

Cooperative Debris Remediation: Ready for Action!

Chuck Dickey, Valentin Uvarov** and Guoyu Wang****

Abstract

An International Non-Governmental Organization (INGO) could remediate the most dangerous orbital debris on behalf of cooperating governments who agree to share cost, risk and information within the INGO's "firewall". No new laws, national or international, are needed! If the INGO process and contractual model previously described by TCTB ("Three Country – Trusted Broker") proved to be effective for the most dangerous debris, it could also be applied to other debris.

Keywords: Space debris, active debris removal.

Acronyms/Abbreviations

Active Debris Remediation (ADR)

Chinese National Space Administration (CNSA)

Cooperative Active Debris Removal (CADR)

European Space Agency (ESA)

Inter-governmental Organization (IGO)

International Institute of Space Law (IISL)

International Non-governmental Organization (INGO)

Low Earth Orbit (LEO)

National Aeronautics and Space Administration (NASA)

State Space Corporation ROSCOSMOS (ROSCOSMOS)

Three Country – Trusted Broker (TCTB)

United Nations (UN)

United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS)

United Nations Economic and Social Council (ECOSOC)

* Member, IISL, Corresponding Author and Principal, TCTB, P. O. Box 591031, Houston, TX 77259, jcdickey@threecountrytrustedbroker.com.

** Member, IISL and Principal, TCTB, uvarov.valent@yandex.ru.

*** Member, IISL and Principal, TCTB, wanguoyu1979@126.com.

1. Introduction

Debris around Earth comes in all shapes and sizes, from millions of tiny objects to school bus-size or larger ones. Among these are a few thousand unmaneuverable rocket bodies and satellites (“Massive Derelicts”), each weighing between one and ten tons, traveling at very high speeds in tightly clustered orbits between 750-1500 kilometers above Earth, just above some of our most valuable satellite belts. Considered by scientists to be the most dangerous debris in orbit,¹ Massive Derelicts will stay in orbit for hundreds or thousands of years before colliding or decaying into Earth’s atmosphere. Conjunctions, or near misses, involving these objects occur daily, but the ability to accurately measure them is limited by distance and speed – a variation on the Heisenberg uncertainty principle. Collisions are simply a matter of time, but are measured in a few years rather than millennia. Each collision will spawn thousands of smaller but still lethal fragments, increasing the likelihood of even more collisions, escalating the cost and risk of space use for everyone, for any purpose, and imperiling our future on this planet and beyond.

Just a handful of governments, primarily China, the Russian Federation, and the United States of America, but also France, Japan, India and the European Space Agency (ESA), left Massive Derelicts in Low Earth Orbit (LEO) predominantly during the last third of the twentieth century, as a common practice – arguably without fault. The practice continues today – if the United States of America, for example, were to remove its own objects, the remaining objects would still dominate risk probability scenarios. But employing a fault-based metric for remediation of these objects is self-serving and myopic. Sharing cost and risk based on future opportunity in space that would be enabled by remediation (i.e., cost avoided) is fairer, and would better motivate participants.

Like cross-border environmental pollution or genocide, Massive Derelicts are another “Problem from Hell”,² mainly because remediation requires cooperation among sovereign governments to avoid a tragedy, but also because the risk they portend is based on statistical probabilities. But there is hope - air pollution has been partially mitigated through the Montreal Protocol, aided by the Precautionary Principle which recognizes that if we

1 C. Tuttle, D. McKnight, T. Maclay, Refining Active Debris Removal Strategies, AMOS (Maui, 20-22 September 2023), in draft as of the date of this paper. The Tuttle, et al. paper will combine several previous methodologies by a number of author-scientists to identify the most dangerous objects in space, in terms of their “debris generating potential”, resulting in a new “Top 50” ranking list. The paper further notes that the practice of leaving spent rocket bodies in space continues among governments today, which has resulted in a modified ranking list.

2 S. Power, *A Problem from Hell: America and the Age of Genocide*, London, England: Flamingo (2003).

wait to act until we are certain about a future danger, it may be too late to defeat it.³

Notwithstanding these similarities, remediation of Massive Derelicts presents a unique mix of legal, political and economic hurdles, including ownership considerations under international law, national security concerns, domestic preferences, and economic inefficiencies lurking within separate national programs, framed by remediation's huge cost. As Gustave Flaubert noted, "God is in the details" – Massive Derelicts require their own "bottom-up" solution.

