Fundamental Challenges for Laser Satellite Communications and Quantum Key Distribution

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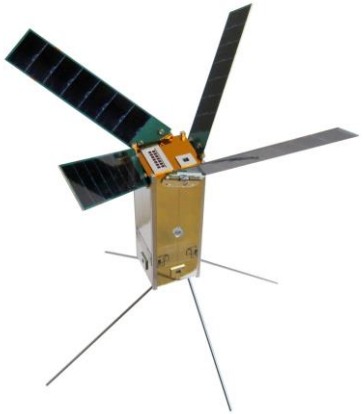
TU Delft

TU Delft spacecraft history

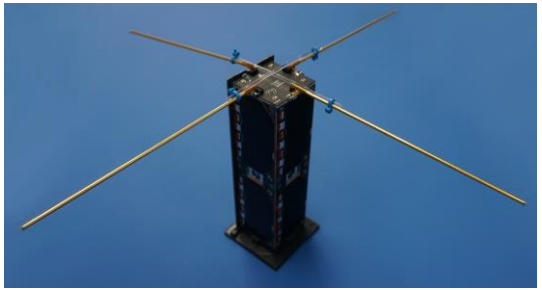


Delfi-n3Xt

Delfi-C3 (2008)

Delfi-N3xt (2013)

Pocket Qube (2022)



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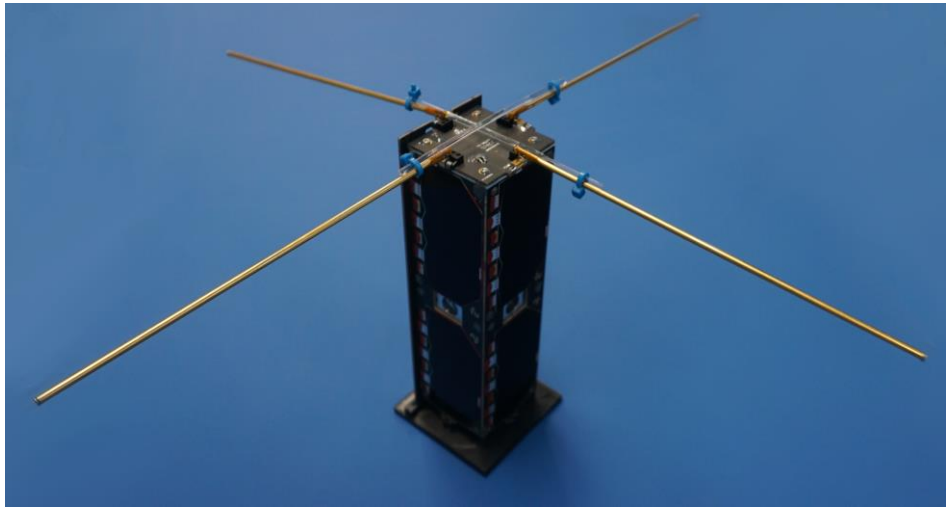
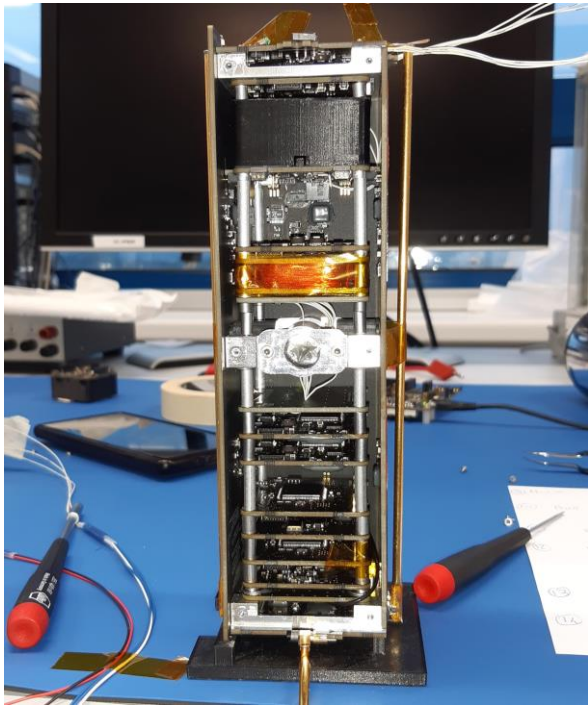
Pocket Qube

