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***ACTIVE DEBRIS REMOVAL:
POLICY AND LEGAL FEASIBILITY***

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DISCLAIMER

While this paper discusses legal, regulatory, and policy issues associated with ADR, nothing in this paper is intended as legal advice.



Summary

Over the last few decades, the complexity of space operations has grown, the number of commercial entrants into the space economy has increased, and the amount of space debris has inflated to a degree that threatens space operations and often requires satellites to maneuver to avoid collisions. Such maneuvers are becoming more common in certain orbital regimes. Preventing the creation of new debris is one way to preserve the space operational environment; removing debris is another. Yet viable options for active debris removal (ADR) remain elusive due, in part, to technical, economic, and legal challenges. Without diminishing the technical and economic challenges of ADR, this paper focuses on the legal questions associated with ADR which are often described as seemingly insurmountable. Our proposed framework aims to resolve these legal questions by applying a simple, bottom-up approach based on mutual consent, regulatory approval, and contractual agreements between participants. Our approach contrasts against the often-discussed comprehensive approach that promotes multilateral agreements and the establishment of international institutions as a necessary means. Recognizing that building a comprehensive, international framework is fraught with challenges, our framework instead centers not on what is difficult, but on what is achievable: (1) removing debris involving only one nation or (2) removing debris where the service provider and the debris owner share the same interests and recognize the need for active debris removal. Further, this framework offers an initial first step towards establishing that active debris removal is indeed legally feasible, leading the way to eventually building more comprehensive debris removal agreements between states at a future time.

Introduction

Space is integral to the safety, stability, and security of the United States and to the everyday functioning of global society. The value of space cannot be underestimated in the 21st century. The gradual increase in space debris, however, poses a threat to satellites and space activities that could disrupt these valuable services.

As such, space debris is a growing concern in the international space community. According to the

European Space Agency (ESA), there are approximately 29,000 pieces of debris larger than 10 centimeters and 670,000 pieces larger than 1 centimeter currently orbiting Earth.¹ The amount of existing debris is only the beginning of the problem. As of February 2021, there are over 6,500 spacecraft and over 2,000 rocket bodies in orbit,² and in the next few decades commercial companies plan to launch proliferated low Earth orbit (pLEO) constellations consisting of several thousand satellites. The proliferation of satellites in low Earth

Orbit (LEO) coupled with increasing space debris will magnify the risk of collision between operational spacecraft and space debris in certain LEO orbits. The rate of conjunction warnings will increase, causing satellite operators to make decisions on maneuvering more often or having to lower their collision risk thresholds. This could shorten the mission lives of satellites and increase the cost of operating in space.³

One way to address the debris issue is to perform effective debris mitigation, including post-mission disposal, to control the debris environment. Reducing the total amount of debris already in space through remediation is also becoming an increasingly important proposal for improving the safety of high population orbits. Active debris removal (ADR) might be one of the tools for remediating existing debris. Models from the National Aeronautics and Space Administration (NASA) have shown that at least five major satellites or rocket bodies should be removed annually to flatten the curve in the space debris population.⁴ Going further than that would decrease the overall amount of debris, moving toward a sustainable model for space.

An international team of scholars recognized this need and created a list of the 50 most worthwhile pieces of debris to remove. Based on predetermined algorithmic criteria to identify the most critical space debris objects, the international team—including representatives from the United States, China, and Russia—found that Russian and Chinese space debris are most critical to remove. Notably, none of the objects on the list top 50 objects were launched by the United States.⁵ Regardless of debris origin and nationality, the approach described in this paper is a first step and can provide a legal

framework to build confidence and transparency.* It can further encourage governments and private industry to invest in the technology needed to build pathfinder missions to remove space debris.

Technological and economic challenges also remain important factors when discussing ADR. A recent Aerospace Corporation Center for Space Policy and Strategy paper discusses the triggers and conditions of an ADR marketplace and examines the current market for ADR technologies. The paper's author notes that "ADR technologies currently live within the R&D and Demo phases of the economic lifecycle" and describes significant external factors that need to be addressed for an ADR marketplace to become fully established.⁶ Looking beyond that economic approach, the following framework aims to address the policy and legal problems associated with ADR. Such a precedent could encourage and build confidence in ADR policies, support transparent operations, enable technological development efforts, and spur economic investments in the ADR market.

Permission-based ADR could encourage and build confidence in ADR policies and operations, set a precedent for the future as well as enable technological development efforts.