But in a world riddled with political and philosophical fault lines, how can we cooperate to meet this existential challenge?

Sovereign governments employ a range of alternatives for cooperation, including the United Nations (UN), a single-purpose Inter-governmental Organization (IGO), and government-to-government bilateral agreements, but none of these would successfully overcome the unique challenges of Massive Derelicts. Timely cooperative remediation must be built on trust, transparency and neutrality, which can best be provided by a private, non-profit, single-purpose International Non-governmental Organization (INGO).⁴

TCTB, an acronym for "Three Country – Trusted Broker" which describes its cooperative plan in a few words, is a novel, non-profit INGO, with partners in China, the Russian Federation and the United States of America, capable of facilitating cooperative active debris remediation (CADR) among the handful of governments responsible for Massive Derelicts before the next collision.

Developed exclusively for that purpose, TCTB is recognized as an INGO by the United Nations Economic and Social Council (ECOSOC), and is also formally recognized as a Permanent Observer to the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS). TCTB operates under an umbrella and subsidiary structure with domestic branches in each participating government – similar to the Red Cross but much smaller by design.

Initiated under a single planning contract with the UN back-funded by participating governments, or under separate domestic contracts with each participating government, TCTB's experts would act as mediators to help reach consensus on necessary principles of cooperation, including legal consent, cost, risk and information sharing, object selection methodology, a

3 Montreal Protocol on Substances that Deplete the Ozone Layer, 16 September 1987, United Nations Treaty Collection. The precautionary principle was first enshrined in the Rio Declaration as Principle 15 (1992).

4 C. Dickey, V. Uvarov, TCTB: A Private-Public Path to Cooperative ADR, IISL (2021).

procurement plan, dispute resolution mechanisms, and protection of sovereign prerogatives.

Remediation agreements among governments would take the form of separate but interdependent domestic “prime” contracts between TCTB and each participating government; TCTB would select and manage “subcontractor” remediators on behalf of participating governments. TCTB would operate inside a “firewall” designed to protect national security and proprietary information.

No changes to international or domestic law would be required to implement TCTB’s streamlined, low-cost planning process and remediation model. Predicated on trust, transparency and neutrality, and more fully described at threecountrytrustedbroker.com, TCTB’s formula merely facilitates diplomacy, offering a bridge over troubled waters for common good.

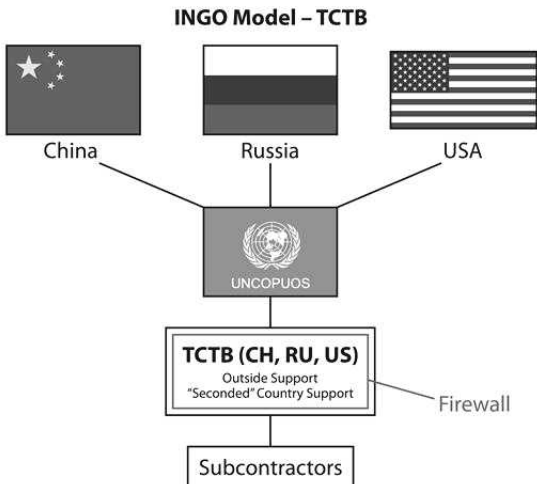
2. TCTB’s Process

The practice of using neutral intermediaries to help adverse parties, including sovereign governments, resolve conflict or achieve shared objectives has existed in many forms for centuries. Although voluntary in nature, to be useful, any mediation process must consider and serve the needs of its parties. Where governments are involved, sovereign prerogatives, diplomatic procedures, confidentiality, and the checks and balances inherent to governmental control structures must be respected and accommodated.

TCTB’s overall process of planning for, and then performing, cooperative remediation is tailored to the needs of government parties. TCTB first introduced its novel “Trusted Broker” concept in 2019.⁵ It consists of (a) *planning and mission Phases* (the “how”) and (b) *principles* (the “what”) to be agreed upon in planning and then enshrined in remediation contract clauses between TCTB and each participating government.

This novel contractual structure allying government parties through separate but equivalent private contracts with TCTB includes information “firewalls” designed to protect sensitive and proprietary information utilized during the remediation planning and mission Phases, as shown in the diagram below:

5 C. Dickey, “Three Country-Trusted Broker: An Effective Public-Private Model for Orbital Debris Remediation, IAC - Washington, DC (2019).



