

# Missões Espaciais

# Categorias de Missões Espaciais

- **Observação da Terra**

- Sensoriamento remoto: observação da superfície da Terra para o estudo de elementos da geografia (natural e artificial) e da vegetação.
- Meteorologia: observação dos elementos relativos ao clima, tais como nuvens, ventos e temperaturas.
- Oceanografia: observação de elementos que caracterizam a dinâmica dos oceanos tais como correntes, temperaturas e elevação de sua superfície.
- Espionagem: observação de instalações militares, industriais e estratégicas, bem como da movimentação de tropas e equipamentos.
- Alarme e reconhecimento: descoberta de incêndios e acidentes nucleares.

- **Observação astronômica**

- Objetivam posicionar telescópios em diversas órbitas para operar em diversos comprimento de onda.

# Categorias de Missões Espaciais

## • Comunicações

- Telecomunicações a partir da órbita geoestacionária: telefonia fixa, transmissão de dados, rádio e televisão.
- Telecomunicações a partir de órbitas baixas: telefonia celular mundial, “pager” mundial, transmissão de dados.
- Navegação por satélite (satélites do tipo GPS, Galileo e Glonass).
- Resgate - aviões, navios, veículos terrestres e pessoas.
- Satélites de coleta de dados.

## • Recuperáveis

- Executam experimentos de curta duração (por meio de satélites que permanecem poucas semanas em órbita) e retornam à superfície terrestre.

## • Militares

- Têm o propósito de contribuir por meio de satélites com sistemas de defesa para a execução de missões de interceptação e destruição.

## • Científicas

- Observação astronômica, medidas do campo magnético da Terra, química da atmosfera, efeitos da micro gravidade, potencial terrestre, atividade solar e meio ambiente espacial.

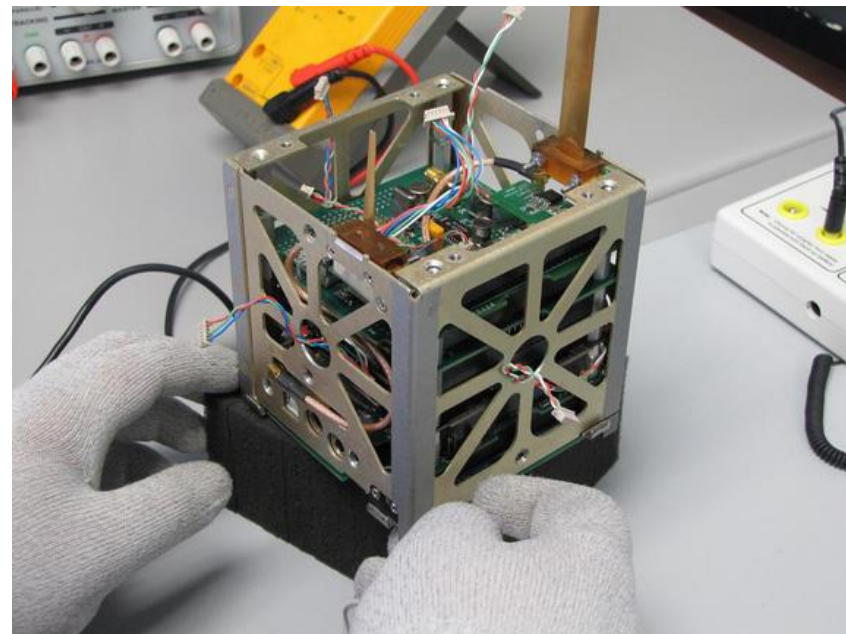
# A Missão Espacial Completa Brasileira (MECB)

- **Objetivo geral do programa:** Desenvolver a tecnologia, infraestrutura, indústria e RH brasileiros na área espacial através de missões de interesse nacional.
- **Início:** Aprovada em 1980
- **Missões estabelecidas:**
  - Desenvolver dois Satélites de Coleta de Dados (**SCD**)
  - Desenvolver dois Satélites de Sensoriamento Remoto (**SSR**)
  - Desenvolver a infraestrutura para qualificação de satélites (**LIT**)
  - Desenvolver o segmento solo para controle dos satélites (**CRC**)
  - Desenvolver as bases de lançamento de Alcantara (**CLA**)
  - Desenvolver 4 foguetes VLS para qualifica-lo (**VLS**)
- **Missões cumpridas:** com siglas destacadas em vermelho

