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**Chuck Dickey - Houston, Texas, USA**

**Valentin Uvarov - Moscow, Russia**

## **TCTB: A Private-Public Path to Cooperative ADR**

### **Introduction**

There is no debate today that reducing risk from the most dangerous large derelict objects in high Low Earth Orbit (LEO) must begin soon. Forecast collisions involving these objects are imminent and unavoidable without Active Debris Remediation (ADR). Each unprevented collision will spawn thousands of deadly fragments, further increasing the cost of operating in space and the necessity of delayed ADR. Although the most dangerous objects are Russian rocket bodies left in high-LEO clusters consistent with then-common international practice before commercial space emerged, spent rocket bodies and dead satellites from China, the U. S., the European Space Agency (ESA), France, Japan and India litter the same crowded orbits.<sup>1</sup> Collectively, these objects number in the thousands<sup>2</sup> and share physical characteristics, which make them an attractive economic market for cooperative ADR, despite their diverse ownership. In fact, emerging ADR technologies from across the world are designed around those similarities. Since hundreds or more of these derelicts must be remediated to achieve significant risk reduction, action by all seven governments will be necessary to meaningfully reduce risk.

Although these objects have been identified and roughly ranked in order of highest priority, and world-wide commercial technology subject to still-needed refinements exists to remediate them, planning has

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<sup>1</sup> McKnight et al., [Identifying the 50 Statistically-Most-Concerning Derelict Objects in LEO](#), 181 Acta Astronautica 282-291 (April 2021); Borelli, et al., [A Comprehensive Ranking Framework for Active Debris Removal Mission Candidates](#), 8th European Conference on Space Debris (SDC), April 2021; Stevenson, et al., “Identifying the Statistically-Most-Concerning Conjunctions in LEO”, advance copy received from co-author McKnight, for presentation at AMOS Conference, September 15, 2021. The first two papers combine several independently derived lists to develop a consensus list based on various risk factors. The third paper lists the most dangerous objects based on risk of conjunctions and consequence of collision. All three of these papers conclude that ADR of these objects is necessary soon to insure space sustainability.

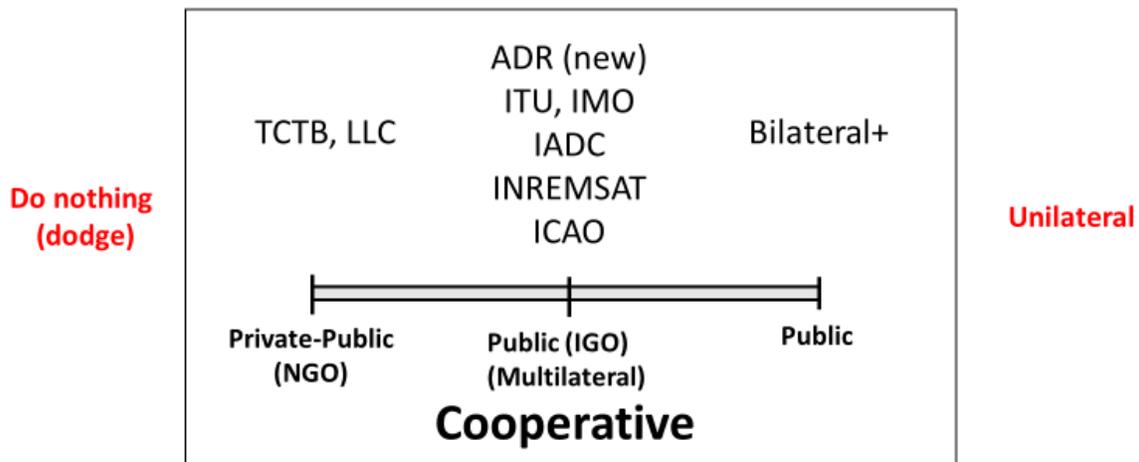
<sup>2</sup> According to research conducted by the author on [Space-Track](#), as of 4/15/2020, roughly 6156 rocket bodies have been left in space, of which 2234 remain in orbit - 1048 are Russian, 709 are U. S., 169 are Chinese, and 308 are from other countries. Of those 2234, 1471 pass through LEO - 643 are Russian, 423 are U. S., 141 are Chinese, and 264 are from other countries. A general history chronicling the identification and categorization of these dangerous objects by the world’s scientific community can be found at Dickey, [A Proposal for Active Debris Remediation – Selecting Objects](#), June 2020.

been thwarted by legal, political, national security, economic and funding hurdles. Planning will take several years before the first missions are possible, and missions will take decades. The cost will be significant. In our politically fractured world of sovereign nation states, each pursuing its own destiny in space which some have described as a “global commons”, how can ADR be accomplished before the next collision?<sup>3</sup>

### ADR Alternatives

A number of alternative structures for ADR exist as academic possibilities or have emerged as concrete proposals. Portrayed in Figure 1 below, these range from doing nothing other than dodging the most dangerous objects, to a variety of cooperative models, to unilateral approaches.

