 1).[24] Figure 1

---

[21] *Id.*

[22] *See e.g.*, Schubert, *supra* note 8, at 250-1; Henaku, *supra* note 1, at 171.

[23] *See e.g.*, Schubert, *supra* note 8, at 251-2; Henaku, *supra* note 1, at 172.

[24] Figure 1 is a reproduction *inter alia* of Figure 2, "The Functional Model of GNSS Signal and Service Provision", as contained in "Regulatory Issues" arising from Task I,

(Appendix 1) summarises the current situation with regard to GPS and GLONASS. GPS (and GLONASS) is a basic signal provider, with its SPS falling within the category of A. No barrier to access is in place, making it a clear open access-type signal available to three categories of players: the end-users, the value-added service providers and the augmentation providers. This, essentially at their own initiative: anyone with the right type of receiver can receive the signal without any service fee being required. (The GPS precise positional services (PPS) are not included in this Model, since they are encoded and made available only to a very limited group of users – basically the U.S. military and NATO allies.)

The major issue in particular for aviation in view of relevant ICAO requirements is that the SPS, in addition to the absence of high-level accuracy and continuity, lacks the level of integrity monitoring[25] necessary for serving as a stand-alone system for approach, landing and take-off operations of aircraft.

As to the augmentation providers, A is currently being picked up by three such satellite-based wide-area augmentation systems in experimental fashion: the European Geostationary Navigation Overlay System (EGNOS)[26] for Europe, the Wide Area Augmentation System (WAAS)[27] for the United States, and the Multi-Functional Transport Satellite-Based Augmentation System (MSAS)[28] for Japan and the surrounding region.[29] These

---

Legal and Institutional Issues, of the GALILEI Study Cluster, DD-123, v. 1.1, 16 July 2002, 24. Whilst this document is only publicly available in v. 2.0, of 5 December 2002, where it has not been included, this Figure lies at the root of all relevant Figures also of Recommendations and Conclusions, *supra* note 10, at 102.

[25] "Integrity" refers to the trust a user can place in the correctness of the signals, and to his being warned if the signals are no longer within the bounds of such correctness as indicated by certain parameters.

[26] EGNOS stands for European Geo-stationary Navigation Overlay System, and is currently developed by the European Tripartite Group consisting of European Union as represented by the European Commission, the European Space Agency (ESA) and Eurocontrol, the European Organisation for the Safety of Air Navigation. *See e.g.*, Henaku, *supra* note 1, at 175-6.

[27] WAAS stands for Wide Area Augmentation System, and is currently developed by the U.S. Federal Aviation Administration (FAA). *See e.g.*, Henaku, *supra* note 1, at 174-5.

[28] MSAS stands for Multi-functional transport Satellite-based Augmentation System, and is currently developed by the Japanese government. *See e.g.*, Henaku, *supra* note 1 at 176.

systems make up for the lack of accuracy and integrity inherent in A that precludes any safety-sensitive usage, by augmenting A into becoming B: signals which do comply with the high levels required for aviation in most or even all phases of flight.[30]

In cases of safety-sensitive usage, value-added service providers would likely be forced by the governmental authorities under national or even international regulation to use B (instead of A); outside such situations, the use of B may be equally at the value-added service provider's, alternatively end-user's own initiative. Of course, aviation would be the clearest example of regulation-induced or -required usage of B.

Whilst indeed the augmentation providers mentioned in terms of operational requirements are very much focusing on aviation, as the most directly interested transport sector, already at present this does not preclude other users – such as for purposes of precision farming – from using EGNOS or WAAS signals. Certainly in principle, nothing prevents augmented signals, even if developed purely for aviation requirements from being of interest to other sectors, at least until access would become closed or controlled.

Finally, value-added service providers may use either A or B, depending upon their need and the costs involved, to incorporate them into value-added services C, such as navigation information, in general, perhaps on a commercial basis but certainly in the case of aviation essentially on a regulatory basis. Currently, to the extent that authorities are considering allowing or even requiring users to use system signals, that is, mainly within aviation, these will be incorporated into C as Air Traffic Services (ATS) and Air Traffic Control (ATC) services, in addition to being directly received and used by aircraft operators. In view of the large measure of orientation on aviation in current global navigation satellite system augmentation, at pre-

---

[29] There are a few non satellite based augmentation systems that will not be discussed. However, examples include LORAN-C (Long-Range Navigation system) and D-GPS (Differential GPS).

[30] As discussed in particular in the context of ICAO, the ultimate ideal would be for GNSS to constitute "sole means" of navigation for all phases of flights, since it is then that in terms of necessary infrastructure and avionics the economic advantages of having a single global coherent and interoperable system become fully available.

sent, the aviation sector is the only sector where such value-added service providers already play an important role. Elsewhere, comprehensive, general and widespread provision of C is hardly at issue so far. It is for that reason also that air law enters into the equation, including the air law liability regimes. Because of the current focus of global navigation satellite systems on aviation, the effect of air law liability has a major impact "upstream" on the signal and service provision by both basic signal and augmentation providers. At the same time, this changes to the extent that system signals and services, either now or in the future, would be used in other sectors – in principle, however, in accordance with the same generic Model for global navigation satellite systems.

IV. GPS AND LIABILITY

The GNSS Legal/Functional Model (Figure 1, Appendix 1) already indicates the major issues for GPS as far as liability is concerned The arrows marked A, B and C, whilst representing categories of signals and services, now translate into the relevant legal relationships in terms of liability. In the case of A, such liability is unlikely to be qualified as contractual liability as previously defined since open access to those signals and the impossibility for the provider to monitor who receives and uses it would negate the existence of a contract. The term "contract" is used here in the widest possible sense: a bilateral agreement, in principle in writing, freely concluded between two parties containing mutual rights and obligations.[31] Thus, an agreement between two states or one state and a foreign private entity would also qualify as a "contract" under this definition, even if the public nature of one of the parties might cause important additional legal problems to arise. In spite of some arguments

[31] "Contract" is defined as, "an agreement between two or more persons which creates an obligation to do or not to do a particular thing", of which the "essentials are competent parties, subject matter, a legal consideration, mutuality of agreement, and mutuality of obligation". BLACK'S LAW DICTIONARY, *supra* note 13, at 291-92, and WEST'S LAW & COMMERCIAL DICTIONARY, *supra* note 13, at Vol. I, p. 338. Whereas, "contract" can also refer to "the writing which contains the agreement of parties, with the terms and conditions, and which serves as a proof of the obligation". *Id.*

that try to establish a "virtual" contract between the primary signal provider and all others,[32] most experts agree that the provision of these signals would not give rise to contractual liability.[33]

In the case of GPS, U.S. authorities have disclaimed the existence of anything similar to a "contract" or bilateral or multilateral international agreement, against efforts to construe a contractual relationship and hence any contractual-type of liability.[34] However, they do not deny in principle the possibility for liability claims under U.S. tort law.

In the case of B and C, there can be far less doubt that the provision of such signals and services even in the current case of GPS, would be a matter of contract. The successful efforts to involve the respective aviation authorities in developing WAAS and EGNOS would amount to a contract even if proper, formal contracts would not be signed.

At the same time, in terms of liability one should realise that, as concluded before,[35] contractual liability principally should be seen to refer to liability in case of damage caused by the one party to the contract to the other. All then depends upon the definition of "damage" in the legal liability regime applied to it. Does it include indirect damage? If not, contractual liability could only refer to the damage caused to the contract partner's receiver, not to the damage, such as an aircraft crashing, resulting from incorrect information delivered to the receiver, or from information not sent to the receiver.

If the focus is on the aviation sector as the major target for augmentation by EGNOS, WAAS and MSAS, the issue of contractual liability in view of the existing air law liability regimes is raised and a fourth relevant category of legal relationships, clearly "contractual" in nature, also arises. In Figure 1 (Appendix 1), the end-users effectively represent the aircraft operators. The consumers, the passengers or consignors of cargo, arise as a separate category of "actors". They find themselves in a contrac-

---

[32] *See e.g.*, Henaku, *supra* note 1, at 183-85.
[33] *See* Milde, *supra* note 5, at 134-35.
[34] *Id.* at 133-35.
[35] *See supra*, Section 2, on the definition of contractual liability.

tual relationship with the airlines, a relationship represented by an arrow D in Figure 2 (Appendix 2). This is an important aspect which in turn relates to liability as will be seen.

For non-contractual liability, as previously defined in terms of the structure summarised by Figure 1 (Appendix 1), this results in the following picture. The essence of non-contractual, third-party liability, it may be reasserted, would be that outsiders to a specific activity suffer damage as a consequence of an activity. For such reasons, regardless of the existence of GNSS, relevant non-contractual tort and third-party liability regimes not specifically focused on GNSS would nevertheless apply.

In terms of "actors" in the area of GNSS, as the building blocks for the Legal/Functional Model of Figure 1 (Appendix 1), such "outsiders" could therefore be easily lumped together in one category, as third-party victims. All possible non-contractual liability relationships of such third-party victims with all of the true "actors" of Figure 1 (Appendix 1), including the consumers added above, can then be represented by various arrows E.

It depends on any applicable third-party liability regime, national or international, whether such third parties suffering damage could assert a claim not only to the entity or person causing the damage directly, for example, the aircraft operator, but also to the system signal provider having delivered wrongful navigation information to that entity ultimately at the root of the accident.

In the case of GPS, U.S. national third-party liability, that is, tort law would be considered. Here, the concept of sovereign immunity is key to successfully assert a claim for non-contractual liability. Absent specific provisions to the contrary, this concept means that any claim for public liability against the U.S. government would be inadmissible. The rule would be that the U.S. government may not be sued for public liability.[36]

---

[36] "Sovereign immunity" is defined as "preclud[ing] litigant from asserting an otherwise meritorious cause of action against a sovereign or a party with sovereign attributes unless sovereign consents to suit". BLACK'S LAW DICTIONARY, *supra* note 13, at 1252, and WEST'S LAW & COMMERCIAL DICTIONARY, *supra* note 13, at Vol. II, p. 552, referring to Principe Compania Naviera, S.A. v. Board of Com'rs of Port of New Orleans, 333 F. Supp. 353, 355 (1971).

By way of exceptions to the rule, precise regulations then exist which provide for circumstances where the sovereign immunity of the U.S. government is or might be waived. The relevant U.S. regulations for the present purpose would be the Federal Tort Claims Act,[37] the Suits in Admiralty Act,[38] the Foreign Claims Act[39] and the Military Claims Act.[40] Generally speaking, it is rather uncertain that either of these acts could be used for the successful assertion of claims regarding GPS failures and consequent damages. As a result, claims for U.S. public liability for GPS might easily fail.[41] For example, the Federal Tort Claims Act does not apply in case of "any claim arising in a foreign country".[42] Or, the Suits in Admiralty Act applies only if "the accident (1) arose on the high seas or navigable waters of the United States; (2) posed a potential threat to maritime commerce; and (3) was substantially related to traditional maritime activity."[43]

Moreover, in view of the global application of GPS, the problem of non-U.S. citizens claiming for compensation in U.S. courts would remain. From a practical and political point of view, such claims would require the claimant to travel to the United States, introduce his claim in English to U.S. courts, possibly hire a U.S. lawyer, and suchlike. There would be no fundamental legal impediment for non-U.S. citizens to do so, but in practice it might turn out to be rather difficult to assert one's claims. Furthermore, a claim before a U.S. court against the U.S. government for damage resulting from the usage of signals provided for free is not a very promising venue in terms of possible success.

It is doubtable, finally, whether other governments which would ultimately be held responsible for the safety of aviation in

---

[37] Federal Tort Claims Act, 28 USC §§ 1346(b), 2671-2680 (1988).

[38] Suits in Admiralty Act, 46 USC Appx. §§ 741-752 (1988).

