

## CONCLUSION

In 2006, Rocketplane Kistler planned to be the dominate force in the new space industry by simultaneously pursuing both suborbital space tourism and LEO transportation services. Now, the company has abandoned its Oklahoma headquarters and the Oklahoma Spaceport.<sup>234</sup> RpK went from being a rising star in commercial transportation services to a company mired in litigation. With a growing emphasis on the privatization of the shuttle program's transportation services to the ISS, NASA and the private sector need to be aware of the difficulties that the new space industry can present. Lessons to absorb from RpK include the importance of setting realistic project goals and meeting contractual milestones. The guidance NASA and the U.S. government need to take from their dealings with Rocketplane Kistler, is that not all of the new space industry is up to the task.

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<sup>234</sup> Jennifer Palmer, *No Spaceships at Oklahoma's Spaceport but They Are Welcome*, DAILY OKLAHOMAN, Jan. 10, 2010.

# TO THE END OF THE EARTH: A STUDY OF THE BOUNDARY BETWEEN EARTH AND SPACE

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## I. INTRODUCTION

With the launch of the diminutive *Sputnik* on 4 October 1957,<sup>1</sup> humankind first left the Earth; or did it? In more than fifty years of space flight and space exploitation, humankind has yet to agree on a seemingly critical question in space development: where does the Earth end and where does space begin? Or, more appropriately for the purposes of this paper, how far above the surface of the Earth does the “territory” of a sovereign state extend? These questions are older than space exploration itself. Eighteen months before the launch of *Sputnik*, a press release of the International Civil Aviation Organization (ICAO) announced that the issue of space sovereignty would be considered at an upcoming meeting:

### *Outer Space Sovereignty Agreement Needed*

Agreement on the use of outer space by the nations of the world will have to be reached soon, according to a report which will be put before the Assembly of the International Civil Aviation Organization when it meets ... this June. The report points out that . . . there is good reason to believe that ‘mechanical contrivances’ will travel beyond the Earth’s atmosphere in the near future.

None of the rules which furnish legal guidance to states on problems of sovereignty apply to trips into outer space. The convention on International Civil Aviation, which has been

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<sup>1</sup> NASA, *Sputnik: The fiftieth anniversary*, <http://history.nasa.gov/sputnik/> (last visited Jan. 18, 2010).

ratified or adhered to by all of ICAO's 67 member nations, gives each of these nations complete and exclusive sovereignty over the airspace above its territory, but it makes no mention of whether this sovereignty extends upwards beyond the boundary of the air . . . as any space craft would have to pass through the atmosphere before it reaches outer space, ICAO itself will be interested in the matter.<sup>2</sup>

Fifty years later, this question remains unanswered.

Amazingly, this unresolved issue does not seem to have hampered space development. However, with the limited "territory" above the Earth becoming increasingly crowded with "mechanical contrivances," and with new Nation-States quickly joining the "elite club" of space faring nations, these questions demand an answer.

Perhaps no event in recent memory made this question more urgent than the successful Chinese anti-satellite (ASAT) test, which took place on 11 January 2007. With the successful destruction of its own aging weather satellite, China proved that not only can it lay claim to orbital spheres above its territory, but, more significantly, it can enforce those claims. China is only the third nation to perform a successful ASAT test (the other two being the United States and Soviet Union).<sup>3</sup> Due to its heavy reliance on space-based technology, the United States took notice.<sup>4</sup>

Just over a year later, 15 February 2008, the United States successfully destroyed one of its own satellites for the first time since 1985.<sup>5</sup> Like the Chinese test, the American test utilized an Earth-based missile. According to Jonathan McDowell, an astronomer at Harvard University, the Chinese ASAT Test marks "the first real escalation in the weaponization of space

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<sup>2</sup> Press Release, International Civil Aviation Organization Aviation Organization, Outer Space Sovereignty Agreement Needed (Apr. 4, 1956), available at [http://www.icao.int/icao/en/nr/1956/pio195606\\_e.pdf](http://www.icao.int/icao/en/nr/1956/pio195606_e.pdf).

<sup>3</sup> Carin Zissis, *China's Anti-Satellite Test*, COUNCIL ON FOREIGN RELATIONS, Feb. 22, 2007, [www.cfr.org/publication/12684/](http://www.cfr.org/publication/12684/).

<sup>4</sup> *Id.*

<sup>5</sup> William J. Broad and David E. Sanger, *China Tests Anti-Satellite Weapon, Unnerving U.S.*, N.Y. TIMES, Jan. 18, 2007, available at <http://www.nytimes.com/2007/01/18/world/asia/18cnd-china.html>.

that we've seen in 20 years."<sup>6</sup> Now that Nation-States are honing their abilities to exercise control over space, it is imperative that an international consensus be reached as to "the vertical limits of State sovereignty."<sup>7</sup>

## II. VARIOUS DESIGNATIONS

As the very premise of this paper suggests, there is no clear boundary delineating the outer limit of airspace and beginning of outer space. As American astronaut, Rhea Seddon, M.D. explained, "space is a continuum."<sup>8</sup> While there are no clear boundaries, there is, however, a series of "arbitrary designations"<sup>9</sup> that have been adopted by custom or convention for the purposes of record keeping, designations, and competitions.<sup>10</sup> In order to give the reader some background knowledge of this issue, a number of the various proposals and designations are discussed below.

### A. Ability to Control

Some scholars have suggested that the upper limit of Nation-State sovereignty should be dependant on the subjacent States' ability to exercise control over their airspace.<sup>11</sup> Obviously, such a designation would make the definition of outer space variable across the globe due the inequality of Nation-States' abilities to project force.<sup>12</sup> Such a capability-based designation would be inconsistent and therefore would lack the uni-

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<sup>6</sup> *Id.* (quoting Jonathan McDowell).

<sup>7</sup> Dean N. Reinhardt, *The Vertical Limits of State Sovereignty* (June 2005) (unpublished LLM thesis, McGill University, Montreal), available at <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA436627&Location=U2&doc=GetTRDoc.pdf>.

<sup>8</sup> Telephone Interview with Rhea Seddon, M.D., United States Astronaut in Murfreesboro, Tenn. (Mar. 24, 2009)(on file with author) [hereinafter Seddon Interview].

<sup>9</sup> *Id.*

<sup>10</sup> See LUCY ROGERS, *IT'S ONLY ROCKET SCIENCE*, 2 (Springer Science and Business Media 2008).

<sup>11</sup> See Stanley B. Rosenfield, *Where Air Space Ends and Outer Space Begins*, 7 J. SPACE L. 137, 140 (1979); Reinhardt, *supra* note 7, at 51.

