The 45%: How Vague, Ambiguous, and Contradictory Language within the International Traffic in Arms Regulation Is Hindering the Development of Space Technology and International Cooperation in the United States

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As of 2010, approximately 44% of graduate students enrolled in American STEM programs were foreign nationals. By 2020 this number is expected to reach 50% or higher, meaning that at least half of the best and brightest minds in American STEM programs will be temporary residents from another country. While it is exciting that thousands of the world's most gifted individuals are crossing oceans and continents to further their development in the States, many of these students are unable to reach their full innovative potential – at a great loss to the United States and the world – due to overly burdensome regulations under the Arms Export Control Act (ITAR). The act barres access by foreign students to vital materials and technical data necessary for the development of new technology in areas – such as satellite remote sensing – where much of the developing world is still struggling to catch up and the United States is quickly falling behind. Although the ITAR appears to allow for the dissemination ("export") of public "fundamental research," the state of U.S. technological primacy will continue to deteriorate while half of its potential future engineers, designers, and innovators remain unnecessarily bound by overly constrictive regulations. Furthermore, these regulations are preventing the globalization

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of useful technologies in a way that is hindering the spirit of international cooperation as envisioned by Article I of the Outer Space Treaty. In order to address these concerns, this article first provides a brief historical overview of the International Traffic in Arms Regulations (ITAR), including its most recent developments. Second, it outlines key provisions within the ITAR regulations that make up the basic framework for export control in general. Third, it identifies vague, ambiguous, and contradictory language associated with the ITAR's "fundamental research exemption" that hinder technological development and act in opposition to Article I of the Outer Space Treaty. Finally, this article proposes changes to the ITAR that would enable these institutions – many of which play a fundamental role in conducting research for national security needs – to more easily and accurately interpret the ITAR's provisions for the purpose of educating the 45%.

I. Introduction

American institutions of higher learning have a unique and long-standing relationship with the R&D arms of the federal government, having spearheaded the progression of scientific and technological development for over seventy years. As early as 1957, the majority of federal research funds for universities were for military purposes, resulting in a vital symbiotic relationship between the government and national research institutions.[1] Universities began to depend on federal research grants, while the government began to depend on cutting edge innovation – led by academic institutions – for the development of national security related technologies. Out of this symbiotic relationship grew a "uniquely effective R&D system where universities are the dominant source of fundamental scientific and engineering research."[2] This is in contrast to nations like Germany and Russia that "struggle with a system of premier laboratories separated from their university structure. This separation hinders the innovation that arises from student-faculty interactions and diminishes the recruiting ability for science and technology research . . ."[3] However, this unique relationship cannot exist without vibrant national and international collaborations that catalyze the free exchange of technical information necessary to push boundaries in STEM (science, technology, engineering, and math).[4] The Reagan Administration's National Security Decision Directive 189 famously stated, "the strength of American science requires a research environment

1 Alice P. Gast, *The Impact of Restricting Information Access on Science and Technology*, MIT 1 (2003), *available at* http://web.mit.edu/nobel-lectures/homeland_security_impact.pdf.
2 *Id.* at 3-4.
3 *Id.*
4 *Id.* at 4.

conducive to creativity, an environment in which the free exchange of ideas is a vital component."[5] This statement has never been more true than it is today.

During the academic year of 2016, more than a million foreign nationals were enrolled in American universities.[6] This number has increased by 85% over the last decade and shows no sign of slowing in the future.[7] Amongst these students, approximately 360,000 were enrolled in STEM related fields.[8] In fact, 45% of graduate students enrolled in American STEM programs today are foreign nationals; the vast majority of these students wishing to study and begin careers in the United States due to the quality of its education system and job market.[9] By 2020, this number is expected to increase beyond 50%, meaning that at least half of the best and brightest minds in American STEM programs will be temporary residents from another country.[10] This massive influx of international participation in American higher education is an exciting reality, especially when considering the incredible contributions our international peers are capable of making to the development of academic, economic, and technological institutions. Alice Gast writes,

> "American leadership in the global science and technology enterprise has arisen in part from the continual influx of the world's best minds in science, engineering, and technology. Foreign students and scholars are critical to the vitality of American innovation. Many stay and contribute significantly to our economy and national research efforts. They provide much of the leadership and skilled workforce of our high tech sector."[11]

However, despite that countless thousands of the world's most gifted individuals are crossing oceans and continents to further their development in the States, many of these students are unable to reach their full innovative potential – at a great loss to the United States and the world – due to overly burdensome regulations under the Arms Export Control Act (ITARs). The act bars access by foreign students to vital materials and technical data necessary for the development of new space technology – for example,

5 National Security Decision Direction 189, Exec. Order No. 12,365, 3 C.F.R. 12,365 (1982), at www.epic.org/open_gov/eo_12356.html.
6 Kelly Mae Ross, *Study: Interest in STEM Fuels Growth in Number of International Students in U.S.,* U.S. NEWS & WORLD REPORT (Nov. 14, 2016). https://www.usnews.com/education/best-colleges/articles/2016-11-14/study-interest-in-stem-fuels-growth-in-number-of-international-students-in-us (last visited April 6, 2017).
7 *Id.*
8 *Id.*
9 *Id.*
10 *Id.*
11 Gast, at 4.

satellite remote sensing – where much of the developing world is still struggling to catch up and the United States is quickly falling behind. Although provisions in the ITARs supposedly allow for the dissemination ("export") of public "fundamental research"[12] without a license, these provisions are overly vague, ambiguous, and – at times – even contradictory, leading some research institutions to avoid certain areas of research altogether in order to avoid potential ITAR complications.[13] Meanwhile, the state of U.S. technological primacy continues to deteriorate[14] while half of its potential future engineers, designers, and innovators remain unnecessarily bound by inefficient and outdated regulations. In order to facilitate a free and creative research environment, advance U.S. technological capabilities, and build strong international relationships (both academically and commercially), the 360,000 foreign nationals making up 45% of U.S. STEM programs must be allowed to interact with information and materials relevant to the future of their respective fields.[15] However, for decades these essential interactions have been severely limited by vague, ambiguous, and contradictory provisions within the ITAR. This situation hinders not only U.S. space capabilities, but also the potential for nations all over the world to benefit from space, working against the spirit of the Outer Space Treaty.

In order to address these concerns, this article first provides a brief historical overview of the International Traffic in Arms Regulations (ITAR), including its most recent developments. Second, it outlines key provisions within the ITAR regulations that make up the basic framework for export control in general. Third, it identifies vague, ambiguous, and contradictory language within these provisions that hinder technological development and act in

12 Often called the "fundamental research exemption," information in the public domain is supposedly exempted from the scope of ITAR. However, this article will show that there is no such exemption in reality. What actually exists is merely selected language from a patchwork of provisions linked together, extrapolated to create a small avenue through which Universities may safely conduct research related to aerospace technologies.