## ADR Alternatives



[Figure 1]

Doing nothing except continually dodging would avoid up front ADR costs but might end up costing more overall, and would not reduce the intrinsic risk derelict objects present to themselves and others.

Unilateral ADR generally relies on single-payers tied to ownership or jurisdiction over target objects. Unilateral models could include national taxes on future regulated commercial space activity to fund ADR,

<sup>3</sup> In August 2021, it was reported that a Russian debris fragment, SATCAT 48078, that had earlier broken off a Russian Zenit 2 (SL-16) rocket body, SATCAT 24298, for unexplained reasons, hit a Chinese satellite, SATCAT 44547, on March 18, 2021. 24298 is near the top of most lists of dangerous objects, even without considering the possibility that it could (and did) fragment leading to a collision with one of the fragments. [Twitter feed, accessed August 20, 2021.](#)

salvage/reclamation arrangements,<sup>4</sup> purely privately funded programs, or single-country ADR “leadership by example” programs hoping others will follow. In general, unilateral plans are economically inefficient in light of the market realities they confront, and will not meaningfully reduce overall risk unless all stakeholding governments act independently and simultaneously, which is extremely unlikely. Moreover, most unilateral government action related to ADR in outer space could carry undesirable political or national security implications.

There are three types of cooperative models for ADR. Private-public arrangements would employ a private non-governmental entity (NGO) to facilitate cooperation among participating governments. The other two cooperative models involve governments acting together without a private intermediary, either multilaterally through intergovernmental organizations (IGO), or directly under bilateral agreements. Figure 1 lists several IGOs (or their derivatives) which could be newly created or re-purposed for ADR including two, the International Civil Aviation Organization (ICAO) (existing) and the International Debris Removal Satellite organization (INREMSAT) (new, derived from INTELSAT), which have already been proposed for that purpose, and one, ADR (new), which could be newly established exclusively for ADR. Direct cooperation among two or more participating governments without forming an IGO, the other purely public alternative, could be implemented on a bilateral basis starting with two governments and then adding governments one at a time after that (i. e., “Debris Accords” approach).

All cooperative models, whether private-public or purely public in nature, achieve some degree of economic efficiency by increasing overall risk reduction while lowering overall cost - cooperation allows for multi-target missions less constrained by target nationality. More importantly, cooperative ADR results in cost and risk sharing, enhancing affordability.

In light of all factors, there is simply no realistic alternative to cooperative ADR, but the effectiveness of cooperative models varies depending on how well each one overcomes legal, political, national security, economic and funding hurdles to ADR, and how nimbly each one meets the urgent need. ADR planning will take several years before the first mission is possible, and missions will span decades before meaningful risk reduction is achieved, yet no cooperative planning among these key handful of government stakeholders has even begun. It should also be noted in this regard that while ADR missions will be costly, planning costs almost nothing. It is therefore critically important to start down the right cooperative path now in order to accomplish ADR before the next collision.

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<sup>4</sup> See, e. g., Al Anzaluda, [“Catalyzing Space Debris Removal, Salvage, and Use: Via Maritime Lessons and a Space Salvage Entity”](#), Presentation at U.N. Committee on Peaceful Uses of Outer Space (COPUOS), Legal Subcommittee, Thursday, June 3, 2021. Although most space salvage proposals involve title transfer based on scrap value and recycling economics, the cited proposal contemplates a complex cooperative approach involving establishment of an Intergovernmental Space Salvage Entity (i. e., IGO) to assign actuarial risk and liability to debris objects and provide a pool of funds from governments, commercial operators and insurance firms for ADR. Whether Russia or China would participate in such an arrangement is questionable if predominantly U. S. and western-based commercial companies and insurers were the principal beneficiaries. Moreover, liability for existing debris remains unclear with or without title transfer. Regardless, salvage arrangements presently have no paying customers nor viable technology solutions. The business cases for in-space or Earth-based use of intact debris, or for use of space-based resources, are still nascent.

