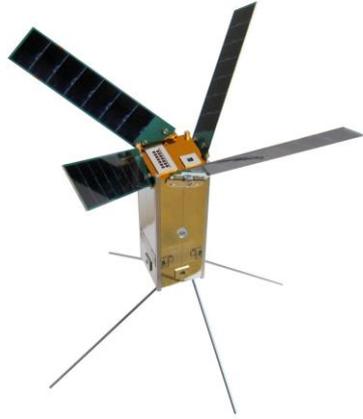


# Fundamental Challenges for Laser Satellite Communications and Quantum Key Distribution

Rudolf Saathof, Stefano Speretta,  
Jian Guo, Hans Kuiper, Eberhard Gill

# TU Delft spacecraft history

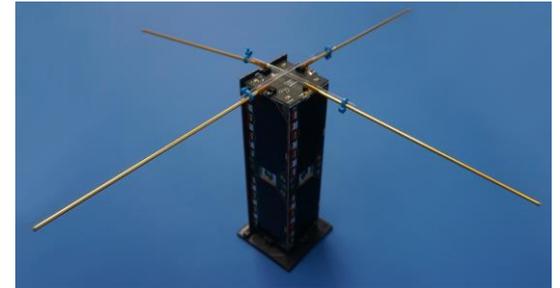


**Delfi-n3xt**

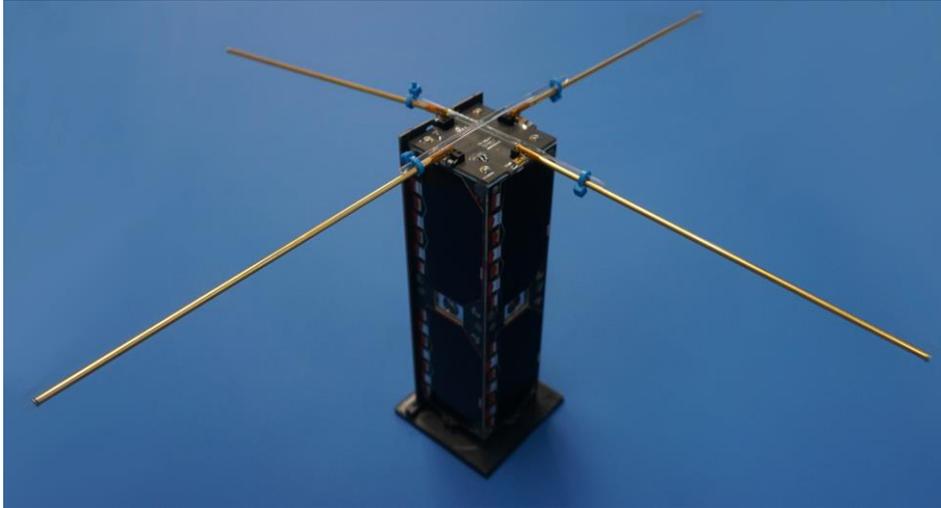
Delfi-C3 (2008)

Delfi-N3xt

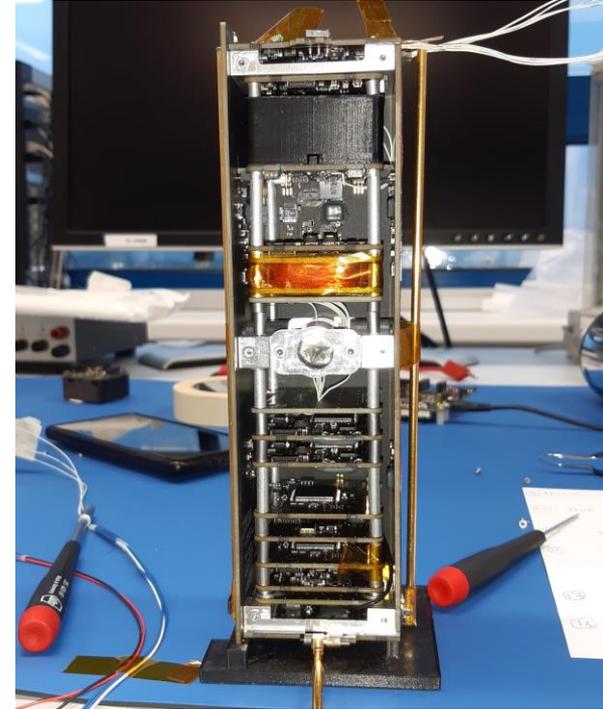
Pocket Qube (2022)



