### Shared Use of Space in the New Space Age

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### Issues With Old, "Unscalable" Approaches to Space

- 1. Collisions in space due to failed satellites & unsafe orbital congestion
- 2. Untenable approaches to shared use of limited orbital resources
- 3. Competition and innovation in the US suffer



#### A Priori US Proportion of Commercial Communications Satellites

- If 20% to 40% globally
- > Then we should expect:
  - 50,000 US licensed LEOs  $\Rightarrow$  125,000 to 250,000 globally
  - 10,000 US licensed LEOs  $\Rightarrow$  25,000 to 50,000 globally



#### Anachronistic Single Satellite Collision Risk Limit

#### Single-satellite limit

- 4,408 satellites
- 4.4 collisions every 5 years

# Collision effect on debris



# Collision effect on orbits





#### Aggregate Collision Risk Limit Must Consider All Risks



Satellites that cannot maneuver cannot avoid collisions



Very, very large number of very low probability events means multiple collisions are expected



#### Aggregate Collision Risk

Proposed limit: 1 in 1,000 (0.1%) chance of collision **per constellation** 



#### Manage Excess Risk Before It Becomes Unmanageable

### Remediation = A plan to contain & manage excess risk As compared to **ignoring** risk



#### Preclusive Effects on Shared Spectrum

	NGSO System B				
NGSO System A	300 Satellites	3,000 Satellites	30,000 Satellites		
300 Satellites	4.8%	80.0%	100%		
3,000 Satellites	0%	43.8%	100%		
30,000 Satellites	0%	0%	100%		

Probability that NGSO System B blocks a location from service by NGSO System A (London, England)



#### **Preclusive Effects on Shared Orbits**



- > 10 km spacing
- > ±30 km altitude tolerance!
- > ±0.5° inclination tolerance

- > Starlink occupies only a small fraction of orbital space
- > Starlink is claiming every altitude from 510 to 580 km
- > They need << 1 km accuracy for collision avoidance anyway!



 There is room for many NGSO systems

- 10 km spacing ±2.5 km orbital tolerance
- ± 0.1° inclination tolerance
- Starlink satellites
- Other NGSO systems

Viasat

#### Conclusion

Risks are different with mega-constellations
Rules must change
Safety and competition must be ensured

