



Space Situational Awareness and Orbital Debris Mitigation

J.-C. Liou, PhD

**Chief Scientist for Orbital Debris
National Aeronautics and Space Administration**

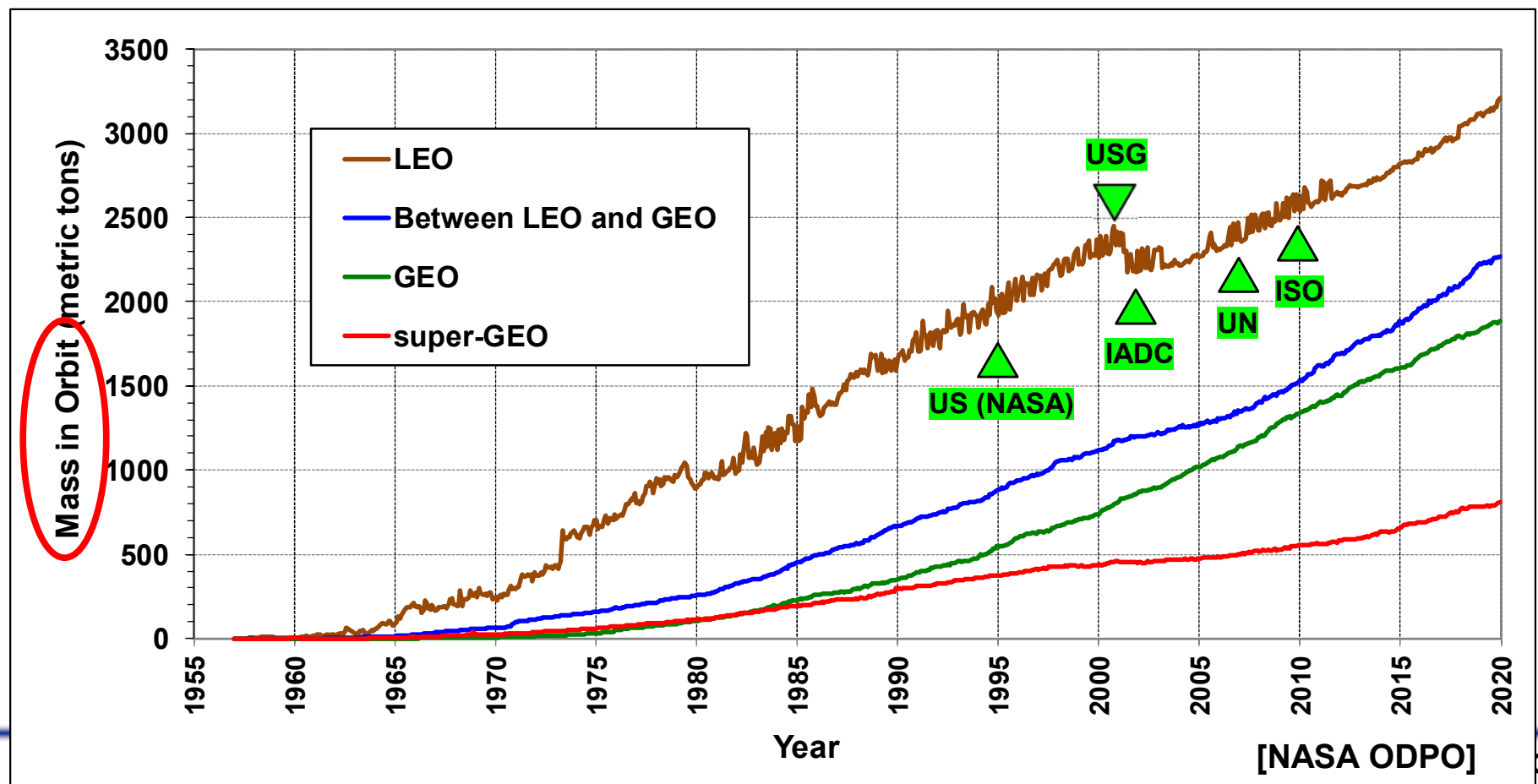
NAS Space Studies Board, Space Science Week