<sup>12</sup> See Rosenfield, *supra* note 11, at 140; Reinhardt, *supra* note 7, at 51.

formity and ease of determination that is necessary for a definition of "space" to be workable.<sup>13</sup>

As well as failing to offer the uniformity that a definition of "space" should provide,<sup>14</sup> a capability-based definition of "space" would also be unjust to smaller, weaker nations that lack the ability to exercise control at higher altitudes:

This is a harsh rule when applied to sovereignty in space. The richest and most powerful States now have means through high altitude rockets to control more or less effectively the "air-space" over their surface territories. But the weaker states have no such power. . . [T]he rule should be that every State, no matter how small or how weak, as a State of equal sovereignty with every other State, has and should be admitted to have territorial rights upward above its surface territories as high as the rights of every other State no matter how powerful.<sup>15</sup>

While Professor Cooper's considerations of fairness are correct, perhaps even more relevant to the discussion is that such a designation does not provide a workable definition of where space ends and begins. Not only would such a definition evolve with technology, but it would vary by nation,<sup>16</sup> extending as high as hundreds or even thousands of miles over nations such as China and the United States and as low as the range of shoulder fired missiles in the cases of other nations.

Allowing the lower reaches of "space" to be determined by the capabilities of the subjacent states would create the potential for international chaos. Sovereign limits would change with time and location and therefore would do little to resolve the ambiguity of current space sovereignty.<sup>17</sup> Not only would space-faring nations be required to keep abreast of advances in technology, but also, these nations would have to remain aware of

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<sup>13</sup> Vladimir Kopal, *The Question of Defining Outer Space*, 8 J. SPACE L. 154, 170 (1980); see generally Reinhardt, *supra* note 7.

<sup>14</sup> Kopal, *supra* note 13, at 170; see generally Reinhardt, *supra* note 7.

<sup>15</sup> Reinhardt, *supra* note 7, at 52, (quoting John Cobb Cooper, *High Altitude Flight and National Sovereignty*, 4 INT'L L. Q., at 263-245 (1951)).

<sup>16</sup> See Rosenfield, *supra* note 11, at 140.

<sup>17</sup> *Id.*

advances in the capabilities of the subjacent states.<sup>18</sup> Failure to remain so aware could result in the space-faring nation sustaining substantial property damage or loss of life (which would likely lead to strife between the nations). One major goal in defining “the vertical limit of State sovereignty” is to prevent border conflicts.<sup>19</sup> A determination of State sovereignty based on a State’s ability to exercise control would only increase the potential for border conflicts as it would encourage Nation-States to demonstrate and enhance the extent of their control. Due to the inherent lack of uniformity that such a system would create, and due to the fact that it would increase the potential for conflict, an ability-based designation is not an acceptable solution to the question of the extent of state sovereignty.

*B. Altitude-Based Designation: The von Kármán Line*

Other proposals have suggested establishing a uniform altitude at which State sovereignty terminates. Some proposals have offered seemingly arbitrary altitudes while other proposals have been based on some physically significant location. One altitude-based designation is known as the “von Kármán Line,” defined as “the point where aerodynamic lift yields to centrifugal force.”<sup>20</sup> This is an elevation of approximately 275,000 feet.<sup>21</sup> However, this “line” was established by the nongovernmental organization, Federation Aeronautique Internationale (FAI)<sup>22</sup> and therefore has no governmental significance. Highlighting this point is that the United States recognizes a person as an astronaut once a person has achieved the lower altitude of fifty miles or eighty kilometers.<sup>23</sup> However, like other designations in the “continuum of space”<sup>24</sup> the altitude designation of an astronaut’s qualifications is an “arbitrary number” which has no “real significance.”<sup>25</sup>

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<sup>18</sup> *Id.*

<sup>19</sup> Reinhardt, *supra* note 7, at 4, 14, 76.

<sup>20</sup> Rosenfield, *supra* note 11, at 139.

<sup>21</sup> *Id.*

<sup>22</sup> ROGERS, *supra* note 10, at 2.

<sup>23</sup> See Seddon Interview, *supra* note 8; ROGERS, *supra* note 10, at 2.

<sup>24</sup> See Seddon Interview, *supra* note 8.

<sup>25</sup> *Id.*

*C. Not "airspace" as Defined by International  
Civil Aviation Organization*

Another proposal has been to say that "outer space" is any space that is not "air space" as defined by the International Civil Aviation Organization (ICAO). ICAO states that "air space" is only that space in which an aircraft can operate. An "aircraft" is "any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface."<sup>26</sup> While this seems to be a workable definition, Professor Rosenfield notes that the definition is flawed because it will change with advances in technology.<sup>27</sup>

*D. Outside the Atmosphere*

Another "boundary" that has been proposed is the limits of the Earth's atmosphere. However, this is problematic because, depending on one's definition of "atmosphere," such a designation could range from thirty miles to thousands of miles.<sup>28</sup> As Dr. Seddon noted, designating "space" as being "outside the atmosphere"<sup>29</sup> creates a nebulous designation which "depends on how many air molecules you say is 'atmosphere' . . . it is all arbitrary."<sup>30</sup> Because of the widely varying interpretations of what constitutes the Earth's "atmosphere," to designate "space" as being the area beyond the Earth's atmosphere<sup>31</sup> does nothing to solve the current problem. Quite to the contrary, creating a definition which is vulnerable to such a wide variety of interpretations could exacerbate the problem. Therefore, to define space as being the area "beyond the atmosphere" is not an acceptable point at which to terminate State sovereignty.

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<sup>26</sup> ICAO, International Standards and Recommended Practices, Annex 13 to the Convention on International Civil Aviation, *Aircraft Accident and Incident Investigation* (9<sup>th</sup> ed. July 2001).

<sup>27</sup> The information in this paragraph is indebted to Rosenfield, *supra* note 11, at 139 (quoting Convention on International Civil Aviation, Chicago, Dec. 7, 1944, 15 U.N.T.S. 295, at Annex 7).

<sup>28</sup> Rosenfield, *supra* note 11, at 138.

<sup>29</sup> *Id.* at 138.

<sup>30</sup> Seddon Interview, *supra* note 8.

<sup>31</sup> See Rosenfield, *supra* note 11, at 138.

*E. Lowest Possible Orbit*

Professor Rosenfield notes that the lowest possible orbit of a satellite has been offered as a possible designation for the upper “limit of state sovereignty.”<sup>32</sup> In fact, the lowest possible orbit seems to have been an early proposal for defining space. General A.J. Goodpaster’s memorandum concerning the launch of *Sputnik* states that, “the Russians have in fact done us a good turn, unintentionally, in establishing the concept of freedom of international space – this seems to be generally accepted as orbital space, in which the missile is making an inoffensive passage.”<sup>33</sup> Interestingly, while the 1957 memorandum states that the “orbital space” was “generally accepted” to be “international airspace,” this seems to be less accepted today than it was on the first day of space exploration.

Defining “space” as the lowest possible orbit would – under present technology – establish space as beginning approximately seventy-five to ninety miles above sea level.<sup>34</sup> However, as Professor Cooper’s designation – with a fifteen mile variance – suggests, defining space as the lowest possible orbit, like many such definitions, is subject to change with advances in technology.<sup>35</sup> Nevertheless, this designation is advantageous in that it is a “natural criterion” on which to determine the lowest level of space.<sup>36</sup> In addition, as Professor Vladimir Kopal notes, this designation is workable because “[i]t reflects actual practice of States performing space flight and at the same time preserves legitimate interests of subjacent States.”<sup>37</sup> The United States has long maintained that orbiting satellites are in “outer space;”

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<sup>32</sup> *Id.* at 140 (citing U.N. Doc. A/ AC. 105 / C. 2/7 (May 7, 1970)).

