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## International Satellite Law

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# Oxford Research Encyclopedia of Planetary Science

## International Satellite Law

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### Summary and Keywords

International satellite law can best be described as that subset of international space law that addresses the operations of satellites in orbit around the Earth. Excluding, therefore, topics such as manned space flight, suborbital space operations, and any activities beyond Earth orbits, this means addressing the use of satellites for telecommunications purposes, for Earth observation and remote sensing, and for positioning, timing, and navigation.

These three major sectors of space activities are, in addition to jointly being subject to the body of international space law, each subject to their specific dedicated legal regime—international satellite communications law, international satellite remote sensing law, and international satellite navigation law.

Keywords: international space law, satellite communications, satellite communications law, satellite remote sensing, satellite remote sensing law, satellite navigation, satellite navigation law, national space law

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## International Satellite Law, International Space Law, and General International Law

A “satellite,” the obvious *prima facie* target of “international space law,” whatever its precise definition, can best be defined as “a manufactured object or vehicle intended to orbit the earth, the moon, or another celestial body.”<sup>1</sup> Noting that the reference to “orbits” around various celestial bodies, including Earth, means that satellites are operating in outer space, the three main sectors comprising such satellite operations, and therefore subject to something which may be called “international satellite law”—satellite communications, satellite remote sensing (which includes satellite Earth observation), and satellite navigation—are all concerned with orbits around the Earth. In legal terms, furthermore, they are all three subject to the general body of international space law, while, in addition, each of the three sectors is subject to its own international regime.

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Starting with the former, international space law is generally considered to constitute a branch of public international law (Lachs, 2010; Malanczuk, 1994; Matte, 2000; Cheng, 1997, pp. 70–87; Jasentuliyana, 1999). Public international law, in essence the law determining the functions of, rights, obligations, and rules applicable to public entities in the international realm, dates back to the 17th century, when, following the Peace of Westphalia, the modern Western concept of a “state” was born, and then effectively spread throughout the world by way of the colonization of many societies outside Western Europe in the following centuries.

In this context, the “law of nations,” as it had been labeled originally, addressed the legal relations between such sovereign states, whereas existing common law, civil law, criminal law, administrative law, and so on were all seen as being basically applicable within a single sovereign state—and addressed to individuals, whether natural persons or legal persons (companies, associations, clubs, etc.). With increasing internationalization over time of trade, commerce, and other human activities, a body of private international law then developed, which aimed to facilitate the interaction between such essentially national systems of law and, where possible or desirable, even harmonize such systems.<sup>2</sup>

The law of nations concurrently morphed into public international law, which increasingly—especially in the 20th century—also came to address the roles of intergovernmental organizations (still public bodies, as they were constituted of sovereign states), then also of individual persons (albeit mainly in the limited context of human rights violations or violations of the laws of war).

Within that overarching concept of public international law, space law originated as a “subset of rules, rights and obligations of states within the latter specifically related to outer space and activities in or with respect to that realm” (von der Dunk, 2015). This obviously includes such prominent sectors of satellite activity as satellite communications, satellite remote sensing, and satellite navigation.

Also in the realm of space, however, the increasing participation of private enterprise—originally mainly in the satellite communications sector, but as of the 21st century, in varying extents also in the launch service sector, satellite Earth observation and remote sensing, and soon (likely) in such areas as (manned and unmanned) space transportation and space tourism, on-orbit servicing, and “space mining”—would come to raise major questions regarding the continuing viability, relevance, and effectiveness of public international law.

## The International Space Treaties and Key UN Resolutions on Space

Dealing with an inherently international realm, much of space law had been developed in the context of the United Nations, where the launch of Sputnik 1 in 1957 quickly gave rise to the establishment of a UN Committee on the Peaceful Uses of Outer Space

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(COPUOS), including a Legal Subcommittee discussing relevant legal issues (Jankowitsch, 2015). Throughout history, COPUOS has included all major spacefaring nations, and thus was able—certainly for the first few decades of the space era—to set the legal standards for states' behavior (and that of those subject to their jurisdiction) in outer space matters. Following a few UN General Assembly Resolutions already providing for the main principles of space law, which, albeit non-binding in and of themselves, were considered authoritative and soon came to reflect international customary law. COPUOS then prepared a handful of key treaties, which are likewise adhered to by all major spacefaring countries.<sup>3</sup>

The 1967 Outer Space Treaty, also nicknamed the Principles Treaty or even the Magna Carta of outer space, provided for the fundamental legal framework for all space activities, the 1968 Rescue Agreement (which elaborated on some provisions of the Outer Space Treaty regarding the rescue and return of astronauts in distress and space objects), the 1972 Liability Convention (detailing the regime on liability for damage caused by space objects as summarily established by Article VII of the Outer Space Treaty), and the 1975 Registration Convention (which detailed the regime of registration of space objects as summarily indicated by Article VIII [and to a minor extent Article XI] of the Outer Space Treaty).<sup>4</sup> Though not stemming directly from deliberations in COPUOS, also the 1963 Partial Test Ban Treaty is often hailed as one of the seminal space treaties, as it prohibited any nuclear explosions in outer space, thus contributing considerably to the preservation of peace and security there.<sup>5</sup>

The fifth treaty developed in the bosom of COPUOS, however, the 1979 Moon Agreement, is generally seen as a failure due to its low overall level of participation and the total absence of major spacefaring countries among the ratifying states.<sup>6</sup> Drafted in an effort to regulate soon-to-be expected commercial exploitation of lunar resources, it came up with the baselines for a regime that many leading space nations considered to be obstructive to any such commercial exploitation, even if undertaken by bona fide companies, and hence unacceptable to—in particular—free market economies (Tronchetti, 2009, 2015, pp. 782–788).

It should be added, however, that in contrast to the Outer Space Treaty, Rescue Agreement, Liability Convention, and Registration Convention, which are each highly relevant for the various satellite sectors under consideration here, the Moon Agreement exclusively focuses on a certain category of activities beyond Earth orbit and can therefore be safely ignored for the present purpose.

In addition to the treaties mentioned, other sources—including not only customary international law but also such disputed concepts as “soft law” and political guidelines and recommendations—also contributed to the development of a general framework legal regime for all of mankind's endeavors in or with respect to outer space (Marboe, 2012). The Legal Subcommittee of COPUOS, for instance, proceeded to draft several more resolutions, of which some did not achieve consensus (and hence remained of relatively small legal value),<sup>7</sup> whereas others were widely seen as soon reflecting customary

international law,<sup>8</sup> and yet others as at least helpful and authoritative practical standards widely followed in practice.<sup>9</sup>

This ever-increasing body of international space law applies, as relevant, also to satellite communications, satellite remote sensing, and satellite navigation. Thus, the activities conducted in those sectors must comply with the substantive rules of law imposed by the Outer Space Treaty; satellites used for the various purposes concerned can be reclaimed pursuant to the Rescue Agreement and conversely may give rise to liability pursuant to the Liability Convention, as well as being subject to the requirements of registration following the Registration Convention.