# Exemplos de Missões com Pequenos Satélites

# Tipos de Missões

- Usos típicos:
  - Teste de componentes espaciais
  - Ciência Espacial
  - Motivação para desenvolver novas tecnologias
  - Baixo custo (riscos experimentais)
  - Motivação Educacional para Estudantes (Missões com endLife de 2 anos)
- Extras:
  - Espionagem (Terra / entre satélites)
  - Observação da terra
  - Constelação em Marte



[http://ccar.colorado.edu/asen5050/projects/projects\\_2013/Naik\\_Siddhesh/Cubesats.html](http://ccar.colorado.edu/asen5050/projects/projects_2013/Naik_Siddhesh/Cubesats.html)

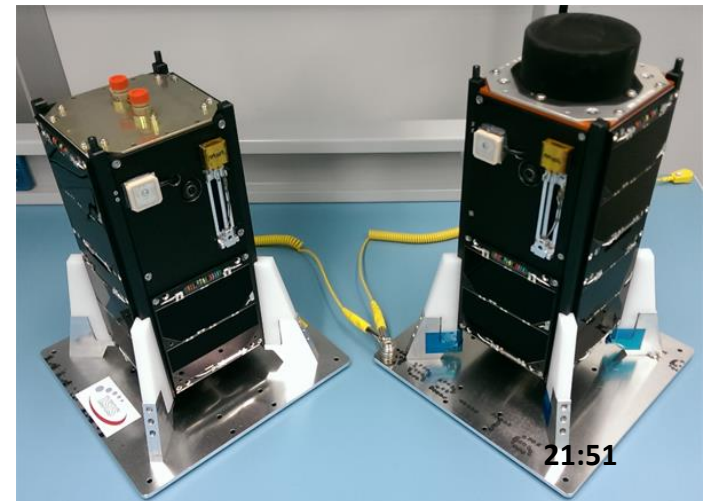
# Considerações

- Missões próximas à Terra\*
  - Potência de transmissão
  - Tamanho do objetiva
- Atividades/Objetivos Distribuídos em Satélites
  - Tamanho do Envelope Mecânico
  - Dimensão do Suprimento de Energia
- Tempo de Retorno
  - “Aerólito sem rumo”
- Tempo de Vida
  - Radiação e Falhas

# QB50

- The QB50 mission demonstrates the possibility of launching a network of CubeSats built by Universities Teams all over the world to perform first-class science in the largely unexplored lower thermosphere.