TCTB has previously described eight Phases of its planning and mission process⁶ and eleven contract clauses reflecting substantive remediation principles.⁷ Planning Phases 1-6 include establishing ground rules and relationships in Phase 1, a methodology for selecting objects for remediation missions in Phase 2,⁸ and a world-wide competitive procurement process for selection of remediation “subcontractors” in Phases 3-6. Phases 7-8 encompass actual remediation missions. For purposes of illustration, we will briefly summarize one Phase of the planning process and one key remediation principle in this paper.

2.1. Planning Phases – Selected Example: Establishing Ground Rules

Establishing the contractual and working relationships between TCTB and participating governments is the subject of Phase 1 of TCTB’s comprehensive planning process. The logistics of establishing a channel for dialogue among governments, whether through an intermediary or directly, is an important first order of business. Phase 1 begins with *establishing ground rules* (e. g., contact points, meeting logistics, non-binding-ness/voluntary nature of the process, confidentiality, work product, contractual vehicles and funding arrangements), to “definitize” the relationships and work plan. TCTB contemplates that each participating government would choose to interface

6 C. Dickey, ‘Three Country-Trusted Broker: An Effective Public-Private Model for Orbital Debris Remediation – Part Two: Country Contracting Phases, IAA-UT Space Traffic Management Conference, Austin (2020).

7 C. Dickey, V. 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, St. Petersburg, Russia (2021).

8 C. Dickey, A Proposal for Active Debris Remediation – Selecting Objects (2020).

with TCTB through its established diplomatic channels, independently coordinating its own internal expertise and resources as needed. Phase 1 establishes TCTB's role as a "Trusted Broker" in working separately with each government to achieve the consensus required for concerted Active Debris Remediation (ADR). These relationships would be non-exclusive – each government would retain the right to work independently through diplomatic or other established channels with other participating governments - as noted above, TCTB's process is merely facilitative.

As reflected in the diagram above, the support available from the UN and in particular UNCOUOS would be invaluable to all parties during planning Phases – besides providing logistics support (e. g., meeting venues, administrative support, translators), the UN has published a helpful guide to using mediation to help resolve disputes and conflicts which contains a wide selection of tools to choose from.⁹

2.2. Principles – Selected Example: Cost Sharing

An important task in Phase 1 of TCTB's planning process is developing the terms of remediation contracts under which actual missions will be performed in Phases 7-8 ("Prime Contract Definitization"). If principles cannot be agreed upon among governments, cooperative ADR is not possible, whether through an INGO intermediary, an IGO, or otherwise. TCTB has previously described the principles it deems to be necessary, addressing cost, risk and information sharing, legal consent, object selection methodology, a procurement plan, dispute resolution mechanisms, and protection of sovereign prerogatives.¹⁰ These principles are codified in eleven contract clauses that would first be proffered by TCTB to governments, discussed and, after tentative agreements are reached, included in each of TCTB's country "prime" contracts.¹¹

9 The *United Nations Guide for Effective Mediation* was issued as an Annex to the report of the Secretary-General on Strengthening the role of mediation in the peaceful settlement of disputes, conflict prevention and resolution (A/66/811, 25 June 2012).

10 *Supra*, note 7

11 TCTB has created a set of prime contract clauses expected to be included in each government prime contract (note that "Country" is used interchangeably with "government"; and the Chinese National Space Administration (CNSA), State Space Corporation ROSCOSMOS (ROSCOSMOS), and the National Aeronautics and Space Administration (NASA) have been arbitrarily chosen as government contracting entities solely for purposes of illustration). These clauses, set forth below in full text in draft form for discussions with governments, will coordinate the otherwise "separate but interdependent" prime contracts to ally them to the common purpose.

"The following Special Provisions, reflective of the unique nature of TCTB's proposed contracting arrangement, shall be inserted in each separate Prime Contract (e. g., one between CNSA and TCTB, one between ROSCOSMOS and TCTB, and one between NASA/Commerce and TCTB):

Consent to ADR of Space Objects: “In furtherance of the Shared Purpose among Country Prime Contracts as further described in the “Shared Purpose and Common Interpretation” clause of this Contract, and in recognition of its jurisdiction over certain space objects under international law, [CNSA][ROSCOSMOS][NASA]/[Country Party] hereby consents to the ADR of its space objects by TCTB under this Contract and by its subcontractors. [Country Party] retains all rights in and jurisdiction over the space objects for which consent is granted, except as expressly negotiated with TCTB on a case-by-case basis.”