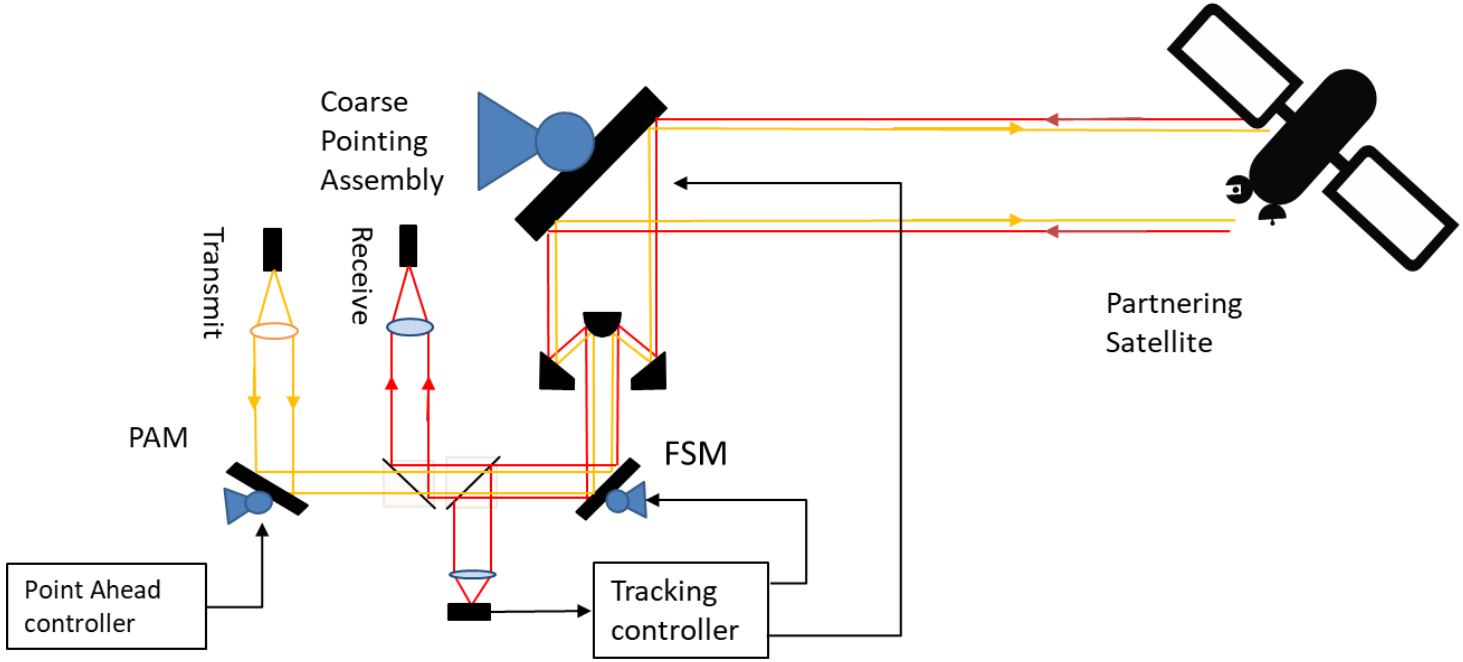




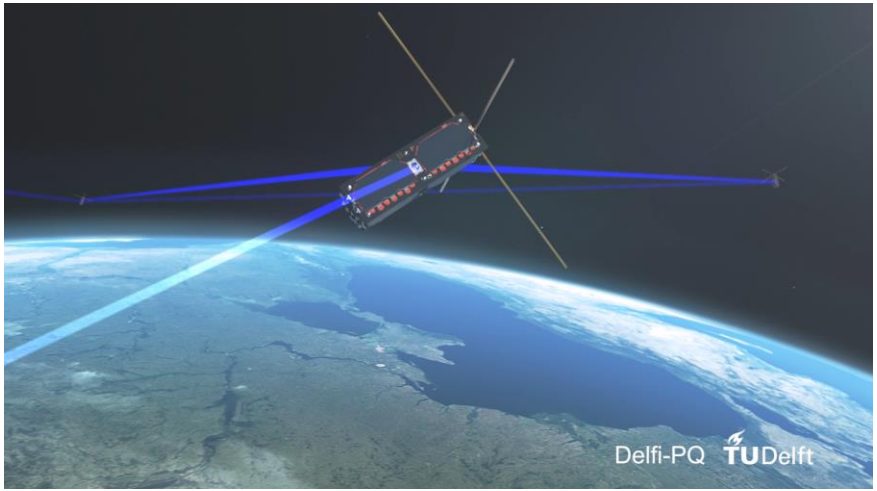
Thanks to:
Stefano Speretta,
Sevket Uludag,
Jasper Bouwmeester
Alessandro Menicucci