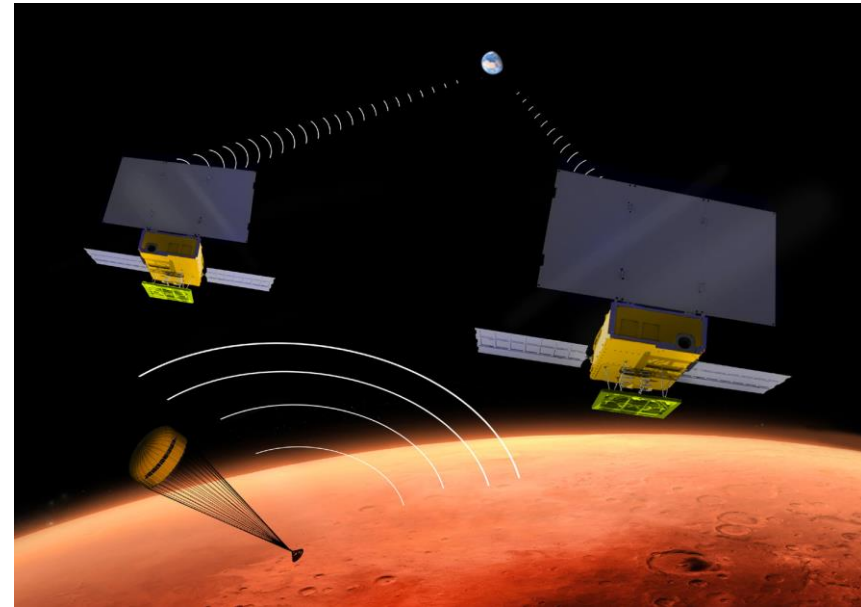
QB50 ID	Satellite Name	Lead Institute	Country	Launch	Deployment date/time (UTC)	Size	QB50 sensor
AU01	SUSat	University of Adelaide	Australia	ISS via Atlas-V	25/05/17, 11:55	2U	INMS
AU02	UNSW-ECO	University of New South Wales	Australia	ISS via Atlas-V	25/05/17, 5:25	2U	INMS
AU03	I-INSPIRE II	University of Sydney	Australia	ISS via Atlas-V	26/05/17, 04:00	2U	mNLP
AZ01	ZA-AEROSAT	Stellenbosch University	South Africa	ISS via Atlas-V	18/05/17, 01:00	2U	FIPEX
AZ02	nSIGHT	SCS-SPACE	South Africa	ISS via Atlas-V	25/05/17, 08:45	2U	FIPEX
CA03	ExAlta-1	U of Alberta	Canada	ISS via Atlas-V	26/05/17, 08:55	3U	mNLP
BE02	LilacSat-1	Harbin Institute of Technology (HIT)	Belgium	ISS via Atlas-V	25/05/17, 08:45	2U	INMS
BE03	NJUST-1	Nanjing University of Science and Technology	Belgium	ISS via Atlas-V	25/05/17, 5:25	2U	FIPEX
BE04	Ao Xiang-1	NPU	Belgium	ISS via Atlas-V	26/05/17, 12:15	2U	INMS
DE02	SOMP2	TU Dresden	Germany	ISS via Atlas-V	16/05/17, 08:25	2U	FIPEX
ES01	QBITO	E-USOC, ETSIA, Universidad Politécnica de Madrid (UPM)	Spain	ISS via Atlas-V	25/05/17, 11:55	2U	INMS
FI01	Aalto-2	Aalto University	Finland	ISS via Atlas-V	25/05/17, 11:55	2U	mNLP
FR01	X-CubeSat	Ecole Polytechnique	France	ISS via Atlas-V	17/05/17, 01:45	2U	FIPEX
FR05	SpaceCube	Ecole des Mines Paristech	France	ISS via Atlas-V	18/05/17, 08:25	2U	FIPEX
GR01	DUTHSat	Democritus University of Thrace	Greece	ISS via Atlas-V	25/05/17, 08:45	2U	mNLP
GR02	UPSat	University of Patras and Libre Space Foundation	Greece	ISS via Atlas-V	18/05/17, 08:25	2U	mNLP
IL01	Hoopoe	Herzliya Science Center	Israel	ISS via Atlas-V	18/05/17, 08:25	2U	mNLP
KR01	LINK	KAIST	South Korea	ISS via Atlas-V	18/05/17, 01:00	2U	INMS
KR02	SNUSAT-1	Seoul National University	Korea	ISS via Atlas-V	26/05/17, 04:00	2U	FIPEX
KR03	SNUSAT-1b	Seoul National University	Korea	ISS via Atlas-V	25/05/17, 23:40	2U	FIPEX
SE01	qbee	Open Cosmos Ltd. & LuleaUniversity of Technology	Sweeden	ISS via Atlas-V	17/05/17, 01:45	2U	FIPEX
TR01	BEEAGLESAT	Istanbul Technical University	Turkey	ISS via Atlas-V	26/05/17, 12:15	2U	mNLP
TR02	HAVELSAT	Havelsan	Turkey	ISS via Atlas-V	16/05/17, 08:25	2U	mNLP
TW01	PHOENIX	NCKU	Chinese Taipei	ISS via Atlas-V	17/05/17, 01:45	2U	INMS
UA01	PolyTAN-2-SAU	National Technical University of Ukraine & Shenyang Aerospace University	Ukraine	ISS via Atlas-V	26/05/17, 04:00	2U	FIPEX
US01	Challenger	University of Colorado	USA	ISS via Atlas-V	25/05/17, 5:25	2U	INMS
US02	Atlantis	University of Michigan	USA	ISS via Atlas-V	26/05/17, 12:15	2U	FIPEX
US04	Columbia	University of Michigan	USA	ISS via Atlas-V	16/05/17, 08:25	2U	FIPEX
AT03	PEGASUS	FHWN	Austria	PSLV	26/06/17, 03:59	2U	mNLP
BE06	NUDTSat	National University of Defense Technology	Belgium	PSLV	26/06/17, 03:59	2U	INMS
CZ02	VZLUSAT1	VZLU	Czech Republic	PSLV	26/06/17, 03:59	2U	FIPEX
DE04	DragSail-CubeSat	FH Aachen, University of Applied Sciences	Germany	PSLV	26/06/17, 03:59	3U	N/A
GB03	UCLsat	UCL	Belgium (made in UK)	PSLV	26/06/17, 03:59	2U	INMS
GB06	InflateSail	University of Surrey	Belgium (made in UK)	PSLV	26/06/17, 03:59	3U	N/A
IT02	URSA MAIOR	Sapienza University of Rome	Italy	PSLV	26/06/17, 03:59	3U	mNLP
LT01	LituanicaSAT-2	Vilnius University	Lithuania	PSLV	26/06/17, 03:59	3U	FIPEX