# Pocket Qube



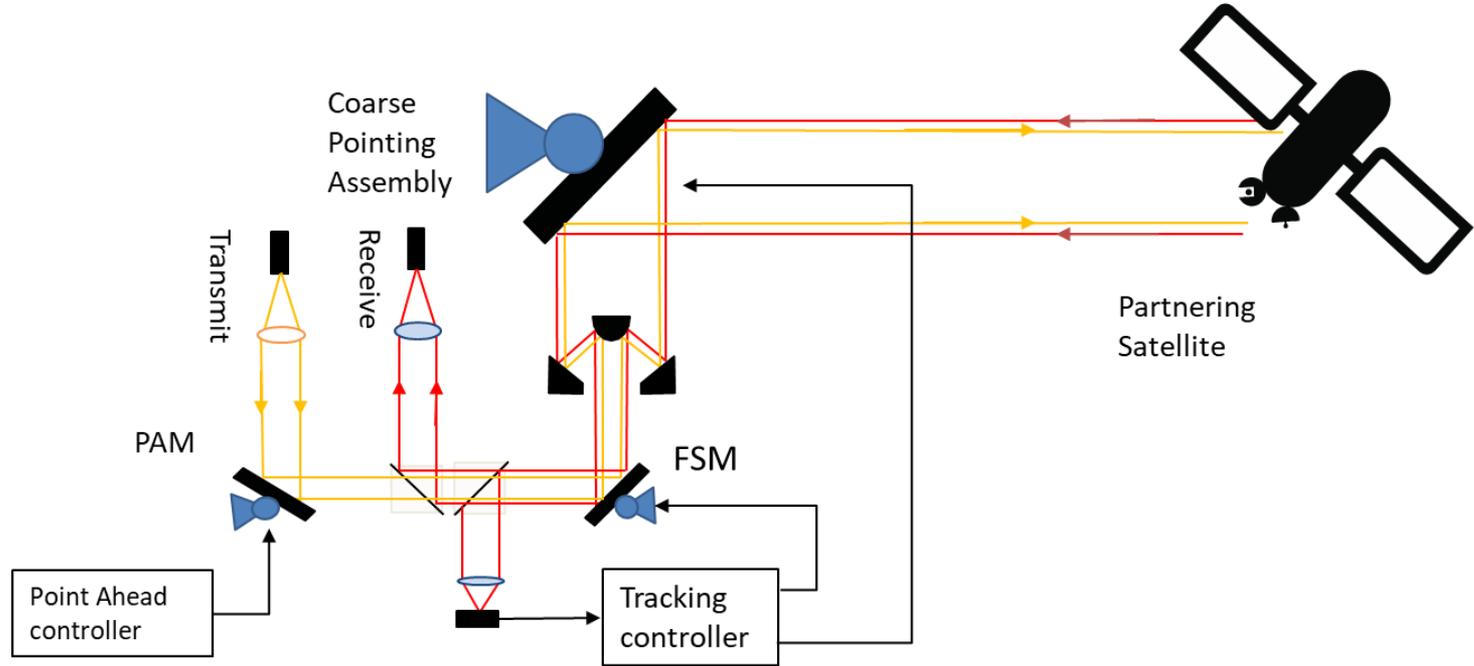
Thanks to:  
Stefano Speretta,  
Sevket Uludag,  
Jasper Bouwmeester  
Alessandro Menicucci