[39] Foreign Claims Act, 10 USC § 2734 (1994).

[40] Military Claims Act, 10 USC § 2733 (1994).

[41] *See* Jonathan M. Epstein, *Global Positioning System (GPS): Defining the Legal Issues of its Expanding Civil Use*, 61 J. AIR L. & COM. 243, 262-68 (1995).

[42] Federal Tort Claims Act, *supra* note 37, §2680(k). *See also* Epstein, *supra* note 42, 265.

[43] Under the so-called "*Sisson* test", Sisson v. Ruby 497 U.S. 358 (1990), as dealt with by Epstein, *supra* note 42, 266.

their own airspace[44] would agree to sue in a private capacity within the U.S. legal system. This was the main reason states in ICAO proposed that a relevant treaty on GNSS liability should be drafted.[45] Additionally, if the damage occurs in a jurisdiction other than that of the United States, it might be possible to assert a claim against the GPS providers in those jurisdictions. In practice however, the option for the United States not to waive its sovereign immunity would make any such possibility a theoretical one.

Finally, as to product liability, the manufacturers and sellers could be brought into Figure 1 (Appendix 1) as another category of relevant actors within the GNSS Model. The potential liability relationships are represented by arrows F in Figure 2 (Appendix 2). This is the result of applying the relevant categories of liability onto the Figure 1 (Appendix 1) Model. These relationships are with all the actors referred to before, including the third-party victims even though in practice this would likely be dealt with by law which is not GNSS-specific (*see* in particular arrow F-6). Since the manufacture or sale of relevant products is not the business of the GPS operators, further analyses are beyond the scope of this paper. In sum, as to the issue of liability for the first generation global navigation systems, Figure 2 (Appendix 2) represents the situation as applicable to GPS as a basic signal provider and for its augmentation provider.[46]

Using the aviation sector as an example for illustrating the relevant liability issues, it is noted that the value-added service providers would be mainly ATS and ATC providers, the end-user would consist of the airlines and the consumers would be the passengers and consignors of cargo.

---

[44] *See* Convention On International Civil Aviation, Dec. 7, 1944, art. 28, 61 Stat. 1180, 15 UNTS 295 [hereinafter Chicago Convention]. *See also* Schubert, *supra* note 8, at 252-54.

[45] *See e.g.*, Schubert, *supra* note 8, at 258-61.

[46] Figure 2 is a reproduction of Figure 4 located in, *The GNSS-1 Functional Model and Liability Issues (GPS, GLONASS)*, [2002] WP I.4.B, GALILEO System Liability – Part I – Interoperability, v.2, of the GALILEI Study Cluster. Whilst this document is not publicly available, this Figure is an adaptation of Figure 1 to the liability scenario, and as such underlying also Figure 5, *infra*.

Since A does not encompass contractual liability, both foreign ATC-providers and foreign airlines could only claim for anything other than contractual liability for GPS-related damages. This leads to the crucial question of how compensable damage is to be defined: events likely to cause damage of a really major dimension as a consequence of erroneous or absent navigation information by GNSS do not concern the direct damage caused by emission of the signals as such, but, for example, the crash of an aircraft. The conclusion should be that such latter cases of liability would normally be dealt with by either contractual liability as far as the passengers or consignors of cargo are concerned, or third-party liability relative to innocent victims on the ground. In air law, the first refers to the 1929 Warsaw Convention[47] and subsequent contractual liability conventions up to the 1999 Montreal Convention[48] – which are subsumed under D. The second refers to the 1952 Rome Convention on third-party liability,[49] or for the many states where this Convention is not in force, national tort law, which is subsumed under E-4.

---

[47] *See* Warsaw Convention, *supra* note 5.

[48] Convention for the Unification of Certain Rules for International Carriage by Air, May 28, 1999, ICAO Doc. 9740 (entered into force Nov. 4 2003) [hereinafter Montreal Convention]. The other international instruments to be referred to encompass such agreements as the Hague Protocol, *supra* note 5; the Convention, Supplementary to the Warsaw Convention, for the Unification of Certain Rules Relating to International Carriage by Air Performed by a Person other than the Contracting Carrier, Sept. 18, 1961, 500 U.N.T.S. 31, ICAO Doc. 8181 (entered into force May 1, 1964) [hereinafter Guadalajara Convention]; the Agreement Relating to Liability Limitations of the Warsaw Convention and the Hague Protocol, May 4, 1966, Civil Aeronautics Board Agreement No. 18,900, approved by Exec. Order No. 23,680, 31 Fed. Reg. 7302; Additional Protocol No. 1 to Amend the Convention for the Unification of Certain Rules Relating to International Carriage by Air, Signed at Warsaw on 12 October 1929, Sept. 25, 1975, U.K.T.S. 1997 No. 75, ICAO Doc. 9145 (entered into force Feb. 15, 1996); Additional Protocol No. 2 to Amend the Convention for the Unification of Certain Rules Relating to International Carriage by Air, Signed at Warsaw on 12 October 1929 as Amended by the Protocol done at The Hague on 28 September 1955, September 25, 1975, U.K.T.S. 1997 No. 76, ICAO Doc. 9146 (entered into force Feb. 15, 1996); and Montreal Protocol No. 4 to Amend the Convention for the Unification of Certain Rules Relating to International Carriage by Air, Signed at Warsaw on 12 October 1929 as Amended by the Protocol done at The Hague on 28 September 1955, September 25, 1975, U.K.T.S. 1999 No. 28, ICAO Doc. 9148 (entered into force June 14, 1998).

[49] Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, October 7, 1952, 310 U.N.T.S. 181, ICAO Doc. 7364 (entered into force Feb. 4 1958) [hereinafter Rome Convention].

It follows that both these regimes would apply in principle regardless of whether navigation errors were the cause of the accident, or more "traditional" events – human errors, thunderstorms, engine failures or sabotage, if not specifically falling under clauses excepting terrorism-related accidents. Both of them point to the airlines as the liable entities. So the first question under non-contractual liability is to what extent claimants might want to circumvent these regimes, and then, as third-party claimants from the perspective of navigation service providers, claim directly against the basic signal or augmentation providers. The extent to which the applicable third-party liability regimes, in this case the U.S. tort system, would allow them to do so is then the next, more important question. Other states do not feel comfortable with this option, hence their desire to solidify possibilities for claims by an international convention on GNSS liability for the aviation sector. However, the United States is not particularly interested in such an option, which may likely cause this approach to be impractical for the time being.[50] As a consequence, Eurocontrol has developed the concept of the contractual liability chain. Contracts are to spell out the extent of liability accepted between the parties, including to what extent derogation to the other party of "ulterior" liabilities under the contract might be warranted.[51]

V. *GALILEO* AND THE LEGAL/FUNCTIONAL MODEL

The complexity of *Galileo* as compared to the current situation becomes apparent upon adapting the Model for GPS, that is for generic systems of the first generation to the case of *Galileo*, which is effectively a second-generation system. Firstly, GPS is operated and controlled by a single-state entity, the U.S. Department of Defense, even if civil users are involved through consultation boards and other mechanisms, whereas *Galileo* is envisaged to be operated by a private operator, provisionally

---

[50] *See* Schubert, *supra* note 8, at 261; Milde, *supra* note 5, at 132 .

[51] *See e.g., Setting up the Contractual Framework*, Eurocontrol *GNSS LTF*, C/SF/p010506/17.05.01; *Skyguide memo to Eurocontrol GNSS LTF* of 5 March 2003; *Refocusing the work of the EUROCONTROL GNSS Legal Task Force, Skyguide Memo*, C/SF/October 6, 2003. *See also* Schubert, *supra* note 8, at 261.

called the *Galileo* Operating Company (Company).[52] It is to be supervised by a public entity provisionally called the *Galileo* Supervisory Authority (Authority) representing the European Union, the European Space Agency (ESA) and their member states.[53] Together they comprise the *Galileo* Core Structure.

The main reasons for involving a private operator as a key entity in the organisational structure for a system with obvious fundamental public aspects were:[54]

- flexible, non-bureaucratic and commercial modes of operation;
- marketing purposes;
- obtaining finances and investments from the capital markets in normal commercial modes;
- dealing with intellectual property rights in a proper and more commercially-oriented fashion;
- obtaining insurance against limited liability;[55]
- making a sensible business partner; and
- the far better capabilities of, and opportunities available to, a private entity to develop new services and markets in a commercially assertive manner.

Conversely, the reasons for involving a public oversight body as a key entity in the organisational structure for a system where private and commercial modes of operation have been deemed to be most beneficial were:[56]

---

[52] It may be noted that the process of tendering the concession began October 2003, the aim being that by the end of 2004 a winning concessionaire will be selected to fulfil that role of the "Galileo Operating Company".

[53] *See also* the Proposal for a Council Regulation on the establishment of structures for the management of the European satellite radionavigation programme, COM(03)471 final at 4 & art. 19 [hereinafter Management Structures Proposal].

[54] *See e.g.*, Recommendations and Conclusions, supra note 10, at 33.

[55] It may be noted that insurance against unlimited liability is either outright impossible to obtain, or likely to be impossibly expensive. *See also infra* note 59.

[56] *See e.g.*, Recommendations and Conclusions, supra note 10, at 33-34.

- negotiating and concluding agreements with states "external" to *Galileo* yet hosting *Galileo*-related assets and service providers;[57]
- licensing non-European augmentation and integrity providers, or negotiating and concluding agreements on such operations by the private operator;
- serving the general public interests, for example in regard of safety, security and search-and-rescue issues;[58]
- possibly offering unlimited liability in the last resort to value-added service providers and end-users;[59]
- enhancing the trust by the public at large in the system with respect to such issues as certification and safety licenses;

---

[57] The Management Structures Proposal provides that,

> "The Supervisory Authority shall be open to the participation of countries which are not members of the European Union and which have concluded agreements with the European Union to this effect. Under the relevant provisions of these agreements, arrangements shall be worked out specifying, in particular, the nature, scope and procedural aspects of the involvement of these countries in the work of the Supervisory Authority, including provisions relating to financial contributions and staff."

Management Structures Proposal, *supra* note 53, at art. 19.

[58] *Id.* art. 1 (the Galileo Supervisory Authority should "manage the public interests relating to the European satellite radionavigation programme"), *also id.* arts. 20-22 (setting up a Centre for Security and Safety).

[59] In order to enhance the attractiveness of Galileo to the maximum, offering acceptance of unlimited liability (where appropriate) would be necessary; this however would somehow have to rest upon the shoulders of the public entities concerned, namely the GSA and the member states behind it. *See also supra* note 56. Clearly, this has not been decided yet. Article 17 of the Management Structures Proposal only mentions:

> "1. Contractual liability on the part of the Supervisory Authority shall be governed by the law applicable to the contract in question..."
>
> 2. In the event of non-contractual liability, the Supervisory Authority shall take steps, in accordance with the general principles common to the laws of the Member states, to remedy any damage caused by its departments or by its staff in the performance of their duties..."

Management Structures Proposal, *supra* note 53, at art. 17.

- for purposes of negotiating where necessary access for the private operator to the markets of states not belonging to the *Galileo* core group of states; and
- liaising with other relevant organisations such as ICAO.

Secondly, *Galileo* aims to provide at least five different sets of services as opposed to GPS which, apart from an open SPS signal, only emits a closed access PPS signal. Technically speaking, a number of various signals-in-space will be emitted by the *Galileo* satellites which, through being combined in various ways and further differentiated by means of additional characteristics, result in the four main *Galileo* services being delivered to value-added service providers and end-users. They are the open service, the commercial services, the safety-of-life services and the public-regulated services.[60] In addition, a contribution to existing search-and-rescue services (SAR) as currently provided by the COSPAS-SARSAT system is intended.[61]

The open service will be provided for free and will be similar to the GPS SPS, albeit perhaps slightly enhanced in respect of accuracy and continuity. Most importantly therefore, from a legal and regulatory perspective the characteristics of this service would again lead to the principled absence of a contractual situation between the Company and the value-added service provider or end-user. Hence, it is referred to as A for the purpose of the Model.

