LEO Kinetic Space Safety Workshop

Sponsored by LeoLabs, ClearSpace, and AXA XL

------- Unique format, knowledgeable planning committee, and results-driven approach ------

> ***Kinetic Space Safety***: all measures to minimize collision risk for current and future space systems.

The workshop uses a three-step process combining a comprehensive industry survey and a hybrid workshop (*i.e.*, in-person and virtual). We aim to create a prioritized list of kinetic space safety activities for use by the space community to drive policy, regulation, development activities, and operational practices.

STEP ONE: Community Polling (through end-2021)

Ask the global community to register their opinions on two areas: (1) ***Why*** do you feel that **kinetic space safety** is important and from what perspective do you make these decisions (space operator, regulator, etc.), and (2) in ***What Order*** would you rank specific **kinetic space safety** activities from the highest to lowest in four critical dimensions:

- **COST**: Resources required to develop and implement a solution
- **BENEFIT**: Positive outcomes from or effectiveness of the solution
- **MATURITY**: Readiness of the solution for implementation
- **RESISTANCE**: Development and implementation difficulty

A draft list of current **kinetic space safety** activities available in the polling is shown to the right. The polling will allow up to three "write-in" activities to help facilitate discussions at the workshop. **The QR code below will take you to a link to the kinetic space safety ballot.**

Improve resilience of spacecraft — increase shielding on spacecraft to help withstand impacts from debris fragments, configure sensitive components for resilience, and enhance fault tolerance of spacecraft
Minimize chance of fragmentation — prevent explosion resulting from design and collision by using collision avoidance operations
Collision Avoidance (CA) for all spacecraft above 400 km — enable responsible behavior and comprehensive CA through responsive (acts in real-time), reliable (high availability), and robust (large ΔV capability)
Capture high accuracy ephemeris (~10-20 m) — use GPS receivers or equivalent
Codify space traffic rules of the road (built upon UN LTS Guidelines) — simplify options for maneuvers between active satellites
Beacons — on all spacecraft and rocket bodies that remain in orbit to enhance identification and tracking – assists in detection and CA
Reduce covariance — for objects that do not capture their own ephemeris (including fragments and derelict objects) improve accuracy of probability of collision calculations, reduce need for collision avoidance (CA) maneuvers through more frequent observations from ground and space observation sensors (e.g., radars and telescopes)
Catalog Lethal Nontrackable (LNT) debris — radar tracking systems that lower size threshold of LEO catalog from 10 cm to as close to the 5 mm (LNT lower threshold) as possible (e.g., UHF can detect down to 10 cm while S-band radars can detect down to 2 cm in LEO)
Develop data and model standards — facilitate smooth exchange of safety-relevant information, especially high accuracy ephemerides and maneuver plans
Share data and coordinate with other operators — share satellite ephemeris, maneuver plans, and other safety-relevant information in real-time with other space operators to minimize chance of collision through data fusion of operator ephemeris, varied SSA-derived state vectors, raw observations from a variety of sources, etc.
Require CA training and operational expertise for space operators
Just-in-time Collision Avoidance (JCA) — use temporary impulse from ballistically-delivered powder or laser illumination to divert an object from a potential collision
Nano-tugs — allow derelicts to share ephemeris and perform CA
Prevent orbital altitude overlap — for constellations of greater than 10 satellites
Reduce 25-year PMD guideline to 1 year — would likely require a propulsion system and extra fuel to move to around 400 km circular orbit after mission completion
Reduce 25-year PMD guideline to 5 years — would likely require a propulsion system and extra fuel to move to around 500 km circular orbit after mission completion
Deploy reliable, autonomous post-mission disposal (PMD) system — mechanism to remove object in event payload fails
Active Debris Removal (ADR) or repositioning of derelicts — deorbit or reorbit massive derelicts (e.g., rocket bodies and payloads) based on debris-generating potential (i.e., probability of collision, and consequence based on mass)
ADR for constellations — deorbit or reorbit satellites in a constellation that fail prematurely to prevent degradation of constellation operations
Add your own: ______________________________

The results from the poll will provide valuable data for the workshop.

STEP TWO: Kinetic Space Safety Workshop (January 2022)

Major topics to be covered are Stakeholder Perspective, Space System Impact Tolerance, Collision Avoidance, Debris Prevention, and Debris Remediation.

Planning Committee for this workshop includes Darren McKnight (LeoLabs), Tim Maclay (ClearSpace), Chris Kunstadter (AXA XL), Christophe Bonnal (CNES), Brian Weeden (Secure World Foundation), Dan Oltrogge (COMSPOC and Space Safety Coalition), Hugh Lewis (Southampton University), Satomi Kawamoto (JAXA), Marie Valentin (IRGC), and Walt Everetts (Iridium). The Planning Committee will lead a series of keynotes and round table discussions to refine and document key findings on space safety activities with respect to their cost, benefit, maturity, and resistance.

STEP THREE: Publication of Position Paper (Summer/Fall 2022)

The Planning Committee will publish a forward-leaning position paper with specific recommendations for the priority of **kinetic space safety** activities. This paper will be published in a variety of public fora with a priority on focusing the community – operators, developers, space agencies, regulators, academia, and others – to advance their respective communities toward a safer LEO environment.

Be part of the solution! Scan the QR Code → to participate in the community polling and register your interest in the workshop!