

# CALLING SPACE TRAFFIC CONTROL

## AN ARGUMENT FOR CAREFUL CONSIDERATION BEFORE GRANTING SPACE TRAFFIC MANAGEMENT AUTHORITIES

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The space environment (at least where the Earth’s orbits are concerned) is increasingly congested. As a natural result, collisions between space objects are becoming more likely and much more disastrous. A collision would not only destroy those colliding objects, but could create a debris cloud that threatens many other objects in the orbit. As a response to this, the United States government has expressed a willingness to consider a regime whereby the trajectory of American satellites is subject to government control, similar to the air traffic management system. While this may be a necessary step in salvaging the space environment, legislators must be appropriately cautious because this level of governmental control may give rise to legal liability for any accidents involving American assets. This paper will address some of the considerations that must be made—particularly that the current space tracking system is not of sufficient quality to allow for trustworthy trajectory manipulations by the government.

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## I. INTRODUCTION TO THE INTERNATIONAL LAW GOVERNING ACCIDENTS IN SPACE

The Convention on International Liability for Damage Caused by Space Objects (adopted in 1971) imposes fault-based liability on states who launch an object into space which then causes damage to another object in space.<sup>1</sup> Any states who contributed to the launching of such an object may be held liable under this agreement.<sup>2</sup> Having an avenue like this through which damaged states may seek specific reparations is relatively novel in international law and it has only been used once.<sup>3</sup> In 1978, the Canadian government demanded damages from the Soviet Union for cleanup costs when a Russian satellite crashed in the Canadian wilderness, spilling fuel waste and other contaminants.<sup>4</sup> Under the Liability Convention, the Russian government was strictly liable for all damage its space object caused on the surface of the Earth,<sup>5</sup> but there was significant debate as to whether that recourse was limited to the direct damages of the fallen satellite (which were limited, due to the unpopulated area in which it fell), or if the indirect damages associated with the cleanup were also payable to the Canadian government.<sup>6</sup> Also at issue was the Soviet obligation to pay for cleanup when it was not afforded the opportunity to conduct it themselves.<sup>7</sup> After lengthy arbitration, the Canadian government agreed to a sum of C\$3 million, which did not encompass the total sum of their costs, but did seem to pay for some indirect cleanup costs.<sup>8</sup> Overall, it is hard to glean any helpful precedent from this case, especially since the vast majority of accidents occur in space, where states are only liable if they are at fault.

The reason for the distinction between Earth accidents and space accidents is obvious. Where there is a possibility for human injury, state parties to the agreement (especially non-space-faring ones) wanted a strict liability imposed on this extremely risky activity.<sup>9</sup> After all, objects re-

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

2. *Id.* at art. V.

3. Alexander N. Yakovlev, *Canada: Claim Against the Union of Soviet Socialist Republics for Damage Caused by Soviet Cosmos 954*, 18:4 INT'L LEGAL MATERIALS 899-930 (1979).

4. *Id.*

5. Convention on International Liability, *supra* note 1, at art. II.

6. See generally Peter P. C. Haanappel, *Some Observations on the Crash of Cosmos 954*, 6:2 J. SPACE L. 147 (1978).

7. *Id.*

8. Protocol Between the Government of Canada and the Government of the Union of Soviet Socialist Republics, Can.-U.S.S.R. art. I, Apr. 2, 1981, 1470 U.N.T.S. 269.

9. Stanley Mazaroff, *Exonerations from Liability for Damage Caused by Space Activities*, 54:1 CORNELL L. REV. 74 (Nov. 1968).

entering the atmosphere have been known to wreak significant damage.<sup>10</sup> In space the loss is financial, though also significant. Large satellites cost upwards of millions of dollars, with some reaching ten figures.<sup>11</sup> Launch services that would have to be redone in the event of a loss of a satellite are extremely expensive. If a satellite is destroyed through the negligence of another party, it is reasonable to want these costs to be remunerated. The Liability Convention foresaw this, and provided for a mechanism. However, the Convention requires that countries seek damages from the Launching States of the object, even if the damage was caused through the negligence of a private organization.<sup>12</sup> So, if a company's satellite was damaged by the negligence of another, they would reach out through their national government and seek damages from the country of nationality of the guilty satellite. Launching states are free to create domestic regimes that require private operators to indemnify them against liability.<sup>13</sup>

