



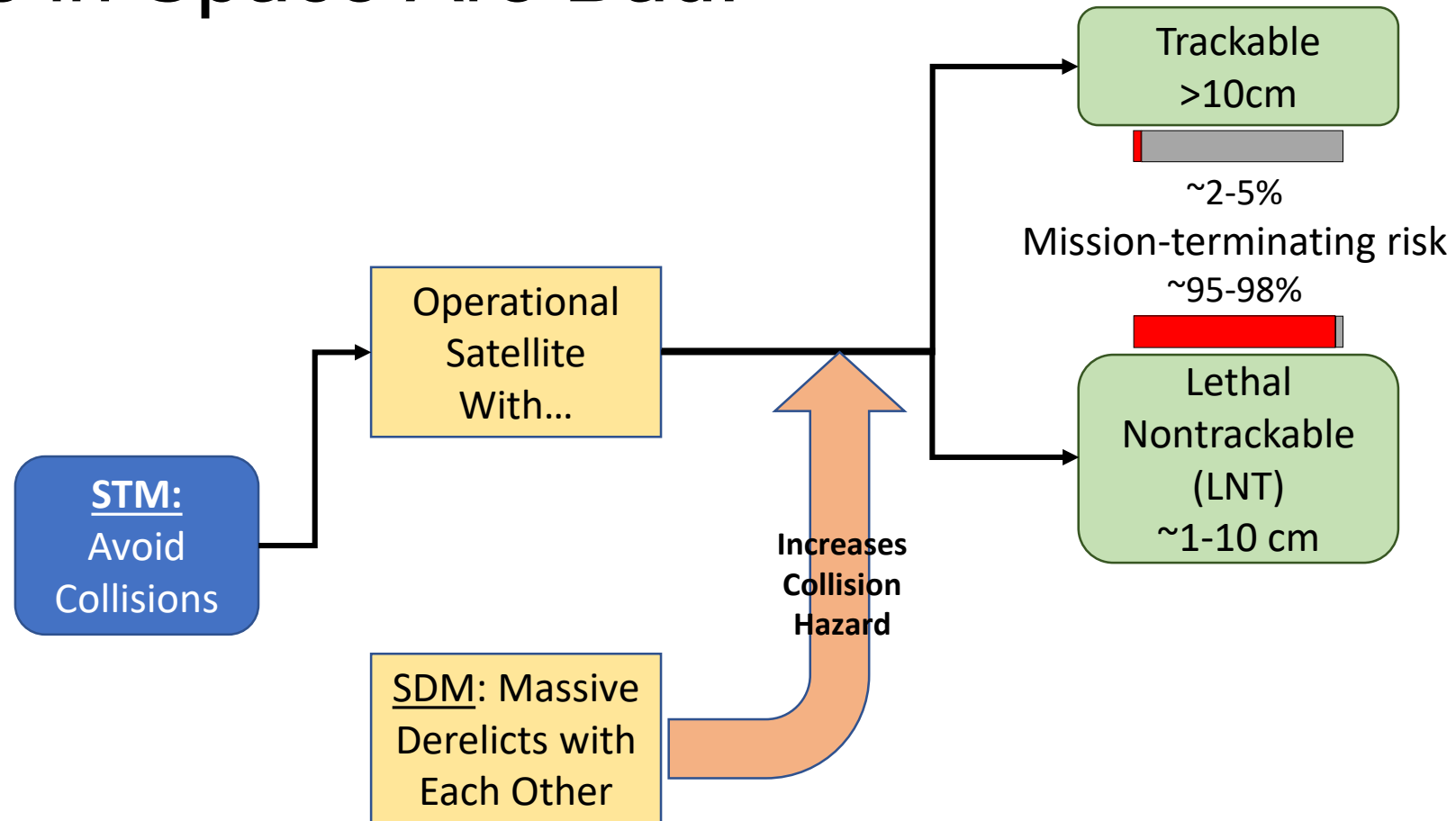
## **The Dangers of Debris and Rocket Bodies**

