

POSITIONING SATELLITES:
CURRENT INSTITUTIONAL ISSUES

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I. INTRODUCTION

Positioning satellites provide identical radio signals. Their signals are available continuously worldwide, regardless of any weather conditions. The United States Global positioning system (GPS) "consists of 24 satellites operating at semi-synchronous altitude in six orbital planes. The satellites contain atomic clocks and processors to minimize the extent of ground contact necessary to maintain accuracy." 1/ All GPS satellites are operated from a master control station and has a worldwide network of five signal monitor stations and three uplink ground antennas.2/ A GPS receiver measures distance from a minimum of four satellites "by calculating the time it takes the signal to arrive and thus pinpoints its own location." 3/ The GPS began operation at the end of 1993. Full operating capability is planned to be reached in 1995. 4/ Other positioning satellite systems are being planned and built.

A satellite positioning system is expensive. It cost the United States approximately

ten billion dollars to start up its GPS satellite system. The cost of sustaining the GPS system after completion is estimated to be approximately \$400 million per year. 5/ One reason for the high cost is that the average life span of each satellite is only six years, so that new satellites will have to be acquired and launched continuously. 6/ On the other hand the economic benefits greatly exceed the costs. For example ICAO estimates the annual value of the air navigation benefits from positioning satellites to be five to six billion dollars. 7/

The benefits of positioning satellites have barely begun to accrue. Its future is very promising. Transportation systems now are changing to take full advantage of the new technology. New air navigation technology is based on satellite navigation. Ships increasingly are being navigated by reference to positioning satellites. In the future the positioning system also will be used for tracking and guidance of automobiles in the intelligent vehicle highway system (IVHS). It will be used in railway transportation to route and track trains. While transportation systems benefit from the ability of positioning satellites to provide real-time reference, other uses, such as surveying and mapping, primarily benefit from the ability of the system to store information for later use. For example, post-processed data from positioning satellites are used in surveying and mapping, environmental protection, land

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management, protection of forests, geological surveys, fisheries management and weather information.

Inevitably, the various uses of the new technology overlap with each other. This paper will examine certain international and domestic civilian institutions that regulate aspects of GPS technology. It does not examine military institutions or legal regimes, and its analysis of domestic institutions is confined to those found in the United States. That is because the purposes of this paper are:

- (1) to list major civil government institutions that affect the operation of GPS;
- (2) to observe how their technical and legal regimes are beginning to overlap; and
- (3) to propose a way to develop guidance that could ameliorate possible conflicts between technical and legal regimes.

II. INSTITUTIONS APPLICABLE TO POSITIONING SATELLITES

In the following description of international and U.S. national institutions it is also important to keep in mind that ultimately it is the users, and not the regulating institutions, that develop various uses for positioning satellites. While we are looking only at governmental institutions, there is a whole network of private

institutions that have a more immediate impact on the development of technology, and which greatly influence the decisions of government institutions.

A. International Laws

U.N. Charter: The United Nations Charter applies to positioning satellites because Article III of the 1967 Outer Space Convention 8/ specifically requires states to carry on outer space activities "in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding." The United Nations thus has a specially comprehensive institutional role to consider the multitude of position satellite functions. The relevant U.N. institution is the United Nations Committee for the Peaceful Uses of Outer Space (UNCOPUOS). Servicing and supporting UNCOUOS is the U.N. Outer Space Affairs Group, presently located in Vienna. UNCOUOS previously has worked on outer space issues in conjunction with specialized U.N. organizations. For example, the technical aspects of the Geostationary Orbit (GSO) were the focus of conferences in the International Telecommunications Union (ITU), while more general GSO issues were considered in UNCOUOS. Direct broadcast satellites (DBS) issues were likewise taken up by these two institutions.

Conventions on liability, registration and aid to astronauts: The outer space conventions on liability, registration, and aid to astronauts 9/ are all relevant to the operations of positioning satellites, but none of these conventions create institutions. These conventions were created in UNCOPUOS and naturally defer to UNCOPUOUS.

International Telecommunications Convention: Positioning Satellites use radio frequencies for communication. Thus the operation of these satellite are subject to the Telecommunication Convention. 10/ That Convention establishes the International Telecommunication Union (ITU). It is a function of ITU to develop world telecommunication standards and to register radio frequencies. Radio interference is thereby avoided. For these purposes positioning satellites become subject to the jurisdiction of the ITU.

