



Aggregate Risk Metrics



Astroscale U.S.



Our Vision

Safe and sustainable development of space, for the benefit of future generations.

Our Mission

Develop innovative technologies, advance business cases and inform international policies that reduce orbital debris and support long-term, sustainable use of space.



Aggregate Risk Measurement is Accurate Risk Measurement

It is *essential* that the Commission's understanding of orbital regimes is shaped by comprehensive metrics. Collision risk posed by space systems must be measured in the aggregate.

*The practice of performing system risk analyses by considering only a single spacecraft in a constellation, abstracted to the entire system, simply **fails to accurately portray** a holistic scope of real collision risk posed, and can lead to erroneous conclusions.*

SPACENEWS

Decommissioned NOAA weather satellite breaks up

by Jeff Foust — March 20, 2021



18 SPCS
@18SPCS

#18SPCS has confirmed the breakup of YUNHAI 1-02 (#44547, 2019-063A), which occurred on March 18, 2021, at 0741 UTC. Tracking 21 associated pieces – analysis is ongoing. #spaceflightsafety #spacedebris @spacetrackorg

2:36 PM · Mar 22, 2021 · Twitter Web App

'Lucky strike': International Space Station's robotic arm survives after being hit by space junk

Rachael Joy and Christine Fernando, Florida Today Published 9:09 a.m. ET June 2, 2021 | Updated 12:15 p.m. ET June 2, 2021

SPACE.com

A piece of space junk zipped by SpaceX's Dragon capsule on its way to the space station