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*September 2021*

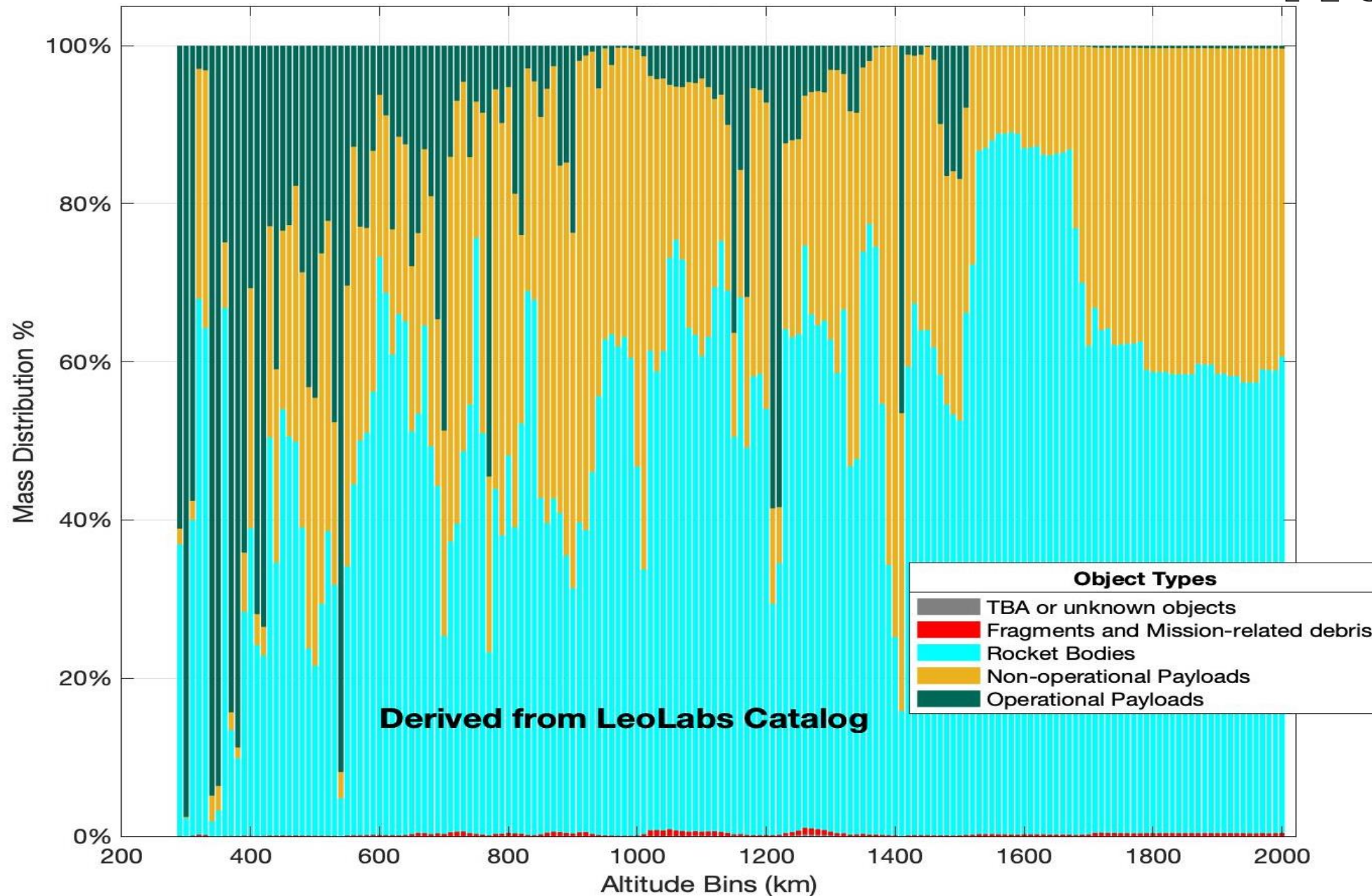
*Monitor, Characterize, & Inform*

# Collisions in Space Are Bad!



STM = space traffic management  
SDM = space debris management

# Mass is Distributed Non-Uniformly in LEO

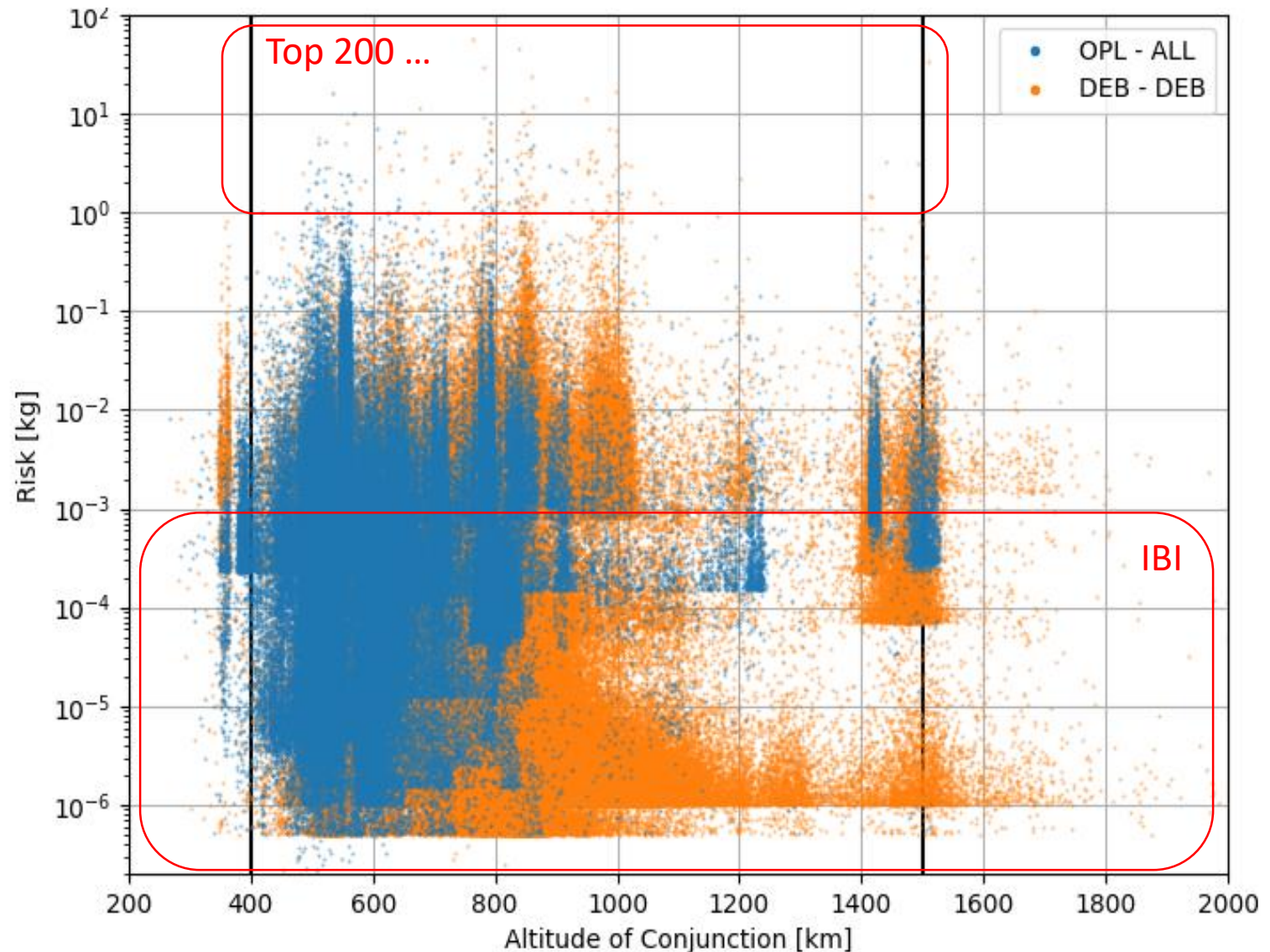


Data as of  
30 June 2021

# The “Heartbeat” of LEO - Bad Neighborhoods



- ~760k conjunctions with PC > 1E-6 from 1JUL20 to 30 Jun21
  - ✓ Highlights debris-generating potential by STM (OPL-ALL) and debris remediation (DEB-DEB)
- Higher risk shows concerns for future debris generation
  - ✓ Clusters > constellations
- Greatest debris-generating potential at 775-850 km followed by 975 km and 1,500 km