Country Audit Rights: “[Country Party] has the right, during normal business hours with reasonable advance notice, for itself or using an independent and licensed auditor, to audit all books and records of TCTB. This right is subject to the limitations expressed in the “Protection of Information” clause in this Contract which protects Country Sensitive Information or Subcontractor Proprietary Information in the custody of TCTB.”

Termination for Convenience: “[Country Party] may terminate this Contract or any Phase thereof for its convenience at any time and for any reason, after thirty days written notice to TCTB. In case of such termination, [Country Party] agrees to pay all reasonable, allocable TCTB costs incurred or obligated to be incurred, and Fees earned, up to the date of termination.”

Protection of Information: “In performing this Contract, TCTB and its subcontractors will need to possess or use sensitive or proprietary information of others. [Country Party] and TCTB agree to establish access controls governing the use and disclosure to others of Country Sensitive Information or Subcontractor Proprietary Information in the possession of TCTB.”

Provision of Information: “[Country Party] agrees to provide all available information within its possession or control, regarding potential ADR objects, or necessary for licensing or other approvals, to TCTB and its subcontractors, subject to any restrictions on further disclosure established under the “Protection of Information” clause in this Contract.” [Country Party] agrees to provide any necessary license or authorization to TCTB and its subcontractors in order to allow TCTB and its subcontractors to perform ADR activity.”

TCTB Support by Seconded Country Personnel: “In the event [Country Party] provides personnel or other resources to TCTB in support of this contract, [Country Party] agrees to bear its own costs of providing that Support. [Country Party] will cause seconded personnel to sign Non-Disclosure Agreements with TCTB to protect sensitive information of other participating Countries during performance of this Contract.”

Risk Allocation for Loss or Damage to Parties or Third Parties: “Each Party is responsible for its own actions or inactions in performing this Contract causing Loss or Damage. However, the Parties recognize that significant risk will be present for all parties participating in Phases 7 and 8 ADR Projects, and that insurance may not be reasonably available to fully cover all those risks and party participants. During Phase 5, ADR subcontractors will be required to propose, as part of the subcontract price, a comprehensive plan for coverage for all risks and all-party participants for each ADR Project (e. g., manufacturing, pre-launch, launch, on-orbit and de-orbit), to include consideration of reasonably available insurance, self-insurance, indemnity and party cross waivers. To the extent any risk remains, [Country Party] agrees to assume a pro rata share of any resulting liability in accordance with the “Shared Purpose and Common Interpretation (Conforming Remedies) clause of this contract.

For the avoidance of doubt, TCTB's cost of insurance for risks arising out of or related to the performance of this Contract are allowable and allocable to this Contract."

Contract Type and Payment: "[Country Party] agrees to pay TCTB's reasonable, allocable Costs arising out of or related to performing this Contract, and to pay TCTB Fees and Provisional Fees. TCTB will endeavor to notify [Country Party] of the amount and nature of anticipated expenses in advance of incurring a Cost. TCTB will maintain customary records of all Costs, and will electronically submit Invoices to [Country Party] on a monthly basis and [Country Party] will pay those Invoices in U. S. dollars to TCTB's designated bank account within 14 days of receipt."

Interdependence and Pro Rata Cost Sharing Among Prime Country Contracting Parties: "In furtherance of the Shared Purpose among all [three] Prime Contracts as further described in the "Shared Purpose and Common Interpretation" clause of this Contract, [Country Party] agrees to pay TCTB a Pro Rata share of its [reasonable, allocable] costs incurred in performing ADR Projects. [Country Party] agrees to pay the full amount of each Invoice under this Contract, subject to audit as described in the "Country Audit Rights" clause of this Contract. Annually, the Parties agree to reconcile payments made to account for any changes among country participation as evidenced by contracting, authorization and funding effective dates. Example: Under Phase 2, TCTB incurs \$3,000 in travel expenses to attend a meeting to develop the Initial Target Ranking Document (ITRD). Assuming all [three] Countries have then entered into Prime Contracts with TCTB and have authorized and funded Phase 2 performance, TCTB submits an Invoice for \$1000 (one-third of the total) to each country Prime Contracting Party for payment. If only two Countries have then funded Phase 2 effort, TCTB will submit an Invoice for \$1500 to each participating country. Subsequently, a third country funds Phase 2 effort. In that case, TCTB will submit a Reconciling Invoice for \$1000 to the third country, and will Refund/Credit \$500 each to the other two Countries. Nothing herein shall be construed as establishing or requiring direct bilateral relations between Prime Contracting Country Parties."