In the present framework, however, it is impossible to address and analyze all the rights and obligations following from these four main space treaties as well as all other aspects of general space law here; this article therefore confines itself to highlighting two broader issues of international space law following from a major paradigm change in space activities and (international) space law (for further details, see von der Dunk, 2015).

## The Major Paradigm Change in Space Activities and Space Law

Originally, the regime of outer space predominantly focused on scientific and military and security-related activities, but with the ongoing development of technology and a more practical orientation of the general space effort, it increasingly came to encompass many more civilian and, ultimately, even commercial activities, largely through downstream applications originating from or depending on space technology and space activities (von der Dunk, 2008).<sup>10</sup>

From that perspective, research in international space law in the early 21st century usually occurs along three general, often interacting or overlapping, yet in theory separately distinguishable lines: ongoing overarching discussions on (international) space law in broad and largely politico-theoretical terms; the development of international (space) law applicable to specific sectors of launch and space transportation activities, including the role of future space mining in that context; and the development of international (space) law applicable to major satellite technology applications, notably communications, remote sensing, and navigation.

As said, first, this concerns the continuing discussion of the overarching, usually more theoretical aspects of international space law—how does it continue to be developed, and what special roles do “soft law” or the military aspects of space activities play in this regard (Tronchetti, 2015, pp. 331–381)? Some elements of that discussion have already been touched upon, but in particular from the perspective of the legal environment for space activities in the 21st century, two further major issues warrant discussion: that of

the increasing threats of “space debris,” and the more general question of how national space laws (also) serve as a tool for interpretation of international space law.

Both are crucial also to the satellite applications specifically addressed as part of international satellite law. On the one hand, space debris presents a serious threat in particular to all sorts of satellite operations. On the other hand, because of the terrestrial applications of satellites in the context of communications (where commercialization and privatization have taken hold for a number of years), remote sensing, and navigation (where it is increasingly making inroads into hitherto state-dominated environments), the general role of national (space) law in interpreting and implementing international space law has taken on special significance for those satellite sectors.

## The Issue of Space Debris in International Space Law

As to space debris, the point of departure of any analysis is that there is as of yet no law prohibiting the creation of space debris, and consequently the amount of space debris and the risks posed by it, both to other space operations but ultimately also on Earth, has continued to grow almost without any fundamental legal limitation (Viikari, 2008, 2015). The closest the Outer Space Treaty, drafted in a time when no one was really concerned with space debris, comes to addressing the issue is by its Article IX, which requires states aware of the possibility that their space activities may cause harm to other states (or entities operating under their jurisdiction) to consult, and then to take the results of such consultation seriously—without, however, necessarily refraining from continuing with the activities at issue (von der Dunk, 2007).

Partly because of the absence of any tailor-made law in this context, such clauses as Article VII of the Outer Space Treaty and the whole of the Liability Convention, as being also applicable to space debris, are then also brought to bear to address the issue of space debris. The result is that, now, the launching states of space debris can indeed be held liable for damage created by such debris—provided, of course, they can be identified, which becomes more difficult the smaller the debris concerned is and the further back in time its launch or destructive event, causing it to become debris, have taken place.

Over time, the threat of space debris has come to be perceived as a more serious issue, and this general attitude started to change. In legal terms, this threat gave rise to two complementary approaches: developing rules that would limit the generation of new space debris and developing rules that would tackle the issue of already existing space debris.

As to the former, following the development of some individual space agencies’ practices and standards on the matter, in 2002 the major space agencies comprising the Inter-Agency Space Debris Coordination Committee (IADC) agreed on a set of guidelines for

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the mitigation of space debris, further updated a few years later.<sup>11</sup> The guidelines, as such not binding law, essentially encapsulated the promise of the space agencies concerned to help addressing the space debris issue by way of such measures as limiting intentional debris creation and intentional controlled de-orbiting (for low Earth satellites) or re-orbiting (of satellites orbiting at higher altitude) at the end of the perceived operational life, to minimize the risk of uncontrolled satellites creating havoc.

By way of a UN resolution in 2007, these guidelines were effectively promoted from the level of space agencies to the level of spacefaring nations; even if still not constituting binding international law, they would now clearly be able to serve as a departing point for the development of customary international law.<sup>12</sup> Meanwhile, many of the individual states involved through their agencies in the IADC had started to use the, as such non-binding guidelines as part of national processes of licensing or authorizing private space operators.<sup>13</sup> If in the course of the application process, the applicants for such licenses or authorizations would not be seen as essentially compliant with the guidelines, they would be unlikely to see their application approved. By that token, the guidelines have been transformed time and again into binding legal obligations for the operators at issue, which also may cause a relevant rule of customary law in this vein to soon become reality (Viikari, 2008, p. 96).

As to the latter, both the spacefaring nations through their space agencies and the industry have begun to discuss the possibilities of undertaking active debris removal (ADR) operations. However, though various drawing board plans and projects have been developed, apart from obvious financial considerations, they have not become a reality (as of 2019) in view of some complex legal parameters involved. Legally speaking, space debris still qualifies as a space object, which has the benefit that liability for damage caused by space debris would be compensable under the Liability Convention (presuming, of course, identification of the launching state(s) would be possible).<sup>14</sup>

However, this also means that the state of registration—which by definition is the launching state, or one of them in case more than one qualifies as such<sup>15</sup>—of such a space object, even after it has turned into debris, maintains jurisdiction into eternity. Such concepts as “abandonment” of wrecks and “salvage rights” of other states than the original state of registration, well-known in maritime law, are not part of space law (yet) (Schaefer, 2013; Lyall & Larsen, 2009). Since, moreover, most satellite technology is considered at least potentially security-sensitive, the likelihood that relevant states would be willing to consent to another state taking space debris out of the way is not substantial. Even if or to the extent that these hurdles could be overcome, the original launching state’s liability for damage caused by the space object would not disappear merely on account of another state trying to take it out of the way; and proper inter-party arrangements would have to be made to deal with that issue.<sup>16</sup>

# The Role of National Space Laws in the Context of International Space Law

The other major issue to be addressed here concerns the role of national space legislation, which is crucial in tying private actors into the international obligations, responsibilities, and liabilities of international space law, since, due to its origins in the Cold War and the state-dominated first decades of space activities, the core body of international space law is very much focused on states (von der Dunk, 2008, pp. 500–503). With the existing level of commercialization in satellite communications and the ongoing commercialization of satellite remote sensing and satellite navigation applications, this situation represents a major issue in particular in the present context.

Notably, pursuant to Article VI of the Outer Space Treaty, states are internationally responsible for any private activities in outer space which are perceived to be their “national activities,” essentially doing away with the fundamental distinction between state acts and private acts, which rules the concept of state responsibility in general public international law (Gerhard, 2009; von der Dunk, 1998, pp. 17–22). Being also obliged to authorize and continuously supervise such activities, this Article provided a strong impetus for states to establish national space legislation as the most fundamental and comprehensive mechanism to take care of such responsibility and exercise sufficient authorization and supervision controls for the purpose (Marboe, 2015, pp. 130–135; Marboe & Hafner, 2011).

