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AN ACTOR NETWORK THEORY APPROACH TO POLITICAL CHALLENGES IN ACTIVE  
DEBRIS REMOVAL

**Abstract**

Over the past two decades, the problem of space debris has worsened considerably. According to data from the European Space Agency (ESA), the number of fragmentation events, which create more debris from existing debris, are increasing rapidly. Studies have clearly indicated that mitigation is not sufficient and active debris removal (ADR) is necessary to stabilize the growth of space debris. ADR is identified as a strategic goal for ESA and the National Aeronautics and Space Administration, and is identified as an essential mechanism for ensuring the safety and sustainability of outer space by the United Nations Office for Outer Space Affairs.

The development and deployment of ADR technologies is made more difficult by political, legal, and economic factors. Conflicting interests between international stakeholders hinder development and use of ADR technologies. Furthermore, as these stakeholders are spread across public and private entities around the world, with varying size and influence, it becomes increasingly difficult to keep track of their interests and relationships. It would be useful to map out the interactions between stakeholders of ADR. This way, we can develop an understanding of the relationships between a complex set of parties and analyze where in the network patterns of power and stability exist.

Actor network theory characterizes social domains in their heterogeneity, looking at the social as networks composed of both human and non-human agents. It treats organizations, hierarchies, power relations, and flows of information as interactive effects. We developed an actor network representation of international actors involved in active debris removal. The actor network considers institutional actors such as space agencies and corporate entities, as well as material actors such as space law treaties and regulations, debris catalogs, ADR technologies, and consumer-facing applications such as communication and meteorological satellites.

We then look at the influence and control different actors exert, and how these are reinforced by the materials around them. By considering the ability of an actor to influence the decisions of other actors over time, we identify patterns of power and stability. Subsequent analysis of patterns of power and instability in the ADR actor network point to areas with potential for emerging conflict and opportunities for collaboration.