## Comparison of Cooperative ADR Models

### Public (IGO) (Multilateral)

An IGO is an organization generally established primarily among several sovereign states through formal treaties under international law in furtherance of a shared purpose. In many cases, the United Nations provides the framework for multilateral IGOs involving sovereign entities.<sup>5</sup> IGOs can be framed around a common interest or region, and the number of members can vary. They can be inclusive or restrictive regarding membership, and broad or narrow in scope. They vary in longevity, degree of formality, granted authority, and internal governance structure.

Two IGOs have already been proposed for an expansion of purpose or as a model to accomplish ADR.

The **ICAO** was formed in 1944 when 52 countries signed the Chicago Convention on International Civil Aviation. After a majority of those countries ratified the Convention, in October 1947, ICAO became an agency of the United Nations under its Economic and Social Council (ECOSOC). Today it has 193 member governments who triennially elect 36 members, known as the Council, to develop and adopt standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. The Air Navigation Commission (ANC) is the technical body with ICAO. The ANC is composed of 19 commissioners, nominated by the ICAO's contracting states and appointed by the ICAO Council. Commissioners serve as independent experts, who although nominated by their states, do not serve as state or political representatives. International Standards and Recommended Practices are developed under the direction of the ANC through the formal process of ICAO Panels. Once approved by the ANC, standards are sent to the Council, the political body of ICAO, for consultation and coordination with the member states before final adoption. ICAO is funded by contributions of member States. Each government's financial contribution to ICAO is roughly proportional to its respective Gross Domestic Product and its use of aviation. Although not immune to politics, ICAO has successfully managed international civil air transportation for several decades. Because travel to space must go through air space, and in order to integrate commercial air and space traffic management, ICAO has been proposed as a vehicle to also manage and accomplish ADR.<sup>6</sup>

Intelsat Corporation (INTELSAT) began in 1964 as an IGO (International Telecommunications Satellite Organization) formed among seven countries to manage a fleet of telecommunications satellites providing international broadcast services. Like ICAO, INTELSAT began under an interim agreement which led to a permanent arrangement among 81 nations in 1973. It operated from 1964 to 2001 under a political agreement among participating nations, and an Operating Agreement setting forth more detailed financial (cost and revenue sharing) and technical provisions. Its charter accommodated commercial participation by permitting private entities from state parties to participate as part of the relevant government's interest. It was privatized after 2001 in response to the growing commercialization of the satellite telecommunications market. In 2020, McGill University proposed to establish an IGO called

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<sup>5</sup> Wikipedia, [Intergovernmental Organizations](#), accessed August 14, 2021; [Intergovernmental Organizations \(IGOs\)](#); Harvard Law School website, accessed August 20, 2021.

<sup>6</sup> Kaul, [International Cooperation in Space Exploration: Managing the Low Earth Orbital Issues](#), GLEX-2021,1,1,2,2, x62001, St. Petersburg, Russia, July 2021.

**INREMSAT**, based on the INTELSAT model, to conduct ADR activities.<sup>7</sup> In doing so, it acknowledged that commercial initiatives or unilateral national programs alone would be insufficient to reduce risk, stating in part that “international cooperation among all stakeholders following proven models is needed”. Under the INREMSAT proposal, each participating government would agree (through treaty or agreement) to remove, on a commercial basis, a number of existing high mass space debris (dead satellites and spent upper stages) created by their national space activity, to be funded through national “space-garbage-collection” taxes to be levied on the final users of space-based commercial services available in the country. The proposal also addressed a licensing regimen to insure “assured removal” of newly created debris. Like INTELSAT, INREMSAT contemplates private commercial participation. A central premise of INREMSAT requires each cooperating nation to pay for ADR of its own objects, presumably to avoid the perception that one country’s taxpayers are paying for removal of another country’s debris.

Three other IGOs or informal intergovernmental associations contain features (attractive similarities) which could be leveraged to accomplish cooperative ADR through repurposing.