<sup>33</sup> General A.J. Goodpaster, Memorandum of Conference with President Eisenhower Following Soviet Launch of *Sputnik* (Oct. 8, 1957), in ROGER BURNS, *ALMOST HISTORY CLOSE CALLS, PLAN B’S, AND TWISTS OF FATE IN AMERICA’S PAST, 193-94* (Fall River Press 2000) [hereinafter Goodpaster].

<sup>34</sup> Kopal, *supra* note 13, at 155 (quoting Cooper, *Background of International Public Air Law*, 6 YB. AIR & SPACE L. 26-27 (1965)).

<sup>35</sup> Rosenfield, *supra* note 11, at 140.

<sup>36</sup> Kopal, *supra* note 13, at 172.

<sup>37</sup> *Id.* at 173.

this position gained general acceptance by the mid-1960s.<sup>38</sup> While defining “space” as the lowest possible orbit has many advantages, it is problematic because the lowest possible orbit may vary with advances in technology and is difficult to determine.<sup>39</sup>

#### *F. Law of the Seas Model*

In his thoughtful thesis, Major Dean N. Reinhardt, United States Air Force, suggests that the law of the seas model should be applied to determine “the vertical limit on State sovereignty.”<sup>40</sup> Major Reinhardt states that the “vertical limit on State sovereignty” should be set at twelve nautical miles, which is twenty-two kilometers or 72,912 feet.<sup>41</sup> Major Reinhardt believes that such a “low limit” is advantageous because it will allow greater access to space.<sup>42</sup> Rejecting security concerns that may be raised against such a low limit on State sovereignty, Major Reinhardt asserts that the capabilities of modern day weapons nullify the benefits that a higher limit would afford.<sup>43</sup> Furthermore, Major Reinhardt believes that fostering greater access to space may actually have a positive impact on space security by giving more nations a vested interest in the security of space.<sup>44</sup>

#### *G. Earth Entry Interface*

One designated boundary that seems to have real significance and which seems to be tantamount to a real boundary in outer space is the “Earth Entry Interface.”<sup>45</sup> The “Earth Entry Interface” is the point at which a space craft returning to Earth

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<sup>38</sup> COLONEL DELBERT R. TERRILL, JR., *THE AIR FORCE ROLE IN DEVELOPING INTERNATIONAL OUTER SPACE LAW* 57 (Air University Press, Maxwell Air Force Base, Alabama 1999) (internal citation omitted).

<sup>39</sup> Rosenfield, *supra* note 11, at 140.

<sup>40</sup> Reinhardt, *supra* note 7, at 58, 65.

<sup>41</sup> *Id.*

<sup>42</sup> *Id.* at 39, 75.

<sup>43</sup> *Id.* at 68.

<sup>44</sup> SPACE SECURITY INDEX, SPACE SECURITY 2008, 80 (2008), available at <http://spacesecurity.org/SSI2008.pdf>.

<sup>45</sup> See Seddon Interview, *supra* note 8.

is considered to be reentering the Earth's atmosphere. The Earth Entry Interface is defined as 400,000 feet<sup>46</sup> (approximately seventy-six miles or 120 kilometers) because that is the point at which the space craft begins to experience "noticeable drag" of the Earth's atmosphere. This atmospheric resistance is manifested as heat produced on the spacecraft.<sup>47</sup>

Surprisingly, the Earth Entry Interface does not seem to have been formally proposed as a boundary between space and Earth (at least no person has used that term in defining his or her proposed boundary). Arguably, earlier proposals of defining space as the area outside of the atmosphere<sup>48</sup> is tantamount to defining space based on the Earth Entry Interface. However, the advantage of the Earth Entry Interface designation is that – unlike saying space is that area "outside the atmosphere,"<sup>49</sup> – the Earth Entry Interface has real significance. Like Kopal's proposal to set space as the lowest possible orbit of a satellite, the Earth Entry Interface is based on a "natural criterion" and should "remain constant for years to come notwithstanding the rapid progress in space technology."<sup>50</sup> Additionally, the Earth Entry Interface is tantamount to a real boundary in outer space. An even greater advantage is that the Earth Entry Interface is uniform across the globe and is easily discernable from the ground or by any spacecraft reentering the atmosphere,<sup>51</sup> and as the name implies, marks a change in the physics of the space-flight.

### III. CURRENT U.S. POLICY CONCERNING SPACE SOVEREIGNTY

While, as of this writing, President Obama has yet to articulate a firm space policy, given his stated opposition to space

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<sup>46</sup> Columbia Accident Investigation Board, *Report Synopsis*, SPACEFLIGHT NOW, <http://spaceflightnow.com/columbia/report/011synopsis.html> (last visited Jan. 18, 2010).

<sup>47</sup> Seddon Interview, *supra* note 8; ROGERS, *supra* note 10, at 2-3.

<sup>48</sup> See Rosenfield, *supra* note 11, at 138.

<sup>49</sup> See *id.*

<sup>50</sup> See Kopal, *supra* note 13, at 171.

<sup>51</sup> *Id.* at 170.

weapons,<sup>52</sup> it can be assumed that the President will adopt a “freedom of access” posture. A November 2009 joint U.S.-China Joint Statement between President Obama and President Hu Jintao of the People’s Republic of China suggests President Obama’s space policy will be one of freedom of access, openness, and cooperation (at least as to China):

The United States and China look forward to expanding discussions on space science cooperation and starting a dialogue on human space flight and space exploration, based on the principles of transparency, reciprocity and mutual benefit. . . . The two sides believed (sic) that the two countries have common interests in promoting the peaceful use of outer space and agree to take steps to enhance security in outer space.<sup>53</sup>

Thus, if the U.S.-China Joint Statement is any indication, the Obama space policy will see greater access to space for a greater number of nations and more international cooperation than in past years.

The George W. Bush Administration also had a freedom of access posture, at least in theory. In his statement to the House Committee on Oversight and Government Reform, Subcommittee on National Security and Foreign Affairs, Major General James Armor, the former Director of the National Security Space Office of the Department of Defense articulated the American policy on space.<sup>54</sup>

Major General Armor explained that the United States takes the position that all States have a right of equal access to outer space for peaceful purposes and that no State can claim its territory extends into space:

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<sup>52</sup> Glenn Reynolds, *Can Obama Ban Space Weapons Successfully?*, POPULAR MECHANICS (Oct. 1, 2009), <http://www.popularmechanics.com/technology/military/4303139>.

<sup>53</sup> Press Release, The White House, Office of the Press Secretary, U.S.- China Joint Statement (Nov. 17, 2009), <http://www.whitehouse.gov/the-press-office/us-china-joint-statement>.