This paper seeks to answer several important questions often highlighted in the ADR discussion: What would international obligations look like for an ADR mission? Does ADR require a transfer of ownership? And how will issues of liability be addressed internationally while abiding by international treaties? Until recently these questions have appeared to be too difficult to answer.† Using the assumption of mutual consent, regulatory

* While some debris pieces might not be attributable to specific launching states, the bigger objects usually are. In addition, the cost-benefit of removing smaller debris pieces might not make economic sense.

† This paper is not addressing ADR by salvaging or salvaging rights, which is a more complex scenario from a legal perspective as that activity might involve ownership transfer and export control issues.

approval, and contractual agreements between participants, however, the answers to the questions above almost become straightforward.

A Contractual and Permission-based Framework as a Solution

A variety of international and national policies and laws govern space operations, some of which are directly or indirectly applicable to ADR. For example, Article VI of the Outer Space Treaty (OST) requires that all states party to the treaty provide authorization and continuous supervision over the operations of entities under their sovereignty.⁷ National law, policy, and regulations from the Federal Aviation Administration (FAA), the Federal Communications Commission (FCC), and the National Oceanic and Atmospheric Administration (NOAA) further incorporate and aim to accomplish that obligation.

Our proposed framework is based on the following principal requirements:

1. Consent between two parties (debris owner and ADR service provider).
2. Legally binding contract between parties that incorporates domestic law and international obligations.

Using the assumption that a mutual understanding between both parties has been formed and incorporated into a legally binding contract, and as long as provisions such as Article VI are being observed, ADR could be a simple legal matter to address. Many potential prohibiting factors (such as export concerns, liability, and ownership concerns) could be addressed in a binding contract between parties. Such contracts between both parties could

build the foundation of making ADR a common practice for the future.

As long as consent is provided and the responsibilities of Article VI are observed, ADR could be a simple legal matter to address.

A contract between debris owner and ADR service provider could address the following items:

- ◆ ADR service provided and re-entry mechanism (controlled or uncontrolled)
- ◆ Retention of debris ownership
- ◆ Liability issues
- ◆ Licensing responsibilities
- ◆ Amount of technical data exchanged, if any
- ◆ Export and ITAR control issues, if any
- ◆ Intellectual property transfer, if any
- ◆ Messaging and public communication responsibilities

Other than the legal and regulatory steps required for satellite operation in the United States, the lack of a fully recognized legal definition[‡] of space debris is sometimes cited as a significant legal obstacle for ADR. This is not an issue for our proposed framework as it is fully based on consent and permission through binding contracts on a case-by-case basis. Having mutual consent in place, it is irrelevant if the removed object is fully functional or not. If both parties agree on the terms of the contract and the provided service, removing an object from

[‡] The Inter-Agency Space Debris Coordination Committee (IADC) provides the following definition: “Space debris are all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional.” As of 2021, only 13 space agencies are members of IADC.

orbit is feasible from a legal, regulatory, and international obligation perspective regardless of the definition of space debris.

If multiple states are involved, a second agreement in the form of a bilateral memorandum of understanding (MOU) may be useful as well to incorporate and address any cross-national issues, such as export control and differences in national regulations.

Memorandum of Understanding Between States

One path forward for international ADR operations between states is to establish an MOU or similar bilateral agreement to address any open questions on a case-by-case basis. This agreement would aim to determine who would carry what liability and to what extent. The ADR provider can be held liable as well as the debris owner and any launching states. Under the definition of a launching state in the Liability Convention (as well as the Registration Convention), the ADR service provider can make the case that the debris-owning state (client) procures their services and therefore the client shall maintain liability throughout the operation. On the other hand, a client may accept their role as a launching state within the Registration Convention but could protest its responsibility to authorize and continuously supervise the actions of another country. Regardless, a written agreement between states involved could resolve such questions.

In addition, states must ensure that the individual domestic regulatory regimes governing ADR operations are similar enough to provide consistent rules across the operation. Should there be any discrepancy between regulatory frameworks, the agreement should outline the common understanding that both states will follow their respective regulatory frameworks and that the commercial operation ultimately is consistent with any Article VI obligations of “authorization and continuous supervision” in the OST. In the case of

regulatory inconsistency across nations, the MOU would be a useful tool to facilitate coordination, authorization, and supervision efforts of the states involved and resolve any discrepancies.