The **Inter-Agency Space Debris Coordination Committee (IADC)**, formed in 1993, is an intergovernmental forum to coordinate research activities related to orbital debris.<sup>8</sup> Its members include the space agencies of Italy, France, China, Canada, Germany, ESA, India, Japan, Korea, the U. S., Russia, Ukraine and the U. K. Its primary purpose is to exchange information among member space agencies on space debris research, through a Steering Group comprised of all member agencies, and four specialized Working Groups addressing Measurements, Environment and Data Base, Protection, and Mitigation. Each agency is responsible to fund its own participation in periodic meetings. Although not formally an IGO, its subject matter and constituency warrants consideration in any analysis of alternatives for cooperative ADR. To expand the IADC’s purpose to include cooperative ADR would require formal establishment of an IGO among some or all of the governments involved, a broadened charter including governance structure, and funding under an agreed sharing formula.

The **International Maritime Organization (IMO)**, a specialized agency of the United Nations, is responsible to regulate shipping on the high seas.<sup>9</sup> It was created through ratification of a multilateral treaty known as the Convention on the International Maritime Organization, and today includes 174 member states. The IMO’s primary purpose is to develop and maintain a comprehensive regulatory framework for shipping, including maritime safety, environmental concerns, legal matters, technical co-operation, maritime security and the efficiency of shipping. IMO is governed by an assembly of members and is financially administered by a council of members elected from the assembly. The work of IMO is conducted through five committees and these are supported by technical subcommittees. Like the ICAO for global air space, the IMO addresses aspects of the maritime “global commons” analogous to outer space.

The **International Telecommunication Union (ITU)** is a specialized agency of the United Nations responsible for all matters related to information and communication technologies.<sup>10</sup> It was established in May 1865 as the International Telegraph Union, pursuant to the International Telegraph Convention, making it among the oldest IGOs still in operation. Today, the ITU promotes the shared global use of the

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<sup>7</sup> [Proposal for an Operational and Regulatory Framework to Ensure Space Debris Removal](#), McGill Institute of Air and Space Law, September 2020.

<sup>8</sup> [IADC website](#), accessed August 28, 2021.

<sup>9</sup> [IMO website](#), accessed August 28, 2021.

<sup>10</sup> [ITU website](#), accessed August 28, 2021.

radio spectrum, facilitates international cooperation in assigning satellite orbits, assists in developing and coordinating worldwide technical standards, and works to improve telecommunication infrastructure in the developing world. It is also active in the areas of broadband Internet, wireless technologies, aeronautical and maritime navigation, radio astronomy, satellite-based meteorology, TV broadcasting, and next-generation networks. The ITU's global membership includes 193 countries and hundreds of businesses, academic institutions, and international and regional organizations. Its space-related character might facilitate repurposing to include ADR.

Finally, any number of cooperating governments could choose to form an entirely new IGO (“**ADR (new)**”) through traditional treaty-based methodology, dedicated exclusively to remediation of orbital debris.<sup>11</sup>

### **Public (Bilateral+)**

The ADR market for high mass debris in high LEO has only a handful of stake-holders, which suggests a bilateral approach among a small group of governments without forming an IGO might be feasible. Although politically charged, the recent Artemis Accords for cooperative exploration of the Moon and deeper space reflects such a model. The Artemis Accords began as a unilateral statement by one country, the U. S., expressing principles for space exploration. The principles set a baseline for agreements with partners on ten relevant topics: Peaceful Purposes; Transparency; Interoperability; Emergency Assistance; Registration of Space Objects; Release of Scientific Data; Protecting Outer Space Heritage; Space Resources (the right to extract and utilize); Deconfliction of Activities (safety zones); and Orbital Debris (mitigation). Some of these principles simply mirror existing international law, but a few go further. Twelve other governments have signed the Artemis Accords as of August 1, 2021, Australia, Canada, Japan, Luxembourg, Italy, the United Kingdom, the United Arab Emirates, Ukraine, the Republic of Korea, New Zealand, Brazil and the Isle of Man. In doing so they have all endorsed a transactional methodology for implementation by agreeing to enter into binding bilateral contractual agreements with the U. S. to share work on the Artemis Program.<sup>12</sup> By analogy, “**Debris Accords**”, initiated by one stake-holding government and then offered to others, could be implemented through bilateral agreements containing mutually agreeable principles (e. g., governance structure, operational plan, legal consent, and cost, risk and information sharing formulas) for cooperative ADR.<sup>13</sup> Unlike the Artemis Accords, “Debris Accords” would not require any changes to existing international law, which might make them more palatable to political rivals.

