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SPACE DEBRIS SYMPOSIUM (A6)
Mitigation and Standards (4)

Author: Dr. David Finkleman
International Organization for Standardization, United States, dfinkleman@comcast.net

Prof. Diane Howard
McGill University, United States, diane.howard814@gmail.com

# THE DEFINITION OF SPACE DEBRIS

**Abstract**

This paper will explain and mitigate contention between the operational space enterprise and legal experts with respect to the definition of "space debris." The IADC Guidelines state that "Space debris are all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non-functional." Legal and diplomatic authorities opine that there is not a sufficient definition of space debris. The IADC and legal perspectives are both correct, since they apply to different spheres of activity.

The IADC definition is too abstract for many operational events and almost all legal purposes. The definition of "non-functional" is the crux. What characteristics of a satellite's operation are essential to being "functional?" Should exhausting energy stored for maneuverability and station keeping be the criterion? If other capabilities that enable data acquisition and communication remain, might the satellite still be functional? There are examples. Satellites intended for geostationary orbit have been stranded in highly elliptical orbits with high apogee. Although they could not focus on a fixed area on Earth as intended, they could still observe periodically, and the data could be transformed for the intended purpose, albeit with some difficulty. Are these "non-functional?"

Galaxy 15 was by reasonable inference "non-functional" for many months. It was uncontrollable even though all other mission essential functions were robust. It was a physical and electromagnetic hazard throughout this period. However, operators knew that when it reached a marginal energy storage state, it would reset autonomously and be completely restored. Was it space debris during this period and be subject to disposal and debris mitigation guidelines or directives? Might some authority have logically declared it flotsam and acted to salvage or dispose of it?

SatMex 5 was declared by the owners to reach end of life in May 2013 due to depletion of station keeping propellant. Recently remaining life was reassessed to be October 2013 conveniently coincidental with enduring delays in replacement satellites and new contracts for SatMex 5 services. Is the initial declaration sufficient to make SatMex 5 space debris next May?

Recent research at MIT furthers the ability to determine rationally whether a satellite is "dead" by tracing functional threads and including provisions for demise throughout the life cycle of a satellite. If accepted in a normative manner internationally, this might make "non-functional" more specific for operational and legal purposes. We will discuss this intersection of operations and law.