In the United States, this has taken the form of a system of federal regulations requiring private space operators to carry insurance up to the maximum probable loss, an amount found by using the statutorily provided formula.<sup>14</sup> The government subsidizes some losses above that number (up to roughly \$3 billion), in an effort to incentivize American private space operations.<sup>15</sup> Combined, the insurance (pursuant to its terms) and the government pay any claims made by injured third parties, or by other nations through the Liability Convention.<sup>16</sup> However, this mechanism has never been activated for a Liability Convention claim. This is not because there have been no catastrophic losses of American satellites because of foreign satellites—quite the opposite.<sup>17</sup> Rather, the problem is proving negligence on the part of the foreign operator as required for a valid claim under the

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10. ASSOCIATED PRESS, FOX NEWS, *About 1,100 Injured as Meteorite Hits Russia with Force of Atomic Bomb* (Feb. 15, 2013), <http://www.foxnews.com/science/2013/02/15/injuries-reported-after-meteorite-falls-in-russia-ural-mountains.html>.

11. *The Cost of Building and Launching a Satellite*, GLOBALCOM, <http://www.globalcomsatphone.com/hughesnet/satellite/costs.html> (last visited Feb. 1, 2017).

12. Convention on International Liability, *supra* note 1, at art. II.

13. *Id.* at art. V.

14. 14 C.F.R. § 440.7(a) (2016).

15. See U.S. GOV'T ACCOUNTABILITY OFFICE., GAO-14-328T, COMMERCIAL SPACE LAUNCHES: FAA'S RISK ASSESSMENT PROCESS IS NOT YET UPDATED (2014).

16. *Id.*

17. See Yuri Pushkin & Melissa Gray, *Russian, U.S. Satellites Collide in Space*, CNN (Feb. 12, 2009), [http://www.cnn.com/2009/TECH/02/12/us.russia.satellite.crash/index.html?\\_s=PM:TECH](http://www.cnn.com/2009/TECH/02/12/us.russia.satellite.crash/index.html?_s=PM:TECH) (explaining in 2009, a derelict Russian satellite crashed into an operational American communications satellite, completely destroying the two satellites and creating a major debris cloud that is a threat to the space environment even today).

Liability Convention.<sup>18</sup> Space is not easily observable, and while we are generally aware of where space objects are because of tracking by the Joint Space Operations Center (JSPOC),<sup>19</sup> we rarely can pinpoint the exact cause of an accident, let alone prove negligence by international standards.

Faced with the ever-increasing number of space objects, Congress passed the U.S. Commercial Space Launch Competitiveness Act in 2015.<sup>20</sup> The legislation illustrated the general sense that the United States is failing to uphold its international obligations to “authorize and supervise” the activities of its nationals in space,<sup>21</sup> which is a topic for a different paper. In short, the United States does not exercise any control over the behavior of objects while they are in space beyond a few restrictions placed on the licenses of remote sensing systems and communication satellites.<sup>22</sup> As part of the effort to correct this failure and to address the increasingly urgent space debris problem, Congress requested thought on the legal ramifications of engaging in Space Traffic Management: a system similar to that of the Federal Aviation Administration’s (FAA) air traffic management system where flight paths are assigned based on mission requirements, and can be altered by the government.<sup>23</sup> Put simply: the government wants to know what the concerns are if a government agency is entrusted with the regulatory authority to make a satellite change its trajectory in order to avoid a collision. It is the opinion of this author that while such authority will likely be necessary in the future, it should be approached carefully as to avoid incurring liability under the Liability Convention, resulting in significant losses to the United States government and any indemnifying parties. To explore this opinion, it is important first to look at why this is a problem: the rise of the small satellite and space debris.

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18. Kay Hailbronner, *Liability for Damage Caused by Spacecraft Proposals of Belgium, U.S.A., Hungary, India, and Italy*, 30 HEIDELBERG J. INT’L L. 125, 133 (1970), [http://www.zaoerv.de/30\\_1970/30\\_1970\\_1\\_t\\_125\\_141.pdf](http://www.zaoerv.de/30_1970/30_1970_1_t_125_141.pdf).

19. U.S. Strategic Command, *USSTRATCOM Space Control and Space Surveillance*, STRATCOM.MIL (Oct. 17, 2016), <http://www.stratcom.mil/Media/Factsheets/Factsheet/View/Article/976414/usstratcom-space-control-and-space-surveillance/>; U.S. Strategic Command, *Functional Components*, STRATCOM.MIL, <http://www.stratcom.mil/components/> (last visited Jan. 30, 2017) (explaining that the Joint Space Operations Center (JSPOC), located in Vandenberg, California, is a component of USSTRATCOM and is tasked with space surveillance and helping coordinate military space efforts in support of American servicemen and against hostile powers).