By Tariq Malik a day ago



Building Blocks of Comprehensive System Risk Management

Quantify



Cap



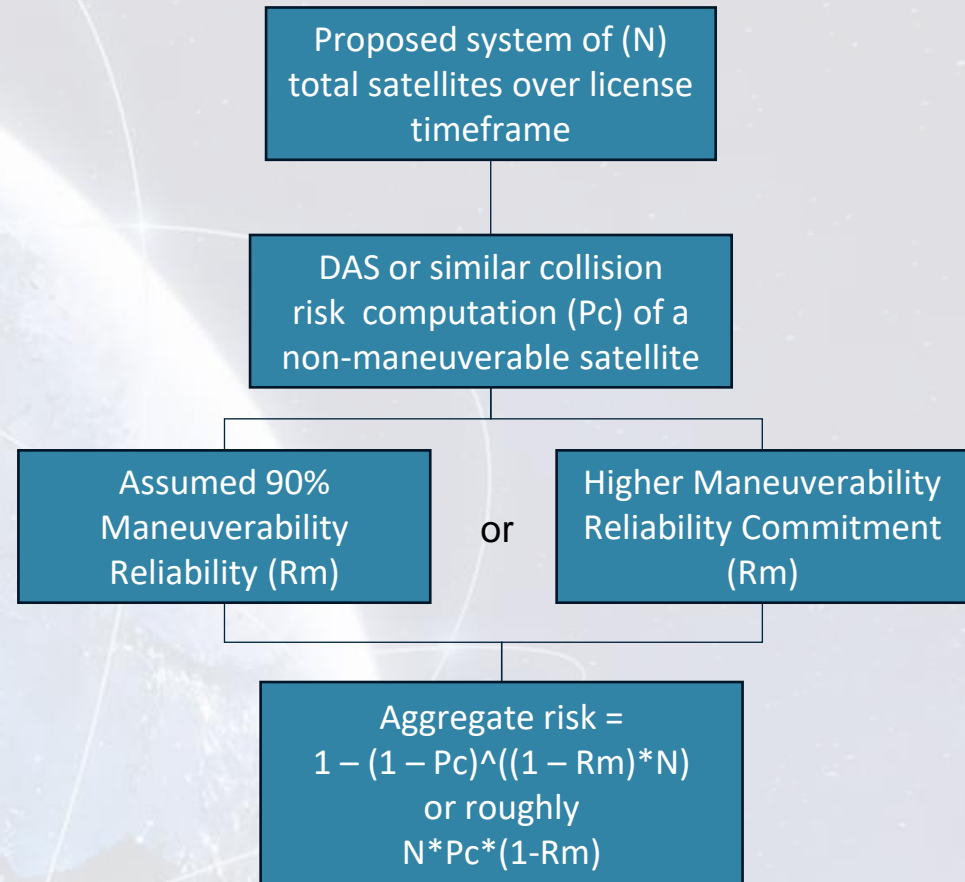
Monitor



Enforce

Quantify

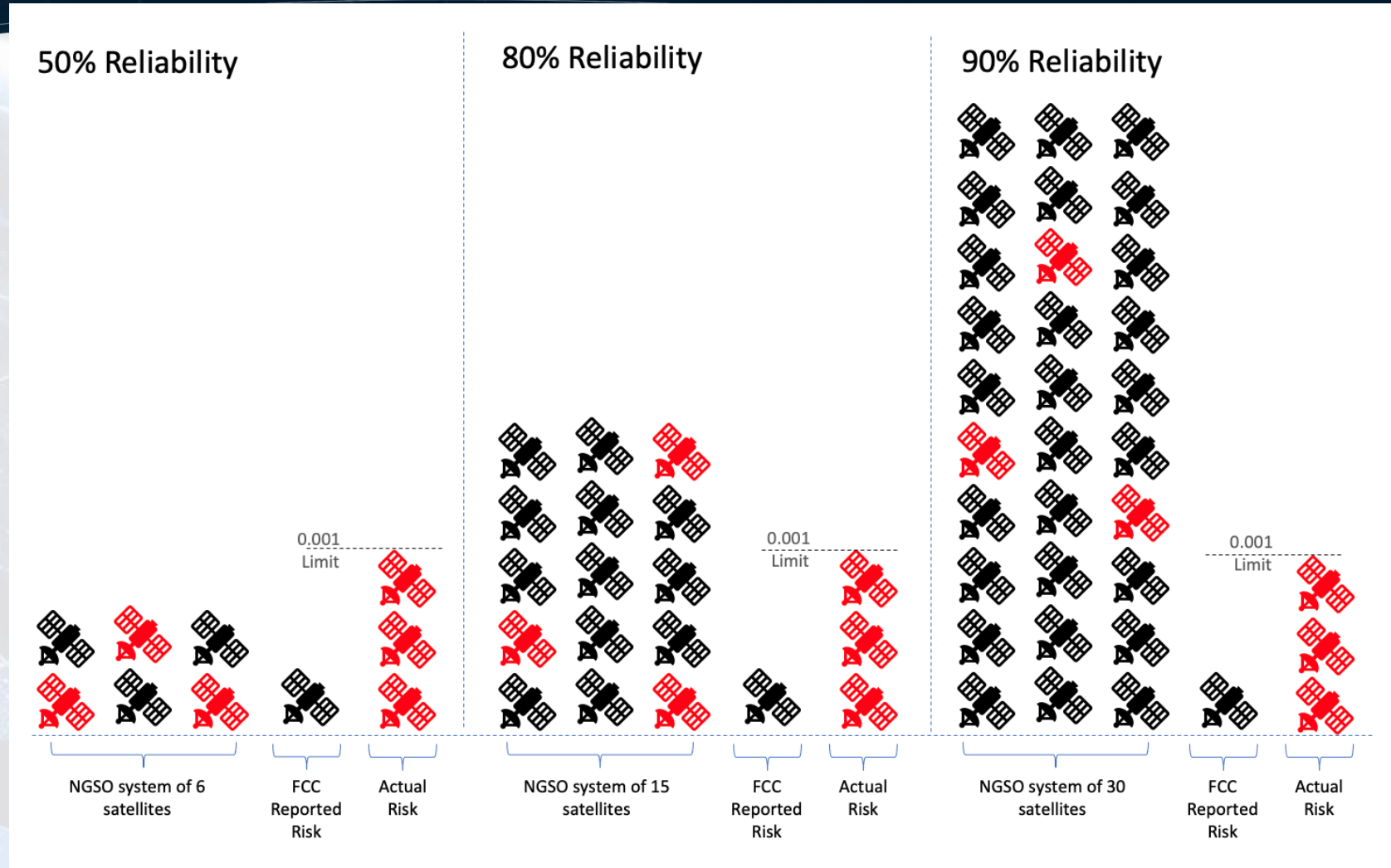
The Commission must measure the total risk that every non-maneuverable satellite in a system will collectively contribute to the space environment when reviewing applications and granting licenses to operate.