In addition, Article VII of the Outer Space Treaty, as further augmented and detailed by the Liability Convention, makes states liable for damage caused by space objects regardless of any involvement of private operators in the launch or operation of that space object (Kerrest de Rozavel & Smith, 2009; von der Dunk, 1998, pp. 22–26, 32–35). For instance, if Boeing would launch a satellite for PanAmSat, both being United States private companies, and the satellite were to crash into Mexico, under the Liability Convention, Mexico would be entitled to claim compensation for the full amount of damage from the U.S. government, since the launch took place from U.S. territory, leaving it to the latter to reclaim all or part of such compensation from either Boeing or PanAmSat.<sup>17</sup> Obviously, these provisions also present a strong incentive for states to legislate nationally to ensure that they can include in licenses or authorizations the desired levels of reimbursement or derogation obligations and attendant insurance obligations (Marboe, 2015, pp. 137–139).

Since a number of key concepts in these key clauses of international space law have not been very precisely defined, the totality of national space laws may shed more light on what apparently would be their appropriate interpretation, at least as far as states, still the main “makers” of international space law, are concerned.<sup>18</sup> Do “national activities,” for the purpose of Article VI of the Outer Space Treaty, refer to activities of nationals, to activities conducted from national territory, any combination thereof, or yet a third criterion for determining its scope? Does the concept of the “launching state,” ruling

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liability pursuant to Article VII of the Outer Space Treaty and the Liability Convention, include cases where not so much the state launches or procures a launch, but a private operator does?

So far, some two dozen states have actually established national space laws in one form or another, licensing or authorizing private space activities, and thus potentially giving answers to these questions. Nevertheless, the diversity is enormous (Jakhu, 2010; Brunner & Walter, 2008; von der Dunk, 2011).

First, there is one country, the United States, which has enunciated a range of national space laws, separately allowing for the licensing of private launch and space transportation providers,<sup>19</sup> communication satellite operators,<sup>20</sup> remote sensing satellite operators,<sup>21</sup> and companies interested in asteroid mining.<sup>22</sup> In addition, other federal laws address certain aspects of commercialization and involvement of the private sector,<sup>23</sup> or have a major impact on space activities in view of their security-sensitive nature.<sup>24</sup>

Second, a range of nations has developed national space laws providing an overarching framework in principle encompassing all space activities the private sector may be interested in, sometimes augmented by further legislation at the national level. In alphabetical order, these nations are: Austria,<sup>25</sup> Belgium,<sup>26</sup> Denmark,<sup>27</sup> France,<sup>28</sup> Indonesia,<sup>29</sup> Kazakhstan,<sup>30</sup> the Netherlands,<sup>31</sup> the Russian Federation,<sup>32</sup> South Africa,<sup>33</sup> South Korea,<sup>34</sup> Sweden,<sup>35</sup> Ukraine,<sup>36</sup> and the United Kingdom.<sup>37</sup>

Third, some nations have chosen to exclusively or primarily address launching activities in view of their close connection to the liability regime of international space law (this applies to Australia,<sup>38</sup> Brazil,<sup>39</sup> and Norway<sup>40</sup>), alternatively to exclusively or primarily address remote sensing activities in view largely of their potentially security-sensitive nature (this applies to Canada<sup>41</sup> and Germany<sup>42</sup>). Most recently, Luxembourg established a national space law exclusively addressing private space mining activities.<sup>43</sup>

The diversity of general approaches to licensing and supervising private space activities unfortunately also extends to the manner in which the relevant laws have applied the key concepts of responsibility and liability. Some states have applied the scope *ratione personae* to nationals and (other) entities with the nationality of the relevant state, others have used a *ratione territoriae* approach to apply the law to activities conducted from national territories, often then also including quasi-territories such as registered ships or aircraft,<sup>44</sup> and yet others have indeed chosen particular combinations of those two approaches and devised more idiosyncratic approaches still (for further details on the ways in which individual states have applied their respective jurisdictional authority, see Marboe, 2015, pp. 133–178; von der Dunk, 1998, pp. 107–164; and Jakhu, 2010), such as focusing exclusively on the territory of launch of the space object (as opposed to the territory from which other space activities may be conducted).

Also in the implementation of international third-party liability as arising from Article VII of the Outer Space Treaty and the Liability Convention, states have taken widely differing approaches. Noting that Article XII of the Liability Convention is widely perceived to mean there is no limit to international third-party liability,<sup>45</sup> some states have chosen to “transfer” such unlimited liability one-on-one to any operator seeking a license; others have applied certain limits of reimbursement/derogation/indemnification; and yet others leave it basically open to individual license “negotiations.” Among the states limiting reimbursement/derogation/indemnification, some have inserted a fixed limit in the law itself; others provided only for a mechanism to determine the appropriate limit for any given license; and still others again leave this open to license negotiations (Marboe, 2015, pp. 139-178; Kerrest de Rozavel & von der Dunk, 2011, pp. 125-161).

Equally on the question of obliging relevant licensees to take out third-party liability insurance, national space laws differ widely. Finally, various laws have taken the opportunity to not only regulate the domestic handling of international third-party liability, but also domestic third-party liability as such, or even certain scenarios of inter-party and contractual liability (Marboe, 2015, pp. 139-178; Kerrest de Rozavel & von der Dunk, 2011, pp. 125-161).

Also, when it comes to regulating the more practically and terrestrially oriented applications of space activities such as satellite communications, satellite remote sensing, and satellite navigation as opposed to the military and political and scientific ones, which were already largely and fundamentally taken care of by the original space treaties themselves, the national space laws play a major role in handling, in particular, private involvement in such space activities.

In each of those cases, however, the relevant legal regime is not limited to the international space treaties or national space laws alone. Precisely because of their applications-oriented and practical character, other regimes come in to co-determine the legal and regulatory parameters within which such activities are allowed.

## **The First Satellite Sector: Satellite Communications and International (Space) Law**

The most important legal regimes specifically addressing satellite communications, still as of 2019 the most extended, most commercialized, and most voluminous application of space technology, in addition to the international space treaties discussed in the section “THE INTERNATIONAL SPACE TREATIES AND KEY UN RESOLUTIONS ON SPACE,” are those developed under the auspices of the International Telecommunication Union (ITU) and the World Trade Organization (WTO), respectively.

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In this context, the ITU presents the main international legal framework for addressing the technical and operational aspects of satellite communications.<sup>46</sup> Like terrestrial communications, in respect of which the ITU had already for almost a century handled the international aspects of arranging for the interference-free usage of radio waves, satellite communications also required such interference-free usage, as determined by the frequencies and orbits the use of which was sought. It was only logical, therefore, that as early as 1959 the World Administrative Radio Conference (WARC) in Geneva—shortly after the launch of the first satellite ever, Sputnik I—confirmed that ITU also was the most logical international forum to address satellite communications.

