ISS Trajectory and Satellite Deploy Operations

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TOPO/Ellery Bohrmann (IMOC)

What is a TOPO?

The Trajectory Operations and Planning Officer **(TOPO)** is the NASA Mission Control Center team member responsible for planning and maintaining a knowledge of where the International Space Station (ISS) and its supporting vehicles are, where they are going to be, and ensuring that they do not get hit by anything.

How does TOPO relate to Small Satellites?

TOPO is one of the main points of contact for smallsats/cubesats that want to deploy their satellite from the ISS. We work with the providers throughout the safety review process, help develop safe trajectory conops, and ensure the satellites are safe regarding the ISS and provide guidance to propulsive satellites on being a **R**esponsible and **S**afe **S**pace **O**perator (**RSSO**)

Image source is NASA publicly released photo

RSSO

RSSO criteria is outlined in the Multilateral ISS and ISS Visiting Vehicle Jettison Policy (ISS PPD 1011 Rev C) but includes:

- Ability to maneuver to and hold a commanded attitude
- Achieve a commanded dV maneuver within an acceptable margin of error
- Output reliable state information and predict postburn states
- Has an approved Collision Avoidance process in place

Goal for propulsive satellites jettisoned from ISS to be able to safely operate **autonomously** from TOPO regarding ISS safety

Other requirements of the Jettison Policy

- Trackability
- Limit the generation of orbital debris
- ISS structural clearance
- Limit the risk of re-contact with the ISS
- For propulsive cubesats/smallsats: Data sharing agreements with USSPACECOM and NASA are in place

ISS PPD 1011 Rev C
Multilateral International Space Station (ISS) and ISS Visiting Vehicle Jettison Policy

Collaboration with Commercial Companies

- NASA collaborates with commercial companies operating nearby or crossing ISS altitudes to ensure safety of flight for the ISS and its supporting vehicles and the commercial spacecraft
- Work with commercial companies to finalize Space Act Agreements (SAAs)
- Operations Agreements in place with companies without SAAs to document data exchanges and conjunction assessment protocols
  - Most common with small satellites

Resources

- **ISS Jettison Team Contact Info: jsc-dl-topo-jettison@mail.nasa.gov**
- Real-time ISS Conjunction Support: jsc-topo@mail.nasa.gov
- Strategic ISS CA Operations Questions: jsc-dl-topo-iwg@mail.nasa.gov
- TOPO is now publishing ISS ephemeris files and associated trajectory summary files on Space-Track for public use (requires Space-Track account)
  - 15 day ephemeris & trajectory summary updated MWF
  - 8 week ephemeris & trajectory summary updated once a week
  - Read Me file also explains which ephemeris should be used depending on use case.

ISS Jettison Policy

NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook

Spaceflight Safety Handbook for Satellite Operators