In summary, a bilateral MOU should address the following components:

- ◆ Authorization and licensing responsibilities
- ◆ Registration responsibilities
- ◆ Technical data exchange
- ◆ Liability Issues
- ◆ Ownership transfer, if any
- ◆ Transparent messaging responsibilities

One of the more political challenges to ADR operations is the perception that ADR capabilities could be used as anti-satellite (ASAT) weapons. While in general this may be possible, the proposed framework would automatically prohibit such activities through the principle that a launching state must give express consent to the ADR operation. The consent-based system draws, therefore, a clear line between prohibited and authorized operations. In addition, the transparency of consenting operations is a vital part of the process of ensuring that the international community is kept informed. Some spacefaring nations might still be concerned that others developing and practicing ADR legal capabilities are in fact developing technology for co-orbital ASATs, but that would be a political, not a legal, concern because the proposed framework prohibits the use of ADR on non-consenting debris owners.

Legal, Regulatory, and Policy Issues

The legal, regulatory, and policy issues involved in ADR can be analyzed through the lens of the proposed framework of consent expressed in a

legally binding contract following domestic laws and international obligations.

Outer Space Treaty Obligations

Article VI of the OST describes international responsibilities for space activities. This article outlines the principle that the state shall maintain international responsibility for all actions in space taken by government or non-governmental actors located within that state and charges the state party with the responsibility to provide “authorization and continuous supervision” for all space activities. The United States has incorporated OST Article VI provisions throughout its outer space regulatory authorities provided to NOAA, the FAA, and the FCC.

While none of these authorities are specifically dedicated to regulating ADR operations, all three entities have some responsibilities associated with ADR. The FAA regulates launch and re-entry, NOAA commercial remote sensing systems, and the FCC radio frequency spectrum use. These regulatory regimes all have relevance to ADR operations and will most likely become involved in the government authorization and supervision process for U.S. ADR service providers.

Specifically, as the FAA regulates the launch and re-entry of non-governmental space vehicles within the United States, the legal definition for invoking FAA regulations for re-entry hinges on the *safe return* to the Earth’s surface.⁸ So far, most ADR activities do not anticipate the complete and intact re-entry of space debris, focusing on uncontrolled breakup where debris would completely burn up or controlled re-entry where the remaining debris would re-enter into the ocean to minimize risk to public safety. As such, re-entry activities as part of ADR will likely not fall under the FAA regulatory framework.

On the other hand, the FAA will regulate launch of any ADR service providers from the United States

and consult with interagency partners through a payload review process. Looking through the lens of public safety as a core FAA interest, in addition to launch, the FAA could review and aid in planning of debris de-orbit, in particular debris that is large enough to survive re-entry and could cause public harm.

NOAA regulates the use of commercial remote sensing satellites, which includes non-Earth imaging operations such as one satellite imaging another satellite. For ADR, non-Earth imaging operations can occur during Rendezvous and Proximity Operations (RPO) when a servicing satellite closely approaches space debris for retrieval. Prior to 2020, commercial companies required government permission to conduct non-Earth imaging operations, a process that could take weeks or months to approve. The U.S. government updated regulations in 2020 and streamlined the process which now only requires the operator of the imaging satellite to receive permission from the client and notify the Secretary of Commerce through NOAA.⁹ This change to consent-based non-Earth imaging regulations, mirroring the principles of permission and consent in this ADR framework, is a major step towards facilitating on-orbit servicing and ADR services. While still requiring a license, it minimizes the regulatory burden on such activities.

The FCC also has a role relevant to ADR. In addition to ensuring communications and spectrum use in space do not interfere with terrestrial communications or other space-based communications, the FCC also provides requirements for orbital debris mitigation in the licensing process. The FCC is becoming increasingly important as more large satellite constellations in LEO stress spectrum allocations. In some circumstances it has also become the “regulator of last resort” for novel commercial concepts that do not fit neatly into other agencies’ jurisdictions, since nearly all satellite activity

requires spectrum. A U.S.-based ADR service provider will likely have to submit an FCC license application which will be evaluated on space debris mitigation compliance as well as spectrum allocation and interference.

Some in the space community have called for a U.S. centralized regulatory entity to license ADR activities in the commercial sector. For example, experts at the University of Maryland's Center for Orbital Debris Education and Research (CODER) Workshop have argued that since ADR involves a variety of U.S. regulatory agencies, a dedicated agency supporting commercial ADR through authorizations and economic support would greatly facilitate progress.¹⁰ The idea of having a well-funded entity within the United States government is not unreasonable and supporting it would be worthwhile; however, relying on the establishment of a regulatory entity, which would require legislation and congressional approval, to resolve legal and policy problems can only be a longer-term solution. In the meantime, our framework could provide a feasible outlet to promote ADR activities until processes and procedures become more mainstream and mature into sound policy or law that then can be implemented by the appropriate regulatory agencies.