In that context, a threefold system was developed. At a first level, bands of frequency spectrum were regularly allocated to categories of services. At a second level, within such bands, specific frequencies could then be allotted to specific services as requested by individual states, with an extended ITU mechanism coordinating such allotments to preclude interference. At a third level, finally, such states, as the case may be, were allowed to use the resulting coordinated frequencies themselves or, in the alternative, to assign them to private operators within their jurisdiction.<sup>47</sup> The ITU Constitution further provides for the main principles to be adhered to in implementing this process.<sup>48</sup>

Following the 1959 WARC, this entire system applied to satellite communications as well, with the additional need to coordinate the physical position of the satellites in outer space. Here, an inherent relationship arose between the (interference-free) usage of frequencies by satellites and the positions they occupied: Using the same frequency in neighboring positions results in white noise for both operators; if the satellites, by contrast, find themselves on opposite ends of the geostationary orbit, there is fairly little risk of interference whatsoever.

In consequence, the ITU frequency coordination process for satellite communications also took into consideration the actual respective intended satellite positions: at first only in the geostationary orbit, later (as they became popular) also in other orbits.<sup>49</sup> The ITU process streamlining international use of radio frequencies in its latest version refers to the need to “effect (. . .) the registration of radio-frequency assignments and, for space services, of any associated orbital position in the geostationary-satellite orbit or of any associated characteristics of satellites in other orbits, in order to avoid harmful interference between radio stations of different countries,”<sup>50</sup> and to “coordinate efforts (. . .) to improve the use made of the radio-frequency spectrum for radiocommunication services and of the geostationary-satellite and other satellite orbits.”<sup>51</sup>

The 1959 WARC had essentially treated space communication services as comprising two new services, the “space service” (the uplink) and the “Earth service” (the downlink), and allocated the first frequency bands to those services. However, as the use of space continuously expanded, the simple concept of one downlink and one uplink service had to be constantly refined, more bandwidth had to be allocated, and the principles guiding the actual allocation and allotment had to be refined. Currently, the ITU framework addresses 21 distinguishable space services.<sup>52</sup>

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Where the ITU inherently focused on the technical and operational aspects of trying to ensure, with the assumed support of all member states, that global communications could develop with maximum efficiency and minimum interference, the increasing commercialization of the sector in the later decades of the 20th century brought legal issues of a different nature to the table: how to ensure market liberalization while preserving the public functions and roles of telecommunications, including satellite communications, and how to guarantee level playing fields for private commercial operators interested in offering their services as widely as possible (McCormick, 2013A)?

By the 1990s, global market developments, in particular in the developed countries, had increasingly raised questions as to the proper role and function of intergovernmental satellite organizations, notably INTELSAT,<sup>53</sup> INMARSAT,<sup>54</sup> and (for Europe only) EUTELSAT.<sup>55</sup> These developments first resulted (for INTELSAT and INMARSAT) in the branching off of certain high-end commercial services to separate private entities (New Skies Satellites and ICO Global Communications, respectively), then more profoundly in the privatization of the satellite operations as a whole by the creation of private operators Intelsat, Inmarsat, and Eutelsat, with residual intergovernmental oversight organizations to protect some fundamental public interests in the context of private commercial operations.<sup>56</sup>

This is also where the WTO came in (for further details, see von der Dunk, 2015, pp. 814–836, 843–853). The enormous impact on international trade of goods of the 1947 General Agreement on Tariffs and Trade (GATT),<sup>57</sup> providing a framework for the breaking down of international trade barriers, with the increasing move of the world economy from a product- to a service-driven environment, began to give rise to calls for a complementary trade regime in the service sector.

The main result was the General Agreement on Trade in Services of 1994,<sup>58</sup> an agreement on a similar framework regime for trade in services to complement the trade in goods, complemented by an agreement to underpin and institutionalize the whole range of trade liberalization efforts by establishing a proper intergovernmental organization, the WTO.<sup>59</sup> In this construct, the WTO Agreement presented the overarching legal document to which all other international agreements were subservient—Multilateral Trade Agreements,<sup>60</sup> Plurilateral Trade Agreements,<sup>61</sup> and a range of even more specific agreements providing the bulk of the substantive trade regimes, by applying the general trade-liberalization regime to specific issues, scenarios, or sectors.

The GATS applies a “positive list approach,” which means member states collectively negotiate commitments to open up and keep open service sectors as listed—any service *not* on such a list remained subject to any trade restrictions relevant WTO member states wanted to apply. The two most important legal instruments serving the overall purpose of trade liberalization were the Most-Favored Nation (MFN) clause and the National Treatment (NT) clause. The MFN principle provides for one particular economic version of “non-discrimination,” as it amounts to an obligation to treat any external trade partner and its companies not worse than it treats its “most-favored nation” and its companies.<sup>62</sup>

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The NT principle goes one step further than the MFN principle in applying non-discrimination: Now also discrimination between foreign providers of products or services and national providers of the same goods and services is, in principle, outlawed.<sup>63</sup> However, as a consequence of the positive list approach, actual liberalization was not a general obligation *ipso facto* stemming from WTO and GATS membership but was dependent on market access as per schedules of specific commitments being offered per sector. These schedules of specific commitments determine the level of access to foreign markets that service providers are to be allowed, for instance, under the MFN principle for specific service sectors, including lists of types of services where individual states can opt out of applying MFN treatment.<sup>64</sup>

Following the major paradigm change in telecommunications, this regime then came to be applied step by step to the satellite communication sector. First, the GATS Annex on Telecommunications, which had entered into force concurrently with the GATS itself, provided for some baseline obligations concerning transparency, general access to infrastructure and markets, and public service-related conditions. It did not, however, as of yet apply the key principles of MFN and NT in that context; actual liberalization of those markets remained dependent on actual Schedules of Commitment.<sup>65</sup>

Second, within a few years, the WTO member states substantially involved in satellite communications came to a more substantive agreement to liberalize the global markets for basic telecommunication services. Telecommunication services were classified in 15 categories, which unequivocally included several categories of satellite communication services. This agreement to liberalize international telecommunication markets was formally enshrined in the Fourth Protocol to the GATS,<sup>66</sup> as implemented in this particular context by the required individual Schedules of Specific Commitments and a list of exemptions from Article II of the GATS.