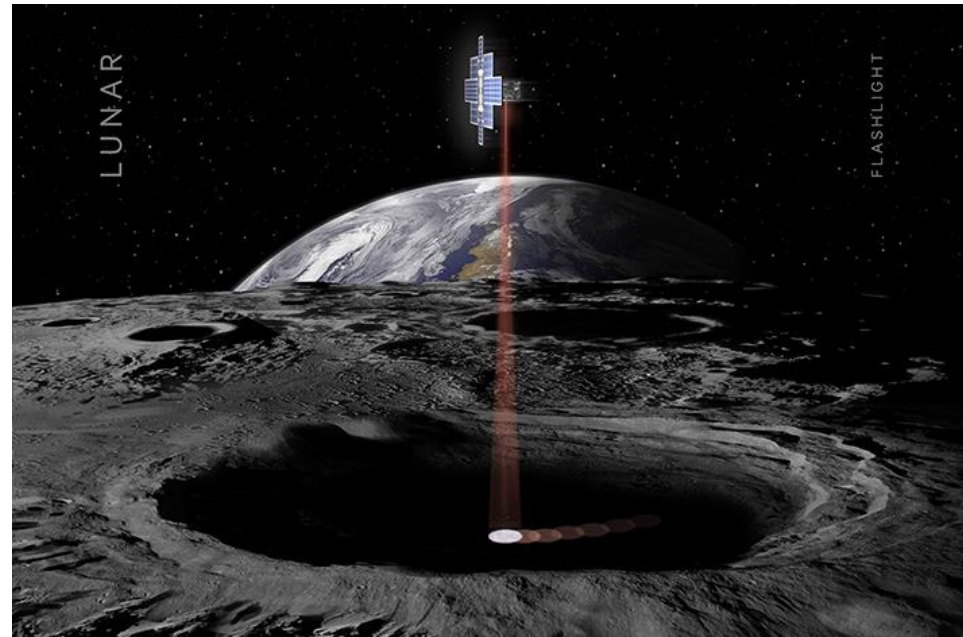
# MarCO - Mars Cube One

- MarCO is an experimental capability that has been added to the InSight mission,
- The two CubeSats will separate from the Atlas V booster after launch and travel along their own trajectories to the Red Planet. After release from the launch vehicle, MarCO's first challenges are to deploy two radio antennas and two solar panels. The high-gain, X-band antenna is a flat panel engineered to direct radio waves the way a parabolic dish antenna does. MarCO will be navigated to Mars independently of the InSight spacecraft, with its own course adjustments on the way.