### **Private-Public (NGO)**

An NGO is a privately held organization that is independent of government involvement (although it may receive government funding) and is operated by voluntary citizens towards a common interest.<sup>14</sup> They are typically non-profit entities. The term as it is used today was first introduced in Article 71 of the newly-

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<sup>11</sup> See Note 4, *supra*, for a salvage-based cooperative ADR proposal.

<sup>12</sup> The elements of NASA's “Artemis Program” are more fully described in Wikipedia, [Artemis Program](#), (accessed May 19, 2021). Most international space cooperative activities are on a no exchange of funds basis to avoid using tax money from one nation on another nation's space activities.

<sup>13</sup> See Dickey, Uvarov, [“Principles for Cooperative ADR”: A Viable Path for Remediation of High Mass Derelict Objects in Crowded Low Earth Orbits?](#), GLEX-21-1,4,9,x62056 (July 2021), for a discussion of “Debris Accords” principles, and describing the political and national security weaknesses inherent in such an approach.

<sup>14</sup> Wikipedia, [Non-governmental organization](#), accessed August 20, 2021.

formed United Nations Charter in 1945. NGOs can operate at a local, national or international level to achieve objectives in support of the public good. They exist today in a variety of models, and have evolved in different ways to best serve the interest they represent.

The **Red Cross** was originally formed in the U. S. by Clara Barton, a private citizen, and then later it became an “instrumentality” of the U. S. government.<sup>15</sup> International Red Cross and Red Crescent organizations were formed in other countries based on a similar model. Today the Red Cross is funded largely by private donations. Collectively, these organizations were formed to support the universally recognized value of humanitarian aid – the symbol, a red cross or red crescent, says “Don’t shoot!” in any language. Nations, even those at war, support the Red Cross because they recognize it serves a fundamental humanitarian value.

Many successful large industries, such as computer chip manufacturers, the cable television industry, and high-definition television developers, have established successful precompetitive collaborations focusing on standards, applied science, and technology that advance the field for all stakeholders and benefit the public. The pharmaceutical industry, however, has a well-earned reputation for fierce competition and did not demonstrate willingness to share data or knowledge until the US Food and Drug Administration (FDA) launched the Critical Path Initiative in 2004. Initiated with a planning grant from the state of Arizona, the FDA, the University of Arizona, and SRI International (a nonprofit corporation, formerly Stanford Research Institute) agreed to create the **Critical Path Institute (C-Path)**.<sup>16</sup> C-Path is envisioned as a neutral third party, without financial support from the regulated industry. Because of C-Path neutral funding and its mission to focus on process, not products, the FDA can actively participate in the work without concerns about conflicts of interest. C-Path serves as a neutral third party to enable multiple stakeholders across the spectrum of medical product development to work together in a pre-competitive consortium model in order to streamline and de-risk decision making in the development and regulatory review process.

Private-public relationships have also been established to employ space science to benefit life on Earth. **NanoRacks**, a profit-making organization, and the **Center for the Advancement of Science in Space (CASIS)**, a non-profit, non-governmental organization, now operate a portion of the International Space Station designated by the U. S. Congress as a national lab, under agreements with the National Aeronautics and Space Administration (NASA).<sup>17</sup>

Similar private-public partnerships are found across the globe, from Private Financing Initiatives in the United Kingdom, to Federally Funded Research and Development Centers in the U. S., to infrastructure improvement projects in China and Russia.<sup>18</sup> Partnering with the private sector has enabled governments to find better ways to achieve important societal needs. Although the variety of public-private combinations are endless, all private-public relationships are formalized using contracts.

Only one private-public ADR model exists at present, **TCTB, LLC**. TCTB is an acronym for “Three Country-Trusted Broker” which describes its business model in a few words. TCTB is a private legal entity to be locally domiciled as a profit or non-profit entity in each participating jurisdiction, as an NGO. It would ally stake-holding governments to a shared purpose through separate but interdependent “prime” contracts

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<sup>15</sup> The history of the Red Cross is described on its [website](#), accessed August 22, 2021.