Thus, it was those Schedules of Specific Commitments that provided the substance of the liberalization achieved. As a result, currently 53 states committed themselves to allow foreign operators to offer some or all types of mobile satellite services or the related transport capacity in their national markets, while 52 states did so with respect to fixed satellite services or the transport capacity involved therein.<sup>67</sup>

In sum, over the past decades within the framework established by the GATS and WTO regimes, a largely liberalized international trade environment for satellite services has evolved, including the largest economies in the world, and later also leading developing nations. At the same time, this was a somewhat haphazard process, leaving many individual idiosyncratic elements intact due to the Schedules of Specific Commitments and the fact that generally four modes of foreign service provision are at issue (see von der Dunk [2015, pp. 847–852] for a summary overview of Schedules of Specific Commitments of major countries and the European Union). Sometimes satellite communications are implicitly included in all or most of such commitments to liberalize foreign access to national markets, as per the MFN and NT principles; sometimes they are expressly singled out. In the latter case, they are often subject to specific but varying

limitations concerning foreign equity in terms of commercial presence or obligatory use of national operators and facilities. In many cases, therefore, extended investigation and close inspection and analysis of the relevant commitment in the light of general GATS obligations are required before any final determination can be made of the actual legal situation concerning the rights of foreign satellite service providers to a certain national market.

## Satellite Remote Sensing and International (Space) Law

The next most important satellite application concerns remote sensing, or Earth observation as it is sometimes also called (see Ito, 2011). In addition to the general international space treaties, the UN Resolution on Principles Relating to Remote Sensing of the Earth from Outer Space of 1986, which indeed is largely considered to reflect customary international law, provides the main legal space law document applicable to this particular kind of space activity.

However, it focuses only on the more politically tinged dispute between states anxious to remain at liberty to conduct any Earth remote sensing operations they were interested in (or allow their operators to do so) as part of the freedom of space activities (as enshrined by Articles I and II of the Outer Space Treaty) and the freedom of information, and states anxious that, in the absence of relevant capabilities of their own, they would be completely dependent upon the few states who have such capabilities and the willingness of those states to share data regarding sensed states' territories with such states themselves.<sup>68</sup> Effectively, the result of the resolution is that sensed states only have a right of access to data concerning their territories "on a non-discriminatory basis and on reasonable cost terms."<sup>69</sup> This meant there was no right of "prior consent" or even a right of prior or preferential access, something the sensed states had originally hoped for.

Consequently, the solutions to the main legal problems concerning satellite remote sensing are currently being sought elsewhere. Do general intellectual property rights regimes, in particular that of copyright, provide sufficient protection of the commercial interests of operators in preventing freeloaders from using the space technology or the products resulting therefrom without appropriate compensation? How are privacy and security considerations properly taken care of in the context of increasingly accurate remote sensing data? Could such data give rise to use as evidence in courts?

As to the first, the European Union went furthest in providing for a specific Database Protection Directive, including prominently space remote sensing databases, and providing them with tailor-made protection, which existing copyright law was often unable to provide.<sup>70</sup> In particular, in many European jurisdictions, the applicability of copyright protection required a level of creativity or originality which could be found wanting in (semi-)automatic remote sensing data generation instruments on board satellites. The Database Protection Directive in this respect addressed all electronic

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databases, including those generated through satellite remote sensing, and established a *sui generis* version of copyright based on substantial investment and individual accessibility, as opposed to creativity or originality.<sup>71</sup>

As to the second, while security issues are, to the extent feasible, managed at a national level—as mentioned in “THE ROLE OF NATIONAL SPACE LAWS IN THE CONTEXT OF INTERNATIONAL SPACE LAW,” Canada<sup>72</sup> and Germany<sup>73</sup> have specific legislation taking care of that, and these issues are addressed also in U.S. remote sensing legislation<sup>74</sup> and French national space law<sup>75</sup>—with respect to privacy concerns, no rules of note have yet developed as specifically targeting the satellite remote sensing component of that issue (von der Dunk, 2013). A good example thereof concerns EU-wide legislation on data protection, the most recent version being the General Data Protection Regulation of 2016.<sup>76</sup> The word “satellite” is not present in the regulation, whereas any satellite data falling within the definition of “personal data” (see Article 4[1], General Data Protection Regulation) obviously would be included in its scope—yet how to apply the obligations to the rather unique sector of remote sensing satellite operations is left unclear.

As to the third, the extent to which remote sensing data could serve as evidence in juridical proceedings in a legal sense has not moved beyond general recognition of the potential value of such data if properly certified and unsuccessfully challenged in such proceedings (Purdy & Leung, 2013). In other words, so far it depends basically on how comfortable judicial bodies within various countries are, whether or not after consulting expert witnesses, with satellite data presented as irrefutable and non-falsified evidence of a certain act or event at issue.

## Satellite Navigation and International (Space) Law

The last major current application of satellite technology warranting discussion at this stage, as the third mature sector of satellite operations subject to international satellite law, concerns the use of satellite systems for timing, positioning, and navigation—the Global Navigation Satellite Systems (Smith, 2015). The peculiarity of the first two systems, operational for a few decades, the U.S. GPS and the Russian GLONASS systems, being originally developed and still maintained and operated by the respective militaries, means that there is fairly little national legislation addressing commercial use, as such use is essentially still dependent on the extent to which the respective military authorities allow free access to the signals and services involved.

The European Galileo system is perhaps set to change that, given that its intention was to develop a civil system to be ultimately operated by a private concessionaire, following which the security concerns—also present in a European context—should be properly addressed by way of specific authorities to intervene with commercial operations.<sup>77</sup> As a consequence of this need to balance security and other public aspects with interest in making Galileo services commercially attractive, Galileo is to some extent already ruled

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by a set of EU directives.<sup>78</sup> However, it is neither fully operational yet, nor, as of 2019, is it being developed under the originally-intended Public–Private Partnership constructions, meaning that most of the legal details of its operational environment still need to be developed. How other impending satellite navigation systems such as those being developed by China, Japan, and India would affect any future legal regime on the sector is even less clearly discernible.

International legislative developments therefore remain fairly marginal as of 2019. In the context of the International Civil Aviation Organization (ICAO), for instance, global discussions on some sort of an international regime with a view toward the desired incorporation of GNSS in global air traffic services have been going on for several decades, without much success (Smith, 2015). More recently, the International Committee on Global Navigation Satellite Systems (ICG), operating under the auspices of the UN, notably the Office for Outer Space Affairs, has engaged in efforts to promote and coordinate technical interoperability of the various systems, meaning at the level of receivers.<sup>79</sup> Yet, the inherent sovereignty, military, and security-related aspects of operating such systems (except, to a certain extent, for Galileo) causes such efforts to fall short of achieving any operational compatibility and of any agreement on international responsibility or liability for GNSS operations beyond general space and public international law.

Like other satellite uses, of course, satellite navigation also requires the interference-free use of radio frequencies and attendant orbits, and to that extent continues to fall under the ITU regime discussed in “THE FIRST SATELLITE SECTOR: SATELLITE COMMUNICATIONS AND INTERNATIONAL (SPACE) LAW.” Beyond that, however, efforts, for example, in the world of aviation—one of the earliest and most interested user sectors of satellite navigation—to arrive at a detailed certification and liability system for satellite navigation services were not at all successful (von der Dunk, 2004).