22 March 2022



The Long-Term Orbital Debris Problem

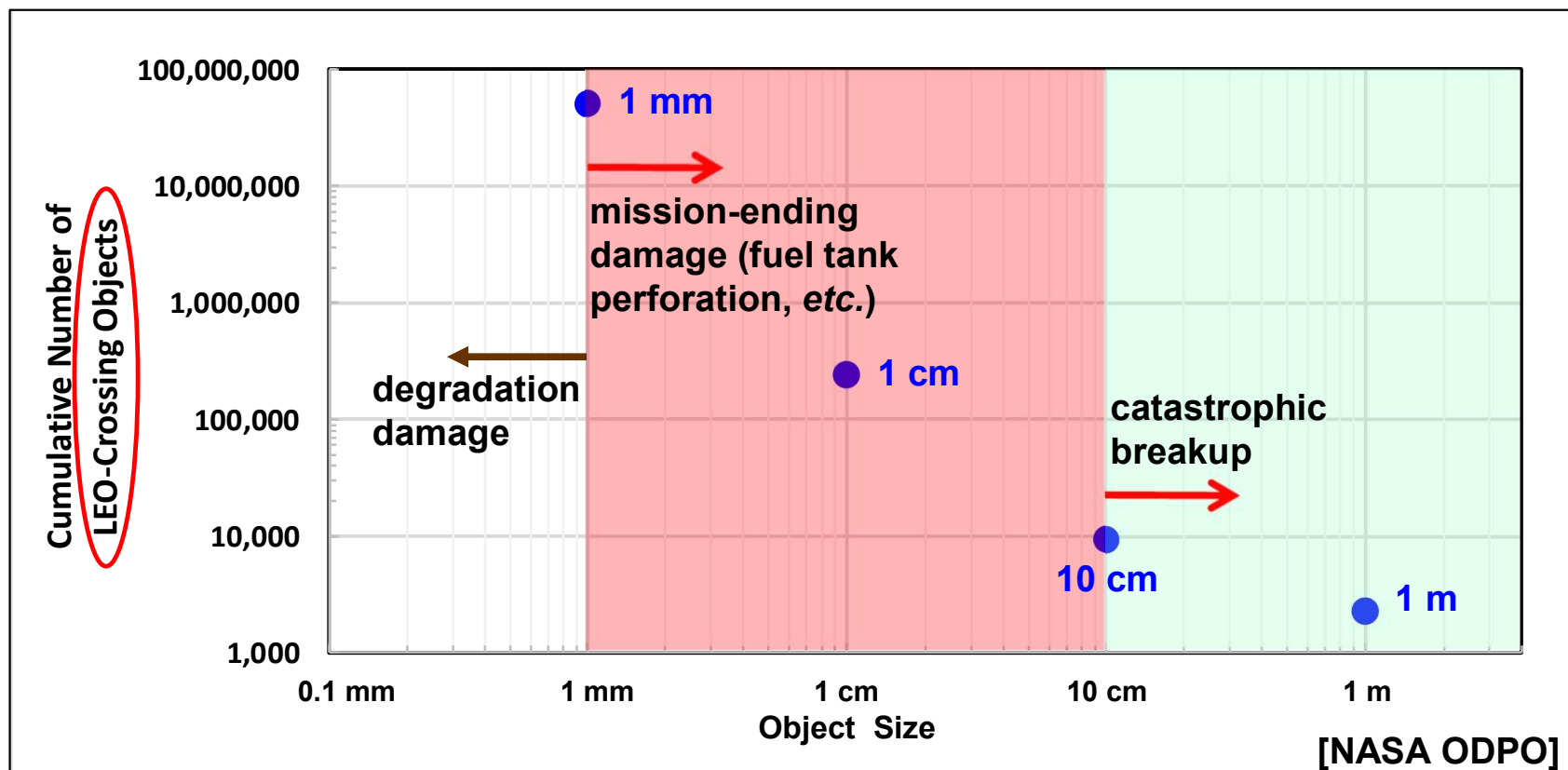
- The orbital debris population continues to increase over time despite decades of efforts to limit the generation of new debris
 - Green triangles indicate when key orbital debris mitigation guidelines and standard practices were first established
 - The global 25-year-rule compliance level has been <40% over the past 15 years





The Short-Term Orbital Debris Problem

- There is far more small debris than large debris
 - Mission-ending risk is driven by millimeter-sized debris in LEO, but there is a lack of direct measurement data on such small debris
 - Conjunction assessments and collision avoidance against the large (≥ 10 cm) tracked objects only address $<1\%$ of the mission-ending impact risk





Managing Risks from Orbital Debris

- **As defined in Space Policy Directive-3**
 - “*Space Traffic Management shall mean the planning, coordination, and on-orbit synchronization of activities to enhance the **safety**, stability, and sustainability of operations in the space environment.*”
- **Key orbital debris priorities to enhance the **safety**, stability, and sustainability of operations in the future space environment**
 - **Improve space situational awareness of small debris**, especially the millimeter-sized debris in LEO, to better protect future space missions
 - **Promote better global compliance with existing orbital debris mitigation best practices** to slow down the debris population growth
 - **Establish long-term goals**, combining mitigation and remediation, to preserve the near-Earth space environment for future generations