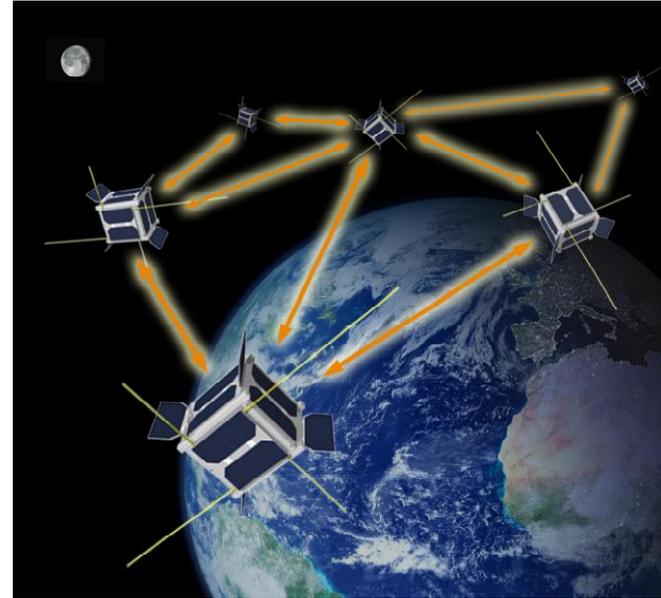
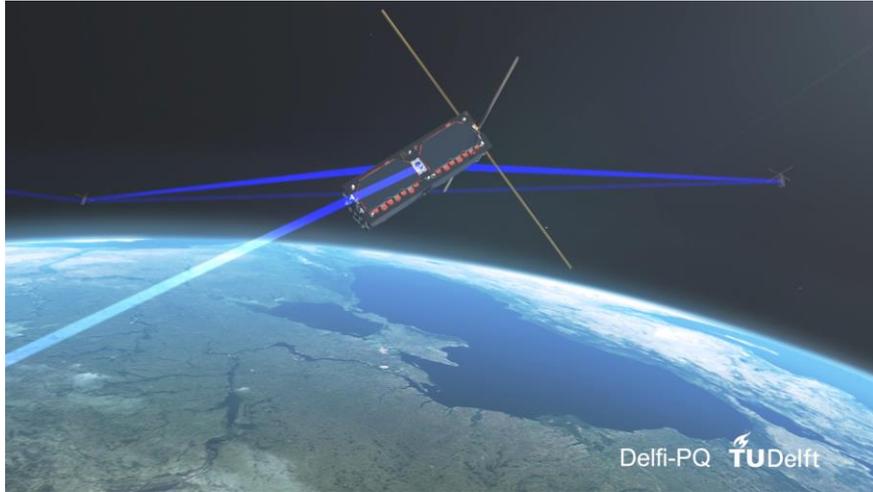
# Challenges