20. See Pub. L. No. 114–90, 129 Stat. 704 (2015).

21. Pub. L. No. 114–90 Sec. 108, 129 Stat. 704 (explaining that legislation required a report on appropriate mechanisms to authorize and supervise all space operations to “meet the United States obligations under international treaties”).

22. See Pub. L. No. 114–90 Sec. 108–109, 129 Stat. 704.

23. See *Space Traffic Control*, LOCKHEEDMARTIN.COM, <http://www.lockheedmartin.com/us/news/features/2015/space-traffic-control.html> (last visited Feb. 1, 2017).

## II. CONGESTED, CONTESTED, AND COMPETITIVE: SMALL-SATELLITES AND SPACE DEBRIS

When the space treaties were written, the only things in space were small government-owned satellites very few and very, very far between. That is simply no longer the case. Currently, there are approximately 500,000 space objects (including debris) in orbit around Earth.<sup>24</sup> Of these, 20,000 are the size of a softball or larger and are trackable by JSPOC.<sup>25</sup> Moving forward, the growth in the number of satellites will be largely due to the launch of small satellites, or satellites roughly five pounds or smaller that generally do not possess any propulsion systems or other intensive operational capabilities.<sup>26</sup> Currently, the JSPOC issues conjunction warnings to all operators, including foreign operators and those of small satellites, when they are likely to collide with another object.<sup>27</sup> However, for small satellites, such warnings are rather perfunctory as without propulsion systems, they cannot maneuver out of the collision course.<sup>28</sup> This is especially true when the collision is likely to be with a small piece of debris barely trackable let alone maneuverable. When involved, large satellite operators with evasive capabilities nearly always adjust trajectory<sup>29</sup>—while expending the fuel to move is expensive, it's not as expensive as losing a trillion dollar satellite.

The JSPOC conjunction warnings are the only governmental service of their kind provided by any nation.<sup>30</sup> Several private companies have also set up tracking systems to alert paying customers to threats to their space assets, which can augment the services provided by the government.<sup>31</sup> However, such data is far from perfect. First, current tracking capability is limited to

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24. Mark Garcia, *Space Debris and Human Spacecraft*, NASA.GOV (Sept. 26, 2013), [https://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html).

25. *Id.*

26. *Nanosats Are Go!*, ECONOMIST (June 7, 2014), <http://www.economist.com/news/technology-quarterly/21603240-small-satellites-taking-advantage-smartphones-and-other-consumer-technologies>.

27. See Duane Bird, *Sharing Space Situational Awareness Data*, AERO.TAMU.ADU, <http://aero.tamu.edu/sites/default/files/faculty/alfriend/S4.1%20Bird.pdf> (last visited Jan. 30, 2017).

28. Rob Matheson, *Electrospray Thruster Make Small Satellites More Capable*, MIT NEWS (Mar. 11, 2015), <http://news.mit.edu/2015/accion-systems-thruster-for-small-satellites-0311>.

29. See Garcia, *supra* note 24.

30. Bird, *supra* note 27; see also Pub. L. No. 114–90 Sec. 109, 129 Stat. 704 (stating that Congress is currently considering a re-delegation of this responsibility to a civilian agency, leaving the actual tracking with the Department of Defense, but allowing a civilian agency to handle the conjunction warnings to private enterprises).

31. See generally Llima Loomis, *Private Firms Spy a Market in Spotting Space Junk*, NATURE.COM (Sept. 23, 2015), <http://www.nature.com/news/private-firms-spy-a-market-in-spotting-space-junk-1.18425>.

objects ten centimeters or larger—roughly the size of a softball.<sup>32</sup> Anything smaller than ten centimeters will not be catalogued or tracked, but smaller objects still pose a serious threat to satellites and should be avoided. Even something the size of a dime travelling at 17,500 mph will do a lot of damage to sensitive equipment (solar arrays are especially at risk). Additionally, the system issues conjunction warnings when an object travels within [two] kilometers of another.<sup>33</sup> This has resulted in a very high number of warnings being issued that are false alarms—the very definition of a boy crying wolf.<sup>34</sup> For now, it is the decision of the satellite operator whether to heed the warning of the JSPOC, something that would likely change if a government agency was granted traffic management authority. This burden would be most heavily felt by large satellite operators with the capability to avoid collision, something that must be taken into consideration moving forward. It will be important for the government to get much better at space object tracking before requiring operators to move on suspect information.