# Top 200 Conjunctions - Derelicts Dominate



- **The top 200 riskiest conjunctions dominated by DEB-DEB (65%)**
  - ✓ Starlink is 10% of LEO population but 2.5% of objects in top 200 conjunctions so factor of four safer than average LEO object
- **Objects involved reinforce need for debris remediation**
  - ✓ 50% massive/intact derelicts
  - ✓ 30% fragments
  - ✓ 20% operational payloads
- **Object types that are most prevalent**
  - ✓ 35 events involved an SL-8 R/B
  - ✓ 26 events involved Fengyun-1C debris fragments
  - ✓ 21 events involved an SL-16 R/B
- **Four individual objects show up three times - all Russian**
  - ✓ Cosmos 1536 at ~549 km
  - ✓ Cosmos 1378 at ~495 km
  - ✓ SL-16 R/B (SSN 22285) at ~842 km
  - ✓ SL-16 R/B (SSN 23088) at ~843 km

## Who owns these objects?

REGION/ENTITY	% of OBJECTS
Russia	50
USA	28
China	16
Europe	2
Japan	1
India	1
Other	2



# LeoLabs' Radar Network - Now



Poker Flat Incoherent Scatter Radar (UHF), Fairbanks Alaska



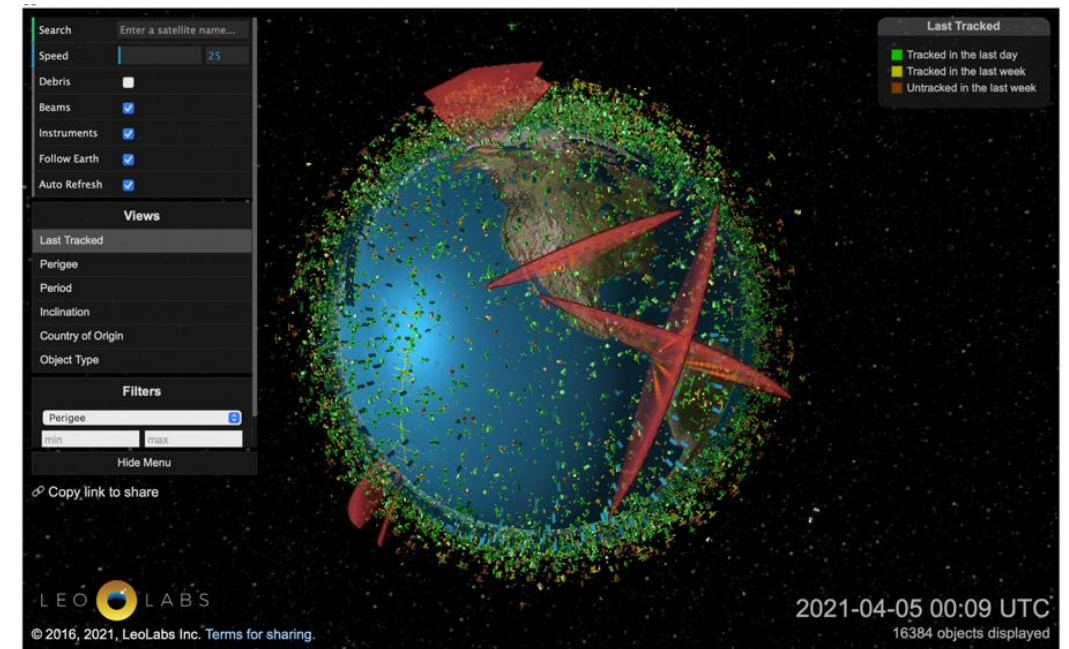
Midland Space Radar (UHF), Midland Texas



Kiwi Space Radar (S-Band), Central Otago, New Zealand



Costa Rica Space Radar (S-Band), Costa Rica



- Distributed architecture delivers powerful capabilities:
  - ✓ New state vectors within 10 min
  - ✓ Info on new incidents in 4 hours or less
  - ✓ Coverage from the Southern Hemisphere and the Equator
  - ✓ Small objects (down to 2 cm) “coming”
- Services delivered **today** with six radars:
  - ✓ 400,000 measurements per day
  - ✓ 15,000 state vector updates per day
  - ✓ ~6M conjunction data messages per day
  - ✓ Six revisits per day for well-tracked objects