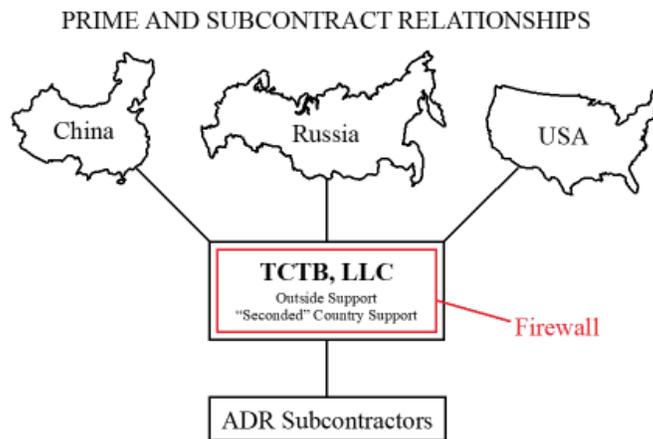
<sup>16</sup> C-Path’s history is described on their [website](#). (LeoLabs is a spinoff from SRI International.)

<sup>17</sup> A description of NanoRacks and CASIS is contained on NASA’s [website](#), accessed August 22, 2021.

<sup>18</sup> Wikipedia, “[Public-Private Partnership](#)”, accessed September 19, 2019.

with TCTB. Cooperation would be achieved through agreement on common principles (e. g., cost, risk and information sharing, dispute resolution, procurement mechanism) contained in each contract. TCTB would facilitate and lead cooperative planning, and then select, engage and manage ADR “subcontractors” using pooled funding legislatively authorized by each participating government. Governments would participate through “firewalls” inside TCTB designed to protect sensitive or proprietary information embedded in the debris target or ADR technology. TCTB would engender trust among governments through transparency. TCTB’s private-public arrangement is portrayed in Figure 2. Depicted as a three-country structure, other governments (i. e., ESA, France, Japan and India) could be added under separate contracts.

## TCTB Business Model – Contracting Relationships



[Figure 2]

### Comparison of Cooperative ADR Alternatives

The unique calculus presented by high mass debris in high-LEO, namely imminent risk, limited market, high overall cost, involvement of only a handful of often adverse sovereign governments, and mismatch between fault and opportunity, requires a novel cooperative solution. Besides the legal, political, national security, economic and funding impediments that have prevented ADR to date, there are two key factors that point to a private-public NGO model as the only viable alternative to accomplish timely ADR.

Removing politics from the solution as much as possible is the first key to success. IGOs are not immune to politics. Purely public IGO ADR models involving existing or new organizations will languish through high diplomatic and bureaucratic involvement, conflicting political agendas, too many “cooks in the kitchen” (i. e., separate governments with varying degrees of interest in ADR) in some cases, a bias against cost-sharing, and will suffer from the unnecessary “permanence” that generally accompanies their formation or restructure. Especially for existing but repurposed IGOs, like ICAO, there are simply too many entrenched interests and power centers as well as concerns about interfering with an organization’s main

initial purpose - using an existing IGO already dedicated to another purpose is a bridge too far. Employing a single purpose NGO like TCTB to accomplish a shared purpose could help to overcome the inevitable political differences that would surely muddy any common ground between the main protagonists for ADR, China, Russia and the U. S., and could more quickly result in concerted action.

Understanding and overcoming the mismatch (imbalance) between fault and opportunity that exists for ADR is the second key. ADR is fundamentally about removal of risk to protect future opportunity, not liability for collisions. In this regard, all space-faring nations have left spent rocket bodies and dead satellites in space as a common practice. In fact, but for the recent commercial race to space, these objects might have been left to decay naturally over hundreds of years without posing significant risk to anyone.<sup>19</sup> It is therefore historically revisionist to blame any nation, roughly in proportion to the numbers or mass of debris they created before the commercial space revolution began. More pointedly, requiring Russia to remediate a disproportionately larger number of objects at their own expense based on a fault or liability premise, would disproportionately reduce future risk to other governments at no cost to them. Stated another way, the same seven governments who are responsible for (but arguably not liable for) today's problem also own the lion's share of future opportunity in space today, but not necessarily in the same proportion as when they entered it! Laying aside the detailed, time-consuming (and unnecessary) task of determining respective shares of future space opportunity, equal cost-sharing for ADR among the three to seven governments who collectively own both the risk of these objects and the future opportunity in space that ADR will enable, is the only economically sound and fair basis to apportion ADR costs.<sup>20</sup> To be clear, any ADR model which would force each government to pay for remediation of its own objects will fail.