### III. WHAT CONSTITUTES “FAULT” FOR THE PURPOSES OF THE LIABILITY CONVENTION?

The reality is that the United States government does not operate with 100% certainty of the location of space objects in orbit. Even with the introduction of Lockheed Martin’s Space Fence (a new space surveillance system using a mixture of space and ground assets on a higher wave frequency to improve object tracking)<sup>35</sup> sometime in 2018, tracking capabilities will still be limited. There is significant risk of the government missing a conjunction, as in the Intelsat disaster, or (worst case scenario) the government could require a satellite operator to alter their trajectory resulting in a collision that otherwise would not have occurred. In the event of a foreign satellite being damaged or destroyed in either of these scenarios, the potential for liability under the Liability Convention is substantial.

The Liability Convention creates a legal duty for states not to damage the space objects of other states through their actions.<sup>36</sup> In that sense, it is clear that if and when the United States government orders the maneuver of a satellite that results in damage or destruction of a foreign satellite, a

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32. Garcia, *supra* note 24.

33. Brian Weeden, *2009 Iridium-Cosmos Collision Fact Sheet*, at 2, (Nov. 10, 2010), [https://swfound.org/media/6575/swf\\_iridium\\_cosmos\\_collision\\_fact\\_sheet\\_updated\\_2012.pdf](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf).

34. *Id.* (explaining this over-warning was largely a reaction to the tracking system failing to notify of the impending conjunction of the Roscosmos and Iridium satellites, resulting in one of the most disastrous debris-creating events in history).

35. *How to Keep Space Safe*, LOCKHEED MARTIN, <http://www.lockheedmartin.com/us/products/space-fence.html> (last visited Feb. 1, 2017).

36. Convention on International Liability, *supra* note 1, at art. II–III.

Liability Convention claim is simple—the United States affirmatively engaged in behavior that resulted in damage. The United States may be able to point to exonerating factors<sup>37</sup> such as faulty information in the tracking system or contributory negligence on the part of the foreign operator for failing to heed conjunction warnings (the United States would obviously have no authority to command a shift in trajectory for a foreign satellite). However, the likelihood of success of a claim for damages under the Liability Convention would be significant because of the government's involvement in the accident.

Where the issue is much less clear is whether an omission (failure to require trajectory adjustment) would constitute fault for the purposes of establishing a claim under the Liability Convention. International law demands that in order for a state to be responsible, they must be in breach of an international obligation.<sup>38</sup> It is unclear whether there is an international obligation to prevent collisions in space. The analysis is further complicated by the fact that until space traffic management authorities are granted, no state has possessed the power to prevent collisions by mandating trajectory adjustment.<sup>39</sup>

Given the state of the international community and international law as a whole, it is unlikely that international obligation to prevent space collisions will be read into the space treaties. However, renewed international commitment to the preservation of the space environment may create an international obligation to avoid and prevent debris-causing accidents. International responsibility for failure to prevent may be imposed that way. International environmental law already recognizes a duty to prevent transboundary harm arising from polluting activities,<sup>40</sup> a theory that could be extended to require states to act affirmatively to protect the space environment from preventable collisions that pollute the orbits with debris. Moreover, this doctrine recognizes that when the damage was the result of

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37. *Id.*

38. U.N. Legislative Series, Book 25: Materials on the Responsibility of States for Internationally Wrongful Acts, 97 ¶ 1, ST/LEG/SER/B/25, (2012).

39. See generally INT'L MARITIME ORGANIZATION, *International Regulations for Preventing Collisions at Sea (COLREGS)*, [http://www.mar.ist.utl.pt/mventura/Projecto-Navios-I/IMOConventions%20\(copies\)/COLREG-1972.pdf](http://www.mar.ist.utl.pt/mventura/Projecto-Navios-I/IMOConventions%20(copies)/COLREG-1972.pdf) (last visited Feb. 1, 2017) (comparing maritime collision regulations to space collision. Interestingly, in maritime law there is a set of international regulations dedicated to preventing collision between seafaring vessels which impose duties on seafaring nations to prevent such collisions, but while maritime law is a useful analogy to space law, it is much more specific and well-developed than international space law. This means that the existence of such collision-prevention regulations can serve only as a glimmer of hope for international consensus in issues of this kind moving forward).