The open service would be provided directly by the *Galileo* system to both value-added services providers and end-users. This is where a number of individualised mass-market applications are envisaged to arise. Any user with a technically compatible receiver will be able to receive and use the signal for his or her own purposes, and he or she would require no more than such a receiver to benefit from the signals.

From a legal and regulatory perspective, the commercial services, the safety-of-life services and the public regulated services, can be taken together as B in the Model because of the

---

[60] *See* GALILEO Mission Requirements Document, *supra* note 10, at 19-22.
[61] *Id.* at 24.

presence of a contract in some form with the Company. Whatever characteristics would then be added per service, or per type of contract, some form of contractual relationship will arise. This allows for considerable opportunities for the Company to determine the legal relationship with value-added service providers and end-users, including liability.

Perhaps the signals involved still would call for a user to have a compatible receiver, were it not devices would be used to control access to them. In the latter case however, which is the current scenario, both a compatible receiver and the encryption or authentication key would be necessary before the signals can be used in an authenticated fashion. Consequently a contract for subscription, or other legal instrument setting forth rights and obligations of the two parties between each other, will be required. These aspects would apply to all three variants of B.

There are, of course, elements which separate those variants. The commercial services would specifically focus on providing higher accuracy by added data, higher continuity and higher availability with the support from local elements where required. A proper service guarantee would come to spell out the obligation of the Company to provide services up to certain standards of accuracy, continuity and availability. These services would be renumerated directly through a user fee, by any value-added service provider, or other user, interested in the higher accuracy, continuity and availability as well as the service guarantee likely to be provided. Applications would arise in such higher-end mass-market areas as location-based services, integrated telecom-and-information services and those traffic control systems which are commercially- but not safety- or security-sensitive, like road tolling.

The safety-of-life services first focused on aviation. With the potential to be extended to other safety-sensitive transportation, high-speed vessels, high-speed trains, for example, these services will have as their outstanding feature integrity monitoring up to the level required by aviation for taxiing, take-off and landing addressed by the Chicago Convention and its Annexes,

containing the relevant SARPs.[62] Where the world-wide integrity to be provided by the Company is not acceptable or not accepted, such integrity monitoring may also be provided by regional elements outside of the *Galileo* Core System (GCS). In this respect the legal situation will be correspondingly complicated because of an additional, non-*Galileo* and presumably non-European entity being involved next to the Company. Furthermore, local elements might be involved in locally providing the necessary higher performance in terms of accuracy, availability and continuity. Payment would be through the general user fees for navigation services of which *Galileo* would only form one element. The payment would be paid by the users to the value-added service providers which in turn would pay the Company for the *Galileo*-input it provided.[63]

Currently, safety and security-sensitive sectors such as aviation, and maritime transport, are involved in the usage of such services, whether GNSS-based or not. They would provide the relevant markets for these types of *Galileo* signals.

The public-regulated services will aim at governmental and other public services such as police, fire-brigades, emergency, perhaps crucial infrastructures for energy, water and communications. Their outstanding feature will be a high level of technical security against interference, jamming, spoofing and unauthorised usage. This will be guaranteed through technical robustness and encryption. Payment for those services would likely occur through availability payments or other lump-sum arrangements, by the relevant governmental department or service. The SAR service falls outside of the construct of the Model. Essentially the signal provider, the *Galileo* core entities, will pay for signal provision, to be refunded through the participating states.

In principle, the *Galileo* Model could be developed for each of the four core services, in order to achieve a precise overview of the relevant issues. This, however, would obviously go beyond the scope of the current article, and it suffices here to "stack"

---

[62] *See supra* note 2.

[63] *See* Recommendations and Conclusions, *supra* note 10, at 122, 175.

the four Models which would otherwise arise onto each other so as to form one "generic" *Galileo* Model.

Further, these four types of core services will, generally speaking, be offered to non-*Galileo* entities, which are for the overwhelming part essentially interested in offering or consuming a service of which the relevant *Galileo* service forms only one element. From a wider perspective therefore, the area of *Galileo*-relevant services is currently envisaged to encompass basically three categories of services:

- *Galileo*-only services (open service, commercial services, safety-of-life services, public-regulated services), to be provided by the GCS, that is, in terms of architecture the satellites in space and the necessary ground infrastructure, alternatively by the GCS in conjunction with regional elements providing regional integrity.

- *Galileo* local services for example, airport approach systems, to be provided by local elements in combination with the GCS, plus – optionally – regional elements.

- *Galileo* combined services such as mapping and database, or telecom services, to be provided by other systems, whether global, regional or local, together with any combination of the GCS, regional elements and local elements.

This last category is where C comes in: a theoretically wide range of value-added services incorporating *Galileo* timing, positioning and navigation information.[64] Provision of value-added services by the Company itself currently is not foreseen. All the above considerations led to the Model for *Galileo* as represented by Figure 3 (Appendix 3).[65]

A word of caution is due here, however. With the process of tendering and finally negotiating for the *Galileo* concession to be awarded by the end of 2004 just having gotten under way, this

---

[64] In the context of the Galileo Architecture Definition (GALA) Study performed for the European Commission, 100 different applications were discerned as presenting potentially interesting markets for Galileo services; see in particular GALA, *Synthesis on Service Definition*, Gala-ASPI-TN011, at 39-44, (Oct. 10 2001).

[65] Figure 3 is a slightly adapted reproduction of Figure 2 of Recommendations and Conclusions. *See* Recommendations and Conclusions, *supra* note 10, at 79.

Model is reflecting the current presumptions on what the *Galileo* structure will look like by 2008, the year of envisaged full operational capability of the *Galileo* system. In the end, that structure may turn out to look different in some areas. These could include the precise outline of the relevant services, the role the Company is going to play in that respect, as well as the respective roles, rights and obligations of the Company and the Authority between them. At the same time, this largely concerns the internal division of tasks, competencies, responsibilities and liabilities within the GCS. It would not fundamentally change the equation as far as the legal role of the GCS relative to other actors is concerned.

VI. GALILEO AND LIABILITY

Similarly to the generic GNSS Model as applied to GPS, the liability issues can be charted upon the specific case of *Galileo* (Figure 4, Appendix 4). Again, the arrows in Figure 3 (Appendix 3) that represent the respective general legal relationships following from the provision of certain signals or services are now translated effectively into liability-relationships; the direction of the arrows pointing to which entity liability might be owed by the entity at the sending end of the arrow.

The regional elements as well as local elements have been left out. As to the regional elements, special contracts namely, in the form of international agreements of a specific nature might be entertained, in which case liability issues might be included in the contracts. If no such contracts would be envisaged, as the GCS would tend to view the role of such regional elements as autonomous, almost as the GPS authorities look upon EGNOS and MSAS, the liability which might apply here would be of a non-contractual nature.

A similar situation would pertain to local elements enhancing the Galileo signals and services without providing value-added services. Unlike the regional elements, local elements might have to be contracted by the Company if the Company sees a need for their involvement. In a sense, the liability issues here might work the other way around: when paying for local enhancement to better sell its services, the Company might look

for protection against liability for damage as a result of the local element-input, rather than being required to offer protection to such local elements in terms of liability. This might also be determined to a considerable extent by contractual negotiations on many levels and among many entities.

Galileo SAR services were not included in Figure 3 (Appendix 3) and are not in Figure 4 (Appendix 4). Thus, the chart in Figure 4 (Appendix 4) emerges.[66]

Figure 4 (Appendix 4) represents a generic liability chart for *Galileo*. Just as the U.S. authorities would likely deny any liability other than of a non-contractual nature for the GPS SPS, *Galileo* would not accept any contractual liability for the open service A, since A is not contracted for. Similarly to GPS, *Galileo* would also refuse to accept such contractual liability in jurisdictions other than those of the European states constituting the Authority,[67] even if the Company may not be able to invoke sovereign immunity in those cases, so that it ultimately depends upon non-*Galileo* jurisdictions whether liability, alternatively a refusal thereof, might nevertheless be acknowledged.

Regarding Figure 4 (Appendix 4), it is important to realise that the major liability issues regarding *Galileo* arise outside the core categories of actors involved in the contractual relationships and therefore are outside the *Galileo* legal framework. In the context of activities covered by the contractual relationships under A, B and even C, the possibilities for causing damage directly, in and of itself, by such activities are likely to result in damage of a rather limited nature. It is under D, that the damages start to be major, leading to key contractual liability issues.

---

[66] Figure 4 is a slightly adapted reproduction of Figure 17 of Recommendations and Conclusions. *See* Recommendations and Conclusions, *supra* note 10, at 105.

[67] It should be noted that recently, the People's Republic of China and the European Commission, acting on behalf of the Galileo Joint Undertaking and hence indirectly also on behalf of ESA, have come to a mutual understanding that the former would invest an amount in the range of 200 million € in Galileo. The details of this understanding, for example as to what the investment will exactly comprise and to what extent the People's Republic of China would become "integrated" in the institutional structure still have to be negotiated, but may for example result in a sort of associated membership of the GSA.

The classical example would be that of an aircraft causing damage to its passengers in the course of the flight for which those passengers contracted, whether ultimately caused by wrong or absent GNSS-derived input, whether A, B or C, or by more traditional human or technical failures. These damages form the subject-matter of a well-elaborated regime of air law.[68]

In case of system signals used in other transport sectors, relevant sector-specific regimes would apply in similar fashion. Thus, for maritime transport, available treaties include the Athens Convention of 1974[69]; for rail transport, the Convention concerning the International Transport by Rail,[70] together with the Convention concerning the Carriage of Passengers and Luggage by Rail,[71] and the Convention concerning the Carriage of Goods by Rail[72] and its 1990 Protocol[73] on cargo; and for road transport, the Convention on the Contract for the International Carriage of Passengers and Luggage by Road[74] on passenger liability.[75]

Major or catastrophic damage could also arise under certain categories of the non-contractual liabilities E, along the lines of the above, especially E-4, mirroring D. It is unlikely that the

---

[68] *See* Warsaw Convention, *supra* note 5, and *supra* note 48.

[69] Athens Convention Relating to the Carriage of Passengers and Their Luggage by Sea, Dec. 13, 1974, U.K.T.S. 1987 No. 40, 14 I.L.M. 945, INTERNATIONAL TRANSPORT TREATIES, I-229 (Supp. 1-10 1986) (entered into force Apr. 28, 1987).

[70] Convention concerning the International Transport by Rail, May 9, 1980, INTERNATIONAL TRANSPORT TREATIES, V-183 (Supp. 1-10 1986), entered into force May 1, 1985 [hereinafter COTIF Convention].

[71] Convention concerning the Carriage of Passengers and Luggage by Rail, Feb. 7, 1970, INTERNATIONAL TRANSPORT TREATIES, V-133 (Supp. 1-10 1986) (entered into force Jan. 1, 1975, effectively incorporated and superseded by the COTIF Convention of May 1, 1985, *supra* note 70).

[72] Convention concerning the Carriage of Goods by Rail, Feb. 7, 1970, INTERNATIONAL TRANSPORT TREATIES, V-58 (Supp. 1-10 1986) (entered into force Jan. 1, 1975, effectively incorporated and superseded by the COTIF Convention of May 1, 1985, *supra* note 70).

[73] Protocol of 1990 to Amend the International Convention concerning the International Transport by Rail (COTIF) of 9 May 1980, Dec. 20, 1990, INTERNATIONAL TRANSPORT TREATIES, V-300 (Supp. 15 1991) (entry into force Nov. 1, 1996).