Shared Purpose and Common Interpretation (Conforming Remedies): "Whereas, the Chinese National Space Administration (hereinafter "CNSA"), State Space Corporation ROSCOSMOS (hereinafter "ROSCOSMOS") and the National Aeronautics and Space Administration (hereinafter "NASA") desire to cooperate to remediate orbital debris (hereinafter "ADR" or "Project(s)"); and whereas they further desire to Equitably Share the obligations, risks, costs and benefits of doing so; and whereas CNSA, ROSCOSMOS and NASA each intend to separately contract (hereinafter "Prime Contracts") with TCTB, LLC, (hereinafter "TCTB") to effectuate that purpose; and whereas TCTB is a private, independent contractor; and whereas TCTB intends to act as a prime contractor on behalf of each Country contracting Party to "definitize" the terms of each Prime Contract, identify and select ADR targets, develop Requests for Proposals (hereinafter "RFP(s)") and Subcontracts for ADR Projects, solicit ADR Proposals from subcontractors, select subcontractors and negotiate subcontracts, manage the ADR subcontracts, and perform other tasks as mutually agreed between the Parties; therefore, in consideration of that Shared Purpose and in order to effectuate it, and notwithstanding any other clause in this Contract to the contrary, the Parties agree to interpret this Contract and their respective rights and obligations hereunder to best facilitate that Shared Purpose."

One of the most important principles of cooperation for remediation of Massive Derelicts involves *cost sharing* – how will participating governments agree to share the costs of planning for, and then conducting, remediation missions?

Initially, it should be noted that TCTB's planning costs are negligible, amounting to little more than mediation fees plus administrative support, to be shared by participating governments. TCTB is, or will be, registered as a non-profit entity in every jurisdiction in which it operates.

However, it is widely acknowledged that costs of remediation missions will be huge, likely more than any single government would wish to bear alone. To illustrate this, and at the risk of oversimplifying the technical challenges remediation faces, assume a US\$5B price tag to remediate the 100 most dangerous objects in 10 missions (10 objects per mission, \$.5B per mission) over ten years. Sharing these costs seven ways, or roughly \$71m per year per government, if cost and risk were shared equally among all seven governments who today bear significant responsibility for Massive Derelicts as well as a prominent share of near-term future opportunity in space, would help make the project affordable.¹²

But cost sharing involves much more than just sharing mission costs - Future technical developments accessible through TCTB's world-wide competitive selection process may provide viable alternatives to removal from orbit, or yield less costly and/or less risky solutions. Some governments might choose to provide in-kind sharing (e. g., launch costs, salvage opportunities¹³) and/or subsidies to domestic remediation competitors. Cooperation, coupled with burgeoning technical capabilities stimulated through national programs, plus competition, enables efficiency, affordability, and wider opportunity.

Disputes Resolution: "TCTB and [Country Party] agree to resolve disagreements arising under this Contract using good faith negotiations. Failing agreement on a disputed matter, the Parties agree that either party may initiate legal proceedings in any court of competent jurisdiction to seek a resolution. For Disputes arising under Phases 7 or 8 of this Contract, the parties agree to negotiate and agree to a binding dispute resolution process addressing venue, choice of law, language, procedure, appealability, enforceability, project continuance during the pendency of a dispute and other related matters. This clause is subject to the Shared Purpose and Common Interpretation (Conforming Remedies) clause of this Contract." The clauses (principles) set forth above are also contained in full text on TCTB's website.

12 C. Dickey, V. Uvarov, G. Wang, B. Weeden, Bridging National and International Efforts on Space Debris Remediation, IAC-22-A6/8-E9.1, at p. 6, IAC Paris (2022). The technical complexities of remediation missions pursuing massive, tumbling objects among varying altitudes and inclinations in LEO should not be oversimplified or underestimated.

13 For creative approaches to incorporate salvage opportunities into the remediation process to reduce costs for participating governments, see A. Anzaldúa, Maritime Lessons for Removal or Salvage of Orbital Debris and Repair and Enhancement of Spacecraft UNCOUOS Technical Presentation (2023).