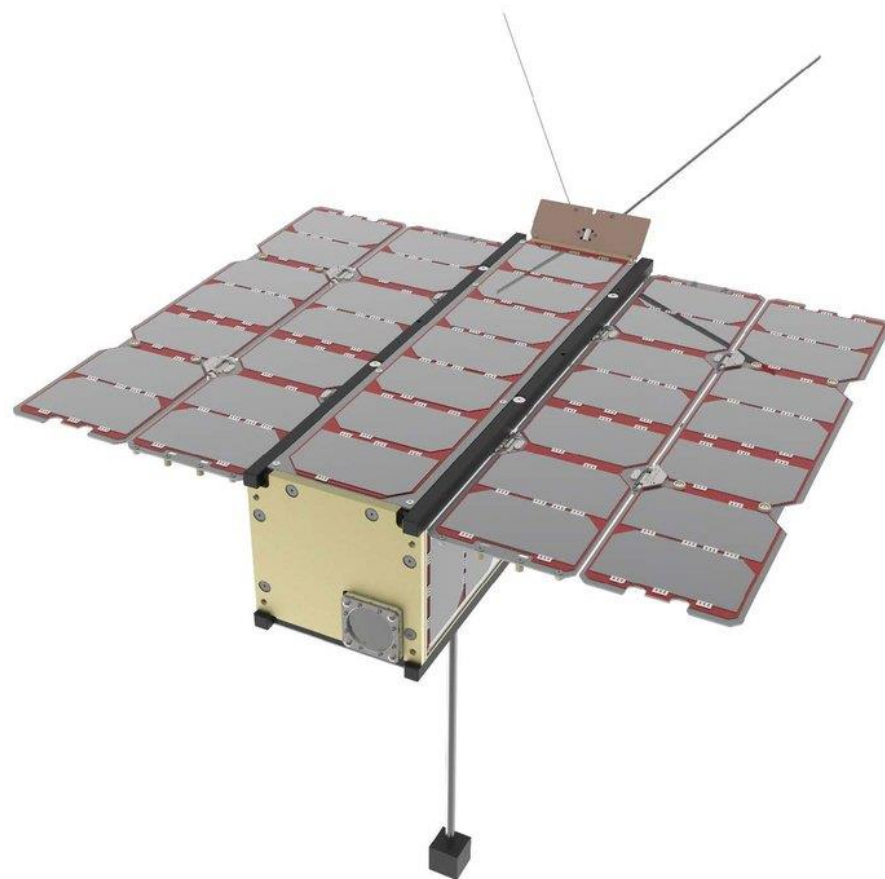
# Lunar Flashlight

- Planned to launch on the Space Launch System's Exploration Mission-1 (EM-1) flight, this innovative, low-cost secondary payload concept will map the lunar south pole for volatiles and demonstrate several technological firsts, including being the first CubeSat to reach the Moon, the first planetary CubeSat mission to use green propulsion, and the first mission to use lasers to look for water ice.



