GNSS INTERNATIONAL AVIATION ISSUES

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INTRODUCTION

A number of current legal issues confront GNSS. They concern:

1. Sovereignty. GNSS satellites operate in outer space but they transmit information into sovereign space. The legal issue is that different legal regimes exist in sovereign space than in to non-sovereign space.

2. Jurisdiction. States have jurisdiction over their GNSS satellites. 1/ The jurisdictional issue concerns the right of ownership and control over GNSS satellites in non-sovereign space.

3. Liability. Liability for satellite activities is governed by the treaty on liability. 2/ Liability also is governed by domestic law, such as the U.S. Federal Torts Claims Act. 3/ These two liability systems do not cover all liability events.

4. Institutions: The legal issue is whether GNSS satellites should be governed by (or subject to oversight by) the countries or groups of countries that launched them . Should they be supervised by specialized international organizations such as ICAO or IMO? Or should they be supervised by a multifunctional international institution?

5. Operating principles. Should GNSS be subject to international operating principles regarding their use. Which international institution should develop such principles?

This author has commented previously on a number of these legal issues. 4/ The focus of this paper is on the fifth issue: Should the GNSS be subject to uniform international operating principles? If so which operating principles should apply? Finally if international operating principles are desirable, should they be made applicable for GNSS use by one mode of transportation only, that is, aviation, or should such principles be made applicable for all GNSS uses (for example, aviation, maritime uses, automobiles, trains, surveyors, agriculture and a host of other current uses)?

I AVIATION SAFETY ISSUES - NEED FOR INTERNATIONAL HARMONY

International uniformity of air navigation is important for the operation of airplanes. Using one navigation system makes everything simpler than using multiple varying systems. The use of globally uniform navigation systems and codes makes flying less complex and thus more safe. International uniformity of navigation eliminates the costly need for aircraft to be differently equipped to use the air navigation facilities in foreign countries. U.S aircraft flying in Europe and Asia need to be able to use the navigation equipment in other countries, as well as in U.S. air space. It is not economical to equip aircraft with multiple navigation equipment to meet a single purpose just because

countries have different requirements. However, aviation safety is the bottom line. International uniformity of navigation tends to be the safest mode of operation. At this early stage of Global Navigation Satellite System (GNSS) development, however, international uniformity has not yet been developed.

A. The Varying GNSS Systems.

Currently two global satellite navigation and positioning systems have been created. The U.S. Global Positioning System (GPS is used interchangeably with GNSS in the following discussion) was presented by the United States to the International Civil Aviation Organization (ICAO) and was accepted by ICAO as the global civil aviation navigation satellite system. "GPS has been approved as a primary means of navigation in several areas of the world, and the number of aircraft equipped for satellite navigation is growing steadily." 5/ The GPS is a dual-use system because it is not only a civilian system; it also is integrated into many facets of military operations. "GPS is also rapidly becoming an integral component of the emerging Global Information Infrastructure, with applications ranging from mapping and surveying to international air traffic management and global change research." GPS is described as "the constellation of satellites, the navigation payloads which produce the GPS signals, ground stations, data links, and associated command and control facilities which are operated and maintained by the Department of Defense; the Standard Positioning Service (SPS) as the civil and commercial service provided by the basic GPS; and augmentations of those systems based on the GPS that provide real-time accuracy greater than the SPS." 6/ The Precise Positioning Service (PPS) is available only to the military services, but not to the civilian users. The availability of the superior PPS to selected GPS users is a source of disuniformity. This qualitative difference is called Selective Availability (SA). The 1996 White House statement stated that "Beginning in 2000, the President will make an annual determination on continued use of GPS Selective Availability." The White House declared its intention to discontinue SA before the year 2006. 7/

The United States Government expressed in 1996 the acceptance of the "the possible future use of internationally shared systems. For example the Russian Global Navigation Satellite System (GLONASS) achieved a full constellation of space vehicles in December of 1995. The system has since been declared operational. 8/ Russia has also offered to ICAO, and ICAO has accepted, GLONASS as the global orbiting navigation satellite system for civilian aviation. At the present time GPS and GLONASS are the main components of satellite navigation and positioning. "Prospects for the combined use of GPS and GLONASS so that the two systems supplement each other are still uncertain. The GLONASS constellation is not maintained at its full deployment level, and a combined GPS/GLONASS receiver for aeronautical use is yet to be fully developed and certified." 9/