Registration Convention

In addition to Article VI of the OST, the Registration Convention¹¹, adopted by the U.N. General Assembly in 1974, requires states to register spacecraft belonging to the launching state or entities therein. The Registration Convention treaty is an amplification of the requirement in Article VIII of the OST to "retain jurisdiction and control" and defines a launching state as the state that launches an object or purchases the launch for a space object.¹² The important aspect of registration for ADR is the ownership principle of the treaty. The state of registry is the entity that is required to execute the obligations under the OST, including the obligations in Article VI requiring states to bear

international responsibility for their activities in outer space. For the purpose of our ADR framework, the typical responsibilities of the launching state for the ADR service provider would be to register the ADR servicer. In a more complex situation where the ADR service provider is part of a larger international conglomerate, the registration question could be resolved as part of the permission and consent-based contractual agreement, an MOU, or bilateral agreements.

The registration convention is typically not an issue for space debris since the object likely would have been registered prior to launch of the ADR servicer. However, concerns are raised involving liability in a case where fuel is left onboard a debris object intended for ADR. If the fuel causes an explosion and creates a debris cloud, who is at fault for the damages caused? An MOU would most likely need to provide the primary answer to such a case.

Liability Convention

In addition to authorization and continuous supervision aspects of the OST Article VI, liability within the international system for actions in space is provided by the United Nations Convention on International Liability for Damage Caused by Space Objects (the Liability Convention). The Liability Convention has a few principles that are applicable to ADR operations, the first of which is Article II: "A launching state shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight."¹³ It is well established that debris from space objects may survive re-entry; therefore, establishing ownership of the space object and, thus, liability for any damages is important. Interpreting the Liability Convention, the launching state is determined by the location from which the space object was launched as well as which entity may have procured the launch. Any complex international configurations requiring answers to the Liability Convention could be addressed through an MOU or bilateral agreement.

Additionally, when damage is caused to an object in space, liability falls on the launching state of the object that is determined to be at fault for the incident. The only time a state party can be exonerated is in a case where the damage was caused by the gross negligence of the launching state of the object that got damaged. However, that applies only to absolute liability, not fault liability. In the case of third party damage, both launching states can be held liable. If the damage occurred somewhere other than the surface of the Earth, the liability to the third party shall be determined based on who is at fault.¹⁴

Determining the liability of an accident is preceded by determining which launching state is the owner/operator and thus liability holder. The question of whether the liability of an ADR mission should be held by the servicing satellite's launching state or the client's launching state could be answered preemptively in a contract between the ADR service provider and the launching state of the space debris.

Third Party Liability Regulation and Insurance

Aspects of U.S. liability insurance and regulatory requirements also apply to the ADR mission. Insurance requirements in the United States for liability in space activities are covered under the Commercial Space Launch Amendments Act of 1988. The Act states that a commercial company must provide an indemnification[§] to the government's liability up to the maximum of \$500 million during the launch and re-entry of an object. Above this limit the government assumes the liability. However, this only addresses liability issues during launch and re-entry.

Liability protection from accidents and mishaps during an ADR activity is also an issue. However, an argument can be made that perhaps states should

provide for the initial liability protection since most of the debris in space today came from government missions. Such liability protection would encourage and promote the development of commercial ADR missions by lowering the financial risk to commercial companies should a mishap occur. Yet, states could require detailed technical review of the ADR operations in lieu of providing liability coverage. Such a detailed technical review of the operations would provide assurance to the approving state and minimize the liability risk exposure should the mission go wrong and harm another party.

States could accept that most of the space debris came from government missions and therefore provide liability protection for commercial ADR operations in space.