[74] Convention on the Contract for the International Carriage of Passengers and Luggage by Road (CVR), Mar. 1, 1973, INTERNATIONAL TRANSPORT TREATIES, IV-43 (Supp. 1-10 1986) (entered into force Apr. 12, 1994).

[75] *See* Frans G. von der Dunk, *The European Equation: GNSS = Multimodality + Liability*, *in* AIR AND SPACE LAW IN THE 21ST CENTURY 240-245 (Marietta Benko & Walter Kröll eds., 2001) [hereinafter *The European Equation*].

provision of open service A, commercial services/safety-of-life services/public-regulated services B, or value-added services C, or even of final services to consumers D, in itself causes any significant harm to third-party victims. More likely, major damage would be the result of end-users using those signals or services and in doing so causing non-contractual damage leading to non-contractual liability.

The example here is an aircraft crash causing damage to third party victims on the ground. Here also air law provides the applicable rules: to the extent applicable, the 1952 Rome Convention, and where not, national tort namely, third-party liability regimes.[76] In case of system signals used in other transport sectors, there are as of yet no international regimes dealing with third-party liability.[77] So, in conclusion, *mutatis mutandis* national regimes likely of a general nature would apply.

In terms of product liabilities subsumed under F, liability may be different in each instance of F represented. It will depend upon the product at issue, the potential uses to which the actors in Figure 4 (Appendix 4) put those products, and the particular risks they entail of being harmed themselves by doing so. They may only incidentally serve to deal with system-induced damage. In any case, the conclusion should be that such liabilities are, so far, not dealt with by GNSS-specific product liability law, but rather, if at all, by general product liability law normally of a national character. Only in the context of EC law has distinct product liability law been developed at an international level.[78]

What remains then are possibilities under general national tort law to assert claims directly against the *Galileo* entities, in spite of the fact that this means circumventing existing and applicable liability regimes. In other words, a passenger (con-

---

[76] *See* Rome Convention, *supra* note 49.

[77] *See The European Equation*, *supra* note 75, at 240-245.

[78] Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, 85/374/EEC, 1985 O.J. (L 210/29); and Directive of the European Parliament and of the Council amending Council Directive 85/374/EEC on the approximation of laws, regulations and administrative provisions of the member states concerning liability for defective products, 1999/34/EC, 1999 O.J. (L 141/20).

sumer) damaged by an aircraft accident may not wish to sue the airline (end-user) under contractual liability through D. But when convinced that the ultimate cause of the accident is a wrongful or absent *Galileo* signal or service, the passenger will directly address the Company through tort/third-party liability law.

This would refer especially to E-1 and E-2, where the distinction between them would justify different arguments being applied to them. Regarding the open access signals used for the open service under E-1, there is no contract. Regarding the closed access signals used for the commercial services, safety-of-life services and public-regulated services under E-2, there is a contract between key players. It is for existing national rules and practices on tort law and third-party liability to be the basis for whether and to what extent claims under E-1 and E-2 would then have to be rejected by courts.

The Company could therefore only deal with liability issues in the context of service guarantees. This depends upon the extent to which offering liability reimbursement in case the *Galileo* service could be blamed for damage would be a feasible and interesting proposition. The Authority, the Concession Agreement, and possibly a *Galileo* Convention would be important in defining the respective roles of the Authority and member states in such arrangements. An international compensation fund similar to the ones used in cases of oil pollution[79] and by the nuclear power industry[80] is an option worth considering.[81] Such

---

[79] International Convention on Civil Liability for Oil Pollution Damage, Nov. 29, 1969, 973 U.N.T.S. 3; and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, Dec. 18, 1971, 1110 U.N.T.S. 57; both amended by the International Maritime Organization Protocol of 1992 to amend the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage of 18 December 1971, Nov. 27, 1992, U.K.T.S. 1996 No. 87; Cm 2657; ATS 1996 No. 3 (entered into force 30 May 1996).

[80] Convention on Third Party Liability in the Field of Nuclear Energy, Paris, July 29, 1960, 956 U.N.T.S. 251 (entered into force Apr. 1, 1968); and the Convention Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, Jan. 31, 1963, 2 I.L.M. 685 (1963); both as amended by the Convention on Supplementary Compensation for Nuclear Damage, Sept. 12, 1997, 36 I.L.M. 1473 (1997) (not yet entered into force).

[81] *See e.g.*, Sean. D. Murphy, *Prospective Liability Regimes for the Transboundary Movement of Hazardous Wastes*, 88 AM. J. INT'L L. 24 , 56 (1994).

arrangements are a matter for negotiation between the *Galileo* Joint Undertaking (GJU), established by the European Commission and ESA *inter alia* to develop the concession for the future Company,[82] and the prospective concessionaire in the bidding process, as well as a matter of commercial policy for the concessionaire once the bidding process is over.

As between the various *Galileo* services subsumed under B in the generic Model, the major distinction between commercial services, safety-of-life services and public-regulated services lies in the measure of involvement of governmental authorities. This translates into issues of sovereign immunity possibly being invoked when it comes to liability for the safety-of-life services and the public-regulated services.

SAR services are a different issue. The role of *Galileo*, the GCS and the Company will be confined to contributing to an existing system, which means basically accepting the legal framework already been developed throughout the life of the COSPAS-SARSAT system. Even the role of local elements is fundamentally circumscribed by that framework, including any issues of liability. Thus, charting liability onto the *Galileo* Model and the inclusion of local elements shows the limits of what contracts can arrange in terms of contractual versus non-contractual liability as well as the special role of product liability, which largely depends upon the actual role of the Company and local elements in terms of producing or selling products.

VII. LIABILITY AND INTEROPERABILITY OF GPS AND *GALILEO*

The final issue to be discussed concerns that of "interoperability", that is, the fact that GPS and *Galileo* to a considerable extent will provide for signals and services which can be used by the same user. "Interoperability" in this context does not mean the operational, economic, institutional or legal integration of the satellite systems. Although previously considered a possible option, the scenario of GPS and *Galileo*, and possibly GLONASS, evolving into one second generation system with

---

[82] *See* Council Regulation 876/2002/EC, *supra* note 9.

shared responsibilities, liabilities and competencies, has been abandoned.[83]

Therefore, for "interoperability" to have meaningful content in the present context, it shall not presume that either A or B will be jointly provided. What "interoperability" then refers to, for the purposes of this paper, is the receiver level, that is, in first instance with the value-added service providers and end-users. Value-added service providers may receive both the A from GPS and A or B from *Galileo* subject to the various applicable conditions and integrate them into the service C delivered to the end-users. Similarly, these end-users may wish to benefit from both at the same time for their own usage, whether these end-users are providing services to consumers or not.

This is illustrated by Figure 5 (Appendix 5), reflecting at the same time the provision of signals and services, and the liability relationships attached to them.[84] For reasons of clarity, as well as the indirect relevance of product liability for interoperability, some of the F-arrows have been shortened. They should be read as extending as far as they did in Figures 2 (Appendix 2) and 4 (Appendix 4). Here, GPS and EGNOS have been specifically mentioned next to *Galileo* as examples of basic signal providers and augmentation providers.

As a consequence of this paper's definition of "interoperability", the generic liability charts depicted for GPS (Figure 2, Appendix 2) and *Galileo* (Figure 4, Appendix 4) will continue to apply in the case of GPS-*Galileo* interoperability (Figure 5, Appendix 5). GPS will continue to provide A, just as *Galileo* will provide A and B, the difference being that they are now being received by the same receiver simultaneously. This is likely to be transparent to the value-added service provider or end-user. It is unlikely that either would be interested in such visibility either, until liability (and hence, for *Galileo*, service guarantees) would become an issue.

The extent to which the U.S. authorities would accept liability for GPS-related accidents remains as described above. This liability is a U.S. domestic matter: claims have to be enter-

---

[83] *See, e.g.*, Schubert, *supra* note 8, at 248-50.

[84] *See* Recommendations and Conclusions, *supra* note 10, at 108.

tained in U.S. courts in accordance with U.S. law. The possibility to sue the U.S. government successfully meets with some severe statutory and practical limitations. Therefore, arguably the U.S. authorities perhaps may not be expected to put a lot of effort into distinguishing GPS input from *Galileo* input unless they would perceive a substantial risk of being held liable for cases of damage where the respective inputs from GPS and *Galileo* would not be clearly distinguishable. Of course, GPS being a national U.S. asset, in the absence of any contract, U.S. authorities are fully entitled to ensure that only national regimes and procedures can be used for claiming liability for damage ultimately caused by GPS, and resist any call for wider liability-acceptance such as, for example, by means of a GNSS Convention. It is then, equally obvious, for any potential user to determine his own risks in doing so, and if such risks are considered unwarranted, to desist from using GPS.

Similarly, the authorities under which the Company resorts to may limit its (non-contractual) liability to that imposed by the relevant national regimes, which will be the case for the open service. By contrast, for the contractual services, it is currently assumed that under the concession the Company should accept a certain additional liability through the contract, but not confined to contractual liability-proper. Apart from such contractual liability, the contracts with value-added service providers should, under current assumptions, allow for derogation of non-contractual liability. For those reasons, the Company should ensure that its input to a dual receiver is recognisable, in order not to risk paying compensation when GPS would be responsible for damage.

There is an additional issue of non-contractual tort liability at stake here. Circumventing any contract, whether concerning GPS or *Galileo*, third-party claimants may wish to ignore the contractual chain, which would cause them to sue only the value-added service providers or end-users that directly caused the damage and instead assert a claim directly against the signal provider(s). Leaving aside the question of the possibilities in any legal system to have such a claim accepted, such a case would require *Galileo* to prove that in the "interoperation" of GPS and *Galileo* signals and services it is the GPS input that

was responsible, if the Company/GCS is to avoid paying unjust compensation. This would amount to a serious defence in court, and the issue of evidentiary value of technical means of monitoring.

Whilst the A and B of GPS and *Galileo* may "interoperate" at the receiver level, by the time it comes to C, the respective inputs of GPS and *Galileo* are indistinguishable. Nor need they be distinguishable from a legal, including a liability, perspective. C, being a matter of contract, is for the contracting parties to decide whether they want to deal with such interoperation, or not. This is the more likely case because the end-user is more interested in being provided with a certain service rather than in knowing the technical requirements of the service. The Company might be interested in ensuring that also on liability the benefits of using *Galileo* will partly accrue to both contracting parties, by ensuring in its contracts with any of those that any liability within C may be derogated to the *Galileo* Core System to the extent *Galileo* is ultimately to blame for the damage at issue.

Going still further down the chain of relevant relationships and ensuing liabilities as illustrated by Figures 2, 4 and 5, Appendices 2, 4 and 5) as a consequence of the foregoing, neither in D, nor in E, nor in F does any "interoperation" of GPS and *Galileo* at the receiver level have any impact on liability as different from liabilities which would anyway exist. D concerns a contractual liability, which would at best lead *Galileo* to undertake the same derogation offer to be provided regarding C, as described above. E concerns non-contractual liability; but where it concerns E-3, E-4 and E-5, *mutatis mutandis* the same applies: applicable derogation could be offered through the contractual chain.

On the other hand E-1 and E-2 apply to a pre-interoperation phase, where consequently the issue of interoperability-liability is not posed. At the same time, both E-1 arrows are similar in referring to open access signals in the context of which contracts are totally absent. Whereas both E-2 arrows refer to controlled access signals where contracts, namely under various versions of B, would crucially be at issue. This distinction may have a bearing on whether liability claims along

these lines would be easily accepted in the presence of other possibilities or absence thereof to sue under A or B.