## Conclusion

Obviously, this article could only touch upon the most important current and near-future aspects of space law, both international and national law; more special issues such as the use of space for disaster mitigation, while hugely interesting, have been left out.

Nevertheless, it is clear that the main trend will be toward more practical applications, whether terrestrial or in space (as some of the more visionary projects are focusing on), meaning that more and more countries from across the globe will develop vested interests, which they would preferably see protected by law, and that the private sector, in particular in the more developed parts of the world, will continue to increase its share in space activities—also demanding protection of their bona fide interests by space law, international and national, at a public and a private level. In this respect, many of the points noted, many of the directions discussed in which solutions are being sought for

current problems, and many of the fundamental tools summarily analyzed herein will continue to be relevant.

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### Notes:

(1.) Merriam-Webster, subentry 2(b).

(2.) An interesting hybrid example of public and private international law concerns UNIDROIT, an *intergovernmental* organization for the unification or harmonization of national *private* laws, normally taking relevant initiatives wherever the need is felt therefore by a specific international community of private entities. In the context of outer

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space, most notably UNIDROIT has developed a Protocol to the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets, Berlin, done March 9, 2012, not yet entered into force; UNIDROIT Doc., DCME-SP-Doc. 43. This Protocol intended to harmonize and thereby enhance the possibilities to obtain asset-based financing in the space sector.

(3.) Notably, this concerned the question of the peaceful use of outer space, UNGA Res. 1348 (XIII), of December 13, 1958; resolutions adopted on the reports of the First Committee, General Assembly—Thirteenth Session, at 5; international co-operation in the peaceful uses of outer space, UNGA Res. 1472 (XIV) A, of December 12, 1959; resolutions adopted on the reports of the First Committee, General Assembly—Fourteenth Session, at 5; UNGA Res. 1721(XVI) B, of December 20, 1961; General Assembly—Sixteenth Session, Resolutions adopted on reports of the First Committee, at 6; and the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, UNGA Res. 1962(XVIII), of December 13, 1963; UN Doc. A/AC.105/572/Rev.1, at 37.

(4.) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereafter Outer Space Treaty), London/Moscow/Washington, done January 27, 1967, entered into force October 10, 1967; 610 UNTS 205; TIAS 6347; 18 UST 2410; UKTS 1968 No. 10; Cmnd. 3198; ATS 1967 No. 24; 6 ILM 386 (1967). Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, London/Moscow/Washington, done April 22, 1968, entered into force December 3, 1968; 672 UNTS 119; TIAS 6599; 19 UST 7570; UKTS 1969 No. 56; Cmnd. 3786; ATS 1986 No. 8; 7 ILM 151 (1968). Convention on International Liability for Damage Caused by Space Objects (hereafter Liability Convention), London/Moscow/Washington, done March 29, 1972, entered into force September 1, 1972; 961 UNTS 187; TIAS 7762; 24 UST 2389; UKTS 1974 No. 16; Cmnd. 5068; ATS 1975 No. 5; 10 ILM 965 (1971). Convention on Registration of Objects Launched into Outer Space (hereafter Registration Convention), New York, done January 14, 1975, entered into force September 15, 1976; 1023 UNTS 15; TIAS 8480; 28 UST 695; UKTS 1978 No. 70; Cmnd. 6256; ATS 1986 No. 5; 14 ILM 43 (1975).

(5.) Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (hereafter Partial Test Ban Treaty), Moscow, done August 5, 1963, entered into force October 10, 1963; 480 UNTS 43; TIAS 5433; 14 UST 1313; UKTS 1964 No. 3; ATS 1963 No. 26.

(6.) Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (hereafter Moon Agreement), New York, done December 18, 1979, entered into force July 11, 1984; 1363 UNTS 3; ATS 1986 No. 14; 18 ILM 1434 (1979).

(7.) One not achieving consensus was, for instance, the Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, UNGA Res. 37/92, of December 10, 1982; UN Doc. A/AC.105/572/Rev.1, at 39.

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(8.) Such a resolution soon to reflect customary international law was, for instance, the Principles Relating to Remote Sensing of the Earth from Outer Space, UNGA Res. 41/65, of December 3, 1986; UN Doc. A/AC.105/572/Rev.1, at 43; 25 ILM 1334 (1986).

(9.) This concerned especially the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, UNGA Res. 47/68, of December 14, 1992; UN Doc. A/AC.105/572/Rev.1, at 47.

(10.) For scientific activities, see, for instance, Article I, Outer Space Treaty, providing for the freedom of exploration and scientific investigation. For military and security-related activities, see, for instance, Article IV, Outer Space Treaty, prohibiting the stationing or orbiting of weapons of mass destruction in outer space.

(11.) See IADC Space Debris Mitigation Guidelines, IADC-02-01, of October 15, 2002; resp. IADC-02-01 Revision, September 1, 2007.

(12.) See Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space, International cooperation in the peaceful uses of outer space, UNGA Res. 62/217, of December 22, 2007; UN Doc. A/RES/62/217.

(13.) This happened, for example, in the United States, the United Kingdom, and France.

(14.) See Articles I-III, Liability Convention.

(15.) See Article II, Registration Convention.

(16.) See also Article IV, Liability Convention.

(17.) Compare Article I(c)(ii), Liability Convention.

(18.) States are almost by definition the entities creating international treaty law obligations by drafting, signing, and ratifying particular treaties, and in a more circumspect and complex manner, also by creating customary international law by means of their behavior in certain circumstances being considered to constitute evidence of a sense of legal obligation. Compare Article 38(1)(a) & (b), Statute of the International Court of Justice, San Francisco, done June 26, 1945, entered into force October 24, 1945; 156 UNTS 77; USTS 993; 59 Stat. 1031; UKTS 1946 No. 67; ATS 1945 No. 1; as providing the authoritative list of sources of (public) international law.

(19.) See the 1984 Commercial Space Launch Act, October 30, 1984, Public Law 98-575, 98th Congress, H.R. 3942; 98 Stat. 3055; *Space Law—Basic Legal Documents*, E.III.3; following various amendments codified as 51 U.S.C. Chapter 509.

(20.) See Communications Act, June 19, 1934; 47 U.S.C. 151 (1988); 48 Stat. 1064; per Communications Satellite Facilities, *First Report and Order*, 22 FCC 2d 86 (1970), Appendix C, p. 1, declared applicable to *satellite* communication operators as well. The Communications Act is now codified as 47 U.S.C. Chapter 5.

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(21.) See Land Remote Sensing Policy Act, October 28, 1992, Public Law 102-555, 102nd Congress, H.R. 6133; 15 U.S.C. 5601; 106 Stat. 4163; now codified as 51 U.S.C. Chapter 601.

(22.) See Title IV, U.S. Commercial Space Launch Competitiveness Act; Public Law 114-190, 114th Congress, November 25, 2015; now codified as 51 U.S.C. Chapter 513.