13 *See 14.2 Open Research and Free Interchange of Information*, MIT Policies & Procedures, http://web.mit.edu/policies/14/14.2.html (last visited April 17, 2017); Export Controls *Compliance Program Plan*, FSU: OFFICE OF RESEARCH, https://www.research.fsu.edu/research-compliance/export-controls/ecplan/ (last visited April 17, 2017); *Export Controls*, CORNELL UNIVERSITY OFFICE OF SPONSORED PROGRAMS, https://www.osp.cornell.edu/export/research/fundamental.htm (last visited April 17, 2017).

14 Josh Chin, *China's latest Leap Forward Isn't Just Great – It's Quantum*, WSJ (Aug. 20, 2016), https://www.wsj.com/articles/chinas-latest-leap-forward-isnt-just-greatits-quantum-1471269555 (last visited April 17, 2017); Brian Barett, *China's New Supercomputer Puts the U.S. Even Further Behind*, WIRED (Junes 21, 2016), https://www.wired.com/2016/06/fastest-supercomputer-sunway-taihulight/ (last visited April 17, 2017).

15 *Supra*, note 1.

opposition to Article I of the Outer Space Treaty. Finally, this article proposes changes to the ITAR that would enable these institutions – many of which play a fundamental role in conducting research for national security needs – to more easily and accurately interpret the ITAR's provisions for the purpose of educating the 45%.

II. ITAR Historical Background & Developments

A. Early Developments

Before having a conversation about how specific ITAR provisions work and where reform is necessary, one must first understand some basic aspects of its function and historical development. The International Traffic in Arms Regulations (ITAR) is the means by which the United States regulates the "export"[16] of "Defense Articles"[17] and "Defense Services."[18] That is, any items listed on the United States Munitions List[19] and their associated "technical data."[20] The Federal Government's right to regulate the import and export of goods is as old as the Nation itself. The United States Constitution first provided the federal government with the ability to regulate both commerce and the import/export of goods in 1789, "The Congress shall have Power . . . to regulate commerce with foreign Nations . . . no State shall, without the Consent of the Congress, lay any Imposts or Duties on Imports or Exports . . . and all such Laws shall be subject to the revision and Control of the Congress."[21] Although this was a fundamental right established over two-hundred years ago, the first nearly 150 years of export control in the United States saw neither consistency nor uniformity, only taking a definite shape with the Neutrality Act of 1935.[22] It was at this time that the U.S. Department of State (DoS) was entrusted with the responsibility of regulating munitions in a way that ensured both national security and foreign policy objectives.[23] The DoS maintained this giant responsibility during the entirety

16 22 C.F.R. § 120.17 (2014).
17 22 C.F.R. § 120.6 (2016).
18 22 C.F.R. § 120.9 (2016).
19 The United States Munitions List, 22 C.F.R. § 121 (2017) [hereinafter USML or Munitions List].
20 22 C.F.R. § 120.10 (2016).
21 U.S. Const. art. I, § 8, cl. 3 (Commerce Clause) & U.S. Const. art. I, § 10, cl. 2 (Import-Export Clause).
22 See Mike Gold & Christopher Hearsey, *Red Tape in the Final Frontier: Bigelow Aerospace's Adventures in Export Control*, THE GOVERNANCE OF EMERGING SPACE ACTIVITIES: LEGAL AND POLICY PERSPECTIVES 3 [eds. Jan Wouters & Rik Hansen, Elgar 2016].
23 Major Matthew Burris, *Tilting at Windmills? The Counterposing Policy Interests Driving the U.S. Commercial Satellite Export Control Reform Debate*, 66 A. F. L. REV. 260 (2010) [Burris].

of the Cold War, carefully regulating early space technology as defense articles, including "dual-use" commercial communication satellites (COMSATs).[24]

However, the end of the Cold War in 1992 saw export controls temporarily relax for COMSATs when the DoS transferred a large portion of COMSAT technology from the highly restrictive, complicated, and expensive ITAR/Munitions List to the much more lenient Export Administration Regulations (EARs) and its Commerce Control List (CCL).[25] By 1996, all COMSAT technology was placed on the CCL. In contrast to the ITAR, "the presumption under the EAR was to *approve* proposed exports of commercial satellites, components, and related services. This presumption aligned with the DOC's charter to promote and regulate U.S. economic interests abroad."[26] This shift resulted in a large swath of satellite technologies becoming easily available for both domestic/international commerce and educational purposes, generally providing a more reasonable balance between the oft-competing interests of national security, commerce, and education. Sadly, this happy balance only lasted for several years due largely in part to the tactless actions of two companies: Hughes Electronics (Hughes) and Loral Space (Loral). Both Hughes and Loral attempted to launch commercial satellites via the Republic of China's[27] Long March rockets; however, both rockets experienced problems with their navigational fairings and exploded after takeoff.[28] In order to assist in ascertaining the cause of these expensive failures, Hughes and Loral submitted technical data to the Republic of China under the authority of a DoC export license.[29] Much to the dismay of the U.S. space industry (and the world), the information included in Hughes and Loral's transmissions included sensitive information regulated by the DoS and the Munitions List, information that had the potential to significantly enhance the Republic of China's intercontinental ballistic missile arsenal. According to Air Force Major Matthew Burris,

> "Hughes was aware of the fact that had it sought the appropriate DoS licenses for the transfer of the technical data necessary to address the fairing problems, the license applications would have been denied. By avoiding the DDTC licensing process, the national security interests of the U.S. were therefore subjugated to the economic interests of Hughes. To be sure, improving the reliability of PRC

24 *Id*.
25 *Id*; *see also* Export Administration Regulations, 15 C.F.R. § 730 et. Seq. (2009). The CCL is administered by the Department of Commerce (DoC) rather than the DoS.
26 *Id*. at 261. [emphasis added].
27 The Republic of China is often abbreviated as "PRC" in academic literature.
28 Burris, at 262; Gold & Hearsey, at 19.
29 Gold & Hearsey, at 19.

> rockets, which included nuclear-tipped ICBMs pointed at the U.S., was decidedly not in the national security interests of the U.S."[30]

Hughes and Loral's corner-cutting ended up changing the face of export controls in the United States for nearly fifteen years.