B. Various GNSS Augmentation Systems

It is not possible to land airplanes using the Global Positioning System. It is necessary to augment GPS in order to make it the primary aviation radionavigation system. Therefore the U.S. Federal Aviation Administration is establishing the Wide Area Augmentation System (WAAS). WAAS will provide sufficient accuracy, integrity and availability for enroute and Category I approaches. WAAS will be available in 1999, and full WAAS capability is planned for the year 2001. Additional augmentation will be provided by the Local Area Augmentation System (LAAS). LAAS will provide additional accuracy, integrity and availability for Category II and Category III approaches. Thus airplanes will be able to navigate exclusively by the augmented GPS service. Other countries and combination of countries are also planning GNSS augmentation. European augmentation will be provided by the European Geostationary Navigation Overlay System (EGNOS) . Japan is also planning augmentation through its Multifunctional Transport Satellite program. 10/ Augmentation of GPS systems is provided for maritime transportation and for the many other uses of the GPS. 11/ The variety of augmentation systems cause GNSS to be disuniform.

C. Conclusion

While the current GNSS technologies for aviation use differ, these technologies can be viewed positively: satellite navigation and positioning makes aviation much safer and is more economical than the now old-fashioned technology.

II. International Law

GNSS is subject to many international legal regimes . They may be divided into the general legal regimes that govern all the functions of GNSS and those that govern only aviation uses. The major legal regimes are as follows.

A. General Multifunctional Legal Regimes

States are required to operate and use GNSS satellites in accordance with the U. N. Charter. 12/ . The United Nations exercises its authority over outer spaces uses through its Committee for the Peaceful Uses of Outer Space (COPUOS). Five comprehensive treaties were prepared by COPUOS. Four of those treaties have achieved almost universal application . Those four are described below. Virtually all the members of the International Civil Aviation Organization are parties to, and thus subject, to those four treaties:

(1)The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. 13/ Art. III establishes that the GNSS satellites in outer space are outside national sovereign territory. Article I provides that their use of outer space "shall be carried out for the benefit of and in the interest of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." 14/ Art. VI provides that contracting states (the United States in the case of GPS) shall supervise its GPS satellites to assure that they are carried out in conformity with the 1996 OST. Art. VII provides that contracting states (the United States in the case of GPS) are internationally liable to other contracting states for damage to the other contacting states and their natural and juridical persons. The launching state retains jurisdiction over its GNSS satellites. Ownership of a GNSS satellite is not affected by its presence in outer space.

(2) The 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and their Return of Objects into Outer Space. 15/ Art 5 provides that contracting states shall return GNSS satellites and their components to the launching state or at least give notice of their availability. The atomic clock onboard a GPS Satellite could also cause a state which finds a GPS satellite to insist on its legal right to request the launching state "to eliminate possible danger of harm." 16/

(3) The 1971 Convention on International Liability for Damage Cased by Space Objects. 17/ The launching state is liable for loss of life, injury, damage to property of States or their natural or juridical persons. The launching state is absolutely liable for "damage caused by its space object on the surface of the earth or to aircraft in flight." 18/ However, damage caused elsewhere is subject to liability of the launching state "only if the damage is due to its fault or the fault of persons for whom it is responsible." 19/. Most states parties to this convention are also parties to the 1967 OST and thus would claim that they are parties to the most restrictive of the two conventions. Those states that are not parties to the 1971 Convention would be subject to the broader liability provision of the 1967 OST, Article VII. Intergovernmental GNSS Organizations would be subject to joint and several liability under Article V , that is, if they declare acceptance of the rights and obligations provided by the 1971 Liability Convention. Under the Liability Convention claims for compensation are presented by States, not by individuals. 20/.

As the United States is one of the two GNSS operators, its interpretation of the 1971 Liability Convention is relevant. The United States does not interpret the Convention to apply to liability for indirect damages. 21/ Liability is restricted not only by this interpretation of the Liability Convention, but also by the U.S. claim of immunity for Governmental liability made in the 1993 Supreme Court case of Smith v. United States, 507 U.S. 197 (1993). The Supreme Court stated in the Smith case that the Federal Tort Claims Act (FTCA) does not apply to Governmental negligent acts outside U.S. territory. 22/ However, private claims against the U.S. Government for negligent GNSS within U.S. territory would be possible, but only to the extent that Governmental negligent acts are not defined as being discretionary.