(23.) Notably, this concerns the Commercial Space Act, January 27, 1998, Public Law 105-303, 105th Congress, H.R. 1702; 51 U.S.C. 50101; 112 Stat. 2843 (1998); now codified as 51 U.S.C. Chapters 501 & 503.

(24.) Notably, this concerns the Arms Export Control Act of 1976; 22 U.S.C. 2751; giving rise to the International Traffic in Arms Regulations (ITARs); and the Export Administration Act of 1979; Public Law 96-72, 96th Congress; 50 U.S.C. 2401; 93 Stat. 503.

(25.) Austrian Federal Law on the Authorization of Space Activities and the Establishment of a National Space Registry (*Bundesgesetz über die Genehmigung von Weltraumaktivitäten und die Einrichtung eines Weltraumregisters [Weltraumgesetz]*), as adopted by Parliament on December 6, 2011; *Federal Law Gazette*, December 27, 2011; 61 *Zeitschrift für Luft- und Weltraumrecht* (2012), 37-42, 56-61.

(26.) Law on the Activities of Launching, Flight Operations or Guidance of Space Objects, September 17, 2005, adopted June 28, 2005; *Nationales Weltraumrecht/National Space Law* (2008), at 183.

(27.) Law on activities in outer space (*Lov om aktiviteter i det ydre rum*), passed by Parliament with the third treatment, May 3, 2016; *Parliament Gazette*, 2015-17, No. L 128.

(28.) Law on Space Operations (*Loi relative aux opérations spatiales*); *Loi no. 2008-518 du 3 juin 2008*; unofficial English version, *Journal of Space Law* (2008), 34, 453.

(29.) Law of the Republic of Indonesia on Space Activities, No. 21, of August 6, 2013; *State Gazette of the Republic of Indonesia* (2013), No. 133.

(30.) Law of the Republic of Kazakhstan on Space Activities, of January 6, 2012, 2012 No. 528-IV.

(31.) Law Incorporating Rules Concerning Space Activities and the Establishment of a Registry of Space Objects, January 24, 2007; 80 *Staatsblad* (2007), at 1; *Nationales Weltraumrecht/National Space Law* (2008), at 201.

(32.) Law of the Russian Federation on Space Activities, No. 5663-1, August 20, 1993, effective October 6, 1993; *National Space Legislation of the World*, Vol. I (2001), at 101.

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(33.) Space Affairs Act, September 6, 1993, assented to on June 23, 1993, No. 84 of 1993; Statutes of the Republic of South Africa—Trade and Industry, Issue No. 27, 21–44; *National Space Legislation of the World*, Vol. I (2001), at 413.

(34.) Space Development Promotion Act, Law No. 7538, of May 31, 2005, entered into force December 1, 2005; unofficial translation, *Journal of Space Law* (2007), 33, 175.

(35.) Act on Space Activities, 1982: 963, November 18, 1982; *National Space Legislation of the World*, Vol. I (2001), at 398; *Space Law—Basic Legal Documents*, E.II.1; 36 *Zeitschrift für Luft- und Weltraumrecht* (1987), 11.

(36.) Law of the Ukraine on Space Activities, No. 502/96-VR, November 15, 1996; *National Space Legislation of the World*, Vol. I (2001), at 36.

(37.) Outer Space Act, July 18, 1986, Chapter 38; *National Space Legislation of the World*, Vol. I (2001), at 293; *Space Law—Basic Legal Documents*, E.I; 36 *Zeitschrift für Luft- und Weltraumrecht* (1987), 12.

(38.) An act about space activities, and for related purposes, No. 123 of 1998, assented to December 21, 1998; *National Space Legislation of the World*, Vol. I (2001), at 197.

(39.) Administrative Edict No. 27, June 20, 2001; *National Space Legislation of the World*, Vol. II (2002), at 377.

(40.) Act on launching objects from Norwegian territory into outer space, No. 38, June 13, 1969; *National Space Legislation of the World*, Vol. I (2001), at 286.

(41.) Remote Sensing Space Systems Act, assented to November 25, 2005; S.C. 2005, c. 45.

(42.) Act Protecting Against the Endangerment of German Security Through the Proliferation of High Resolution Aerial Imagery of the Earth (*Satellitendatensicherheitsgesetz*), November 23, 2007, effective December 1, 2007; *Federal Gazette (BGBl.)* Year 2007 Part I, No. 58, of November 28, 2007.

(43.) Law on the exploration and utilization of space resources (*Loi du 20 juillet 2017 sur l'exploration et l'utilisation des ressources de l'espace*); of July 20, 2017, published July 28, 2017.

(44.) Note that pursuant to registration, the flag states of ships and aircraft can apply national legislation on board those vehicles on a quasi-territorial basis; as said, pursuant to Article VIII, Outer Space Treaty, and the Registration Convention, that also applies to space objects so registered.

(45.) It requires restoring the injured party “to the condition which would have existed if the damage had not occurred.”

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(46.) In its present iteration, the ITU, its operation and the regime developed under its *aegis* are essentially based on the Constitution of the International Telecommunication Union (hereafter ITU Constitution), Geneva, done December 22, 1992, entered into force July 1, 1994; 1825 UNTS 1; UKTS 1996 No. 24; Cm. 2539; ATS 1994 No. 28; Final Acts of the Additional Plenipotentiary Conference, Geneva, 1992 (1993), at 1; the Convention of the International Telecommunication Union, Geneva, done December 22, 1992, entered into force July 1, 1994; 1825 UNTS 1; UKTS 1996 No. 24; Cm. 2539; ATS 1994 No. 28; Final Acts of the Additional Plenipotentiary Conference, Geneva, 1992 (1993), at 71; and the Radio Regulations Articles, Edition of 2012 (hereafter 2012 Radio Regulations). See also Lyall (2011, pp. 127–212) and von der Dunk (2015, pp. 458–493).

(47.) See Article 1(2), ITU Constitution.

(48.) See Articles 34(2), 38(3) & (4), 44(1) & (2), 45, 46, 48, ITU Constitution.

(49.) See Article 44(2), ITU Constitution.

(50.) Article 1(2.a), ITU Constitution; emphasis added.

(51.) Article 1(2.b). ITU Constitution; emphasis added.

(52.) See Article 1, Section III, 2012 Radio Regulations.

(53.) INTELSAT was established as an intergovernmental organization by way of the Agreement Relating to the International Telecommunications Satellite Organization (INTELSAT) (hereafter INTELSAT Agreement), Washington, done August 20, 1971, entered into force February 12, 1973; 1220 UNTS 21; TIAS 7532; 23 UST 3813; UKTS 1973 No. 80; Cmnd. 4799; ATS 1973 No. 6; 10 ILM 909 (1971); and the Operating Agreement Relating to the International Telecommunications Satellite Organization (INTELSAT) (hereafter INTELSAT Operating Agreement), Washington, done August 20, 1971, entered into force February 12, 1973; 1220 UNTS 149; TIAS 7532; 23 UST 4091; UKTS 1973 No. 80; Cmnd. 4799; ATS 1973 No. 6; 10 ILM 946 (1971). See further von der Dunk (2015, pp. 283–287); Lyall (1989, pp. 74–208).