Cap

An aggregate Pc limit of 1/1000 caps the proportion of *failed satellites* in a system, which affords operators flexibility in their constellation size.

Operators have a range of options to adhere to a 1/1000 aggregate Pc limit.



Monitor

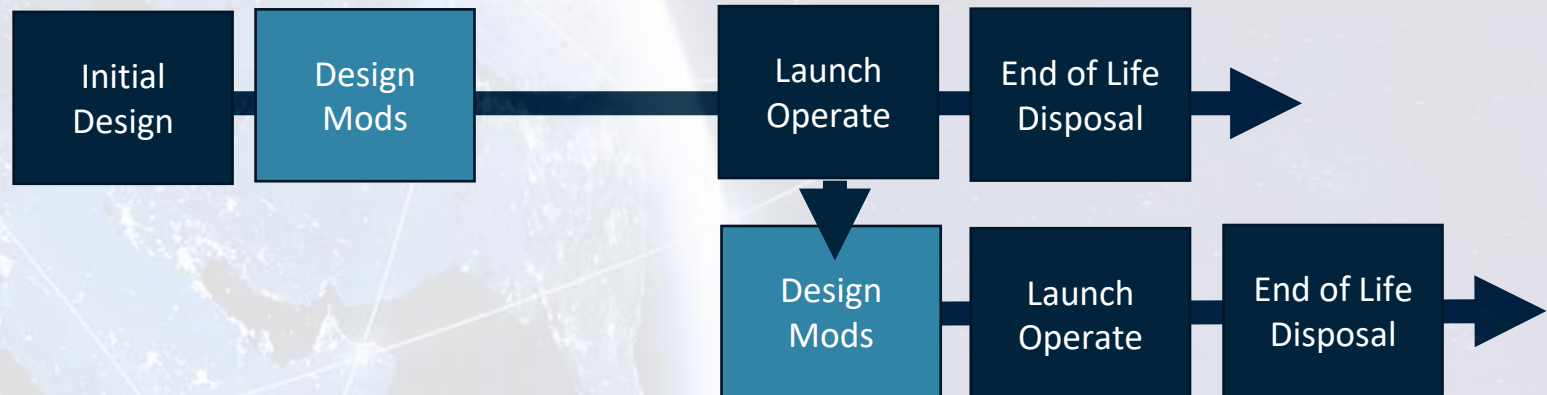
The Commission should regularly monitor the aggregate Pc of licensed systems through frequent real-time reporting, or system “health checks.”

Operators should have the opportunity to take advantage of improvements to their system Pc levels through design changes or deorbit of high-risk satellites.