# Space systems architecture

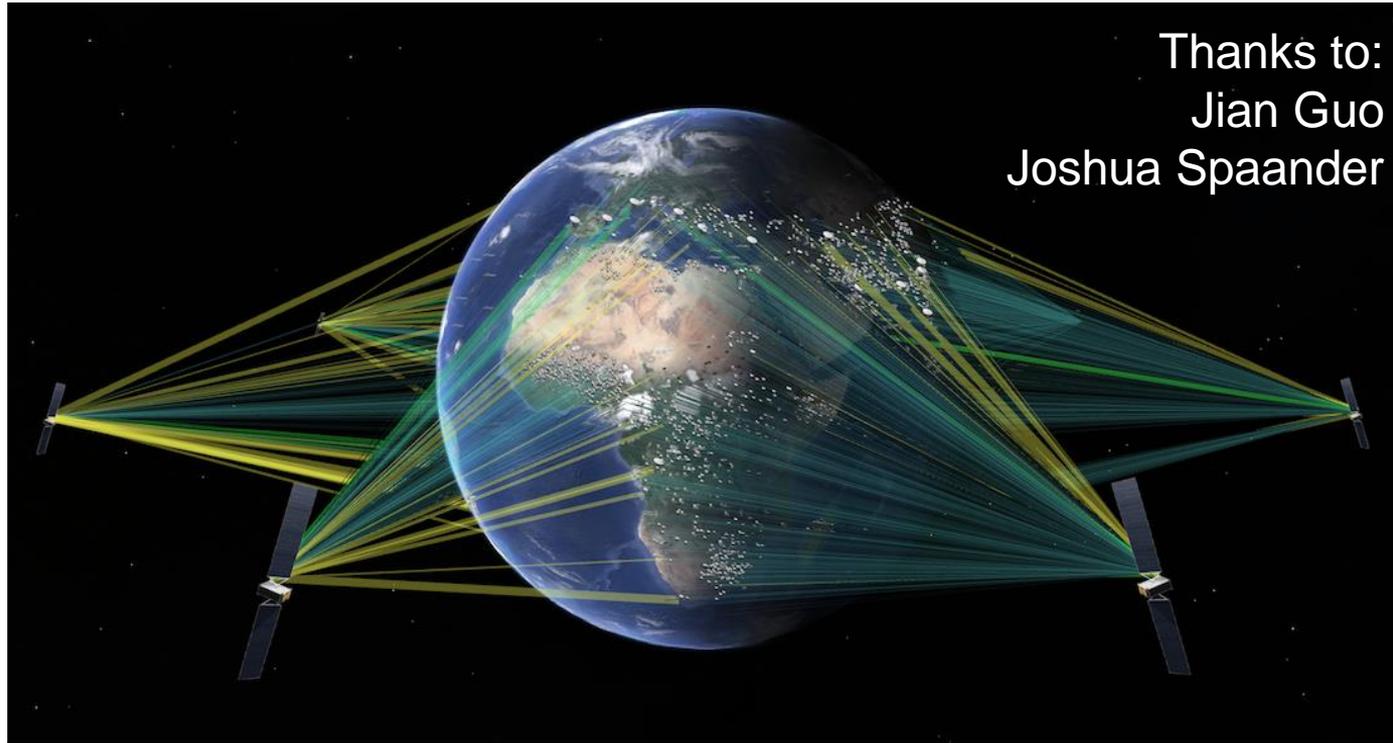


# Formation flying and Satellite communications

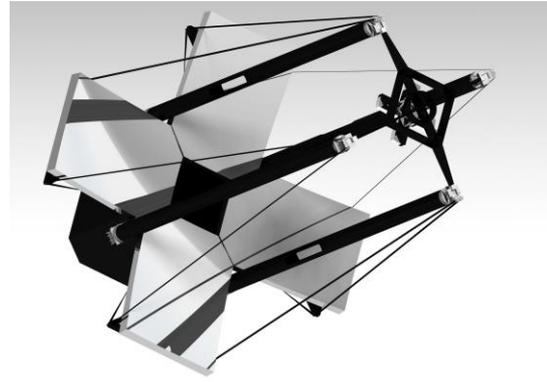
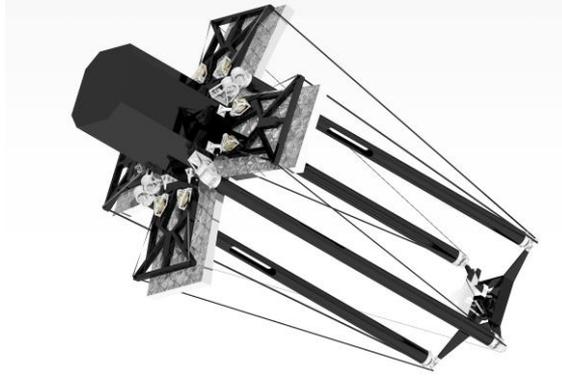


Thanks to:  
Stefano Speretta,  
Alessandro Menicucci

# Multibeam 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

# Thank you for your attention

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