Moreover, once begun, cooperative remediation would yield recurring cost savings through repetition (economy of scale) and enable adjacent markets. To begin the dialogue about cost sharing among participating governments, TCTB has prepared a clause establishing *pro rata cost sharing* on behalf of participating governments, the partial text of which is set forth below:

“In furtherance of the Shared Purpose among all [three] Prime Contracts as further described in the “Shared Purpose and Common Interpretation” clause of this Contract, [Country Party] agrees to pay TCTB a Pro Rata share of its [reasonable, allocable] costs incurred in performing ADR Projects.”¹⁴

Under TCTB’s planning process, this language (in fuller text on TCTB’s website to address other details of sharing costs, risks and information) could be provided to each government during Phase 1 as a means to initiate dialogue in search of consensus. Consensus will be formally incorporated into separate but equivalent domestic remediation mission contracts in Phases 7-8 of TCTB’s process between TCTB and each participating government (or in a single contract between TCTB and the United Nations as authorized by each participating government), subject to all sovereign prerogatives including legislative funding approvals. Thus, the voluntary nature of TCTB’s process would only become binding when each participating government passes funding legislation or otherwise authorizes the expenditure of funds towards the defined remediation activity.¹⁵ Finally, another contract clause/principle would allow governments to terminate their participation in the project at any time for any reason, subject only to the obligation to reimburse TCTB’s incurred cost, a reflection of the nature of contracting with sovereign entities.

3. Conclusion

As with any other form of mediation, TCTB’s planning process begins with dialogue.

To get started, following TCTB’s Technical Presentation to UNCOPUOS in Vienna in June 2023,¹⁶ TCTB has issued invitations to the UN and UNCOPUOS Delegations for China, the Russian Federation and the United

¹⁴ *Supra* note 11.

¹⁵ Proposals to create an Inter-governmental Organization (IGO) called INREMSAT have mentioned the difficulty in taxpayer-funded cleanup by one government of another government’s debris/space objects. Proposal for an Operational and Regulatory Framework to Ensure Space Debris Removal, McGill Institute of Air and Space Law (September 2020).

¹⁶ C. Dickey, V. Uvarov, G. Wang, Technical Presentation, “TCTB: Facilitating Cooperative Remediation of Massive Derelicts”, UNCOPUOS (2023).

States of America, to engage in dialogue about cooperatively remediating Massive Derelicts.

TCTB believes that these governments share an interest in remediating these objects in furtherance of their own national interests, and is optimistic that cooperation to remediate Massive Derelicts among three (or more) governments is possible.

Although we are confident that TCTB is the lowest cost, most expeditious path to remediation of these most dangerous objects, it is also important to make clear what we are not. Engaging in our “mediation” process is not an obligation to remediate, but working through our thorough planning process would help inform each Delegation of possible hurdles to cooperation, it could highlight possible differences in approaches, and it could provide insight into how any hurdles or differences might be reconciled.

It is important to note that any work product derived from this process will be owned by governments and may be useful for cooperative approaches directly among governments without involving a facilitator. It is also important to reiterate that TCTB’s process does not substitute for diplomacy or political decision-making – our process fully respects and incorporates the checks and balances all sovereign governments employ. We recognize there is no shortcut for national commitment regardless of the streamlined nature of our planning process.

Finally, we acknowledge that TCTB is not a solution for all debris in space – but let’s take care of the most dangerous, before tackling the rest.

Looking forward even further, a host of other “Problems from Hell” confront humanity’s path to the future. A successful INGO solution to Massive Derelicts might inform or enable solutions to similar otherwise intractable problems requiring cooperation among sovereign governments. Although TCTB is only a tool, nothing more, that governments can use to facilitate cooperation, all governments are populated by private citizens attuned to national interests, so TCTB’s proposed solution deserves to be considered.

TCTB’s private citizen partners, Guoyu Wang in China, Valentin Uvarov in the Russian Federation, and Chuck Dickey in the United States of America, are committed to facilitating cooperation among stakeholder governments. We collectively possess broad experience in international and space law, procurement law and planning, international mediation, management systems, government structures, and public-private collaboration. These are exactly the right skills to help governments build a cooperative framework to remediate Massive Derelicts before they begin to collide.

The time to act is now.

Acknowledgements

The authors would like to thank the International Institute of Space Law, Secure World Foundation, and UNCOPUOS, for enabling platforms for dialogue about the international broker concepts discussed in this paper.