(54.) INMARSAT was established as an intergovernmental organization by way of the Convention on the International Maritime Satellite Organization (INMARSAT) (hereafter INMARSAT Convention), London, done September 3, 1976, entered into force July 16, 1979; 1143 UNTS 105; TIAS 9605; 31 UST 1; UKTS 1979 No. 94; Cmnd. 6822; ATS 1979 No. 10; 15 ILM 1052 (1976); and the Operating Agreement on the International Maritime Satellite Organization (INMARSAT) (hereafter INMARSAT Operating Agreement), London, done September 3, 1976, entered into force July 16, 1979; 1143 UNTS 213; TIAS 9605; 31 UST 1; UKTS 1979 No. 94; Cmnd. 6822; ATS 1979 No. 10; 15 ILM 233, 1075 (1976). See further von der Dunk (2015, pp. 290–293); Lyall (1989, pp. 209–243).

(55.) EUTELSAT was established as an intergovernmental organization by way of the Convention Establishing the European Telecommunications Satellite Organization (EUTELSAT) (hereafter EUTELSAT Convention), Paris, done July 15, 1982, entered into

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force September 1, 1985; UKTS 1990 No. 15; Cm. 956; Cmnd. 9069; *Space Law—Basic Legal Documents*, C.II.1; and the Operating Agreement Relating to the European Telecommunications Satellite Organization (EUTELSAT) (hereafter EUTELSAT Operating Agreement), Paris, done July 15, 1982, entered into force September 1, 1985; UKTS 1990 No. 15; Cm. 956; Cmnd. 9154; *Space Law—Basic Legal Documents*, C.II.2. See further von der Dunk (2015, pp. 295–296); Lyall (1989, pp. 264–295).

(56.) See in detail on INTELSAT, McCormick (2013b); von der Dunk (2015, pp. 287–290); on INMARSAT, see Sagar and McCormick (2013); von der Dunk (2015, pp. 293–295); on EUTELSAT, see Roisse (2013); von der Dunk (2015, pp. 297–301).

(57.) General Agreement on Tariffs and Trade, Geneva, done October 30, 1947, entered into force January 1, 1948; 55 UNTS 194; TIAS 1700; ATS 1948 No. 23.

(58.) General Agreement on Trade in Services (hereafter GATS), Marrakesh, done April 15, 1994, entered into force January 1, 1995; 1869 UNTS 183; UKTS 1996 No. 58; Cm. 3276; ATS 1995 No. 8. See Bhala and Kennedy (1998, pp. 1242–1270); Krajewski (2012).

(59.) Agreement Establishing the World Trade Organization (hereafter WTO Agreement), Marrakesh, done April 15, 1994, entered into force January 1, 1995; 1867 UNTS 154; UKTS 1996 No. 57; ATS 1995 No. 8; 33 ILM 1125, 1144 (1994).

(60.) See Article II(2), WTO Agreement.

(61.) See Article II(3), WTO Agreement. Further, see Bhala and Kennedy (1998, pp. 60–78); Guzman and Pauweleyn (2009, pp. 287–314).

(62.) See Article II(1), GATS.

(63.) See Article XVII (1), GATS. Further, see Bhala and Kennedy (1998, pp. 90–105); Guzman and Pauweleyn (2009, pp. 225–285).

(64.) See Article II(1), resp. (2), GATS. Further, see von der Dunk (2015, pp. 832–835).

(65.) See GATS Annex on Telecommunications. Further, see Bhala and Kennedy (1998, pp. 1292–1294).

(66.) Fourth Protocol to the General Agreement on Trade and Services of April 15, 1994, Geneva, done April 15, 1997, entered into force February 5, 1998; WTO Doc. S/L/20 of April 30, 1996 (96-1750); 2061 UNTS 209; ATS 1998 No. 9; 33 ILM 1167 (1994); 36 ILM 354 (1997). Further, see Bhala and Kennedy (1998, pp. 1296–1300).

(67.) See highlights of the basic telecommunication commitments and exemptions; “Subsector by subsector commitments.”

(68.) Note that Principle IV calls for “respect for the principle of full and permanent sovereignty of all States and peoples over their own wealth and natural resources”;

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Principles Relating to Remote Sensing of the Earth from Outer Space, UNGA Res. 41/65, of December 3, 1986; UN Doc. A/AC.105/572/Rev.1, at 43; 25 ILM 1334 (1986).

(69.) Principle XII, Principles Relating to Remote Sensing of the Earth from Outer Space, UNGA Res. 41/65, of December 3, 1986; UN Doc. A/AC.105/572/Rev.1, at 43; 25 ILM 1334 (1986).

(70.) Directive of the European Parliament and of the Council on the legal protection of databases, 96/9/EC (hereafter Database Protection Directive), of March 11, 1996; OJ L 77/20 (1996). See further Bond (1997).

(71.) Compare Articles 1, 3, 5, 7-11, Database Protection Directive.

(72.) Remote Sensing Space Systems Act, assented to November 25, 2005; S.C. 2005, c. 45.

(73.) Act Protecting Against the Endangerment of German Security Through the Proliferation of High Resolution Aerial Imagery of the Earth (*Satellitendatensicherheitsgesetz*), November 23, 2007, effective December 1, 2007; *Federal Gazette (BGBl.)* Year 2007 Part I No. 58, of 28 November 2007.

(74.) See 51 U.S.C. § 60122(b)(1), (6).

(75.) See Articles 23, 24, Law on Space Operations (*Loi relative aux opérations spatiales*); *Loi no. 2008-518 du 3 juin 2008*; unofficial English version, *Journal of Space Law* (2008), 34, 453.

(76.) Regulation of the European Parliament and of the Council on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (hereafter General Data Protection Regulation), No. 2016/679/EU, of April 27, 2016; OJ L 119/1 (2016).

(77.) It should be noted here that the original aim to have a concessionaire run the system has so far not materialized, meaning the system for the time being will be operated and the services provided by the European GNSS Agency, as a Commission Agency a public agency rather than a private concessionaire. Nevertheless, the hope with the European Commission and the EU member states remains for such a concession in the future to become attractive enough for a private consortium.

(78.) Notably, this concerns the Council Regulation setting up the Galileo Joint Undertaking, No. 876/2002/EC, of May 21, 2002; OJ L 138/1 (2002); the Regulation of the European Parliament and of the Council on the further implementation of the European satellite navigation programs (EGNOS and Galileo), No. 683/2008/EC, of July 9, 2008; OJ L 196/1 (2008); and the Decision of the European Parliament and of the Council on the rules for access to the public regulated service provided by the global navigation satellite system established under the Galileo program, No. 1104/2011/EU, of October 25, 2011; OJ L 287/1 (2011).

(79.) See ICG - unoosa.

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