The 1944 Convention on International Civil Aviation (Chicago Convention): The Chicago Convention governs navigation of aircraft. 11/ Article 44 establishes the International Civil Aviation Organization (ICAO) as the internationally competent institution to establish minimum Standards and Recommended Practices (SARPs) for use of positioning satellites by aircraft. 12/ The ICAO institution is the major forum for discussion not only of positioning satellite

standards for flight navigation, communication, surveillance, and air traffic management, but also for legal issues relating providers and users of positioning satellites. 13/

International Maritime Convention (IMO): Maritime navigation standards are established in IMO. 14/ Furthermore, IMO was the forum in which the International Maritime Satellite Organization Convention, creating INMARSAT, was negotiated. 15/ INMARSAT is primarily in the business of providing maritime communication but has also become a provider of aeronautical communication. 16/ INMARSAT also is involved in providing service by position satellites. INMARSAT will install navigation differential correction transmitters in the INMARSAT satellites launched in 1995 17/

Conventions on Road and Rail Transportation: None of the road or rail transport conventions have yet established regulations regarding positioning satellites. In the future it is possible that uniform international regulations may be adopted by the United Nations or by specialized organizations, such as COTIF 18/

B. Domestic United States Laws

Communications Law: The Communications Act of 1934 19/ and the Communications Satellite Act of 1962 20/ are the domestic counterparts

to the International Telecommunication Convention creating ITU. These laws regulate the use of radio frequencies for communication and establish the Federal Communication Commission (FCC) as the institution to administer these laws. Because positioning satellites use radio frequencies, they are subject to FCC regulation. One must emphasize immediately that the U.S. domestic regulatory laws are much more mandatory in nature than the ITU regulations. The enforcement powers of the FCC are formidable as compared with the weak enforcement powers of ITU. However, because the U.S. GPS was established by the U.S. Government itself, the FCC regulatory role was insignificant. The role of the FCC in the establishment of a private positioning system would be much more significant.

U.S. Space Law: The United States does not yet have a single body of space law. Fragments of space law are scattered throughout the U.S. Code. For example, the Commercial Space Launch Act, 49 U.S.C. 70101, requires a license by the U.S. Department of Transportation before a positioning satellite may be launched. The license requirements primarily relate to the safety of the launch, but also are related significantly to the U.S. international responsibility assumed under the 1967 Outer Space Treaty, Article VI, VII 21/ and under the Liability Convention. 22/

Air Law: The Federal Aviation Act 23/ is the major law applicable to the navigation of airplanes by position satellites. The Federal Aviation Administration (a part of the U.S. Department of Transportation) is by law in charge of aviation safety. The FAA establishes flight standards, operates the air traffic control system, certifies airplanes and aviation equipment and licenses aircraft and pilots. The FAA Administrator also has a statutory duty to promote aviation. Because aircraft are and will become major users of position satellites, the FAA is a significant U.S. institution in the operation and promotion of positioning satellites. The FAA has issued a national aviation standard for GPS thus permitting GPS use in U.S. national airspace. The FAA will improve the accuracy of GPS by the creation of an augmentation system (DGPS). FAA approval of GPS as a sole navigational sensor over the oceans is expected in 1995. At the present time GPS is a supplemental navigation device. 24/

Maritime Law: The U.S. Coast Guard is part of the U.S. Department of Transportation. The Coast Guard controls all navigation of ships in the United States. 25/ Thus it oversees the use of GPS by ships. Beginning December 3, 1993, the Coast Guard accepted GPS as the maritime electronic position fixing device. The Coast Guard is augmenting the GPS signal with marine beacons. 26/

Road Law: The U. S. Department of Transportation (primarily the Federal Highway Administration, which is part of DOT) is developing the Intelligent Vehicle Highway System (IVHS). IVHS will integrate electronic communications, computer and control systems into automobiles and highways. IVHS will improve the mobility, efficiency and environmental compatibility of road transportation. Equipment of all automobiles with IVHS capability will be a major application of positioning satellites and a major investment of capital. 27/ The Federal Highway Administration is the institution primarily charged by the U.S. law to administer IVHS. 28/

Railway Law: Positioning satellites will monitor the location and speed of trains, thereby improving safety and efficiency of rail transport. The U.S. Department of Transportation (primarily the Federal Railroad Administration) is the major governmental institution involved. 29/ The Federal Railroad Administration oversees the individual private railroads which primarily are responsible for their own regulation.

III. OVER-ALL GUIDANCE FOR INSTITUTIONS

The great variety of users of positioning satellites ranging from aviation, maritime, intelligent vehicles, to mapping, surveying and meteorology give rise to a similar variety of

institutions that regulate their use. The thought comes to mind that it may be possible to establish some broad guidance for these institutions. Virtually all of the institutions described above have as a focus their particular uses of and needs for positioning satellites. In the United States all the uses derive from one positioning system, the GPS. However, none of the domestic institutions are competent to look at all GPS uses and all needs. Only one international institution has a mandate broad enough to encompass all GPS uses. 30/ That is the United Nations Committee for the Peaceful Uses of Outer Space (UNCOPUOS). UNCOPUOS has experience in providing overall guidance on space activities. For example, UNCOPUOS produced mankind's fundamental legal guide to the use of outer space: the 1967 Outer Space Convention. That Convention establishes rules regarding access to space, non-sovereignty in outer space, application of international law, prohibition on weapons of mass destruction, responsibility and liability for national activities, jurisdiction and much more.