B. Strom Thurmond National Defense Act

In response to these unexpected events, Congress enacted the Strom Thurmond National Defense Act for Fiscal Year 1999 (1999 NDA).[31] This act transferred all COMSAT related articles and technical information to the DoS/ITAR and its Munitions List, expressly listing "experimental, scientific and research" satellites – including their "associated systems" and "related equipment" – for the first time as defense articles.[32] Unlike the EAR, "the presumption under the ITAR is to *disapprove* proposed exports of commercial satellites, components, and related services[.]"[33] The DoS retained complete control over all satellite technology with a clenched fist for nearly fifteen years, regardless of whether the technology was military, dual-use, or purely commercial in nature.[34] In fact, much of technological know-how concerning the design and manufacture of civilian-use satellite that was transferred back to the Munitions List by the 1999 NDAA had arguably been in the public domain for up to 30 years, and was therefore outside the purview of the ITARs.[35] The U.S. space industry suffered immensely under this ITAR stronghold on COMSAT technology; "the onerous requirements of the ITAR not only drove up the costs and burdens of compliance with U.S. export control regulations, but also drove down the level and frequency of business conducted with international customers and partners."[36] During these years it was estimated that simple compliance with ITAR regulations cost U.S. companies approximately $ 50 million per year, including expenses such as hiring export control officers, legal specialists in export regulation, and training employees in compliance measures.[37]

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30 Burris, at 262.

31 Strom Thurmond National Defense Authorization Act for Fiscal Year 1999, Pub. L. No. 105-261 (1998) 112 Stat. 1920. [hereinafter 1999 NDAA].

32 Rachel Lehmer Claus, *Space-Based Fundamental Research and the ITAR: A Study in Vagueness, Overbreadth, and Prior Restraint*, 2 SANTA CLARA J. INT'L L. 9 (2004). [hereinafter Claus].

33 Burris, at 263. [emphasis added].

34 Dara Panahy & Bijan Ganji, *ITAR Reform: A Work in Progress*, 26 THE AIR & SPACE LAWYER 1 (2013), https://www.milbank.com/images/content/1/5/15123/ITAR-Reform-A-Work-In-Progress-December-2013.pdf. [hereinafter Panahy & Ganji].

35 Claus, at 9.

36 Panahy & Ganji, at 2.

37 Morgan Dwyer, Gwen Gettliffe, Whitney Lohmeyer, Annie Marinan, Erik Stockham, Annalisa Weigel, Kerri Cahoy, *The Global Impact of ITAR on the For-Profit and*

These steep hurdles often proved too tenuous for smaller technology firms, resulting in losses from both international competition and the U.S. space industry at large.[38] Furthermore, ITAR's totalitarian control of the U.S. space industry led to the development of a technological landscape that produced negative impacts to both international trade and national security. Because even foreign-made goods would require compliance with the ITARs if they contained a single Munitions List component, it became highly undesirable for international consumers and developers to implement U.S. made space technology.[39] Even requesting additional information regarding a Munitions List component – even one that had already been licensed for use in a foreign-built article – required an additional license for any additional/related technical information.[40] Although the two-fold purpose of the ITAR is to effectively balance the competing interests of national security and the vitality of the U.S. space industry, the 1999 NDA constructively bound the hands of not only the space industry, but also the R&D capabilities of federal laboratories and public research institutions,

> "[F]ollowing passage of the 1999 NDAA, the space industry endured a period of unprecedented globalization. Hardware and services that traditionally had been difficult to procure in the global market gradually became readily available from manufacturers and service providers throughout the world. Such globalization only further diminished the competitive standing of U.S. manufacturers vis-a-vis their foreign competitors. More importantly, however, these economic forces undermined the purpose and effectiveness of the U.S. export control regulations, particularly the ITAR, to safeguard U.S. national security. As satellites, their components, and related technology were no longer only, or even primarily, available from the U.S. market, heightened export controls became a significant burden to U.S. competitiveness instead of an effective barrier to the proliferation of sensitive space technology."[41]

Fortunately, this overly burdensome and inefficient regime eventually did not last forever.

C. National Defense Authorization Act for Fiscal Year 2013

After over a decade of being condemned as a "national security risk," "overly complicated," "excessively redundant," and "attempting to protect too much,"[42] Congress passed the National Defense Authorization Act for Fiscal

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Non-Profit Space Communities, MIT Open Access Articles 10 (2012), http://hdl.handle.net/1721.1/80837. [hereinafter MIT Open Access].

38 *Id*. at 11.

39 Panahy & Ganji, at 2.

40 MIT Open Access, at 10.

41 Panahy & Ganiji, at 2.

42 Burris, at 266.

Year 2013 (2013 NDAA),[43] which effectively eliminated the requirement that all satellite technology be controlled by the ITAR and returned to the President the ability to decide which export control regime should govern different types of satellite technology.[44] The Obama administration immediately set about identifying which articles no longer belonged on the Munitions List, initiating the transfer of those articles which are neither "inherently military" or "carry capabilities that provide a critical military or intelligence advantage to the United States" from the Munitions List to the Commerce Control List.[45] These technologies include "commercial communications satellites, remote sensing satellites, planetary rovers, planetary and interplanetary probes, and in-space habitats, not identified in USML Category XV(a)."[46] As to what is identified in the USML, Category XV of the list now contains more precise specifications as to what constitutes a defense article, identifying specific electro-optical hyperspectral bandwidths and various forms of infrared sensing (essential aspects of defining the difference between military satellites and COMSATs).[47] Although the changes

43 National Defense Authorization Act for Fiscal Year 2013, Pub. L. No. 112-239, 126 Stat. 1632.

44 Panahy & Ganiji, at 2.

45 Id; Munitions List, Category XV. "Spacecraft not identified in this paragraph are subject to the EAR (see ECCNs 9A004 and 9A515). Spacecraft described in ECCNs 9A004 and 9A515 remain subject to the EAR even if defense articles described on the USML are incorporated therein, except when such incorporation results in a spacecraft described in this paragraph."