The United States is not the only country that requires private companies to purchase liability insurance to indemnify the government for liability of space activities. The United Kingdom has provisions in its Space Industry Act of 2018 that require the license holder to indemnify the government for any international claims of liability under the Liability Convention.¹⁵ Japan likewise has indemnification requirements; however, like the United States, Japan requires private space operators to have insurance up to a government-determined amount. Should damages exceed this amount, the government takes over the liability.¹⁶

Ownership Transfer Not Required

The question of ownership is closely related to considerations of U.S. export controls and third-party liability. Article VIII of the Outer Space Treaty provides that nations "shall retain jurisdiction and control" over objects launched into outer space. Ownership transfer within a nation is

[§] Definition of indemnification: security against legal liability for one's actions.

likely not an issue from an OST perspective but needs to be addressed between nations. Our assessment is that ownership transfer of a space debris object is not necessarily required for ADR. First, there is no precedent for a transfer of ownership between client operator and service provider within the space community. Secondly, the argument can be made that servicing a space debris object to deorbit does not require relinquishing ownership or control of the debris object to the ADR service provider. Ownership of the space debris object could remain with the original owner and control is maintained through the contractual agreement with the service provider. This would be similar to a tow truck on the street removing a car. The owner of the defunct car does not need to transfer ownership to the towing company but has likely signed a contractual agreement specifying the provided service, cost, and any liability questions in case of an accident during the towing operation. The owner would fully retain ownership over the towed car even if a municipality tows an illegally parked car.

An additional example is that a commercial launch provider does not assume ownership of a payload that it places into orbit. Liability in these cases is determined by fault or by contract. Providing a service is not considered a transfer of ownership and the client maintains ownership of its asset as well. Therefore, in the case of ADR, there is no precedent for the requirement of ownership transfers between client owner and ADR service provider.** This approach would remove a major obstacle to the legal conduct of international ADR operations.

Framework Analysis with Domestic and International ADR

Using the framework based on consent and permission, this paper provides a matrixed analysis in Table 1 as an overview of what legal, policy, and regulatory issues might need to be addressed. In general, the analysis can be divided into two scenarios: (1) debris removal occurring within a single state's responsibility, and (2) involvement of two or more states.

Domestic Entity Removing U.S. Objects

In order for a U.S. company to remove a U.S.-registered and -owned space debris object, a few simple procedures need to be followed. The United States regulates applicable on-orbit activities such as remote sensing and, therefore, an ADR operator will need to acquire the requisite licenses relating to their operation, including launch from U.S. soil and allocating spectrum if transmitting to a U.S. ground station. Specifically, a NOAA license will need to be acquired for any camera "capable of imaging the Earth."¹⁷ This process is relatively straightforward and once a license is acquired, a simple notification process for the imaging of a non-Earth object is sufficient according to current remote sensing regulations. Since the Departments of Defense (DOD) and State (DOS) both are involved in the remote sensing licensing process, concerns regarding national security and international obligations can be addressed through the interagency coordination process. However, NOAA only regulates remote sensing and not the full extent of the space operations and how they are conducted.

** If the debris object is not removed but instead salvaged and remaining in orbit, ownership transfer might be necessary but that is beyond the scope of this paper.

Table 1: Summary of Applicable Laws, Regulations, and Policies

	U.S. Government-Owned Debris	U.S. Commercially Owned Debris	Internationally Owned Debris
U.S. Government as the ADR Service Provider (e.g., DARPA Mission)	Legal: ♦ No specific applicable laws to ADR		Legal: ♦ MOU or bilateral agreement recommended
	Regulatory: ♦ Not applicable, any issues would be addressed in interagency deliberations on policy	Regulatory: ♦ Debris: follow existing regulations; update any licenses ♦ Service provider: no specific regulations applicable	Regulatory: ♦ U.S.: Not applicable and would be handled through interagency deliberations ♦ Follow any applicable foreign laws and regulations
	U.S. Policy: ♦ U.S. space policy ♦ U.S. ODMSP ♦ NTIA/FCC Frequency Assignment ♦ Export issues unlikely		
	International: ♦ IADC guidelines ♦ OST and Registration Convention ♦ Solid messaging campaign recommended		
U.S. Commercial Service Provider	Legal: ♦ Remote Sensing Policy Act ♦ Space Launch Act		Legal: ♦ MOU or bilateral agreement recommended
	Regulatory: ♦ NOAA (to license camera) ♦ NTIA/FCC spectrum deconfliction ♦ FAA payload review if applicable		Regulatory: ♦ NOAA ♦ FCC ♦ FAA payload review if applicable ♦ Follow any applicable foreign law and regulations ♦ Export issues unlikely
	U.S. Policy: ♦ U.S. ODMSP ♦ SPD-3		
	International: ♦ IADC guidelines ♦ OST and Registration Convention ♦ Solid messaging campaign recommended		
International Service Provider	Legal: ♦ No specific applicable laws to ADR		ADR without U.S. involvement will need to follow applicable laws and regulations from the debris owner and service provider nation.
	Regulatory: ♦ Not applicable	Regulatory: ♦ Debris: follow existing regulations; update any licenses; export control if applicable ♦ Service provider: no specific regulations applicable	
	U.S. Policy: ♦ Export issues possible ♦ U.S. space policy ♦ U.S. ODMSP ♦ SPD-3		
	International: ♦ IADC guidelines ♦ OST and Registration Convention ♦ Solid messaging campaign recommended		