A bilateral "Debris Accords" approach will also languish or fail for many of the same reasons that will doom an IGO model, but more particularly because political and national security hurdles prevalent among the three most indispensable stake-holders, China, Russia and the U. S., will likely prove insurmountable or, at best, result in dangerous delays. Some of these problems include avoidance of domestic preferences in selecting "subcontractors" for performing projects, political restraints on direct interaction with others, and national security issues embedded in the debris chosen for remediation or in the remediation technology that might limit involvement in a particular cooperative ADR mission.

Using a dedicated, single-purpose NGO like TCTB to facilitate cooperation among three to seven stakeholder governments for the limited purpose of remediating several hundred dangerous objects in high-LEO as soon as possible would simplify and streamline ADR, and best overcome the legal, political, national security, economic and funding hurdles that have prevented ADR to date. Although TCTB's model would not entirely supplant diplomacy among cooperating governments,<sup>21</sup> it would facilitate a cooperative solution by helping to overcome certain legal, political and national security impediments to ADR that would be exacerbated in direct cooperation among protagonist governments without an intermediary. Moreover, transparency (and trust) among participating governments would be

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<sup>19</sup> The increased number of objects in space from recent commercial activity does in fact increase the risk posed by the pre-existing derelict objects. See Stevenson, et al., Note 1, *supra*.

<sup>20</sup> Although future opportunity in space is theoretically equal for all, which further buttresses a *pro rata* cost sharing formula for ADR, taken to the extreme, however, ADR cost-sharing among all nations on Earth through the United Nations would default to a political impasse.

<sup>21</sup> At a minimum, legislative funding authorizations would still be required within each participating government. Sovereignty would be protected through a common "termination for convenience" clause in each "prime" country contract with TCTB, facilitating planning while preserving options.

challenging working through an IGO or bilaterally, but could be alleviated by working through a single-purpose NGO. Finally, without an NGO “broker”, information sharing of space technology among sovereign governments (either in the subcontractor’s ADR proprietary technology, the ADR target itself, or the export authorization), and selection of remediators, even in furtherance of a shared objective, could be problematic. All things considered, it would be far easier and faster to reach agreements on common ADR principles through separate but interdependent private commercial contracts with a multi-jurisdiction-domiciled single purpose NGO, rather than through treaties or direct agreements.

### Conclusion

Regardless of the model adopted for ADR, the world must find a path to a sustainable future in space. Besides governments cooperating, scientists, economists, environmentalists, lawyers and procurement professionals must all contribute their expertise to the planning process for ADR of high mass objects in high-LEO in order for it to succeed, but only in a way that avoids the divisiveness, parochialism and insecurity spawned by national allegiance. In the end, cooperating on debris remediation would bind us together as humans in space, transcending political differences and the conflicts that arise from competing national priorities. Who knows where that might lead? TCTB is the best path to cooperative ADR.

### TCTB Status

TCTB, LLC was incorporated under Texas law in early 2019. TCTB submitted formal contracting Proposals to the U. S. (NASA, the National Space Council and the Department of Commerce), Russia (Roscosmos and the Russian Ministry of Foreign Affairs), and China (CNSA and the Department of Foreign Affairs) on May 19, 2019. TCTB engaged Valentin Uvarov as a partner in Russia in early 2020, and plans to establish TCTB II in Russia in the near future. TCTB is also seeking to partner with the United Nations Education, Scientific and Cultural Organization (UNESCO) as an NGO for ADR, and is exploring other options for obtaining NGO status. Besides addressing alternative models for ADR in this paper, TCTB has written four previous papers regarding cooperative ADR. [Paper One](#) addressed the legal, political, national security, economic and funding hurdles cooperative ADR faces, and how a private entity like TCTB could help overcome them. [Paper Two](#) described the ADR planning process, consisting of six Phases leading to ADR missions in Phase 7, that will be necessary to accomplish cooperative ADR whether led by TCTB or not; [Paper Three](#) covered object/target selection for ADR missions; and [Paper Four](#), co-written with Valentin and presented during GLEX 2021 in St. Petersburg, Russia in June 2021, described fundamental principles that participating governments will have to agree upon under any cooperative structure for ADR. More information about TCTB’s NGO model for cooperative ADR is contained on TCTB’s website, [threecountrytrustedbroker.com](http://threecountrytrustedbroker.com). Non-proprietary versions of the 2019 Proposals to China, Russia and the U. S. are contained on the website along with all five papers, plus a series of FAQs regarding TCTB, a Library of informative material about ADR, and contact information.