46 Commerce Control List, 15 C.F.R. § 774 (2016).

47 Munitions List, Category XV(a) (2017). "(a) Spacecraft, including satellites and space vehicles, whether designated developmental, experimental, research, or scientific, or having a commercial, civil, or military end-use, that: *(1) Are specially designed to mitigate effects (e.g., scintillation) of or for detection of a nuclear detonation; * (2) Autonomously detect and track moving ground, airborne, missile, or space objects other than celestial bodies, in real-time using imaging, infrared, radar, or laser systems; *(3) Conduct signals intelligence (SIGINT) or measurement and signatures intelligence (MASINT); *(4) Are specially designed to be used in a constellation or formation that when operated together, in essence or effect, form a virtual satellite (e.g., functioning as if one satellite) with the characteristics or functions of other items in paragraph (a); *(5) Are anti-satellite or anti-spacecraft (e.g., kinetic, RF, laser, charged particle); *(6) Have space-to-ground weapons systems (e.g., kinetic or directed energy); *(7) Have any of the following electro-optical remote sensing capabilities or characteristics: (i) Electro-optical visible and near infrared (VNIR) (i.e., 400nm to 1,000nm) or infrared (i.e., greater than 1,000nm to 30,000nm) with less than 40 spectral bands and having a clear aperture greater than 0.50m; (ii) Electro-optical hyperspectral with 40 spectral bands or more in the VNIR, short-wavelength infrared (SWIR) (i.e., greater than 1,000nm to 2,500nm) or any combination of the aforementioned and having a Ground Sample Distance (GSD) less than 30 meters; (iii) Electro-optical hyperspectral with 40 spectral bands or more in the mid-wavelength infrared (MWIR) (i.e., greater than 2,500nm to 5,500nm) having a narrow spectral bandwidth of $\Delta\lambda$ less than or equal to 20nm full width at half

implemented by the 2013 NDAA are undoubtedly a significant positive development for Universities conducting research in the area of satellite remote sensing, unnecessary confusion and inefficiency remain due to overly vague, ambiguous, and contradictory provisions within the ITAR related to the fundamental research exemption.[48] However, this issue will be fully discussed later in this article.

III. How ITAR Works

A. The Regulations

1. Authority

In order to identify which areas need reform within the ITAR, one must first understand how the basics of how the ITAR works. In order to understand how the ITAR works, one must pay careful attention to the – often rigorous – language of its key provisions. This section addresses several key ITAR provisions that make up the framework for regulating the export of defense articles/services.

The ITAR begins in 22 C.F.R. § 120 and continues through 22 C.F.R. § 127. Part 120 contains the key authorities, definitions, and exemptions of interest to this paper and to Institutions of Higher Learning in the United States. 22 C.F.R. § 120.1 (the Genesis of the ITAR) begins by authorizing the President to "control the export and import of defense articles and defense services."[49] This section also delegates who is eligible for a license to export defense articles:

> "(1) A *U.S. person*[50] may receive a *license* or other approval pursuant to this subchapter. *A foreign person*[51] *may not* receive such a license or other approval, except as follows:

maximum (FWHM) or having a wide spectral bandwidth with Δλ greater than 20nm FWHM and a GSD less than 200 meters; or
(iv) Electro-optical hyperspectral with 40 spectral bands or more in the long-wavelength infrared (LWIR) (i.e., greater than 5,500nm to 30,000nm) having a narrow spectral bandwidth of Δλ less than or equal to 50nm FWHM or having a wide spectral bandwidth with Δλ greater than 50nm FWHM and a GSD less than 500 meters. . ."

48 See *supra*, note 12.

49 General Authorities, receipt of licenses, and ineligibility, 22 C.F.R. § 120.1 (2014). [emphasis added].

50 U.S. Person, 22 C.F.R. § 120.15 (2014). "U.S. person means a person (as defined in §120.14 of this part) who is a lawful permanent resident as defined by 8 U.S.C. 1101(a)(20) or who is a protected individual as defined by 8 U.S.C. 1324b(a)(3). It also means any corporation, business association, partnership, society, trust, or any other entity, organization or group that is incorporated to do business in the United States. It also includes any governmental (federal, state or local) entity. It does not include any foreign person as defined in §120.16 of this part.

> (i) A foreign governmental entity in the U.S. may receive a license or other approval;
> (ii) A foreign person may receive a reexport or retransfer approval; or
> (iii) A foreign person may receive a prior approval for brokering activities.
> A request for a license or other approval by a U.S. person or by a person referred to in paragraphs (c)(1)(i) and (c)(1)(iii) of this section will be considered only if the applicant has *registered with the Directorate of Defense Trade Controls pursuant to part 122* or 129 of this subchapter, as appropriate."[52]

An export license is required for "*Any person who intends to export* or to import temporarily a *defense article* . . . unless the export or temporary import qualifies for an *exemption*[53] under the provisions of this subchapter" (one of the first clues that certain exemptions to the strict application of ITAR provisions are meant to exist).[54]

2. Registration

Furthermore, any applicant seeking a license to export "must be registered with the Directorate of Defense Trade Controls pursuant to part 122 of this subchapter prior to submitting an application."[55] This registration requirement is detailed in 22 C.R.R. § 122.1 as "primarily a means to provide the U.S. Government with necessary information on who is involved in certain manufacturing and exporting activities. Registration does not confer any export rights or privileges. It is generally a precondition to the issuance of any license or other approval under this subchapter."[56] Furthermore, registration is required for "any person who engages in the United States in the business of manufacturing or exporting or temporarily importing defense articles or furnishing defense services . . ."[57] This requirement does not apply to "persons who engage in the fabrication of articles *solely for experimental or scientific purposes, including research and development*."[58] However, even those who qualify under this exemption

51 Foreign person, 22 C.F.R. § 120.16 (2014). "Foreign person means any natural person who is not a lawful permanent resident as defined by 8 U.S.C. 1101(a)(20) or who is not a protected individual as defined by 8 U.S.C. 1324b(a)(3). It also means any foreign corporation, business association, partnership, trust, society or any other entity or group that is not incorporated or organized to do business in the United States, as well as international organizations, foreign governments and any agency or subdivision of foreign governments (e.g., diplomatic missions)."
52 22 C.F.R. § 120.1(c)(1) (2014) [emphasis added].
53 Exemption of general applicability, 22 C.F.R. § 125.4 (2016).
54 Requirement for export or temporary import licenses, 22 C.F.R. 123.1(a) (2014) [emphasis added].
55 *Id.*
56 Registration Requirements, 22 C.F.R. § 122.1(c) (2014).
57 *Id.* at § 122.1(a).
58 *Id.* at (b)(4) [emphasis added].