(4) Convention on Registration of Objects Launched into Outer Space . 23/ Article II requires States to register their satellites in their domestic registry and in the U.N. registry. Thus all GNSS satellites are registered with the United Nations. Registration clarifies the issues of national jurisdiction over GNSS satellites because Article II provides that only one state can register a satellite in the U.N registry. The filing State is the state which exercises

jurisdiction. States launching GNSS satellites jointly may agree among themselves how to share obligations and benefits. 24/

(5) International Telecommunications Convention. 25/ This Convention establishes the International Telecommunications Union (ITU). Radio frequencies necessary for operation of GNSS satellites are coordinated through ITU . The ITU Radiocommunications Service registers radio frequencies in the ITU master registry in accordance with ITU policies and agreements.

Several current GNSS issues are affected by ITU administration of radio frequencies . For example the U.S. GPS is planning to add radio frequencies. In 1998 the United States announced that GPS will provide two new civilian radio signals in order to separate civilian and military GPS uses. One of the two civilian signals will be located in the radio frequency of the current GPS L2 signal previously used only for military purposes. On March 30,1998 Vice President Gore announced the U.S.Government's decision that "separate civil and military signals can coexist on this frequency, as they already do at the GPS L1 frequency. The frequency for the third civil signal remains to be defined over the next several months." New exclusive civilian radio frequency "will have profound effects on the civilian transportation system and the people who use it, saving time, cutting costs, enhancing safety and providing unprecedented mobility." The U.S. Government will make the second civil signal available by the year 2005. The reason for this late date is that it takes time to build the new radio signal into the next generation of GPS satellites. 26/

Both existing and new ITU allocations of GNSS radio frequencies have become increasingly difficult because of the intense competition for frequencies from other (non-aeronautical) users, in particular the mobile satellite operators. The World Radiocommunication Conference to be held in year 2000 (WRC-2000) will consider several radiofrequencies allocations related to aviation. For example, WRC-2000 will consider whether GPS can share part of the 1559-1567 MHz band with mobile satellite service (space to earth). The aviation view is that such sharing is not desirable nor feasible. Secondly, WRC-2000 will consider the use of the 1559-1610 MHz band by terrestrial fixed service for microwave radio-relay links in many countries. Such use could interfere with GPS radio signals. Consequently "[p]rotection of the GNSS frequency allocation needs serious attention." 27/

It is uncomfortable for the aviation industry that decisions on this and related radio frequency issues will be made in a non-aviation forum, e.g. ITU. The commercial (mobile satellite) service operators are pressing their needs very hard; they have a history of success in obtaining their goals. Unless governments realize the value of GNSS and insist on ITU protection of radiofrequencies needed for interference-free GNSS , the satellite navigation and positioning operations may not be viable.

B. GNSS Legal Regime for Aviation

The 1944 Convention on International Civil Aviation 28/ Art. 1, recognizes the exclusive sovereignty of States over their airspace. Aviation safety is the main purpose of the 1944 Convention and for the International Civil Aviation Organization (ICAO) which it created. ICAO is the major institution to develop "the principles and techniques of international air navigation and to foster the planning and development of international air transport." 29/ Thus ICAO "is the major forum for discussion not only of positioning satellite standards for navigation, communication, surveillance, and air traffic management, but also for legal issues relating to providers and users of positioning satellites." 30/.

ICAO is the competent forum to establish global minimum Standards and Recommended Practices (SARPs) for aviation use of GNSS. Failure to comply with ICAO minimum standards could trigger Article 33 of the Chicago Convention, that is, States' failure to recognize the validity of GNSS certification for air international navigation use. ICAO Member States have agreed in Article 28 to provide governmental oversight for their air navigation facilities in accordance with ICAO minimum standards. This oversight role is similar to the oversight of satellites required of States under Article VI of the 1967 OST. 31/

ICAO Annex 10 32/ expresses ICAO's policy that GNSS will be used for Categories I, II, and III flying. Therefore ICAO is developing GNSS SARPs (including SARPs for augmented GNSS). Specifically, ICAO is completing SARPs for the GPS. The SARPs for GLONASS have yet to be done. 33/ .

GNSS navigation is a major change because it involves "a reallocation of the roles that are at the present split between ground and aircraft elements, with emphasis on the ground element. This re-allocation involves, in particular, the imposition of very stringent requirements for databases and a common coordinate system for safety-critical applications. The required level of data quality, in terms of accuracy and integrity, cannot be easily achieved worldwide." 34/

ICAO's acceptance of The United States offer to make GPS available, without charge, for global navigation, and ICAO's acceptance of Russia's offer to do the same was the initial step towards ICAO oversight of global GNSS. Subsequently, ICAO has worked substantially to establish a legal framework for global GNSS. The most recent step is that ICAO committees prepared a draft charter of principles which was presented to the world-wide CNS/ATM System Implementation Conference held in Rio de Janeiro, Brazil on 11-15 May, 1998. The conference supported ICAO adoption of the draft charter as a short term legal framework. The predominant ICAO view was that a legal treaty would be required in the long term. On June 10, 1998 the ICAO Council agreed that the following described Charter on Rights and Obligations of States Relating to GNSS Services be submitted to the 32nd Session of the ICAO Assembly for adoption: 35/

Aviation Safety: States recognize that the safety of international civil aviation is the paramount purpose of GNSS.