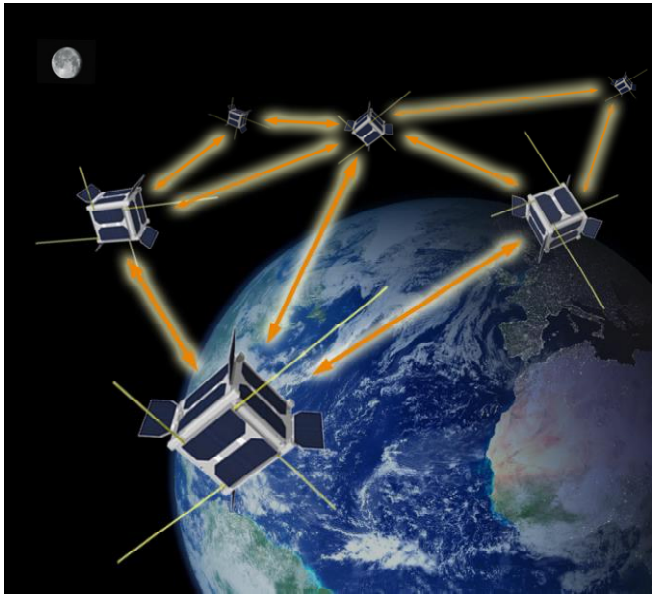
Challenges

Space systems architecture



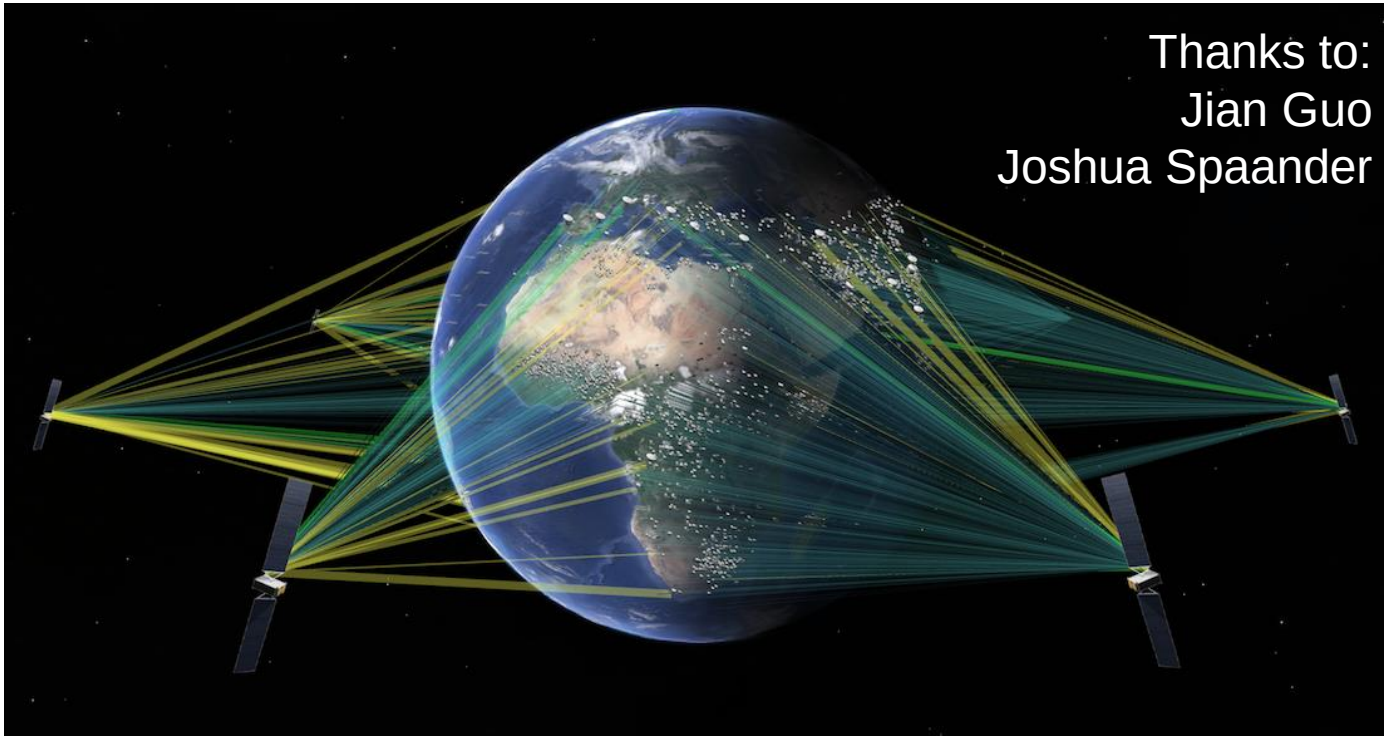
Formation flying ad Satellite communications