"remain subject to the requirements for *licenses* or other approvals for exports of defense articles and defense services and may not receive an export license or approval unless registered under § 122.2."[59]

3. Export

However, what does it mean to export a defense article? As it turns out, a plethora of activities may constitute an export. According to 22 C.F.R. § 120.17, an export is as follows:

> "(1) An actual *shipment or transmission out of the United States*, including the sending or taking of a defense article out of the United States in any manner;
> (2) Releasing or otherwise *transferring technical data* to a *foreign person* in the United States (a "deemed export");
> (3) Transferring registration, control, or ownership of any aircraft, vessel, or satellite subject to the ITAR by a U.S. person to a foreign person;
> (4) Releasing or otherwise transferring a defense article to an embassy or to any of its agencies or subdivisions, such as a diplomatic mission or consulate, in the United States;
> (5) *Performing a defense service* on behalf of, or *for the benefit* of, a *foreign person*, whether in the United States or abroad; or
> [6](b) *Any release* in the United States of *technical data* to a *foreign person* is deemed to be an export to all countries in which the foreign person has held or holds citizenship or holds permanent residency."[60]

As is evidenced by this regulation, a wide breadth of activities – some more clear than others – could potentially constitute an export of a defense article, defense service, or technical data.

4. Defense Article

The next logical question is what constitutes a defense article, and how does one ensure not to export one without a license? According to 22 C.F.R. § 120.6, a defense article means "*any item* or *technical data* designated in § 121.1 of this subchapter [the Munitions List]."[61] Whereas this may seem simple enough; it surely is not. A defense article constitutes not only the complete physical item itself, but also any "*technical data* recorded or stored in any physical form, models, mockups or other items that reveal technical data directly relating to items designated in [the Munitions List]."[62] This includes, but is not limited to, forgings, castings, extrusions, machined bodies, and any other similar partial designs that have "reached a stage in

59 *Id* [emphasis added]. The ambiguities within this provision will be addressed later in this article.
60 Export, 22 C.F.R. § 120.17 (2014) [emphasis added].
61 Defense article, 22 C.F.R. § 120.6 (2014) [emphasis added].
62 *Id*.

manufacturing where they are *clearly identifiable* by mechanical properties, material composition, geometry, or function as defense articles."[63]

i. Defense Service

Additionally, a defense service is similar to a defense article in that it includes the "furnishing of *assistance* (including training) *to foreign persons*, whether in the United States or abroad in the design, development, engineering, manufacture, production, assembly, testing, repair, maintenance, modification, operation, demilitarization, destruction, processing or use of *defense articles*."[64] This includes any transfer of technical data to foreign persons or any form of military training, whether by "formal or informal instruction."[65] This "informal instruction" is painted broadly and even includes materials such as "information publications" and "media of all kinds."[66]

5. Technical Data

Seeing as a defense article/service includes its associated technical data, it becomes of great import to understand what constitutes technical data. As already expressed by 22 C.F.R. § 120.6, technical data is associated with models, mockups, and other various forms of item design; however, 22 C.F.R. 120.10 also includes the following in its definition of technical data:

> "(1) *Information*, other than software as defined in § 120.10(a) (4), which is required for the design, *development*, production, manufacture, assembly, operation, repair, testing, *maintenance* or modification of defense articles. This includes information in the form of blueprints, drawings, photographs, plans, instructions or documentation.
> (2) *Classified* information relating to defense articles and defense services on the U.S. Munitions List and 600–series items controlled by the Commerce Control List;
> (3) Information covered by an invention secrecy order; or
> (4) *Software* (see § 120.45(f)) directly related to defense articles."[67]

Upon reading such a comprehensive definition, one might reasonably infer that information of any kind could potentially be construed as technical data. However, section (b) of this regulation provides an exception (of sorts) regarding technical data;

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63 *Id.*
64 Defense service, 22 C.F.R. § 120.9 (2014) [emphasis added].
65 *Id.*
66 *Id.*
67 Technical data, 22 C.F.R. § 120.10 (2014) [emphasis added].

> "(b) The definition in paragraph (a) of this section does not include information concerning *general scientific, mathematical, or engineering principles* commonly taught in schools, colleges, and universities, or information in the *public domain* as defined in § 120.11 of this subchapter or telemetry data as defined in note 3 to Category XV(f) of part 121 of this subchapter. It also does not include basic marketing information on function or purpose or general system descriptions of defense articles."[68]

Therefore, by definition, it would seem that protected technical data does not include general STEM principles or information in the public domain. But what constitutes the public domain?

6. Public Domain

One of the most controversial aspects of the ITAR concerns what information does and does not fall under "general scientific, mathematical, or engineering principles" or "the public domain." This question is at the center of many research institutions' policies regarding foreign students and STEM research projects; it is also at the center of this article's focus. However, before diving in to this proverbial can of worms, it is helpful to understand what is considered to be within the "public domain." The definition of "public domain" found in 22 C.F.R. § 120.11 is helpful:

> "(a) Public domain means information which is *published* and which is *generally accessible* or available to the public:
> (1) Through sales at newsstands and bookstores;
> (2) Through subscriptions which are available without restriction to any individual who desires to obtain or purchase the published information;
> (3) Through second class mailing privileges granted by the U.S. Government;
> (4) At libraries open to the public or from which the public can obtain documents;
> (5) Through patents available at any patent office;
> (6) Through unlimited *distribution at a conference*, meeting, seminar, trade show or exhibition, generally *accessible to the public*, in the United States;
> (7) Through *public release* (i.e., unlimited distribution) in any form (e.g., not necessarily in published form) after approval by the cognizant U.S. government department or agency (see also § 125.4(b)(13) of this subchapter)."[69]

Information in the public domain also includes information gathered through "*fundamental research* in science and engineering at accredited institutions of higher learning in the U.S. where the resulting information is *ordinarily published* and shared broadly in the scientific community."[70] Fundamental research is defined as information gathered via "*basic* and *applied* research in science and engineering where the resulting information is ordinarily

68 *Id*. at (b) [emphasis added].
69 Public domain, 22 C.F.R. § 120.11 (2014) [emphasis added].
70 *Id*. at (a)(8) [emphasis added].

published and shared broadly within the scientific community, *as distinguished* from research the results of which are *restricted* for *proprietary* reasons or specific *U.S. Government access and dissemination controls*."[71]
To briefly summarize the basics, the President has authority to designate what kinds of articles/information constitute defense articles to be included on the Munitions List; effectively deciding which items require a license in order to be exported. An export includes the transmission of both Munitions List defense articles and their relevant technical data to a foreign person, whether in the U.S. or abroad. However, information in the public domain – including fundamental research conducted by U.S. institutions of higher learning – does not (according to the plain language) constitute protected technical data. In its most condensed form, the ITAR may seem simple enough. In fact, based on nothing more than a brief exposure to its provisions, one may ask why any controversy exists regarding the ITAR and its effects on U.S. universities and their international students? While it is understandable that this question may be asked, the problem with ITAR lies beneath the skin. Despite its lengthy provisions, detailed language, and seemingly exhaustive scope, the ITAR inadvertently creates a vague, ambiguous, and contradictory regulatory framework that is both overly burdensome and prohibitively unclear when applied to U.S. universities attempting to develop the next generation of aerospace innovators. These inherent problems exist with regard to both information that requires a license to export and that which (supposedly) does not. Although there is much to be said about problems associated with how one acquires a license to export a defense article, this article will focus specifically on issues related to information that – ideally – does not require a license to export.[72]