Application and Oversight Process



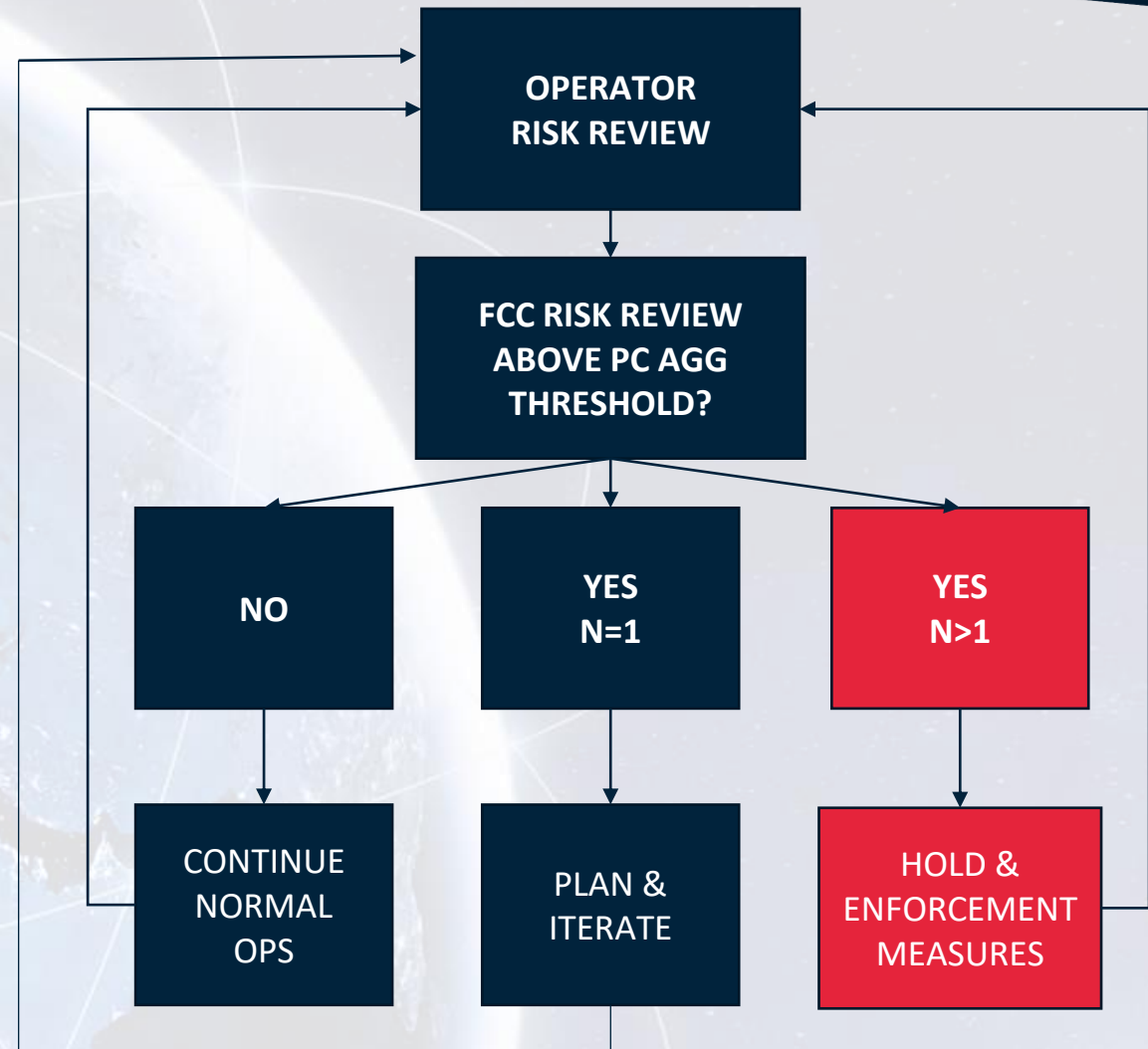
Tech Development and Operations Process



Enforce

If a system's aggregate collision risk exceeds the limit, the operator should take remedial action.

Repeated violations of the aggregate risk limit should result in Commission enforcement measures, in accordance with its duty to serve the public interest.



The Big Picture: Aggregate Pc Metrics Set Us On A Path to Spaceflight Safety

Aggregate Risk Metrics

- Accurate Quantification
- Performance-Based Standards
- Flexibility for Iterative Designs
- Enforced Risk Limits

Common Sense Safety Norms of Behavior

- ASAP time to disposal, not > 5 yrs
- Maneuverability
- Backup means of Disposal
- Responsible Design and Operations

Space Environmental Management

- Mitigation + Remediation
- Financial Incentives for Disposal
- Improvements to CA data covariances

Desired End State

- Risk to Operations is Known, Controllable, and Limited
- Growth in Activity can Continue Unimpeded

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