In 1987 UNCOPUOS established principles on the use of a satellite resource which was at a similar stage of development as GPS now is. UNCOPUOS work on remote sensing is worth considering as we search for a way to develop broad guidance for GPS. The UNCOPUOS United Nations General Assembly resolution listed fifteen issues that related to use of

remote sensing. 31/ These issues could well be found on a similar list for a GPS resolution. 32/ Rephrased to fit GPS. they would be:

1. The extent to which the operator of positioning satellites should be permitted to process data received by the positioning system.
2. Access to positioning satellite systems. 33/
3. Application of international law to positioning satellite systems. 34/
4. Prohibition on discrimination regarding availability of information based on a country's stage of economic or scientific development. 35/
5. International cooperation.
6. Adequate storage of information for later use.
7. Technical assistance to other interested States on mutually agreed terms.
8. Technical assistance by the relevant specialized institutions, such as ICAO and IMO.
9. Distribution of Information regarding unusual events involving positioning satellites.
10. Protection of Earth's environment. 36/

11. Warning of approaching disasters.

12. Availability of positioning information on a non-discriminatory basis and on reasonable cost terms. 37/

13. Consultations upon request.

14. International responsibility for the activities of positioning satellites. 38/

15. Resolution of disputes through established procedures for the peaceful settlement of disputes.

Discussion of the issues of non-discriminatory access and international responsibility for positioning satellites may be found in an excellent and thorough paper by Drs. Shin and Hong in the Proceedings of the Thirty-sixth Colloquium on the Law of Outer Space. 39/ That paper concerned ICAO responsibilities for air navigation. This paper proposes an even wider inquiry which includes all of the uses of positioning satellites but which does not preclude activity of ICAO of the nature envisioned by the two authors.

Over-all guidance by UNCOPUOS would leave the specialized U.N. agencies and the Governments free to focus on more technical issues and thus to move more rapidly towards universal availability of the tremendous benefits of position satellites.

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SUMMARY

Global positioning satellites are among the most versatile technologies found in outer space. Formed into a single technological system (as is characteristic of the United States' GPS), they affect an amazing variety of human endeavors by improving navigation, environmental protection, resource management, and meteorology. Because GPS is so versatile, a number of international institutions claim jurisdiction over some aspects of it. Similarly, there are as many civilian domestic institutions that regulate the system, as there are uses for GPS. Inevitably, GPS uses overlap the boundaries of the separate institutions that seek to regulate it.

This paper lists the primary international and U.S. civilian institutions that claim some regulatory control over global positioning satellites, and emphasizes that while each of these agencies seeks to govern some particular use of the satellites, none of them is competent to organize the uses of the other institutions. Is there a way to establish international guidance for all international and domestic institutions?

The agency with the broadest reach is the United Nations Committee for Peaceful Uses of Outer Space (UNCOPUOS). UNCOPUOS is concerned with all satellite activities. In the past, UNCOPUOS has been involved in establishing basic principles for certain

satellite activities which also were the subject of technical regulation in specialized international and national agencies. For example, both UNCOPUOS and the International Telecommunications Union (ITU) address geostationary orbit. They could work in tandem because the UNCOPUOS mission was to lay down fundamental legal principles, while ITU has handled specific technical issues.

The need for some cooperative effort is apparent because a number of specialized international agencies have been expanding their work on GPS. For example, the International Civil Aviation Organization (ICAO) has begun to work seriously with technical GPS issues, establishing standards on flight navigation, communication, surveillance and traffic management for providers and users of positioning satellites. The International Maritime Organization (IMO) has begun a similar process for ship navigation. International transportation by road and rail soon will present a sweep of issues arising from increased use of GPS by those modes of transportation. Each of the specialized agencies is working with GPS issues that also are addressed in other fora.

Looking at a few of the dominant civilian agencies in the United States we see that the Federal Aviation Administration (FAA) has established national standards permitting the use of GPS as a supplemental navigation device

in domestic air space. Over the oceans, GPS will become the sole navigational sensor in 1995. The U.S. Coast Guard, a branch of the Department of Transportation, also has accepted GPS as a legitimate position fixing device. Both the FAA and the Coast Guard are planning augmentation of GPS. The Federal Highway Administration and the Federal Railroad Administration now are planning to use GPS for Intelligent Vehicle Highway Systems (IVHS) and for trains. While efforts are made to blend the U.S. laws with international legal regimes, domestic uses are compounding too rapidly to make a neat fit.