Finally, F concerns product liability, and to the extent neither GPS nor *Galileo* have a role in manufacturing the involved products, this kind of liability will not be a relevant issue. In case manufacturers would be directly contracted by the *Galileo* Core System to manufacture hardware, the situation again becomes similar to the previous ones: product liability resting on the manufacturer not going away merely because of such a contract, the contract may be used by the *Galileo* Core System for offering derogation.

VIII. CONCLUSION

As the analysis and Model have shown, under current law the situation with respect to liability for global navigation satellite systems operations is still fairly simple at the abstract level, that is, which liability regimes might or do apply. However, statements of certainty might have to wait until a proper case which represents a first instance where various national regimes, basically of all states on whose territory or by whose citizens global navigation satellite systems services are made use of. It may be expected however that for GPS, no contractual liability would be accepted, whereas in the absence of international treaties stipulating otherwise non-contractual liability claims would only be possible under U.S. tort law, where the few statutes mentioned would severely limit the possibilities for successful claims in this respect.

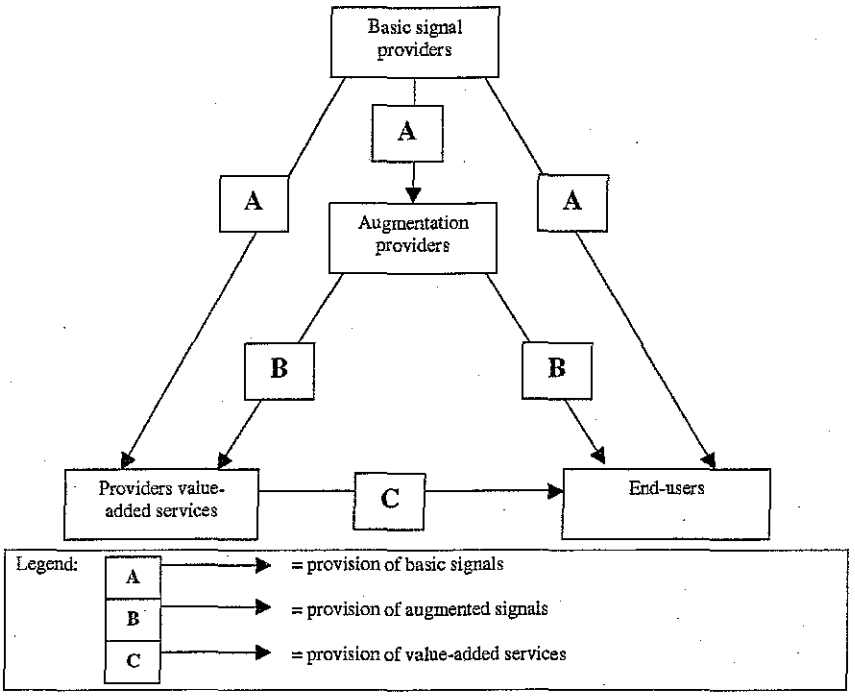
Even with GPS, however, that is not the full story, as from a civil perspective at least the applications downstream are more important. This is where the area of sector-specific liability regimes become relevant such as, the largely international one of contractual liability and the partly international one of third-party liability in air law. Whilst for GPS authorities such liabilities may be less relevant, for the measure of interest in the downstream applications sectors such liabilities to a considerable extent determine the interest, feasibility and ultimately, perhaps, the commercial viability of using GPS.

That is where *Galileo* will come in, representing a quantum leap in operational as well as legal complexity precisely. Because for *Galileo*, contrary to GPS and as evidenced also by the private operator in the centre of the *Galileo* institutional structure, a major justification for its future existence lies in attracting and serving downstream applications: aviation and other transport sectors as well as telecommunications, leisure activities, urban planning, banking and suchlike.

Dealing with liability in a customer-oriented fashion is part of that approach. In principle, the Model applicable to the liability issues works no differently for *Galileo* than it does for GPS. Thus, for the open service, principally similar to GPS's SPS, no liability would be accepted other than general tort or third-party liability under applicable national regimes. For the other services, commercial services, safety-of-life services and public-regulated services, *Galileo* could have chosen the same approach, but it likely will not. In order to entice downstream value-added service providers, end-users and ultimately also consumers properly speaking into using *Galileo*. It may be expected *Galileo* will offer under relevant contracts and through service guarantees certain contractual liabilities to reimburse downstream contractual partners under applicable contractual or non-contractual liability regimes if they would be forced to pay for claims to their contractual partners, third-party victims. The damage leading to such compensatory payments has to be proven to have been ultimately caused by erroneous or absent *Galileo* signals.

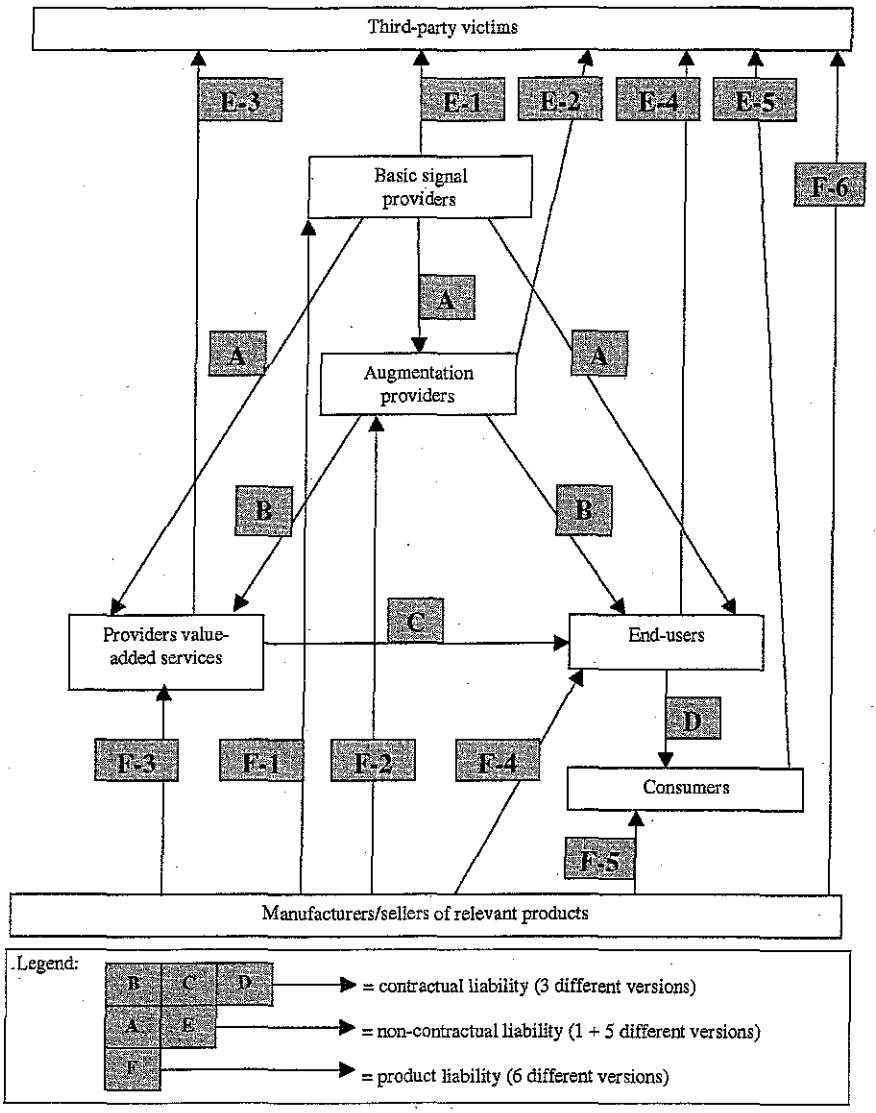
What this means in terms of substantive liability obligations and consequences downstream, however, is a totally different matter, which is beyond the scope of this paper. Such obligations and consequences would depend on whether and how any of the plethora of relevant liability regimes would apply. This paper addresses a theoretical and general perspective of liability regimes relevant for any sector involved in any national jurisdiction where global navigation satellite system applications would be feasible, plus a few international and European Community law-regimes.

Figure 1. The Legal/Functional Model of GNSS (GPS) signal and service provision.



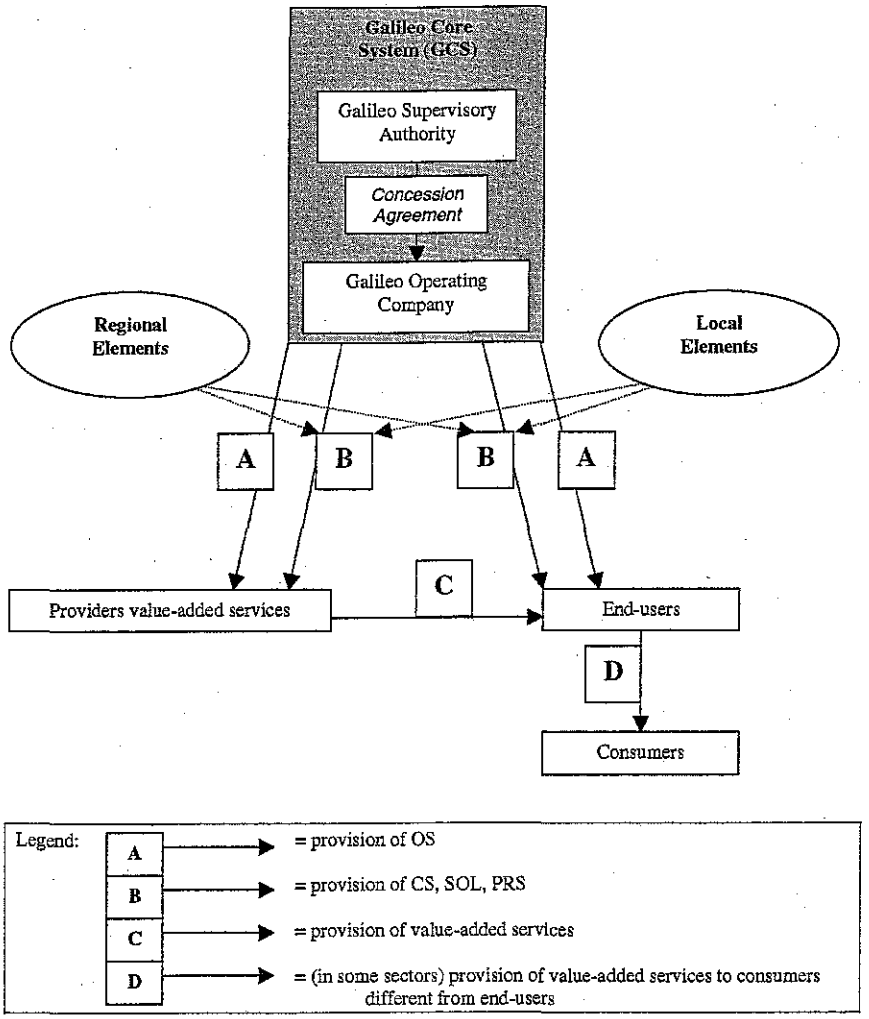
Appendix 1

Figure 2. The GNSS (GPS) Legal/Functional Model and liability.