Non Discriminatory Access to GNSS: All aircraft and states shall have non-discriminatory access to GNSS (including augmented GNSS), under uniform conditions.

Respect for sovereignty: States control air navigation within their sovereign airspace. Furthermore, GNSS operation and its augmentation shall not limit the sovereignty, authority or responsibility of states to control aviation .

Standardized GNSS Service: Provider States "shall ensure the continuity, availability, integrity, accuracy and reliability" of GNSS, in accordance with ICAO minimum standards, and shall notify users of changes in GNSS services.

Uniformity: States shall work together towards the greatest possible uniformity in providing GNSS services. Furthermore, ICAO member states shall ensure similar uniformity of regional and subregional GNSS services .

GNSS User Charges: States shall not discriminate between domestic and foreign GNSS users (they shall comply with Article 15 of the Chicago Convention).

Mutual Assistance and Cooperation: States shall cooperate and assist each other in planning and implementing GNSS.

Respect for other States: GNSS Provider States shall duly respect interests of user states,

Joint GNSS: The Charter does not inhibit joint GNSS services.

III. Concluding Observations

All of the principles described above express bona fide aviation concerns. These principles are consistent with the fifteen Principles Relating to Remote Sensing of the Earth from Outer Space which COPUOS prepared and which were adopted by the United Nations General Assembly on 3 December, 1986. 36/ This author proposed to the 37th Colloquium of Outer Space that such global principles should be adopted for GNSS. 37/

It is interesting to note that these principles also express the concerns of non-aviation civilian users of GNSS. While aviation currently is the greatest use of GNSS, the civilian uses of GNSS, other than aviation, may in time greatly exceed aviation uses. For example, it is realistic to expect that future automobiles will be equipped with GNSS receivers. Assuming that there are 650 million automobiles in the world, 38/ the use of GNSS for future automobiles will be huge. It is possible that all handheld telephones will be equipped with a GNSS receiver. Maritime operators, railways, surveyors, farmers, fishermen, backpackers, telecommunications providers, and a long list of other users also wish to be assured of GNSS service. Their concern merely indicates how valuable GNSS has become and is yet expected to become for all users.. As Vice President Gore stated on March 30, 1998. GNSS "has become an engine of economic growth and efficiency as businesses and consumers are continually developing new and creative applications of the system." Vice President Gore compared GNSS to the Internet as an economic generator. 39/

While the aviation mode tends to view GNSS as an aviation issue, other GNSS users also tend to view it as their issue. GNSS is clearly more than an aviation issue. The comparison of GNSS to the Internet is appropriate. The use and application of GNSS service is broader than aviation and is expected to become yet broader. There is some danger in one function, aviation, setting operating principles for GNSS use when those principles are not intended to encompass all GNSS uses. Fortunately, the principles currently formulated by ICAO can well be applied broadly to all the other uses.

The danger of unifunctional agencies developing GNSS principles has become apparent in the current contest over the use of radio frequencies for GNSS use. ICAO and aviation users clearly lack clout in their struggle to wrestle radiofrequencies in ITU for GNSS , as described above. Obtaining sufficient GNSS radiofrequencies needs the coordinated campaign of all the GNSS operators, users and suppliers.

Furthermore a larger GNSS constituency would be more effective in achieving the kind of principles that the aviation community is seeking. Thus, if virtually the same principle that ICAO is now seeking were adopted for a larger constituency, including aviation, then all the constituencies would benefit. In fact the principles would be stronger because they would cover the wider constituency.

Serious thought should be given to having a multifunctional international body such as COPUOS review the GNSS uses for the purpose of establishing multifunctional GNSS principles. The year 1999 presents an opportunity for such consideration because UNISPACE III 40/ could be the forum in which the utility of GNSS could be assessed and development of multifunctional principles could begin. Such assessment could draw on the abundant technological and economic research accomplished by the U.S National Research Council, by the Rand Corporation, 41/ and by the specialized U.N. agencies, including ICAO and IMO. If it is not possible for COPUOS to take up this issue, we may be left with piecemeal, conflicting GNSS legal principles.