How likely is it that States, in an international forum, could reach an agreement on broad policies to guide development of GPS regimes? When UNCOPUOS prepared the U.N. General Assembly resolution on remote sensing, it included non-discriminatory access, application of international law, protection of Earth's environment, availability of positioning data on nondiscriminatory basis and on reasonable cost terms, international responsibility for the activities of positioning satellites and dispute resolution. Most of these items are drawn from existing space law, in particular the 1967 Outer Space Treaty. Using that Committee's experience, therefore, we might hope that agreement could be reached on a similar basket of issues without a great deal of controversy. This might be done through a

U.N. Resolution drafted by UNCOPUOS. If so, work of the specialized agencies would be eased considerably. Such an agreement also would be a beacon for domestic legislation.

FOOTNOTES

*) The views expressed in this article are the author's and should not be attributed to any organization with which he is associated.

1. The Global Positioning System: Management and Operation of a Dual System, Report of the Joint DOD/DOT Task Force, December 1993, at 2.

2. Id.

3. Poesky, FAA Statement before the Committee on Public Works and Transportation, Subcommittee on Aviation, July 28, 1993, at 6. See discussion in Larsen, Liability for Global Positioning Navigation Satellite Systems, Proceedings of the Thirty-sixth Colloquium on the Law of Outer Space, at 71.

4. DOD/DOT Task Force report, supra note 1.

5. Id. at 3.

6. Id.

7. ICAO docs 9583, 9524; see Stoffel, Legal Aspects of Astronautical Mobile Satellite Services - the ICAO FANS Concept, Proceedings of the Thirty-sixth Colloquium on the

Law of Outer Space, at 117. The FAA estimates that U.S. air carriers in the Pacific and Atlantic ocean regions will save over ten billion dollars over the next 20 years, see Pozesky, GPS Implementation for use by civil aviation is on a fast track, ICAO Journal, December 1993, at 18.

8. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967 (hereinafter referred to as the 1967 Outer Space Convention), 18 UST 2410, TIAS 6347, Jasentuliyana and Lee, Manual on Space Law (hereinafter referred to as the Manual on Space Law), at 851.

9. Convention of International Liability for Damage caused by Space Objects, 24 UST 2389, TIAS 6347 (1972); Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 19 UST 7570, TIAS 6599, 672 UNTS 121 (1969); Convention on Registration of Objects Launched into Outer Space, 28 UST 695, TIAS 8480, Manual on Space Law, at 23.

10. 1932 Telecommunication Convention, 151 LNTS 4, as amended; the latest amendment was in 1992. For discussion see Lyall, The International Telecommunication Union Reconstructed, Proceedings of the Thirty-sixth Colloquium on the Law of Outer Space, at 78.

11. 61 Stat. 1180.

12. See Report of the Tenth

Navigation Air Navigation Conference, Montreal 5-20 September, 1991. Also see Guldiman and Kaiser, Future Air Navigation Systems: Legal and Institutional Aspects; and Larsen, supra note 4, at 69.

13. ICAO Journal, December 1993, 5-26.

14. Convention on the Intergovernmental Maritime Organization, 9 UST 621, TIAS 4044.

15. 31 UST 1.

16. See Shin and Hong, Legal Aspects of Space Activities of ICAO in implementing FANS, Proceedings of the Thirty-sixth Colloquium on the Law of Outer Space, 107.

17. Air Transport World 9/93, at 38.

18. Convention Concerning International Carriage by Rail, Bern, 1980, Cmd. 8536.

19. 47 U.S.C. 151.

20. 47 U.S.C. 701.

21. 1967 Outer Space Convention, supra note 8.

22. Liability Convention, supra note 9.

23. 49 U.S.C. 40101 et seq..

24. Pozesky, GPS Implementation for use by civil aviation is on a fast track, ICAO Journal, supra note 7.

25. 14 U.S.C. 2, 81-90.

26. Federal Register, March 23, 1994, at 13757.

27. \$2-5 billion by year 2000.

28. 23 U.S.C. 307.

29. 49 U.S.C. 103.

30. Note that within the United States the GPS is jointly managed by the Department of Defense and the Department of Transportation Executive Board. The civilian side of GPS is largely managed by the Position and Navigation (POS/NAV) Executive Committee chaired by the Assistant Secretary of Transportation for Policy.

31. 1987 UNGA Res.41/65.
A/CN.105/370.

32. See remarks on guiding principles by Kotaite, Mechanism to provide implementation coordination and assistance under active consideration, ICAO Journal, December 1993, at 6. The author is the President of the ICAO Council.

33. 1987 Outer Space Convention, *supra* note 8.

34. *Id.* Art III

35. *Id.* Art. I. Also see Kotaite, *supra* note 32.

36. 1967 Outer Space Convention, Art IX, *supra* note 8.

37. Kotaite, *supra* note 32

38. 1967 Outer Space Convention, *supra* note 8; Liability Convention, *supra* note 9; Larsen, *supra* note 6

39. *Supra* note 16.