40. Lada Soljan, *The General Obligation to Prevent Transboundary Harm and Its Relation to Four Key Environmental Principles*, 3 AUSTRIAN REV. INT'L & EUR. L. 209, 232 (1998).

an accident, and nobody was at fault, there is no liability assigned.<sup>41</sup> Therefore, if the United States government fails to warn of an impending collision but without any negligence or wrongdoing, they could not be held internationally liable under this theory of international law.

However, at home the story could be quite different: domestic law could grant American companies a cause of action against the government in the event of satellite damage or destruction stemming from the government failing to require evasion of a potential collision—the current cross-waiver system does not envision a situation where the government could fail to uphold its end of a licensure bargain. This would be akin to filing suit against the FAA in the event of a failure of air traffic controllers to prevent an in-air collision. Because the federal government waived its immunity in the Federal Tort Claims Act of 1944, it may face liability for negligent conduct in official duties<sup>42</sup>—such as those duties required in space traffic management. However, a court may find that a space traffic controller acts with discretion in determining whether an order to change trajectory is necessary, and therefore the government retains its immunity under the law.<sup>43</sup> Case law suggests that, if the model for air traffic control is used, a space traffic controller may be held liable for his negligence because “operators merely handle operational details which are outside the area of the discretionary functions and duties referred to in s. 2680.”<sup>44</sup> Ultimately, the differences between air and space (and the lack of a specific international regime like the International Civil Aviation Organization mandating air regulations) may distinguish a space traffic controller from air traffic controllers for the sake of domestic claims in negligence.

In short, by taking an active role in the maneuvering of space objects into and out of harm’s way, the United States government may open itself up to a host of international liability concerns for damage caused to space objects due to its actions, as well as domestic liability for failure to protect American space assets. Fault is much easier to prove when there is evidence that the opposing party either could have done something about the accident and didn’t, or actively caused it through bad information or negligent behavior.

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41. Alexandre Kiss & Dinah L. Shelton, *Strict Liability in International Environmental Law*, GEO. WASH. U. L. SCH. SCHOLARLY COMMONS 1131, 1136 (2007), [http://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=2046&context=faculty\\_publications](http://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=2046&context=faculty_publications).

42. Federal Tort Claims Act, 28 U.S.C. § 1346(b) (2013).

43. *Id.*

44. See *E. Air Lines v. Union Trust Co.*, 221 F.2d 62, 75 (D.C. Cir. 1955); see also *U.S. v. Union Tr.*, 330 U.S. 907 (1955).



#### IV. INTERMEDIATE STEPS BEFORE STM AUTHORITIES

Given the current state of the space environment (a mess), and the interest of Congress, space traffic management authorities seem to be a guaranteed eventuality. With the potential for an increase in viable cases brought against the United States under the Liability Convention as explored above, some intermediary steps should be taken before such authorities are granted.

First, the United States should make a significant investment in its space object tracking system, including those augmentations available from the private sector. It is unrealistic to demand companies to expend precious resources to maneuver away from collisions that are as likely as not to happen. There must be a degree of certainty in the likelihood of accident before space traffic management authorities can be invoked. This investment should also include incentivizing the use of materials that make space objects easier to track—reflective paint, tracking beacons, etc.

Second, the United States should determine (as foreign policy) an official position on whether failure to heed a warning constitutes negligence and fault for an accident in space.

Finally, the government should interface with industry to determine acceptable levels of collision risk operators are willing to face before expending resources to maneuver. As the burden will fall disproportionately on large satellite operators with propulsion capabilities, it must be clear how much government influence on their maneuvering decisions is acceptable before operating in the United States becomes too burdensome.

#### V. CONCLUSION

The United States is clearly headed toward a regime in space similar to the air traffic management system on Earth—where a regulatory agency can demand a satellite move in order to avoid collision. This is not a bad idea. The space environment is extremely congested and increasingly more dangerous and difficult to navigate. Introducing space traffic control may help clean up the mess. However, accepting that role may come with increased risk of liability for the actions of the government in steering satellites in and out of harm's way. These risks must be carefully considered as space traffic management authorities are debated and built. Otherwise, the Liability Convention may finally be used with some regularity to demand payment for accidents in space (which are more and more likely to occur).