<sup>54</sup> *Weaponizing Space: Is Current U.S. Space Policy Protecting Our National Security? Hearing before the Subcomm. on Nat'l Sec. & Foreign Affairs of the H. Comm. on Oversight & Gov't Reform*, 110th Cong. 32-33 (2007) (statement of Major General James Armor, Jr., Director, National Security Space Office of the Department of Defense [hereinafter Armor Testimony]).

The new Space policy, consistent with previous national Space policies, reaffirms longstanding policy principles, namely: the U.S. commitment to the use of outer Space by all nations for peaceful purposes; international cooperation; and continued adherence to existing international agreements regarding the use of outer Space. These principles also reaffirm that the United States rejects claims of sovereignty by any nation over outer Space and any limitations on the *fundamental right of the United States* to use or acquire data from Space, and the United States *retains the right of free passage* through and operations in Space without interference.<sup>55</sup>

General Armor makes clear that the United States does not recognize any claims of sovereignty in outer space and insists that the United States has a “inherent right” to use space.<sup>56</sup> Furthermore, his statement that the United States “retains the freedom of passage through and in space without interference” implies that the United States has always enjoyed such a right; a statement consistent with the policy of the Outer Space Treaty<sup>57</sup> that outer space is “the province of all mankind” and that all states shall enjoy an equal right of access to and use of space.<sup>58</sup>

America’s policy of space for all does not mean that all actions in space will go unchecked by the United States. General Armor stated that the United States is prepared to counter other space actors who interfere with space capabilities:

Consistent with these principles, the United States views purposeful interference with its space systems as an infringement on its rights and will take actions necessary to preserve its rights, capabilities, and freedom of action in space including denying, if necessary, adversaries the use of space capabilities hostile to U.S. national interests . . .

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<sup>55</sup> *Id.*

<sup>56</sup> *Id.*

<sup>57</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty]

<sup>58</sup> See Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, art. 11, *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 21 [hereinafter Moon Agreement].

The Secretary of Defense is charged with developing capabilities, plans, and options to ensure freedom of action in space, and if directed, to deny such freedom of action to adversaries.<sup>59</sup>

General Armor's statement demonstrates that the United States is sensitive to the vulnerability of its space assets. Furthermore, the General clearly states that the United States is prepared to prevent other parties from enjoying space capabilities that the United States perceives as "hostile."<sup>60</sup>

Significantly, though General Armor's statement concerns American space capabilities, and America's preparations to deny its enemies access to space, General Armor makes no attempt to define "space." He simply explains that the United States "rejects claims of sovereignty by any nation over outer space" but does not define "outer space."<sup>61</sup> This highlights Major Reinhart's concerns that the lack of a definition of outer space creates the potential for conflict.<sup>62</sup> A nation defining the limits of its sovereignty while attempting to avoid conflict with the United States is left simply to guess what the United States (or other nations) consider to constitute outer space. In order to avoid the potential for conflict, the international community must reach a concrete consensus on the meaning of outer space.<sup>63</sup>

#### IV. DESIRABILITY OF ESTABLISHING A DEMARCATION BETWEEN EARTH AND SPACE

Before setting out to establish a line defining the upper limits of Earth and of a State's control over its territory, policymakers must first determine whether establishing such a designation is advantageous or desirable. In the early days of spacefaring, even before humans had first ventured into space, governments showed reluctance – or even hostility – toward the idea of establishing a line between Earth and space. American officials

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<sup>59</sup> Armor Testimony, *supra* note 54, at 33.

<sup>60</sup> *Id.* at 38.

<sup>61</sup> *Id.* at 33.

<sup>62</sup> Reinhardt, *supra* note 7, at 4.

<sup>63</sup> *Id.*

were particularly opposed to establishing such a limit. Policy-makers did not want to fix an altitude above which a nation had no right to control objects “over” that nation’s territory.<sup>64</sup>

United States Air Force officials voiced several justifications for their reluctance to allow such a limit to be established. The first such reason was that space technology was simply too young to be constrained by such agreements. In a 1958 Memorandum, Assistant Secretary of Defense for Internal Security Affairs, Mansfield D. Sprague, articulated the concern that America did not have enough information about the applicability of space technology to place restraints on it: “there is a real danger that we may harm ourselves by too early commitments, before the full implications of space potentials are known. Our policy and national interest should be permitted to develop first: the law, and commitments should follow, and be consonant with the former.”<sup>65</sup> For Secretary Sprague, the United States should not close the door to space technologies before the door was even discovered.

The Department of Defense also discouraged the Department of State from adopting or agreeing to a “rigid definition of outer space” before the performance of a “detailed evaluation by *all* agencies concerned of possible consequences of such a definition to the US and its allies.”<sup>66</sup> Highlighting the implications that such a definition may have on the development of unforeseen technologies, the statement concluded: “The proposed definition would establish a space floor which might at some future date be lower than the capabilities of very high flying aircraft.”<sup>67</sup> The Department of Defense feared that establishing a boundary

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<sup>64</sup> TERRILL, *supra* note 38, at 37-39, 54-59.

<sup>65</sup> *Id.* at 37 (*quoting* Outline, *Some Elements Requiring Consideration in Formulating a National Policy on Outer Space*, at 6, attachment to Mansfield D. Sprague, assistant secretary of defense, to assistant secretary of the Air Force et al., memorandum, subject: Proposal for a National Policy on Outer Space Feb. 25, 1958).

<sup>66</sup> *Id.* at 56 (*quoting* DOD Planning Luncheon, paper, United States Initiative at the 16th General Assembly, at 3 (Sept. 12 1961)) (emphasis added).

<sup>67</sup> *Id.* at 56 (*quoting* DOD Planning Luncheon, paper, United States Initiative at the 16th General Assembly, at 3 (Sept. 12, 1961)).

could have unforeseen consequences that would be revealed only with the advent of future technologies.<sup>68</sup>

In a 1962 memorandum to the Secretary of Defense, the Joint Chiefs of Staff opposed the establishment of a definition of outer space because they felt such a definition would be “premature” and would place unnecessary restraints on military uses of outer space.<sup>69</sup> Such concerns were not without historical foundation. American policymakers had likely learned from the mistakes of the Soviets who had to reverse their policies concerning sovereignty in outer space after the launch of *Sputnik*.<sup>70</sup>

The Assistant Judge Advocate General of the Air Force, Major General Moody R. Tidwell also believed that “it was unwise to attempt to define a line of demarcation where a nation’s sovereignty ended.”<sup>71</sup> General Tidwell believed that a discussion centered around the altitude of an object or activity was misplaced. For General Tidwell, the concern should be the *activities* carried out over a subjacent state, not the altitude at which the activities are executed.<sup>72</sup> General Tidwell wisely stated that the “agreement to any fixed distance” is meaningless “as long as an equal danger may exist from above such point.”<sup>73</sup>

General Tidwell’s focus on the function of the spacecraft rather than the craft’s location begs the question whether a “vertical limit” of sovereignty is even necessary.<sup>74</sup> However, given the secretive nature of many satellites and other space objects, it seems unlikely that satellite-operating nations would

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<sup>68</sup> *Id.* at 56 (quoting DOD Planning Luncheon, paper, United States Initiative at the 16th General Assembly, at 3 (Sept. 12, 1961)).