IV. The Fundamental Research Exemption: Vague, Ambiguous, and Contradictory

Although the primary purpose of export controls is to ensure that sensitive technology and dangerous weapons are kept away from those who would cause harm to the United States, the DoS must still strike a pivotal balance between two competing interests: (1) national security and (2) the competitiveness and sustainability of U.S. universities and businesses dealing in technology associated with defense articles.[73] However, it is this author's belief that certain key provisions of the ITAR – relating to the famed

71 *Id.*
72 For a detailed description of problems related to the convoluted, complicated, and overly burdensome export licensing process, see Michael N. Gold, *The Wrong Stuff: America's Aerospace Export Control Crisis*, 87 NEB. L. REV. 521 (2008).
73 Clinton Long, *An Imperfect Balance: ITAR Exemption, National Security, and U.S. Competitiveness*, 2 NAT'L SEC. L. J. 45-46 (2013).

"fundamental research exemption" – contain language that is, by definition, overly vague, ambiguous, and contradictory; thus, upsetting this delicate balance by creating undue burdens for Universities attempting to conduct important research and development. Because universities would rather be "safe than sorry," the 45% are barred from accessing their true potential, harming not only the United States' interests, but also that of every nation looking to venture into space. This end result constitutes a violation of the Outer Space Treaty by one of the very nations that helped draft it.

A. Vague

According to the Merriam-Webster English Dictionary, the common definition of "vague" is something that is "not clearly expressed," "stated in indefinite terms," or "not clearly defined, grasped, or understood."[74] The ITAR suffers from vagueness regarding both general concepts and specific language. Nowhere is this more evident than in the famed fundamental research exemption: a provision within the ITAR that exempts public information and fundamental research from export controls for use by research universities. However, in reality this exemption does not actually exist. There is no section number in the ITAR with the header, "fundamental research exemption." If such a broad, black & white exemption existed, it would live in the ITAR's "exemptions of general applicability" section located at 22 C.F.R. § 125.4.[75] Yet, a review of this section actually reveals limitations on the transfer/use of applied research,[76] an expressly stated subset of the public domain.[77] The existence of the fundamental research exemption is actually extrapolated from a patchwork of ITAR provisions daisy-chained together. However, the language within these provisions is unnecessarily ambiguous and even contradictory, creating great uncertainty around fundamental research and the public domain.

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74 *Vague*, MERRIAM-WEBSTER, *available at* https://www.merriam-webster.com/dictionary/vague.

75 Exemptions of general applicability, 22 C.F.R. § 125.4 (2016).

76 *Id*. at § (c)(3). This section allows for the export without a license of certain information to nationals of NATO countries (and others) pursuant "to an official written request or directive from an authorized official of the U.S. [DoS]," as long as the information falls within certain categories. One of these categories is "basic research." However, this same provision also explicitly bars the transmission of "applied research," that is, "a systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met. It is a systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements."

77 See *supra*, note 69.

B. Ambiguous

The definition of "ambiguous" is something that is "doubtful or uncertain" or "capable of being understood in two or more possible senses or ways."[78] Unfortunately, nearly every provision relating to fundamental research and the public domain creates both doubt/uncertainty and various possible interpretations. For example, the registration requirements enumerated under 22 C.F.R. § 122.1(b) exempt from registration persons producing only unclassified technical data and persons fabricating articles "solely for experimental or scientific purposes, including research and development."[79] Nonetheless, a note to these provisions states that persons qualifying for these exemptions "remain subject to the requirements for licenses or other approvals for exports of defense article and defense services and may not receive an export license or approval unless registered under § 122.2."[80] One possible interpretation of this language suggests that neither unclassified technical data, nor articles "solely for experimental or scientific purposes" require registration because they are not considered defense articles and, therefore, do not require a license before export/sharing. Alternatively, this language can be interpreted as meaning that the above mentioned persons are exempt from the registration requirement as long as they are not actually exporting their unclassified technical data or experimental/scientific articles. What requires a license, and what does not? This language is ambiguous and confusing for those who would seek to follow it.

The definition of technical data only heightens this uncertainty by including "*classified*[81] information relating to defense articles,"[82] yet failing to expressly exclude *unclassified* technical information as a facet of the public domain.[83] The definition of public domain continues this trend of ambiguity by incorporating both basic and applied fundamental research, yet distinguishing that research from "research the results of which are restricted for proprietary reasons or specific U.S. Government access and dissemination controls."[84] Is this provision referring to the different levels of classification as defined by Executive Order No. 13526?[85] Or, perhaps it is referring to an even broader scope of possible restrictions? How far do these restrictions go?

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78 *Ambiguous*, Merriam-Webster, *available at* https://www.merriam-webster.com/dictionary/ambiguous.

79 See *supra* note 59.

80 *Id.*

81 Classified National Security Information, Exec. Order NO. 13526, 75 FR 707 (2009). Classification levels include "Top Secret," "Secret," and "Confidential," depending on the degree to which the disclosure of information concerned could be reasonably expected to cause harm to the national security.

82 Technical data, *supra* note 67. [emphasis added].

83 See *supra* note 68.

84 See *supra* note 71.

85 See *supra* note 80.

To what extent can the Government limit, withhold, and control a University conducting research? The language of these provisions provide no concrete answers.

As evidenced earlier in this article, leading research institutions actively avoid certain forms of government funded research to avoid potentially unlimited restrictions on the dissemination and application of its activities, not to mention potential fines in the event that foreign students are exposed to information that unexpectedly falls within said access and dissemination controls;[86]

> "The ambiguous treatment of fundamental research creates quite a quandary for those involved in university-based unclassified aeronautics and astronautics programs, as well as in courses in the field of electrical engineering, computing, optics, and mechanical engineering, which deal with principles and applications that are not classified or secret. Those involved in university-based spacecraft-related research or teaching are not able to determine, no matter how carefully they parse the ITAR, whether their activities are subject to ITAR restrictions that will affect who may participate in those courses or have access to that research."[87]

Finally, there is exists great uncertainty as to how information enters the already ambiguous protections of the public domain. As previously stated, the definition of public domain includes any information released, published, generally accessible, or available to the general public;[88] however, is something available to the public domain purely because it is published? Alternatively, is something suitable for publication only because it is available to the public domain? The answer is unclear. Furthermore, is something barred from license-free export if the author had an opportunity to publicly reveal the information but declined it? In such a scenario, would the export status of would-be-public-domain information change simply because the author decided to shelf his/her research for the time being? Because the language of these provisions leads to such inconclusive results, it is, by definition, ambiguous.