ENDNOTES

1. 1967 Treaty of Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including and Moon and Other Celestial Bodies, 18 UST 794.

2. 1972 Convention on International Liability for Damage Caused by Space Objects, 24 UST 1973.

3. U.S. Federal Torts Claims Act. 28 U.S.C. 2671 - 2680.

4. Larsen, Legal Liability for Global Navigation Satellite Systems, 36 Coll. on the Law of Outer Space.
Larsen, Recent Changes in Space Law's Concept of Sovereignty, Proceedings, 88th Annual Meeting of the American Society of International Law, 264 (1994).
Larsen, Positioning Satellites: Current Institutional Issues, 37 Coll. on the Law of Outer Space.
Larsen, Use of Global Navigation Satellite System (GNSS) Evidence for Land Surveys: Legal Acceptability, 38 Coll. on the Law of Outer Space.
Larsen, Global Navigation Satellite System (GNSS) Interference Testing: Legal Issues, 39 Coll. on the Law of Outer Space.
Larsen, GNSS Augmentation: Legal Issues, 40 Coll. on the Law of outer Space.

5. ICAO Journal, Vol. 53 at 7 (June 1998).

6. White House Policy Statement, March 29, 1996.

7. Id.

8. Federal Radionavigation Plan, at I-29 (hereinafter referred to as the FRP).

9. ICAO Journal, supra n. 5 at 7-8.

10. See Larsen, GNSS Augmentation: Legal Issues, supra n. 4.

11. Id.

12. 1967 OST, supra n. 1, Art III.

13. Id.

14. For discussion see Dr. Eileen Galloway, The United States and the 1967 Treaty on Outer Space, 40 Coll. on the Law of Outer Space.

15. 672 UNTS 121.

16. Id.

17. 1972 Liability Convention, supra n.2.

18. Id., Art II.

19. Id., Art III.

20. Id. Art IX states that claims may also be presented through the Secretary General of the United Nations if the claimant State and launching State are members of the United Nations.

21. For discussion of U.S. interpretation see Spradling, The International Liability Ramifications of the U.S. NAVSTAR Global Positioning System, 33 Coll. on the Law of Outer Space.

22. Smith v. United States, 507 U.S. 197 (1993); Smith's estate brought claim against the U.S. Government for loss of his life in Antarctica. For discussion see Borneman, This is Ground Control to Major Tom.. Your wife would like to sue but there's nothing we can do....The Unlikelihood that the FTCA Waives Sovereign Immunity for Torts Committed by United States Employees in Outer Space: A call for Preemptive Legislation, 63 J. Air L. & Com. 517 (1998).

23. 1023 UNTS 15.

24. For example the 1998 Space Station Agreement, Art. 5, states that each partner shall register its flight elements.

25. 151 LNTS 4, as amended.

26. DOT News Release, March 30, 1998.

27. ICAO Journal, Vol. 55, No. 5 , at 20 (1998).

28. 61 Stat. 1180 (hereinafter the 1944 Chicago Convention).

29. Id. Art 44.

30. Larsen, Positioning Satellites: Current Jurisdictional Issues, supra n. 3.

31. Supra n. 1.

32. ICAO Annex 10, Vol. I, Attachment B.

33. ICAO Journal supra n. 5 at 8.

34. Id.

35. ICAO Doc. A32-WP/24, Appendix A, June 6, 1998.

36. International Instruments of the United Nations, U.N. Publications, at 305.

37. Larsen, Positioning Satellites: Current Institutional Issues, supra n. 4.

38. One billion motor vehicles are predicted for the year 2025, Washington Post, July 11, 1998, at A 16.

39. DOT News Release, supra n. 26.

40. The UNISPACE III Conference is a special session sponsored by the United Nations and is open to all U.N. members. It will be held at the United Nations in Vienna in 1999. The tentative agenda includes discussion of satellite-based navigation and precise location systems. A/AC.105/672, at 51; also see description of GNSS issues at the U.N. Conference on the Exploration and Peaceful Uses of Outer Space, U.N. Doc. A/Conf.184/BP/11 at 13; A/CONF.184/BP12 at 12-13.

41. National Academy of Public Administration and the National Research Council, The Global Positioning System: Charting the Future (1995, also the Global Positioning System: A shared National Asset (1995), National Academy Press. Critical Technologies Institute, the Global Positioning System: Assessing National Policies (1995), Rand Corporation.