<sup>69</sup> *Id.* at 57 (citing Will H. Carroll, The Role of the Air Force JAG in the Early Development of the Law of Outer Space, at 7 (unpublished, n.d.)).

<sup>70</sup> See Reinhardt, *supra* note 7, at 19 (citing MYRES S. MCDUGAL ET AL., LAW AND PUBLIC ORDER IN SPACE 235 (1963)) Ironically, many believe that the fact that the U.S.S.R. launched a satellite into outer space before the United States actually aided the American Space program in that it “establish[ed] the concept of freedom of international airspace.” Goodpaster, *supra* note 33, at 193-95.

<sup>71</sup> TERRILL, *supra* note 38, at 54.

<sup>72</sup> *Id.*

<sup>73</sup> *Id.* at 54 (quoting Major General Moody R. Tidwell).

<sup>74</sup> See also Rosenfield, *supra* note 11, at 148 (“[a] definition of the geographic point where sovereign air space ends and free outer space begins may never need to develop”).

be willing to disclose information about satellites and other space objects.

Even if States were willing to share information concerning the nature and missions of their spacecraft, verification of that information by other nations would be extremely difficult. Therefore, it is unlikely that a workable agreement based on the mission and function of the concerned spacecraft could ever be reached. In his history, Colonel Delbert R. Terrill notes that a 1967 letter between U.S. Military officials “concluded that making a distinction between civil and military satellite observations opened a Pandora’s box.”<sup>75</sup> Given that the United States has wisely declined to disclose significant information about its satellites, the United States cannot expect other nations to disclose such information. Therefore, it seems unlikely that a standard of State sovereignty based on the activities conducted over a State will be achieved.

Dr. Seddon suggested that there has been an intentional decision not to define “outer space.”<sup>76</sup> The astronaut stated that the United States has “not been pushing for anyone to define [space] so there must be some reason; it either has no applicability or people do not want it defined for some reason.”<sup>77</sup> Colonel Terrill’s history provides evidence that the latter of Dr. Seddon’s options is the answer.<sup>78</sup> It seems that, at least historically, U.S. Military officials have feared that defining “space” too early or too concretely could limit American options in this new frontier.<sup>79</sup>

The United States is not the only nation to express reservations about establishing a space boundary. In 1959, The Outer Space Committee of the British House of Lords discussed “what view they [should] take as to the jurisdiction of sovereign powers over outer space and whether this matter has been the sub-

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<sup>75</sup> TERRILL, *supra* note 38, at 58.

<sup>76</sup> Seddon Interview, *supra* note 8.

<sup>77</sup> *Id.*

<sup>78</sup> *Id.* at 35-39, 54-59.

<sup>79</sup> *Id.*

ject of international discussion.”<sup>80</sup> The Lord President of the Council (Lord Hailsham) explained that while there is most definitely a point at which British sovereignty terminates, not enough was known about space to establish that limit:

My Lords, Her Majesty's Government consider that sovereignty over space above national territory cannot extend indefinitely upwards. . . however . . . International Law has [not] yet determined the exact limit to be placed on the extension of sovereignty upwards or what legal régime should apply in realms of outer space to which sovereignty does not extend. There are still too many unsolved problems in this field to justify the adoption at present of any sweeping legal propositions, in whatever direction they tend.<sup>81</sup>

England, as well as the United States, maintained that nations should not establish the “vertical limit of state sovereignty”<sup>82</sup> while space exploration was still in its infancy. Lord Hailsham’s statement “there are still too many unsolved problems” to establish such a limit<sup>83</sup> suggests that Britain, like the United States, feared that to establish such a limit so early in the history of space exploration risked foreclosing opportunities before those opportunities were recognized.

While there has been a traditional reluctance to define space, the time has come to resolve this ambiguity. As Major Reinhardt notes, failing to define such a boundary creates the potential for conflict.<sup>84</sup> With an ever-increasing number of States – and now even some private actors<sup>85</sup> – joining the space community, the potential for conflict will only increase.<sup>86</sup> While we should certainly allow for flexibility so that the rules can

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<sup>80</sup> OUTER SPACE COMMITTEE OF THE BRITISH HOUSE OF LORDS, 216 PARL. DEB., H.L. (June 11, 1959) § 975-7, at 53 available at <http://hansard.millbanksystems.com/lords/1959/jun/11/outer-space> [hereinafter OUTER SPACE COMMITTEE].

<sup>81</sup> *Id.*

<sup>82</sup> See Reinhardt, *supra* note 7.

<sup>83</sup> OUTER SPACE COMMITTEE, *supra* note 80.

<sup>84</sup> Reinhardt, *supra* note 7, at 4, 14, 76.

<sup>85</sup> See generally MICHAEL BELFIORE. ROCKETEERS: HOW A VISIONARY BAND OF BUSINESS LEADERS, ENGINEERS AND PILOTS IS BOLDLY PRIVATIZING SPACE (Harper Collins 2007); Reinhardt, *supra* note 7, at 25.

<sup>86</sup> See Reinhardt, *supra* note 7, at 4, 14, 76.

adapt with evolving technology, we now have enough information, and know enough about space capabilities and potential, that such an agreement is no longer “premature.”<sup>87</sup> The international community must reach a consensus as to the maximum extent of a State’s control over its airspace.

#### V. IMPLICATIONS OF THE CHINESE ANTI-SATELLITE TEST

The Chinese ASAT test of 11 January 2007 shed new light on the old problem of the lack of rules for space. With China on the cusp of superpower status, “the test appears to mark a new sphere of technical and military competition.”<sup>88</sup> The test (that was almost certainly intended as a warning to the United States<sup>89</sup>) is particularly concerning because the weather satellite hit by the weapon orbited further from Earth than American spy satellites do.<sup>90</sup> China has long openly expressed an interest in the ability to attack American space capabilities; as early as 2000, *Chinese State News* reported that the Chinese military was creating new methods to counter American space assets.<sup>91</sup> With its ASAT test, China has presumably demonstrated the capability to destroy American spy satellites.<sup>92</sup> Because some Chinese assert that their country’s sovereignty extends into outer space, this capability is particularly concerning.<sup>93</sup>

Commenting on China’s claim of sovereignty over space, Air Force General Ted Kresge maintained that Chinese claims of sovereignty were “illegitimate” because of international trea-

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<sup>87</sup> TERRILL, *supra* note 38, at 56.

<sup>88</sup> Broad and Sanger, *supra* note 5.

<sup>89</sup> See Zissis, *supra* note 3, at 1-2.

<sup>90</sup> Broad and Sanger, *supra* note 5.