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86 See *supra* note 13; Claus, at 5. "[U]niversities operating in the public domain and carrying out unclassified space based research in various disciplines (environmental studies, bio-molecular research, particle and astrophysics, cosmology) may find they are not allowed to involve foreign students, faculty, and collaborators unless they first obtain an export license from the State Department . . . obtaining such a license may be difficult and time-consuming, and the process, bereft of clear standards is unpredictable. Moreover, merely submitting to such a restriction may alter forever and adversely the character and treatment of the research."

87 Claus, at 18.

88 See *supra* note 69.

C. Contradictory

As if the vague and ambiguous language surrounding the fundamental research exemption were not already a sufficient hurdle for universities to overcome, the ITAR also contains blatant contradictions that make the task of accurately deciphering its intent nearly impossible. The common definition of "contradictory" is "a proposition so related to another that if either of the two is true the other is false and if either is false the other must be true."[89] This catch-22 is especially problematic in regards to what constitutes fundamental research and information in the public domain. As previously shown, publicly released/published information within the public domain is excluded from the definition of technical data.[90] The definition of public domain also expressly includes both basic and applied fundamental research.[91] Therefore, a plain reading of these provisions strongly suggests that information in the public domain – including both basic and applied fundamental research – is exempt from export control under the ITAR. However, several provisions glaringly contradict this basic understanding of the text.

The first of these contradictions is found in 22 C.F.R. § 120.9(a)(3) under the definition of a defense service.[92] As previously expressed in this article, defense services are controlled under the ITAR and require a license in order to export; however, a defense service expressly includes "military training of foreign units and forces, regular and irregular, including formal or informal instruction of foreign persons in the in the United States or abroad or by correspondence courses, technical, educational, or information publications and media of all kinds, training aid, orientation, training exercise, and military advice."[93] In complete contradiction to the definition of technical data and the public domain, this provision requires a license for "information publications and media of all kinds."[94] Although under the umbrella of "military training," absent a concrete definition of military training this contradiction creates a giant question mark. This provision creates uncertainty as to whether the information Universities are using to teach foreign nationals could be interpreted, twisted, or framed by the DoS as the irregular or informal instruction of foreign persons for military purposes.

The second of these contradictions is found in 22 C.F.R. § 124.1(a), where it states that,

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89 *Contradictory*, Merriam-Webster, *available* at https://www.merriam-webster.com/dictionary/contradictory.
90 See *supra* note 68.
91 See *supra* note 71.
92 See *supra* note 61.
93 See *supra* note 66.
94 *Id.*

> "the approval of the Directorate of Defense Trade Controls must be obtained before the defense services described in § 120.9(a) of this subchapter may be furnished . . . the U.S. person must submit a proposed agreement to the [DDTC] . . . the requirements of this section apply whether or not technical data is to be disclosed or used in the performance of the defense services described in § 120.9(a) of this subchapter (e.g., all the information relied upon by the U.S. person in performing the defense service is in the *public domain* or is *otherwise exempt* from licensing requirements of this subchapter pursuant to § 125.4 of this subchapter."[95]

Although the language of this provision is somewhat murky and convoluted, it essentially requires a license and DDTC approval before even information in the public domain – or "otherwise exempted" – may be furnished to a foreign national if that information is included as part of a deemed defense service.[96] The result of this blatant contradiction is absolute uncertainty as to whether publicly available information is available to foreign nationals at American universities. If even the informal transfer of public domain information to a foreign national can potentially constitute a defense service, how are institutions of higher learning to distinguish with surety what is and is not protected information when teaching nearly half of their STEM students?

A third contradiction is found in in 22 C.F.R. § 125.4(c), where the ITAR lists its "exemptions of general applicability."[97] One of these exemptions is for certain defense services and technical data exported to countries within NATO, Australia, Japan, and Sweden, "for the purposes of responding to a written request from the Department of Defense for a quote or bid proposal."[98] At first, this exemption makes sense from a purely business perspective: the U.S. has a vested interest in encouraging the sale/trade of arms to its closest allies. However, § 125.4(c)(3) goes on to specify which kinds of information are available for license-free export under this exemption,[99] and one of these expressly exempted types of information is "Basic Research;" that is, "a systemic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and observable facts without specific applications towards processes or products in mind."[100]

But wait, if basic research has already been exempted from export control under the definition of public domain,[101] why is this provision necessary? The

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95 Manufacturing license agreements and technical assistance agreements, 22 C.F.R. § 124.1(a) (2016). [emphasis added].
96 See Claus, at 29.
97 See *supra* note 74.
98 *Id.*
99 *Id.*
100 *Id.*
101 See *supra* note 71.

answer lies in the second half of § 125.4(c)(3), where it states that basic research does not include "'Applied Research' (i.e. a systemic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met. It is a systematic application of knowledge toward the production of useful materials, devices, and systems or methods . . .)."[102] Therefore, despite previous language excluding both basic and applied research from the definition of technical data,[103] § 125.4(c)(3) expressly bars the export of applied research even to close allies. Therefore, "any foreign student involvement may also negate the exemption of fundamental research and require ITAR licensing even if the project is within the public domain."[104] If applied research is controlled as a defense service under the Munitions List, are any new space-related systemic studies, developments, advancements, or devices procured by universities actually defense articles?[105] The ITAR answers both yes and no.

D. ITAR vs. The Outer Space Treaty

The export control regime in the United States is among the most famously restrictive in the world. Even a brief review of other export regimes in Europe,[106] Australia,[107] and India[108] reveal systems of export control that allow for an easier, more comprehensive, and efficient process for sharing technical information, software, and hardware to peaceful nations (and people) around the world. The ITAR stands in isolation as an antiquated, overly restrictive and convoluted regime, barring the efficient transmission of even public domain information to some of United States' closest allies. Not only does this reality set a negative example for developing space nations, but it goes against both the spirit and the language of the Outer Space Treaty. Article I of the OST states,

> "The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be

102 22 C.F.R. § 125.4(c)(3).
103 See *supra* note 71.
104 MIT Open Access, at 12.
105 See Claus, at 24.
106 Setting up a Community Regime for the Control of Exports, Transfer, Brokering, and Transit of Dual-use Items, Council Regulation (EC) NO. 428/2009, May 5, 2009.
107 *Export Controls Legislation*, Australian Government: Department of Defense, www.defence.gov.au/ExportControls/Legislation.asp (last visited, September 5, 201). 7.
108 *India's Export Controls: current Status and possible Changes on the Horizon*, SECURUS: STRATEGIC TRADE SOLUTIONS, www.securustrade.com/India%27s%20Export%20Controls_Article__July_10_2011_FINAL.pdf (last visited September 5, 2017).