Legal
 Regulatory
 U.S. Policy
 International

It would certainly be beneficial, for example, for the Department of Commerce to cover commercial on-orbit activities writ large that are not captured under any other regulatory authorizations. This would provide additional assurance that the ADR operations are conducted safely and in accordance with guidelines and best practices. However, in the absence of such on-orbit authority, the remote sensing license and the associated interagency process will have to be sufficient for fulfilling the OST obligation for authorization.

If the ADR service vehicle is launched by a U.S. launch provider, the ADR service provider will also be captured through the FAA payload review. The FAA does not regulate commercial on-orbit activities such as ADR, but has a payload review process that consults with the DOS and DOD. Regardless of which regulatory agency will license ADR activities, de-orbit and re-entry stipulations will need to be considered: (1) if the removed space debris is large and pieces are more likely to survive re-entry, a controlled re-entry may be required to limit the risk of human casualties; (2) if debris is small enough and will likely not survive re-entry, uncontrolled re-entry could be deemed sufficient. This requirement is already implemented through NOAA's remote sensing regulation based on the Orbital Debris Mitigation Standard Practices (ODMSP). The FCC and FAA have similar requirements.

International Debris Removal

The legal questions associated with ADR are similar on the international stage; however, there is an additional component on the question of export control. What export control would be triggered in conducting an ADR operation between states? The principles for ADR described in this paper can apply to any combination of nations. However, nations

that are like-minded and who share the same interests on long-term sustainability of outer space activities will likely be among the first cooperating for international debris removal.^{††}

Export control is often cited as an issue in ADR when involving objects belonging to different states. Nations have put in place laws and regulations to limit the dissemination of information and technologies that are relevant for economic protections and military applications. Export can occur in information, data, equipment including technical drawings, and imagery. Relevant to ADR, export controls could be triggered through (1) the transfer of ownership (unnecessary as discussed above) or (2) through the transfer of detailed technical information.

According to on-orbit servicing (OOS) experts, when dealing with allied nations like Japan, France, or the United Kingdom, there are fewer export control considerations than for other nations. The exact answer depends on many factors, but most importantly relates to the amount of technical detail that would need to be shared across states in order for the ADR operation to be successful. Agencies controlling the export of technical information will look at the amount of detail shared and decide on thresholds of technical information that would trigger restrictions. Such thresholds may vary for different forms of ADR. For example, a debris-capturing net would not necessarily require many technical details of the internals of the satellite and the imagery data captured throughout the debris removal process may not be sufficient to cause significant export concerns. However, an ADR maneuver with other capture processes, like docking through a rocket nozzle, may need more technical details of the satellite leading to higher export control scrutiny. Regardless, the answer on export

^{††} "Like-minded" is taken here in the context of active debris removal and allied nations that have shared goals of long-term sustainability.

control issues will depend on the countries involved, the capturing mechanism, and what level of technical data would need to be shared.

Conclusion

The space debris issue is not resolving itself and neither are the legal concerns, technological barriers, and economic considerations. By adopting the framework presented in this paper, the United States and other nations can take the first vital step to lead in the debris remediation effort. Our legal framework establishes a method by which the United States can demonstrate its commitment to the remediation of space debris, establish pathfinder missions, and contribute to long-term sustainability of outer space. A pathfinder mission based on permission and consent would greatly facilitate transparency, confidence building measures, best practices, and make active debris removal a common practice. Once pathfinder missions are underway, the process can be repeated and perhaps made more efficient without having to renegotiate from scratch every single agreement.

Also, dealing with less contentious scenarios—first involving only one nation or only like-minded nations before addressing ADR globally—would serve to identify solutions as a new baseline from which international discussions on ADR can grow. It also shows that permitted and legal ADR does not have to be prohibitively complicated. Some issues are either irrelevant or easily answered and addressed in a legally binding contract or bilateral MOU. At least in the near term, establishing international organizations or centralized national authorities may be unnecessary and impractical.

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- ¹⁷ “Licensing of Private Remote Sensing Space Systems,” NOAA, May 20, 2020, <https://www.govinfo.gov/content/pkg/FR-2020-05-20/pdf/2020-10703.pdf>.