<sup>91</sup> REPORT OF THE COMMISSION TO ASSESS UNITED STATES NATIONAL SECURITY SPACE MANAGEMENT AND ORGANIZATION 22-23 (Jan. 11, 2001), available at <http://www.fas.org/spp/military/commission/report.htm> [hereinafter REPORT OF THE COMMISSION].

<sup>92</sup> Broad and Sanger, *supra* note 5.

<sup>93</sup> Bill Gertz, *U.S. Satellites dodge Chinese missile debris*, THE WASHINGTON TIMES, Jan. 11, 2008, available at <http://www.washingtontimes.com/news/2008/jan/11/us-satellites-dodge-chinese-missile-debris/>; *Disharmony in the Spheres – The Militarization of Space, The Vulnerability of Military Satellites*, THE ECONOMIST, Jan 19, 2008, available at [http://www.economist.com/displaystory.cfm?story\\_id=10533205](http://www.economist.com/displaystory.cfm?story_id=10533205) [hereinafter *Disharmony in the Spheres*].

ties.<sup>94</sup> General Kresge continued that if China intends to “enforce” those claims “we run into a space protection problem, and that is why we are so aggressively working the issue.”<sup>95</sup> The Chinese ASAT test makes America’s “aggressive” work on this issue all the more urgent.

The urgency of the Chinese ASAT test issue is due largely to the fact that space-based technology is a critical component of American military and economic supremacy.<sup>96</sup> While these capabilities allow the United States to achieve its unprecedented power, America’s extensive reliance on space-based technology creates an “Achilles heel,” which is vulnerable to any party able to launch an object into space.<sup>97</sup> General Armor warned that, “space is a critical enabler for U.S. forces . . . , and potential adversaries *have and will* continue to seek capabilities to counter this advantage.”<sup>98</sup>

Particularly concerning to United States military officials is that they do not know how to interpret the Chinese ASAT Test. The Chairman of the Joint Chiefs of Staff, Marine General Peter Pace explained that the ASAT test concerned “the international community” primarily because, “it was [not] clear what their intent was . . . when things are not clear, and there are surprises, then it tends to confuse people and raise suspicions.”<sup>99</sup> General Pace continued that while it is not necessary for nations to “agree or disagree with any particular country’s objective . . . it [is] very helpful to understand what those objectives are and why they [are] going in that direction.”<sup>100</sup> General Pace suggested the establishment of “officer exchanges” between the two nations.<sup>101</sup> Highlighting the necessity for open communication and understanding between the two powers, General Pace

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<sup>94</sup> Gertz, *supra* note 93.

<sup>95</sup> *Id.* and accompanying text (quoting General Ted Kresge).

<sup>96</sup> Armor Testimony, *supra* note 54, at 32-33; See generally, *Disharmony in the Spheres*, *supra* note 93

<sup>97</sup> *Disharmony in the Spheres*, *supra* note 93.

<sup>98</sup> Armor Prepared Statement, *supra* note 54, at 39.

<sup>99</sup> Ben Blanchard, *U.S. general says China missile test “Confusing”*, REUTERS, Mar. 23, 2007, available at <http://www.reuters.com/article/idUSPEK17108920070323> (quoting General Peter Pace).

<sup>100</sup> *Id.*

<sup>101</sup> *Id.*

stated, “[t]he biggest fear I have of the future is miscalculation, misunderstanding based on misinformation.”<sup>102</sup> While the capability demonstrated by the ASAT test is sobering, the ambiguous motivation for the test is terrifying.

General Pace is not the only American official concerned about “miscalculation.” General Armor explained that China is building a variety of anti-space capabilities. The General continued that, “[t]he lack of transparency into China’s . . . overall intentions is most troubling as it could lead to miscalculation of intent and crisis instability.”<sup>103</sup> General Armor’s statement shows the need for a determination of space. Because China has a demonstrated ability to control outer space, the United States must reach an agreement as to how much of outer space China intends to control – or will be permitted to control – under established principles of international law so that the United States can conduct our space activities accordingly. If China and the United States are not clear as to each other’s sovereign claims, this could lead to “miscalculation” and conflict.<sup>104</sup>

One particularly concerning aspect of Chinese space policy is that China does not appear to have a unified space policy. While the Chinese government claims that its sovereignty extends to *all* space above Chinese territory<sup>105</sup> a white paper issued by the China National Space Administration in 2006 insists that “China is unflinching in taking the road of peaceful development, and always maintains that outer space is the common wealth of mankind.”<sup>106</sup> The same white paper states that “[a]dhering to the policy of opening up to the outside world, and actively engaging in international space exchanges and cooperation. [sic] China supports all activities that utilize outer space for peaceful purposes.”<sup>107</sup> While this statement suggests

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<sup>102</sup> *Id.* (quoting General Peter Pace).

<sup>103</sup> Armor Testimony, *supra* note 54, at 41.

<sup>104</sup> *See id.*; Reinhardt, *supra* note 7, at 4, 14, 76.

<sup>105</sup> Gertz, *supra* note 93 (emphasis added).

<sup>106</sup> Information Office of the State Council of the People’s Republic of China, China National Space Administration, *China’s Space Activities in 2006*, 1, available at <http://www.fas.org/spp/guide/china/wp2006.pdf>.

<sup>107</sup> *Id.* at 3.

that China supports an “freedom of access” policy, it conflicts with China’s stated claims of infinite “vertical sovereignty.”<sup>108</sup>

In addition to the contradictions between China’s statements and actions, there is concern that the various branches of the Chinese government may not be communicating adequately. The delay between China’s ASAT test and the government’s confirmation of that test caused some to theorize that China’s civilian government and military leaders had not been in adequate communication with each other.<sup>109</sup> Such fears, if true, are particularly alarming. If transparency of action is important between powers, it is essential within a power.<sup>110</sup>

As General Pace’s statements suggest, the United States believes that transparency is vital, particularly in the realm of space. In a media roundtable discussion, Secretary of Defense Robert Gates explained that the United States ASAT test was a “very different activit[y]” from the Chinese ASAT test.<sup>111</sup> Secretary Gates explained that the primary differences were that the United States was “open and transparent” about its test, conducted its test at a lower orbit so as to mitigate the creation of debris, and that the United States conducted the test in order to protect human beings from harm by the malfunctioning satellite:

First of all, we were very open and transparent from the very beginning about the problem that we saw and that we were going to try and modify the software in some of our missile defense capability in order to be able to deal with this threat. Our view was however remote the possibility that this hydrazine tank<sup>112</sup> might harm people here on Earth that the only responsible thing was to try and deal with the problem. We were very open about it. We hit this dead satellite in a very low orbit so that the debris was very limited and would decay and burn up in the atmosphere within a matter of hours to days or weeks.

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<sup>108</sup> See Gertz, *supra* note 93.

<sup>109</sup> Zissis, *supra* note 3, at 1.

<sup>110</sup> See Blanchard, *supra* note 99.

<sup>111</sup> Defense Link News Transcript, Media Roundtable with Sec’y of Def. (Feb. 27, 2008), available at <http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4161> (quoting Sec’y of Def. Robert Gates).