> the province of all mankind. Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation."[109]

When interpreting the language of this article according to its ordinary meaning,[110] a problem quickly arises. Specifically, Article I demands that the exploration of outer space be carried out "for the benefit and in the interests of all countries," and that "States shall facilitate and encourage international cooperation" in the "freedom of scientific investigation of outer space."[111] As one of the primary drafters of the Outer Space Treaty and a representative of everything for which it stands, the United States should stride not only to develop technological leadership in outer space, but also to provide leadership in the humanitarian, ethical, educational, and futurist aspects of space. Unfortunately, certain aspects of the current export control regime in the United States actively work against the principles enshrined in the outer space treaty. They do not serve to benefit all nations, facilitate technological progress, or encourage international cooperation. In fact, this author argues that many aspects of the ITAR are designed to blatantly work against these objectives. It is time to make a change.

D. What Needs to Change?

The current vague, ambiguous, and contradictory state of the famed fundamental research exemption is, in many ways, masterfully crafted to provide the semblance of a free public domain, whilst retaining the ability to control information in the public domain when desirable. As described above, the fundamental research exemption is hardly an exemption, but a collection of exceptions to an exemption that doesn't actually exist in definite form. This haphazard collection of mixed signals is a hindrance to the development of remote sensing technologies in both the United States and the world at large. In light of the difficulties faced by research institutions attempting to comply with the ITAR, it is this author's belief that a clear, definite, and unadulterated fundamental research exemption be implemented under the ITARs Exemptions of General Applicability enumerated under 22

109 Treaty on the Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, art. I, opened for signature, Jan. 27, 1967, 610 U.N.T.S. 205.

110 Vienna Convention on the Law of Treaties, art. 31, *opened for signature* May 23, 1969, 1155 U.N.T.S. 331.

111 *Id.*

C.F.R. § 125.4.[112] This exemption would exclude from licensing requirements all information already in the public domain, available to the public domain, or created for the public domain. Regardless of whether public information is being used as part of a defense service, its status as publicly available information would allow for its export without a license. Although some may deem such a proposition as troublesome from a national security perspective, one must remember that the ITAR exists to serve a dual purpose: (1) protect national security and (2) the competitiveness and sustainability of U.S. universities and businesses dealing in technology associated with defense articles.[113] Charles Vest writes,

> "As we respond to the reality of terrorism, we must not unintentionally disable the quality and rapid evolution of American science and technology, or of advanced education, by closing their various boundaries. For if we did, the irony is that over time this would achieve in substantial measure the objectives of those who disdain our society and would do us harm by disrupting our economy and quality of life."[114]

By definition, information available to the public domain is – surprise! – publicly available. Placing export restrictions on public domain information/research of any kind is not only ineffective and illogical, but also an unnecessarily burdensome hindrance to the academic pursuits of research universities and their increasingly diverse student bodies. Creating a true fundamental research exemption within the ITAR would not only affirmatively free up public information for use by researchers and developers, but also serve to alleviate the administrative expenses, headaches, and hassles borne by institutions of higher learning when attempting to adhere to the ITAR. In accordance with the de-regulating trend begun by the Obama administration in transferring a large percentage of COMSAT technology back to the EAR/CCL, creating a comprehensive fundamental research exemption would help provide the currently isolated %45 with the necessary tools to freely contribute to the advancement of space technologies – including satellite remote sensing technology – in both the United States and abroad.

V. Conclusion

Under the vague, ambiguous, and contradictory language of ITAR, information in the public domain is currently both free for dissemination and

112 *Supra*, note 76.
113 *Supra*, note 74.
114 Charles M. Vest, *Response and Responsibility: Balancing Security and Openness in Research and Education*, MIT (2002), *available at* http://web.mit.edu/president/communications/rpt01-02.pdf.

tightly controlled by the DoS. This end result is unnecessarily burdensome to those who would seek to adhere to the ITAR, a hindrance to forward progress/development, and even unconstitutional. The Supreme Court held in *Grayned v. City of Rockford* that,

> "statutes and regulations must clearly define their terms and proscriptions, to ensure that people 'of ordinary intelligence will have a reasonable opportunity to know what is prohibited.' Consequently, they are to be written clearly, without ambiguity, and free of internal inconsistencies, because a law with such defects fails to give warning to those who wish to act lawfully."[115]

When analyzing provisions within the ITAR related to the export of information in the public domain, it becomes apparent that not even the well-educated can interpret with surety whether any given data or information is truly ITAR-free. This poses a unique challenge to universities wishing to conduct space-related research, seeing as universities "often face the additional challenge of meeting their commitment to providing equal education opportunities for all of their students" while also struggling with what articles and information are available for use in educational/research environments.[116] After all, unlike some large commercial ventures, universities are far less likely to have sufficient legal infrastructure in place to support consistent compliance with the ITAR, especially when half of the students enrolled in ITAR sensitive programs are foreign nationals.[117] Some U.S. universities attempt to manage this conflict by declining altogether to accept classified research,[118] while others establish separate entities – such as MIT's Lincoln Laboratory[119] – as means of isolating ITAR sensitive research from any possible exposure to foreign students.[120] However, neither of these approaches utilize the full-extent of information available or maximize the potential of the 45%. The first approach provides every student with a bag of basic white flower and asks them to imagine a cake, while the second approach provides only half of the students with actual cake and leaves the rest with a handful of basic white flower. Both scenarios severely limit the potential of students to bake innovative new recipes.

In order to catalyze the development of space-related technologies around the world and faithfully adhere to the Outer Space Treaty, the previously enumerated vague, ambiguous, and contradictory language within the ITAR must be removed or otherwise clarified with the intent to encourage the participation of foreign nationals in the development of space technology.

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115 Grayned v. City of Rockford, 408 U.S. 104, 108 (1972).
116 MIT Open Access, at 11.
117 *Id.*
118 See *supra* note 13.
119 *Lincoln Laboratory*, MIT, https://www.ll.mit.edu/ (last visited April 23, 2017).
120 Claus, at 3.

Creating a true fundamental research exemption – allowing for the free exchange/export of unclassified public domain information – would not only provide clarity to the ITAR, but also help push the progressive development of essential space technologies forward in the U.S. and around the world.