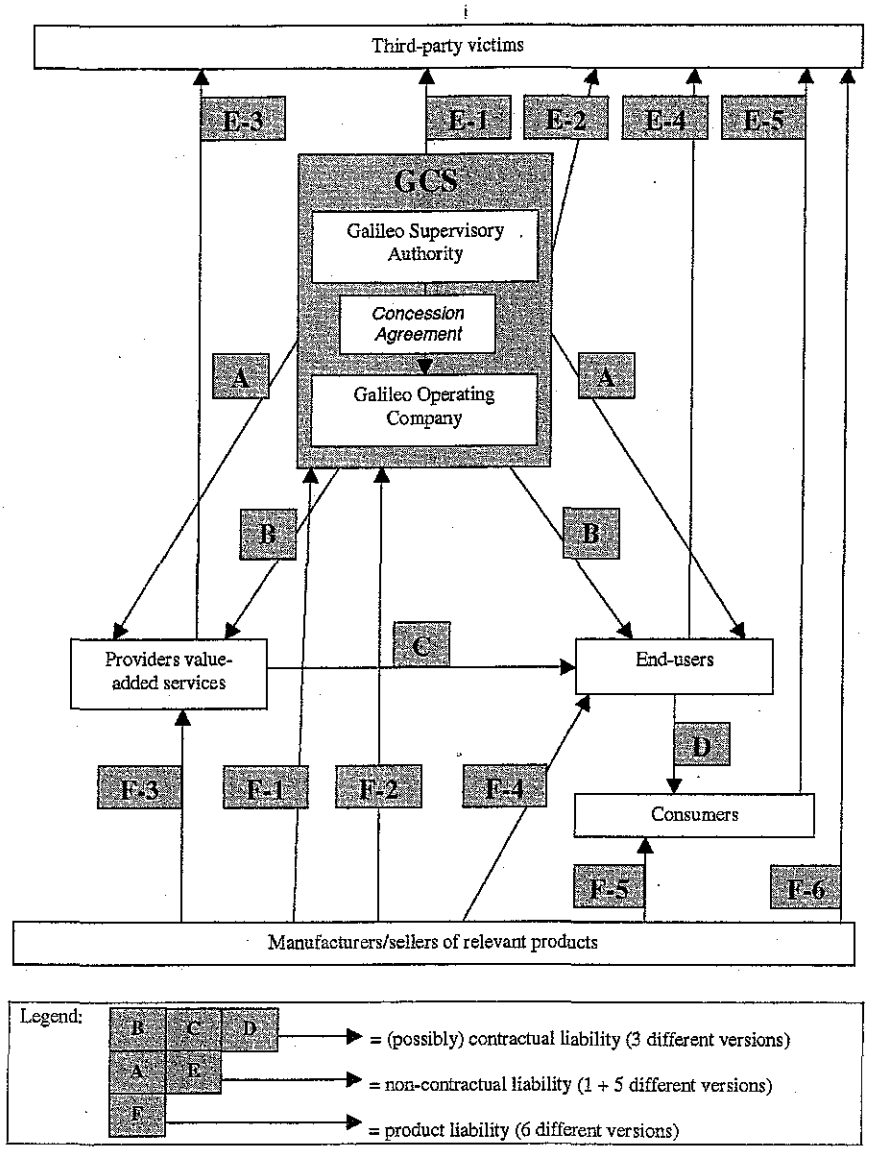
Appendix 2

Figure 3. The Legal/Functional Model of *Galileo* signal and service provision (generic and envisaged).



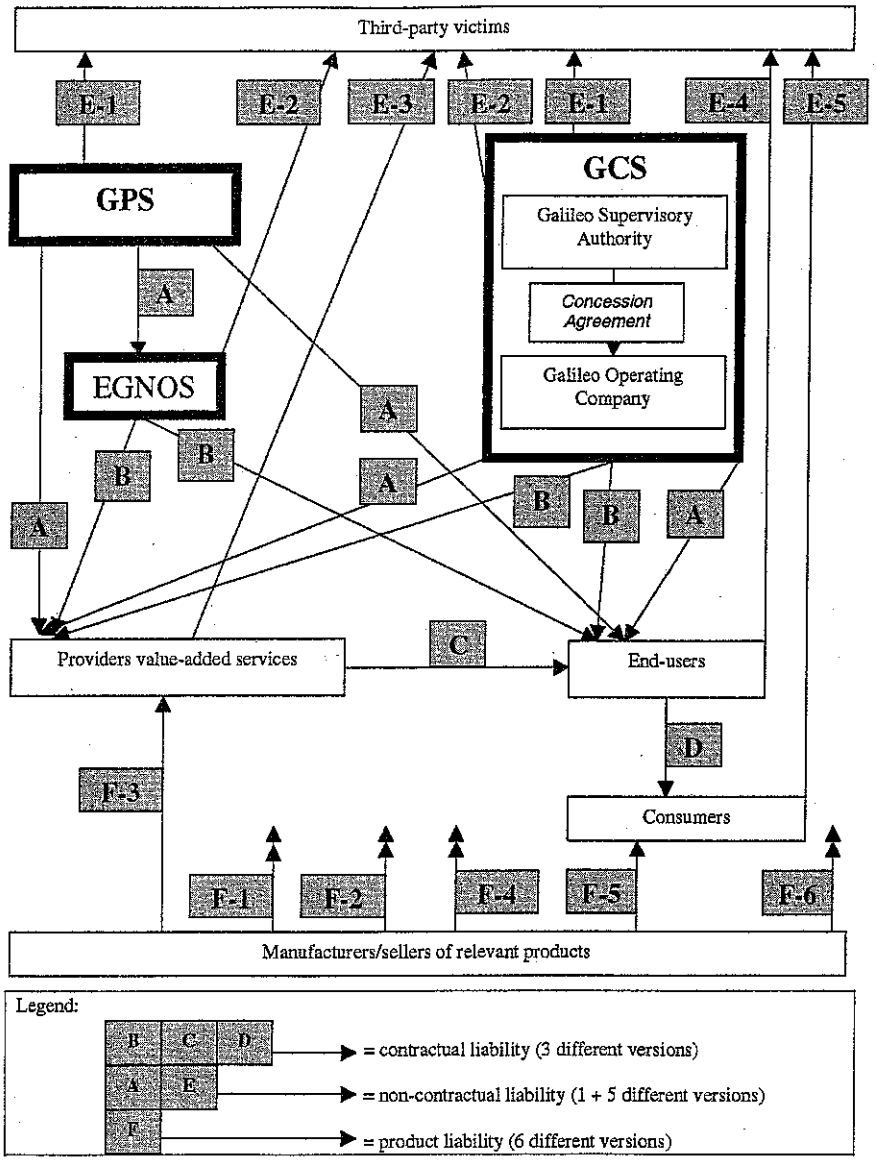
Appendix 3

Figure 4. The *Galileo* Legal/Functional Model and liability.



Appendix 4

Figure 5. Interoperability of GPS and *Galileo*, and liability.



Appendix 5

COMMENTARY

NO SPACE COLONIES: CREATING A SPACE CIVILIZATION AND THE NEED FOR A DEFINING CONSTITUTION

George S. Robinson[*]

Principal issues *not* addressed by the Congress, the National Aeronautics and Space Administration (NASA), as well as by other U.S. departments and independent agencies in the Executive Branch, and by most if not all relevant public and private international organizations, in their many studies of future directions of the U.S. and international space programs, are: (1) that infinite growth on a finite planet is not an option, and (2) human curiosity is not necessarily synonymous with species survival as a driving factor in human and human*kind* space migration. Not addressed, also, is whether we must confront the realities and demands of the New Millennium that might force human and/or human*kind* migration to the broader ecotone of near space, including the Moon and perhaps Mars, with greater urgency, alacrity, and deliberateness in the context of species survival. In a broader, but no less compelling, context needing emphasis is the ageless and most noble quest of *Homo sapiens sapiens* to determine the self-explanatory extraterrestrial imperative of humankind, i.e., where we came from, where we are going, and what the likelihood might be that our descendents will survive long enough to know they have arrived there and why.[1]

---

[*] Dr. Robinson, retired from the Smithsonian Institution, is currently in private law practice, and serves on several boards of trustees and advisory committees, including NASA's Planetary Protection Advisory Committee. He received an AB from Bowdoin College ('60), an LL.B from the University of Virginia ('63), an LL.M. from the McGill University Institute of Air and Space Law ('67), and the first Doctor of Civil Laws degree from McGill University's Graduate Law Faculty, Institute of Air and Space Law ('71).

[1] Although clearly using the term "colonize" as an undefined generalization, renowned aerospace engineer and visionary Krafft A. Ehricke addressed why humans

Mark R. Whittington, a space policy analyst in Houston, Texas offered a much-needed restatement of the obvious by calling for the United States and its allies to recommit to human occupation and settlement of near and deep space. He emphasized the view that "more important than any economic and scientific benefit, space settlements would ensure the long-term survival of the human species." He continued a bit gloomily that "should human folly or nature cause the death of the human race on the Earth, space settlements can ensure that humanity survives beyond the Earth."[2] We mostly are well aware that life on Earth has experienced six major species extinctions, with the seventh being the current one orchestrated by our own hands.[3]

It is an extraordinarily unique point at which we find ourselves in the natural and cultural history of the hominid evolutionary bush, where we, ourselves, are consciously beginning to change, through the application of our biotechnological accomplishments the very nature or essence of being human. And what will be the role of these capabilities in formulating the kinds of "envoys of mankind",[4] or perhaps even of human*kind,* or "spacekind" to which our various space treaties refer. We are in the midst, also, of another birthing process for our species, or species*kind,* based on two elemental principles of evolutionary biology and species survival: grow or die, and seed dispersal.

---

must migrate to space. *See* Krafft A. Ehricke, The Extraterrestrial Imperative: Why Mankind Must Colonize Space, Address at a New York Fusion Energy Foundation meeting (Nov. 1981), *cited in* Adriano Autino, *New Credit Tools and Tax Concepts for the Opening of the Space Frontier,* 51ST INT'L ASTRONAUTICAL CONG. (Rio, 2000).

[2] *See* Mark R. Whittington, *Missing the Big Picture,* SPACENEWS, May 5, 2003, at 13.

[3] *See generally* PETER WARD, THE END OF EVOLUTION: ON MASS EXTINCTION AND THE PRESERVATION OF BIODIVERSITY (Bantam 1994); RICHARD E. LEAKEY & ROGER LEWIN, THE SIXTH EXTINCTION: PATTERNS OF LIFE AND THE FUTURE OF HUMANKIND (Anchor 1996); George Moffet, *The Population Question Revisited,* 28 WILSON QUATERLY 54, 54-79 (1994).

[4] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]. Article V of the Outer Space Treaty provides in part that "States Parties to the Treaty shall regard astronauts as envoys of mankind". For an interesting assessment of astronaut status, *see generally* GEORGE S. ROBINSON & HAROLD M. WHITE, JR., ENVOYS OF MANKIND: A DECLARATION OF FIRST PRINCIPLES FOR THE GOVERNANCE OF SPACE SOCIETIES (Smithsonian Inst. Press, 1986).