<sup>112</sup> A toxic fuel used to power the satellite.

The Chinese anti-satellite test was conducted in secret, never explained to anyone, was carried out at an altitude several hundred miles higher than ours and led to a significant debris field that will be in orbit for decades. So I think that there is a significant difference between what we did and the way we approached it and the Chinese anti-satellite test last year.<sup>113</sup>

For Secretary Gates, the American and Chinese ASAT tests are completely different due to the manner in, and the circumstances under, which they were carried out.<sup>114</sup> Like General Pace, Secretary Gates stressed the openness with which the United States conducted its test as the key difference between the American and Chinese ASAT tests.<sup>115</sup> Furthermore, the high altitude of the Chinese test creates a long-lasting debris field: an act not consistent with responsible space citizenship.<sup>116</sup>

As Secretary Gates' statement implies, an ASAT test does not have to directly target or strike an American satellite to effect American space-based interests.<sup>117</sup> The Chinese ASAT tests created a "debris field" in the orbit of some 800 satellites (between 300 and 400 of which are American) satellites.<sup>118</sup> The American satellites alone are valued at approximately \$100 billion.<sup>119</sup> The debris is no passing threat; the single Chinese ASAT test added twenty percent more space debris which will remain in orbit for as much as 100 years.<sup>120</sup>

The debris problem demonstrates that an ASAT test does not have to directly impact a nation's satellite to have an impact on the nation. As of 11 January 2008, two U.S. satellites had to alter their orbits to prevent becoming cosmic "road kill."<sup>121</sup>

The debris created by the Chinese ASAT test, and the impact it is having on other nations' space activities demonstrate the need for a clear consensus of sovereignty in space. If China,

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<sup>113</sup> Defense Link News Transcript, *supra* note 111.

<sup>114</sup> *Id.*

<sup>115</sup> *Id.*

<sup>116</sup> *Id.*

<sup>117</sup> *Id.*

<sup>118</sup> Zissis, *supra* note 3, at 3; Gertz, *supra* note 93.

<sup>119</sup> Zissis, *supra* note 3, at 3.

<sup>120</sup> Gertz, *supra* note 93.

<sup>121</sup> Zissis, *supra* note 3, at 3 (quoting Michael Krepon and Michael Katz-Hyman of the Henry L. Stimson Center). Gertz, *supra* note 93.

or other nations, continue to operate in space with such reckless disregard for the welfare of other States – aided no doubt by the Chinese belief that they are sovereign over their territory<sup>122</sup> – then their actions will continue to have a negative impact on the space operations of other States. The international community must reach a clear resolution concerning sovereignty in space to prevent similar acts in the future.

## VI. SPACE TERRORISM

America's reliance on space has caused the United States to "identify space capabilities as a top national priority and vital to U.S. National interests."<sup>123</sup> The *Report of the Commission to Assess United States National Security Space Management and Organization* called attention to the gravity of the threat. The Report warned that the United States is "an attractive candidate for a 'Space Pearl Harbor'"<sup>124</sup> and could fall victim to such an attack if it fails to "take seriously the possibility of such an attack on US Space Systems."<sup>125</sup> As the chaos caused by the Chinese ASAT test shows, a party does not have to be able to accurately target the satellite in order to destroy it. Due the "predictable orbit" of satellites, one only has to release "a cloud of 'dumb' pellets in [a satellite's] path – using a shotgun rather than a hunter's rifle to kill the orbiting 'bird.'"<sup>126</sup> Therefore, while China has demonstrated its ability to destroy a particular, targeted satellite, any party with the ability to place an object into orbit poses a potential threat to satellites and therefore to the United States.

Ten nations and two commercial entities have demonstrated capabilities to place satellites into orbit.<sup>127</sup> It is widely known that any object in space can become a space weapon.<sup>128</sup> Thus, any entity – including non-State actors – which have the

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<sup>122</sup> See Gertz, *supra* note 93.

<sup>123</sup> Armor testimony, *supra* note 54, at 57.

<sup>124</sup> REPORT OF THE COMMISSION, *supra* note 91, at 22.

<sup>125</sup> *Id.* at viii-ix.

<sup>126</sup> *Disharmony in the Spheres*, *supra* note 93.

<sup>127</sup> *Id.*

<sup>128</sup> *Id.*

capability to “reach space” have the potential to challenge this key component of American military supremacy.<sup>129</sup>

Using history as a guide, it is clear that technology becomes rapidly cheaper and more widely available with the progression of time. With the 1957 launch of *Sputnik*, it would have been inconceivable that a non-State actor would be able to achieve orbit. Now, at least two commercial entities have demonstrated this capacity.<sup>130</sup> In addition, for a cost of \$25 million, the privately developed and owned *SpaceShipOne* successfully put the equivalent weight of three people into suborbital “space” (for the purposes of the *X-Prize*) when it reached an altitude of 367,463 feet (69.6 miles or 112 km).<sup>131</sup> Space is no longer the domain of superpowers; it is not even reserved for State actors. Even private entities have joined the “elite club” of spacefarers.

While *SpaceShipOne* did not achieve an altitude sufficient to pose a direct threat to any orbiting satellite, the accomplishment should raise eyebrows. If a \$25 million, privately-funded program, nearly five years ago, demonstrated the capability to propel the equivalent of three human beings to such a height, what capabilities might such private actors have today? Which capabilities might they achieve in the future?

As previously stated, at least two commercial entities have achieved orbit, which gives them the capability to compromise American space assets.<sup>132</sup> Control of these corporate entities could become a matter of national – if not *international* – security. Al-Qaeda and other terrorist organizations are devoted to destroying the United States. Through their actions, these terrorist organizations have proven that they will stop at nothing to inflict damage upon the United States. With non-State actors achieving space capabilities, the age of “space terrorism”<sup>133</sup> may be a future risk.

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<sup>129</sup> *Id.*

<sup>130</sup> *Id.*

<sup>131</sup> Reinhardt, *supra* note 7, at 25.

<sup>132</sup> *Disharmony in the Spheres*, *supra* note 93.

<sup>133</sup> Gerry Oberst, *Protecting Satellites from “Space Terrorism”*, SATELLITE TODAY, Mar. 1, 2009, <http://www.satellitetoday.com/via/globalreg/29927.html>

The threat posed by the prospect of “space terrorism”<sup>134</sup> should not be overlooked. This author’s research did not reveal any government sources predicting such a threat; the prospect appears to be largely ignored. Aside from a report by the European Space Policy Institute stating that the prospect is not getting enough attention, the possibility appears to be largely ignored.<sup>135</sup>

The effects of “space terrorism”<sup>136</sup> would hold the potential to be more spectacular than any act of terrorism the world has ever seen.<sup>137</sup> Due to modern society’s heavy reliance on satellite technology, interference with satellite “constellations” could disrupt military operations (particularly those of the United States) and “essential daily functions – from financial transactions to telephone communication to power grids . . .”<sup>138</sup> Commenting on the Chinese ASAT test, Professor William C. Martel explained that the destruction of American satellites could cause the United States to “be propelled back into the nineteenth century.”<sup>139</sup> Professor Martel’s statement should not be dismissed as alarmist. Even a single satellite attack could have wide sweeping implications. In 1998 one American satellite malfunctioned causing many television video feeds to be lost and eighty percent of pagers in the United States to lose service.<sup>140</sup> Technicians took several weeks to completely restore service.<sup>141</sup>

With more and more States becoming increasingly reliant on space and space assets for their economic and defense operations, States will view space as essential to their national security.<sup>142</sup> This increasing reliance on space will create a greater incentive to protect one’s own space assets. Furthermore, the

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<sup>134</sup> *Id.*

<sup>135</sup> Oberst, *supra* note 133.

