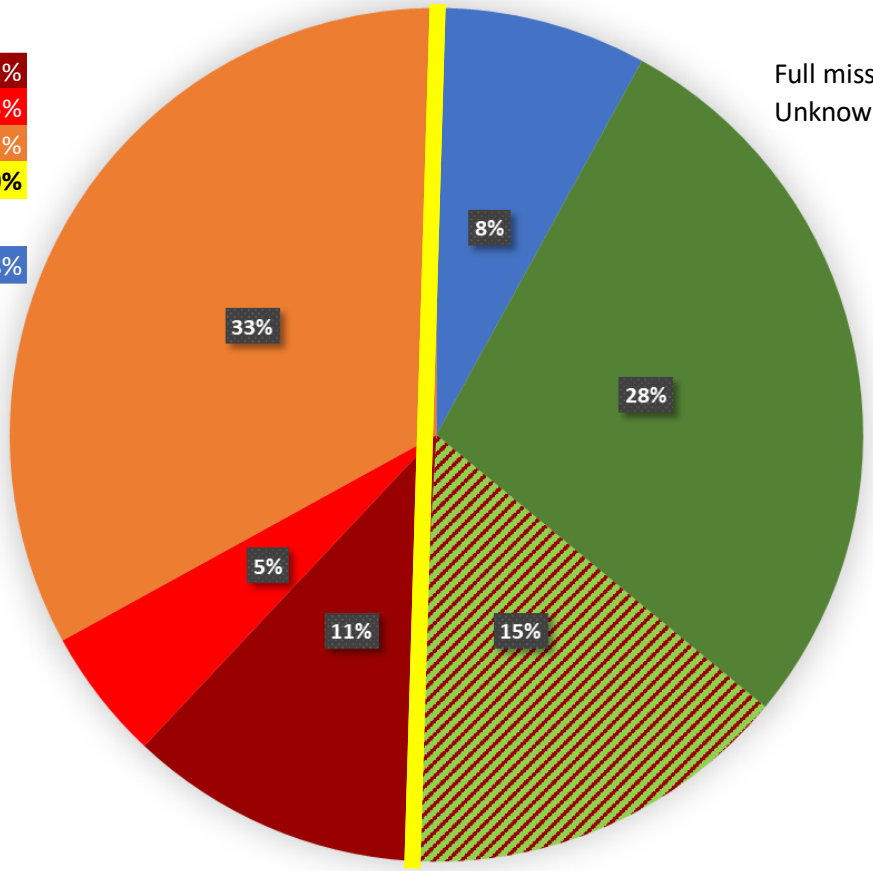
Smallsats – The Reliability Gap

Cubesats mission success rate

1,184 launched since 2000 (649 cubesats / 535 cubesats from constellations)

DOA	11%
Commissioning failure	5%
Partial mission success (>50% success)	33%
Annual Mission Failure Rate	**40%**
Launch failure	8%



Full mission success	28%
Unknown (50% success/failure)	15%

650 GEO Satellites launched since 2000: annual mission failure rate ~2%

Source: Dr Swartwout cubesats database (CubeSat Database - swartwout), www.nanosats.eu, Seradata, Beazley

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The Reliability Challenge

- **High attrition rate**: fly-fix-fly approach to technology insertion, "if you just keep going, eventually you get there"

→ Run-and-gun "Fly/Retry" model has its limits

- **Lower barriers to entry**, opening the door to organisations that do not necessarily have the experience or resources to build and produce reliable spacecrafts at scale

- **No industry standards or guidelines** for smallsat reliability activity across different risk classes

- **Extended use of COTS** and the rapid update cycle for electronic components

- **Critical systems redundancy and margins**

- Higher vulnerabilities to **generic defects**?

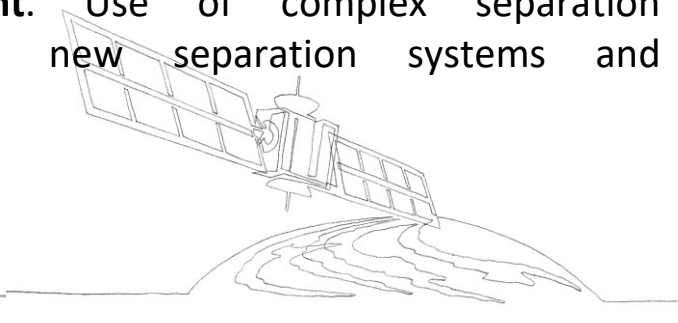
- **Optimum level of oversight**, "Insight vs Oversight"

- **Supply chains still in their infancy** (late deliveries, unproven or contaminated equipment, or even anomalous upon delivery). Problem could be amplified by a design philosophy that places less emphasis on component level testing

- **Testing**. Smallsat testing often mostly done at fully assembled system level, rather than at systems and sub-systems levels

- **Launch environment qualification / interface**

- **Deployment**. Use of complex separation sequences, new separation systems and spacetugs



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