That, in essence, sums up our timely effort to migrate from the womb of Earth into space, to occupy and settle it,and to create a new civilization(s). Our current and ongoing achievements relating to human biotechnological integration, genome mapping, and gene replacement/modification/sequencing intervention, reflect our growing and technological capacity to disperse our "seed" long-duration, if not permanently, into a broader ecotone in order to enhance survivability of *Homo sapiens sapiens*, or its human*kind* variations and descendants.[5]

The Orbiter Shuttle *Columbia* disaster in February 2003 brought us to the point, once again, of an imperative and critically serious assessment of directions to pursue in giving solid and durable meaning to the next step, not only in the U.S. space odyssey, but that of all nations on behalf of its citizens, perhaps even that of the species at large. If the human population is to continue a crewed program, as determined by President George W. Bush to be the case for the moment,[6] at least for the United

[5] Much discussion is taking place regarding direct and indirect intervention with the human genome and gene sequencing as a method for altering human capability to accommodate the extreme environments of outer space. The alteration, both by biotechnological integration and technological merging, have emphasized the likelihood of changing what traditionally has been considered, both culturally and biologically, to be the essence of humans; thus, the emphasis in human*kind*, and the evolving use of *Homo sapiens alterios*, and *Homo alterios spatialis*, or Space*kind*. For interesting discussions regarding the ethics of human genetic intervention, *see* WALTER GLANNON, GENES AND FUTURE PEOPLE; PHILOSOPHICAL ISSUES IN HUMAN GENETICS, (Westview Press, 2002). *See also* Deepak R. Kaura, *Drawing the Line on Genetic Intervention in Humans*, CAN. MED. ASSOC. J., 154, 927-929 (1996). In the context of the potential for human alterations and enhancements for specific purposes (such as protection against high radiation levels in space) through lateral gene transfer from other vertebrates, *see* Diane P. Genereux, & John M. Longsdon, Jr., *Much Ado About Bacteria-to-Vertibrate Lateral Gene Transfer*, 19 TRENDS IN GENETICS 191, 191-94 (2003). Finally, *see also* George S. Robinson, *Editorial: Human Rights and Rebus sic Stantibus*, COSMOS 2001 (2001), *available at* http:// www.cosmos-club.org/journals/2001/robinson.html (last visited Apr. 12, 2004), in which the editor discusses work conducted at the Max Planck Institute for Biochemistry in Germany where several brain cells from a snail were linked with silicon chips to create a living mechanical-electronic circuit, and notes that at the very least, the implications for human-machine intelligence and accumulative changes to taxonomic characterizations of *Homo sapiens sapiens* may well be fruitful paths of research for enhanced human*kind* migrating to space.

[6] *See* President George W. Bush, Renewed Spirit of Discovery, The President's Vision for U.S. Space Exploration, White House Press Release (Jan. 14, 2004) (delineating the Administration's policy that emphasized, in part, the manned portion of the U.S. space program by returning to the Moon and establishing a permanent base, with expectations that the next phase would be to send humans to Mars).

States, and provide all the sustaining resources and commitment necessary to ensure its success and a growing space migration of human*kind*, all nations must become responsible in some degree in a global effort to uncover and illuminate the fundamental requirements for such an undertaking beyond transitory economics, strictly domestic and international partisan politics, and shifting military requirements for the protection of equally shifting national and international interests.

A reasonable, rational, and real-time recognition is critical that the world's spacefaring cultures are in the process of structuring and building an entirely new and unique civilization in space, i.e., they are pursuing the incipient design and fabrication stages that will establish a "cradle of space civilization"; not simply a space "colony" or society, but a *civilization*.[7] And yet, Earth indigenous historical values, principles, and motivating factors are being relied upon that largely are irrelevant to societies and civilizations that exist and will exist in completely synthetic and alien life support environments. In short, cultural recidivism is being relied upon to establish the legal foundation and social constructs for human and human*kind* evolution off Earth. This deficiency is classically represented in the multilateral agreement[8] governing the cutural/social/commercial/military aspects, as well as operational objectives and control, of the *International Space Station.*

We seem to be giving no significant and meaningful time to investigating and assessing in a systematic and disciplined fashion the underlying values of the "why" and the "how" of humankind space migration beyond transitory interests. We are focusing only on the fact that our technology has allowed us

---

[7] *See* George Robinson, *Must There be Space Colonies?: A Jurisprudential Drift to Historicism, in* PEOPLE IN SPACE: POLICY AND PERSPECTIVES FOR A NEW CENTURY (U. Texas Press, 1985).

[8] Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, Jan. 29, 1998, *available at* 1998 U.S.T. LEXIS 212 (entered into force Mar. 27, 2001) [hereinafter IGA]. A full text of the IGA, as well as dependent bilateral agreements that involve NASA, can be obtained by contacting the NASA Office of General Counsel, Code G, 300 E Street, SW, Washington, DC 20546.

access to near and deep space with very little thought being given to the reality that we are in the process of laying, albeit in a helter-skelter and piecemeal fashion, a complex foundation for new civilizations. And our technology is telescoping drastically the time available to us to determine how and why we migrate to and settle near and deep space, rather than just dragging old and frequently irrelevant Earth indigenous values and requirements along with us. We seem to be repeating all the disasters in economic, military, and cultural imperialism that inevitably result, as history has shown time and again, in establishing "colonies" the futures of which will assume, yet again, the complexion of subsequent ongoing violent confrontations.[9]

The human brain and its entire morphological and physiological support system (regardless of whether synthetically altered to meet unique demands of off-Earth existence) are capable of adjusting to new, even unique, psychopathological demands and stimuli offered by a physically and socially-alien near and deep space existence and survival. The technological, genetic, pharmacological, and bio-surgical tools available to assist in that effort of re-adaptation to a totally different physical and cultural ambience are at hand. And yet, we are not exploring how to use them to create a new civilization ideally suited to a non-Earth society embracing equally as new and evolving biological and cultural dictates.[10]

---

[9] *See* NICHOLAS THOMAS, COLONIALISM'S CULTURE: ANTHROPOLOGY, TRAVEL AND GOVERNMENT (Princeton Univ. Press 1994); NICHOLAS B. DIRKS, COLONIALISM AND CULTURE (Univ. of Mich. Press 1994); JÜRGEN OSTERHAMMEL, COLONIALISM: A THEORETICAL OVERVIEW (Markus Weiner 1996).

[10] For an interesting discussion outlining the biological foundations of unique values and laws applicable to early and current space habitat participants, *see generally* GEORGE S. ROBINSON, LIVING IN OUTER SPACE (Public Affairs Press, Wash. D.C. 1975); George S. Robinson, *Man's Physical and Juridical Relationships in Space: A Key to Quantification of His Cultural Activities on Earth*, J. MAN/ENVTL. SYS. (April 1972); George S. Robinson, *Psychoanalytic Techniques Supporting Bio-Juridics in Space*, 2 J. SPACE L. 95 (1974); George S. Robinson, *Astronauts and a Unique Jurisprudence: A Treaty for Spacekind*, 3 HASTINGS INT'L & COMP. L. REV. 483-499 (Spring 1984); George S. Robinson & J. Hughes, *Space Law: The Impact of Synthetic Environments, Malnutrition and Allergies on Civil and Criminal Behavior of Astronauts*, 19 JURIMETRICS J. No. 1 at 59 (Fall 1978). *See also* M. Ephimia Morphew, *Psychological and Human Factors in Long Duration Spaceflight*, 6 MCGILL J. MED 74 (2001).

A recognition of this shortcoming was attempted in 1985 when, as a part of the bicentennial celebration of the United States Constitution, a project was undertaken by the Smithsonian Institution in Washington, D.C., to help determine which, if any, of the underlying values and principles of that document could, or indeed must, be applied to American citizens and others subject to U.S. jurisdiction who are living and working in space habitats, not colonies, such as the *International Space Station*, as well as settlements planned for other extraterrestrial bodies. More than forty experts from around the country, ranging from astrobiologists, engineers, scientists, economists, senators, thespians, diplomats, and lawyers, were asked to participate. Among those involved and contributing were: U.S. Supreme Court Justice William J. Brennan, Jr.; Senator/astronauts John Glenn; Harrison Schmitt; Representative Don Fuqua; Walter Cronkite; astrobiologist Dr. Gerald Soffen; and actor Richard Dreyfuss.

In furtherance of the undertaking, two three-day meetings were held at the Smithsonian's National Air and Space Museum, one in December 1986 and one in November 1987. The conferees decided at the outset not to attempt to frame an actual constitution. Rather, they would examine the values and principles underlying the formulation of the American Constitution and draft a *Declaration of First Principles for the Governance of Outer Space Societies*. Both the document and the process of formulating it were intended only as templates for addressing and establishing principles for free and quasi-independent societies in space habitats or settlements. Nevertheless, several conferees stated a strong preference, under appropriate circumstances and timing, for presenting the document to the White House and to the United Nations.

The Declaration that ultimately emerged from the deliberations is a three-part document. The first part is a ringing preamble embracing the reasons for the Declaration; the second is a reaffirmation of faith in fundamental human freedoms and the inalienable rights of individuals who live in space; and the third is an assertion that the governance of and by space societies should reflect the "will" of the participants. The document is designed to evolve and adjust to equally as evolving realities,

not the least of which is the changing nature and definitions of what constitutes "normal" human functions, what in fact is "human," and what are "*inherent* human rights." The focus of the conference was on the most fundamental values and principles underlying any space civilization.[11]

President George W. Bush's recently announced policy for the future of the U.S. space program seems heavily oriented toward enhancing military interests and re-establishing broad leadership in space technology.[12] Permanently staffed habitats on the lunar surface and that of Mars sound more like the establishment of military outposts or "colonies" than the genesis of a new civilization of human*kind* or space*kind*, a unique part of the human evolutionary odyssey. Various ongoing private and public conferences to study and assess whether the American space program in the New Millennium are not much more than a convening of the usual suspects, that is, bringing into one forum a broad scope of the nation's elite space experts from the aerospace industry, NASA, the Department of Defense, Congress, and the executive branch to help continue in a parochial fashion the vision of America's role as leader in space activities.

Time is much shorter than Earth's current civilizations seem prepared to recognize in order to avoid dragging old and frequently irrelevant values/principles and controlling legal constructs into space simply because we know them and are comfortable with them, despite their histories in practice of destruction as well as creativity. We should be pressing with great urgency to catch up with our unfolding space technology in terms of philosophical, theological, and biocultural constructs necessary for establishing a civilization that reflects not only a framework of values we wish to inculcate at the outset, but the

---

[11] For a complete text of the Declaration of First Principles for the Governance of Outer Space Societies *See* George Robinson, *Re-Examination of Our Constitutional Heritage: A Declaration of First Principles for the Governance of Outer space Societies*, 3 HIGH TECH. L.J. 79 (1989). *See also* George Robinson, *Rethinking Outer Space in the 200th Year of our Constitution*, AIR & SPACE LAW. (Fall 1987).

[12] Pres. George W. Bush established a Commission on Moon, Mars, and Beyond, on Feb. 9, 2004, "to provide recommendations to the President on implementation of the vision outlined in the President's policy statement entitled "A Renewed Spirit of Discovery" and the President's budget submission for Fiscal Year 2005. *See* http://www.moontomars.org (last visited April 12, 2004).

unique demands and physical exigencies, as well, of a non-Earth life support system. At present, though, we seem to be adopting a tragic cultural *laissez faire* attitude that does not challenge our intellectual capabilities, and that does not recognize the imperative requirement of a well-considered establishment of a space civilization(s) that will ensure not only that *Homo sapiens sapiens* and its altered descendents will evolve biologically, biotechnologically, and culturally in sensible fashions but that they will evolve at all.

It is necessary in large part to return to basics and start developing core values for and by this new space civilization; values that are responsive not only to the needs and dictates of space habitation, but as well to this new phase of human biotechnological evolution. We need to address carefully the philosophical and theological constructs that might serve as the foundation to guide this phase of evolution. Toward accomplishing the first step, i.e., identifying ecumenically shared or accommodated core values and principles around which a space civilization constitution ultimately might be drafted, the proposed resolution set forth below is offered as a working template.