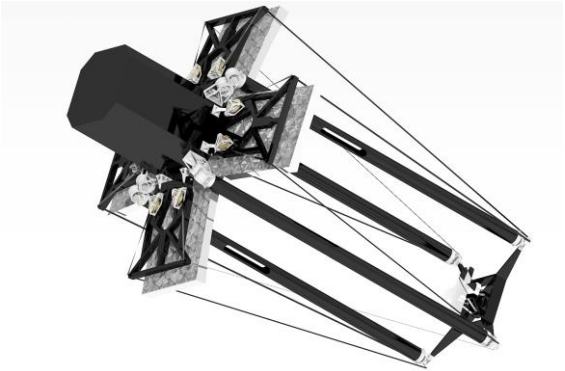
Thanks to:
Stefano Speretta,
Alessandro Menicucci

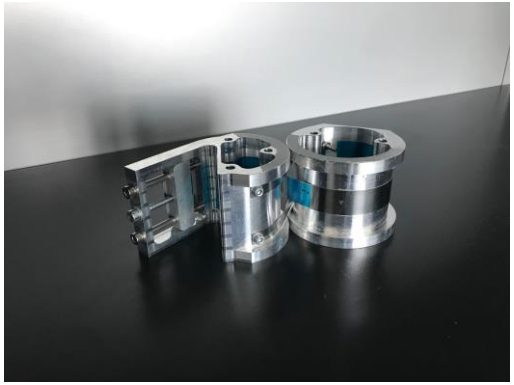
Multibeam terminal

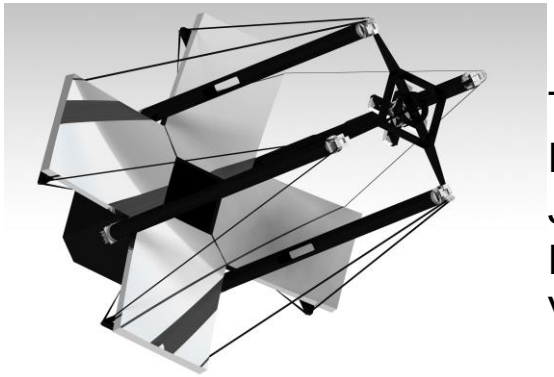


Source: https://www.aviationtoday.com/2020/09/28/isotropic-systems-ses-win-contract-test-multi-beam-o3b-terminal/

End-to-end opto-thermo-mechanical modelling and deployable telescopes







Thanks to:
Hans Kuiper,
Jasper Bouwmeester,
Dennis Dolkens,
Victor Villalba Corbacho

Take-Away

- TU Delft Aerospace engineering is joining laser satellite communications:
  - Cubesats and Pocket Qubes satellites
  - Miniaturisation and distributed systems
  - Optical space systems engineering
  - Turbulence and link budget modelling
- PhD projects: Optical Wireless Superhighways:
  - Laser satcom for formation flying
  - Multibeam space terminals
  - End-to-end opto-thermo-mechanical modelling
- Future challenges:
  - Orbital location and pointing
  - Turbulence mitigation
  - SNR/filtering for day-time and power efficiency
  - In field/orbit demonstrations
  - Reduced SWAP
- Using hardware for other purposes:
  - Laser satellite ranging
  - Formation flying
  - Space situational awareness

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Thank you for your attention

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