<sup>136</sup> *Id.*

<sup>137</sup> *Id.*

<sup>138</sup> Zissis, *supra* note 3, at 2.

<sup>139</sup> *Id.* (quoting William C. Martel, “a professor of international security studies at the Fletcher School of Law and Diplomacy and a former member of the U.S. Air Force Scientific Advisory Board”).

<sup>140</sup> REPORT OF THE COMMISSION, *supra* note 91, at 22.

<sup>141</sup> *Id.*

<sup>142</sup> SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136.

increasing importance of space assets will increase the incentive to develop the ability to neutralize the space assets of one's adversaries. In addition, those non-State actors (e.g. terrorists) will view space assets as an increasingly attractive target due to the impact such an action would have on the targeted State or States. Conflicts concerning sovereignty in space will only fuel the flames of disputes concerning the security of space assets. In order to prevent such conflicts, the global community must agree upon an elevation at which the sovereignty of nations terminates.

## VII. CONCLUSION

Surprisingly, humankind has been exploring space for over half of a century without yet defining where "space" begins and where the Earth's airspace, and therefore a nation's sovereignty "ends." Even more surprising is that this lack of a definition of the extent of national sovereignty has not sparked any significant international conflict. However, this good fortune cannot reasonably be expected to continue. The world's increasing reliance on space will create a greater incentive to protect one's own space assets. In addition, the increasing importance of space assets will also create a greater incentive for nations and non-State actors to develop the potential to neutralize the space assets of other nations.<sup>143</sup> As the international uproar caused by the Chinese ASAT test demonstrates, the desire to protect one's own space assets while developing the ability to neutralize others' space assets creates the potential for conflict. This potential for conflict will only be exacerbated if there is not an agreement as to the "vertical extent" of the sovereignty of the subjacent nations.<sup>144</sup> As space assets become increasingly integrated into national economic systems and military defenses, space will become an increasingly attractive battleground.<sup>145</sup> The potential

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<sup>143</sup> *Id.*

<sup>144</sup> See Reinhardt, *supra* note 7, at 4, 14, 76.

<sup>145</sup> SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136.

for a conflict in space will only be increased if there is no clear definition of the extent of a State's sovereignty.<sup>146</sup>

While it is essential that the global community come to a consensus on the "vertical limit of State sovereignty,"<sup>147</sup> reaching such a consensus will be a difficult task. Because space is a continuum, there is no clear physical boundary which could be established as the end of the Earth's airspace.<sup>148</sup> However, as stated above, there are a number of different elevations and designations in the "continuum" of the atmosphere<sup>149</sup> which have been suggested as the boundary between Earth's airspace and space and therefore the upper extent of State sovereignty.

The most logical boundary to establish as the "vertical limit of State sovereignty"<sup>150</sup> is 400,000 feet, a number based on astronaut Rhea Seddon's proposal: the Earth Entry Interface. This limit should be defined and established as the static elevation of 400,000 feet above sea level. To define the limit simply as the Earth Entry Interface would be unwise, as a limit so defined would be open to interpretation and could change with advances in technology or changes in the climate. Basing a limit on the Earth Entry Interface is the most attractive designation to establish as the upper extent of State sovereignty. The Earth Entry Interface is tantamount to a physical boundary and is presently detectable in space.<sup>151</sup> Furthermore, ground-based systems can easily verify the altitude of an object to determine whether the sovereignty of a State has been violated. It has many of the characteristics of a boundary because it has a physical impact on objects that encounter it (the drag of the atmosphere and the heat produced on the space craft).<sup>152</sup> As the name implies, the Earth Entry Interface is a point at which it is logical to say an object has "entered" the Earth's atmosphere. As nations are considered to be Earthly entities, it is only logical that they should extend to the outer limit of the Earth's atmos-

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<sup>146</sup> Reinhardt, *supra* note 7, at 4, 14, 76.

<sup>147</sup> See generally *id.*

<sup>148</sup> See Seddon Interview, *supra* note 8.

<sup>149</sup> See *id.*

<sup>150</sup> See Reinhardt, *supra* note 7.

<sup>151</sup> See Seddon Interview, *supra* note 8.

<sup>152</sup> *Id.*; ROGERS, *supra* note 10, at 2-3.

phere. While this paper proposes establishing the altitude of 400,000 feet as the extent of State sovereignty, the fact that this altitude is based upon the Earth Entry Interface should allow the established altitude of 400,000 feet to enjoy the same benefits of logic afforded to the Earth Entry Interface.

The inherently logical nature of the Earth Entry Interface should make it more likely to be accepted by other nations. Because the Earth Entry Interface is a number based on real significance, rather than an arbitrary number selected with no independent importance, it should be easier to convince other nations to agree to it. Furthermore, it is a high enough elevation that it will not have to be adjusted to allow for underlying geographical features.<sup>153</sup>

In addition to being logical, the Earth Entry Interface is also practical. The fact that it is far higher than any conventional aircraft can fly<sup>154</sup> should help to assuage many security concerns from over flight. However, the standard would infringe minimally, if at all, on the lowest possible orbit.<sup>155</sup> Therefore, it is a level high enough to prevent over flight by conventional aircraft while low enough that it would not significantly interfere with space activities. The Earth Entry Interface is high enough, without being too high.

The need for a clear definition of the upper limit of State sovereignty will only become more urgent. With space assets becoming increasingly important, space is becoming an increasingly attractive battlefield.<sup>156</sup> This battlefield will attract not only State actors, but also terrorists.<sup>157</sup> Nations can be expected to execute at least those actions which they feel are necessary to protect their national interests. Each State will likely do everything in its power to prevent threats to its interests from persisting in what the State considers to be its sovereign domain. A failure to establish an international standard defining the

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<sup>153</sup> See Reinhardt, *supra* note 7, at 65.

<sup>154</sup> Rosenfield, *supra* note 11, at 139.

<sup>155</sup> Kopal, *supra* note 13, at 155 (quoting Cooper, *Background of International Public Air Law*, 6 YB. AIR & SPACE L. 26-27 (1965)).

<sup>156</sup> SPACE SECURITY INDEX, *supra* note 44, at 63, 67, 136; REPORT OF THE COMMISSION, *supra* note 91, at 22; Oberst, *supra* note 133.

<sup>157</sup> Oberst, *supra* note 133.