PROPOSAL

SPACE MIGRATION: AN ECUMENICAL MEETING OF MINDS

WHEREAS, the U.S. Government's response to the loss of the *Columbia* orbiter and its crew has been assessed principally, if not exclusively, from safety, engineering, and economic perspectives, as well as military interest in the human space program; and

WHEREAS, the current policy of the U.S. Executive Branch is to create and fund human missions that would establish a permanent U.S. presence on Earth's moon and ultimately Mars; and

WHEREAS, a number of domestic and global leaders have expressed a preference for deemphasizing the human space flight program and putting more attention on robotic exploration and

settlement activities, and still others call for the return to true human space exploration, migration, and settlement of near and deep space, including a return to the moon and human missions to Mars; and

WHEREAS, approximately thirty-five years have passed since NASA conducted a major in-depth directional program review (such as the post-Apollo "Outlook for Space" study and conclusions co-sponsored by the Smithsonian Institution in Washington, D.C.) embracing both the solicited and unsolicited views of a broad international civilian population, as well as industry and government experts and leaders; and

WHEREAS, an international conference co-sponsored primarily by non-governmental research and educational organizations, with in-kind logistical and financial support from all interested governmental and non-governmental sources, should convene for approximately five days (at an appropriate non-governmental facility, with follow-on working panels at sites appropriate to the panel tasks and participant resource locations) a diverse global community of minds united by a common interest in identifying and formulating the biocultural constructs and guiding philosophical and theological principles necessary to direct humankind's evolutionary odyssey into and settlement of near and deep space, and essential for establishing the unique framework of values for a space civilization that will ensure survival of that civilization and its component participants,

NOW THEREFORE, it is hereby proposed that said conference and follow-on working panels in furtherance of defining these constructs and guiding principles be convened to take advantage of the pivotal moment of forced reassessment of the U.S. and multilateral human space program as an opportunity to restate or redefine for and by the broadest international sector possible the core beliefs, hopes, biological imperatives, and socio-cultural survival ideals concerning the destiny of humans and human*kind* on Earth and in space, and the establishment of a cradle of space civilization.

Toward this end, the following issues and questions should be among those addressed by the conference organizers and participants:

1. Why should/must humans and human*kind* depart planet Earth to occupy and settle near and deep space?

a. Biological imperative

b. Cultural imperative

c. Philosophical constructs and theological imperatives

2. What should be the purposes or objectives of free standing and independent human*kind* (including biotechnologically integrated entities with advanced artificial intelligence components) societies in space once second generation, *et seq.*, and/or permanent space habitation have been established?

3. What ought or must be the characteristics of military participation in human*kind* space migration?

4. Who should participate in addressing these questions? Among others, participants ought to include the following:

a. Evolutionary biologists

b. Astrobiologists

c. Philosophers

d. Theologians

e. Economists

f. Cultural/physical anthropologists and historians

g. Space human factors experts, including space psychologists

h. Astrophysicists

i. Engineers and other representatives of pragmatic/empirical disciplines

j. Legislators, jurisprudents, and constitutional law experts

k. Experts in artificial intelligence, telepresence and teleportation communication, robotics, human genome mapping and gene sequencing intervention, biotechnology integration, cryogenics, cyberspace issues, etc.

ANTICIPATED RESULT

A published proceedings for distribution to participants, the United Nations, sovereign governments, members of theological organizations, and institutions of higher education; a basic statement (manifesto) of the globally formulated fundamental principles and imperatives for moving human*kind* or the essence(s) of man*kind*/human*kind* off Earth; and a constitutional structure to assure a legal framework for survival of a complex and unique culture in space, a cradle of *space civilization*.

BIBLIOGRAPHY

SPACE LAW CASES AND RELEVANT PUBLICATIONS

Tracy Bowles[*]

A. BOOKS

B.J. CONRATH ET AL., EXPLORATION OF THE SOLAR SYSTEM BY INFRARED REMOTE SENSING (Cambridge Univ., 2d ed. 2003).

DUST PLASMA INTERACTION IN SPACE (P.K. Shukla ed., Nova Science 2002).

EXPLORATION OF SPACE: ISSUES AND STATUS (Vivian M. Abelson et al. eds., Nova Science 2002).

M.W. FRIEDLANDER, A THIN COSMIC RAIN: PARTICLES FROM OUTER SPACE (Harvard Univ. 2002).

N.A.S.A., CENTENNIAL OF FLIGHT, 1903 – 2003 (Dryden Flight Research Center 2002).

N.A.S.A., EXPLORATION SYSTEMS AUTONOMY: 2001 RESEARCH UPDATE (Jet Propulsion Laboratory 2002).

SPACE POLICY IN THE TWENTY-FIRST CENTURY (W. Henry Lambright ed., Johns Hopkins Univ. 2002).

FERNAND VERGER ET AL., THE CAMBRIDGE ENCYCLOPEDIA OF SPACE (Cambridge Univ. 2002).

B. ARTICLES

Adeno Addis, *The Thin State in Thick Globalism: Sovereignty in the Information Age*, 37 VAND. J. TRANSNAT'L L. 1 (2004).

---

[*] Ms. Bowles is a third year law student at the University of Mississippi School of Law and is a Research Assistant at the National Remote Sensing and Space Law Center.

William L. Andrews, III., *The Right to Combat OECD 'Harmful Tax Competition:' The International Space Company*, J. INT'L TAX. (2003).

Robert C. Bird, *Procedural Challenges to Environmental Regulation of Space Debris*, 40 AM. BUS. L.J. 635 (2003).

Anupan Chander, *The New, New Property,* 81 TEX. L. REV. 715 (2003).

Paul S. Dempsey, *Aviation Security: The Role of Law in The War Against Terrorism*, 41 COLUM. J. TRANSNAT'L L. 649 (2003).

Joanne I. Gabrynowicz, *Something New Under The Sun: The National Remote Sensing and Space Law Center*, 17 A.B.A. AIR & SPACE LAW. 8 (2002).

George S. Robinson, *NASA's Accountability for Life and Informed Public Consent: Planetary Protection and Evolving Law*, 17-WTR AIR & SPACE LAW 9 (2003).

Nicholas A. Robinson, *Enforcing Environmental Norms: Diplomatic and Judicial Approaches*, 26 HASTINGS INT'L & COMP. L. REV 387 (2003).

Armin Rosencranz, *The Origin and Emergence of International Environmental Norms,* 26 HASTINGS INT'L & COMP. L. REV. 309 (2003).

Evan R. Seamone, *The Duty to "Expect the Unexpected": Mitigating Extreme Natural Threats to The Global Commons Such as Asteroid and Comet Impacts with The Earth*, 41 COLUM. J. TRANSAT'L L. 735 (2003).

Richard L. Williamson, Jr., *Hard Law, Soft Law, and Non-Law in Multilateral Arms Control: Some Compliance Hypotheses*, 4 CHI. J. INT'L L. 59 (2003).

C. NOTES/COMMENTS

Lynn M. Fountain, *Creating Momentum in Space: Ending The Paralysis Produced by The "Common Heritage of Mankind" Doctrine*, 35 CONN. L. REV. 1753 (2003).

Raphael Prober, *Shutter Control: Confronting Tomorrow's Technology with Yesterday's Regulations*, 19 J.L. & POL. 203 (2003).

Thomas Rankin, *Space Tourism: Fanny Packs, Ugly T-Shirts, and The Law in Outer Space*, 36 SUFFOLK U. L. REV. 695 (2003).

D. CASES

Arbitration Between Space Systems/Loral, Inc. v. Yuzhnoye Design Office, 164 F.Supp.2d. 397 (S.D.N.Y. 2001). – satellite launch service agreement

E. OTHER

Commercial Space Transportation Act of 2003, S. 1260.IS, 108th Cong. (2003) (Introduced in Senate).

Commercial Space Transportation Act of 2003, S. 1260.RS, 108th Cong. (2003) (Reported in Senate).

Commercial Space Launch Amendment Act of 2004, H.R. 3752, 108th Cong. (2003).

Commercial Space Launch Amendments Act of 2004, H.R. REP. 108-429, 108th Cong. (2004).

Agreement concerning Cooperation between the National Aeronautics and Space Administration of the United States of America and the Canadian Space Agency on the SciSat -1 Atmospheric Chemistry Experiment Mission, July 18, 2003, State Dept. No. 03-106, *available at* 2003 WL 22324885.

Memorandum of Understanding between the National Aeronautics and Space Administration of the United States and the Centre National D'Etudes Spatiales of France for Cooperation in the Calipso Mission, June 18, 2003, State Dept. No. 03-79, *available at* 2003 WL 22137187.

JOURNAL OF SPACE LAW

Reprints of vols. 1-13 of the
JOURNAL OF SPACE LAW
Contact
William S. Hein & Co., Inc., 1285 Main Street, Buffalo, New York 14209

Subscriptions should be made payable to the JOURNAL OF SPACE LAW and paid for by check drawn on a U.S. bank or money order in U.S. dollars or by VISA/Mastercard:

Mail Order Journal of Space Law
1 Grove Loop
558 Lamar Law Center
University, MS 38677 USA

Fax Order 1.662.915.6921
Email: jsl@olemiss.edu
Tel: 1.662.915.6857

The 2004 subscription rate for two issues, incl. postage and handling:

Domestic USA individuals	$100.00	
Domestic organizations	$120.00	
Foreign individuals, regular mail	$105.00;	air mail $125.00
Foreign organizations, regular mail	$125.00;	airmail $145.00

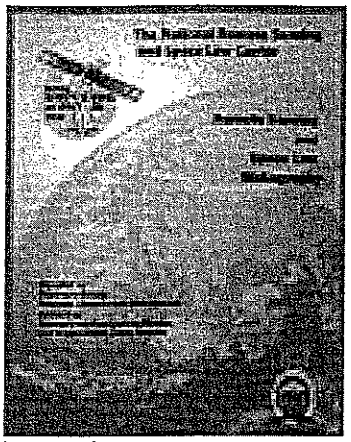
Single issue price is $70.00

Single issues vols. 14-29: $70.00

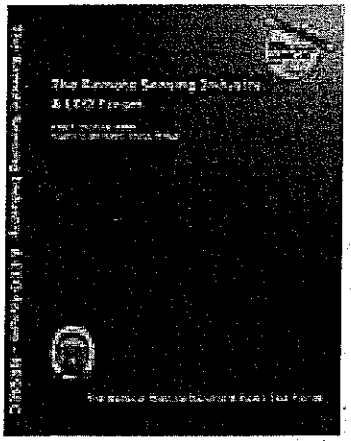
Order for 2004 Volume 30 (Nos. 1 & 2) $_____.____
Order for 2005 Volume 31 (Nos. 1 & 2) $_____.____
TOTAL $_____.____

Name:_____
Company/Organization: _____
_____
Address:_____
_____
City: _____ State: _____
Country: _____ Zip:_____
Telephone No: (____) _____; Fax No: (____) _____
Email:_____
For Credit Order (please add 5%) _____ VISA _____ MASTERCARD
No: _____ Exp Month: _____ Year: _____

The NATIONAL REMOTE SENSING AND SPACE LAW CENTER has the following books available for purchase. For book descriptions and ordering information, please visit our website at: http://www.spacelaw.olemiss.edu/store.htm

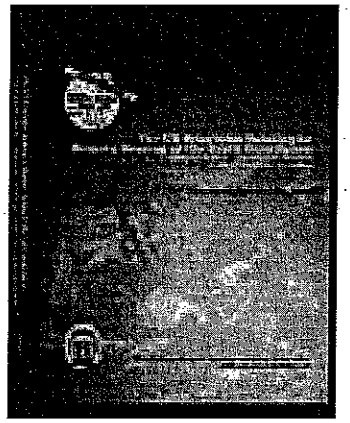


Remote Sensing and Space Law Bibliography $45.00

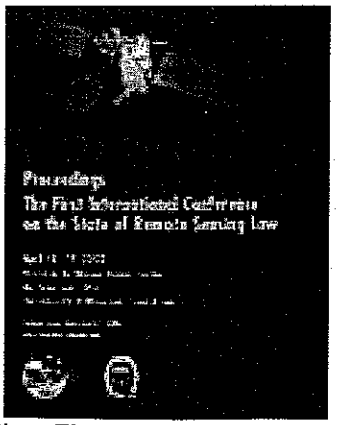


The Remote Sensing Industry: A CEO Forum $45.00

Landsat 7: Past, Present, and Future $50.00



The UN Principles Related to Remote Sensing of Earth from Space $45.00



Proceedings, The First International Conference on the State of Remote Sensing Law $80.00