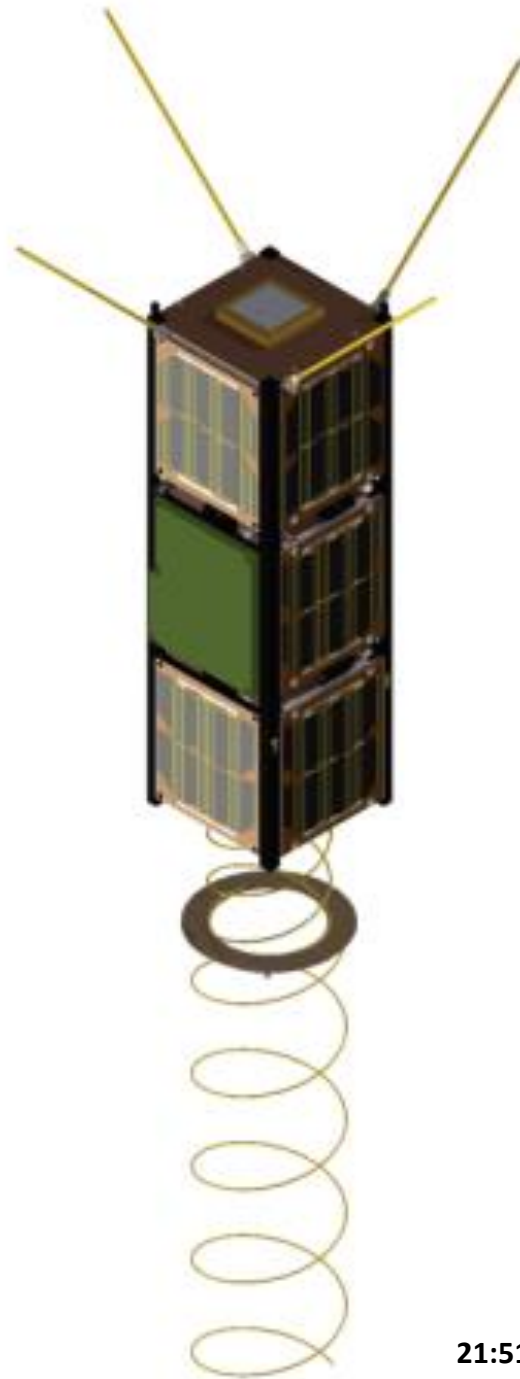
# RadCube

- RadCube (led by C3S with MTA EK in Hungary, Imperial College London in UK, and Astronika in Poland): a 3-unit CubeSat mission to demonstrate miniaturised instrument technologies that measure in-situ the space radiation and magnetic field environment in Low Earth Orbit for space weather monitoring purposes. The platform developed by C3S will also be demonstrated in flight. The project is currently in the preliminary design phase and planned to be ready for flight in late 2019.



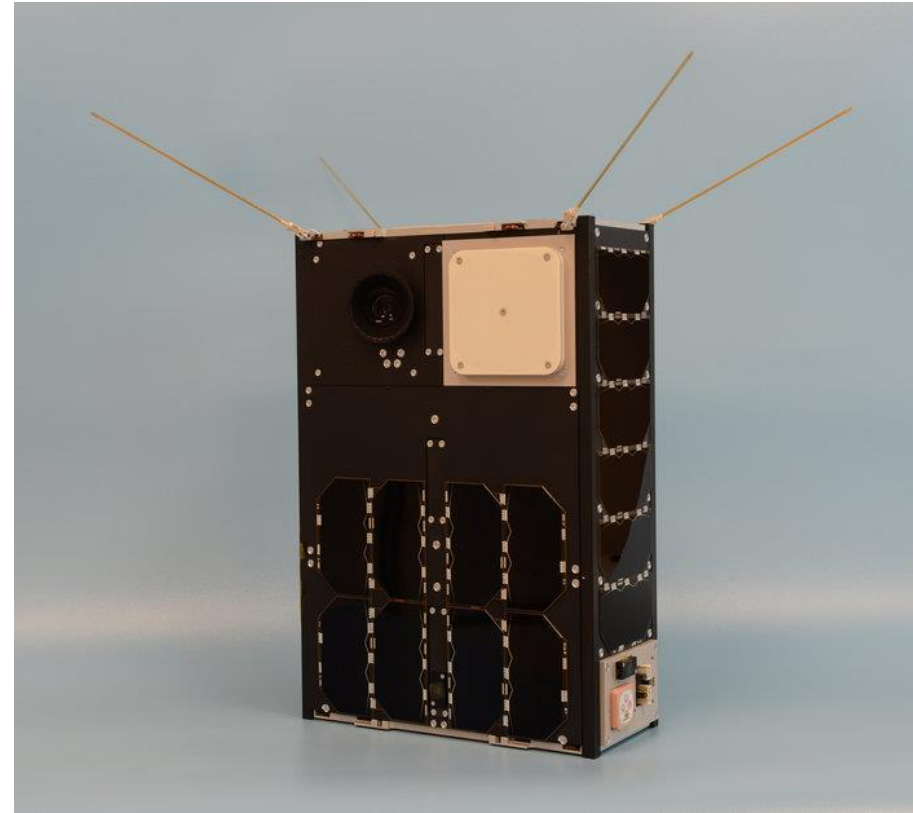
# GomX-3

- GOMX-3 (led by Gomspace, Denmark): a 3-unit CubeSat mission to demonstrate aircraft ADS-B signal reception and geostationary telecommunication satellite spot beam signal quality using an L-band reconfigurable software defined radio payload. A miniaturised high data rate X-band transmitter developed by Syrlinks and funded by the French space agency CNES was flown as a third party payload. The satellite was deployed from the International Space Station on 5 October 2015 and re-entered Earth's atmosphere after 1 year of successful operations.



# GOMX-4B

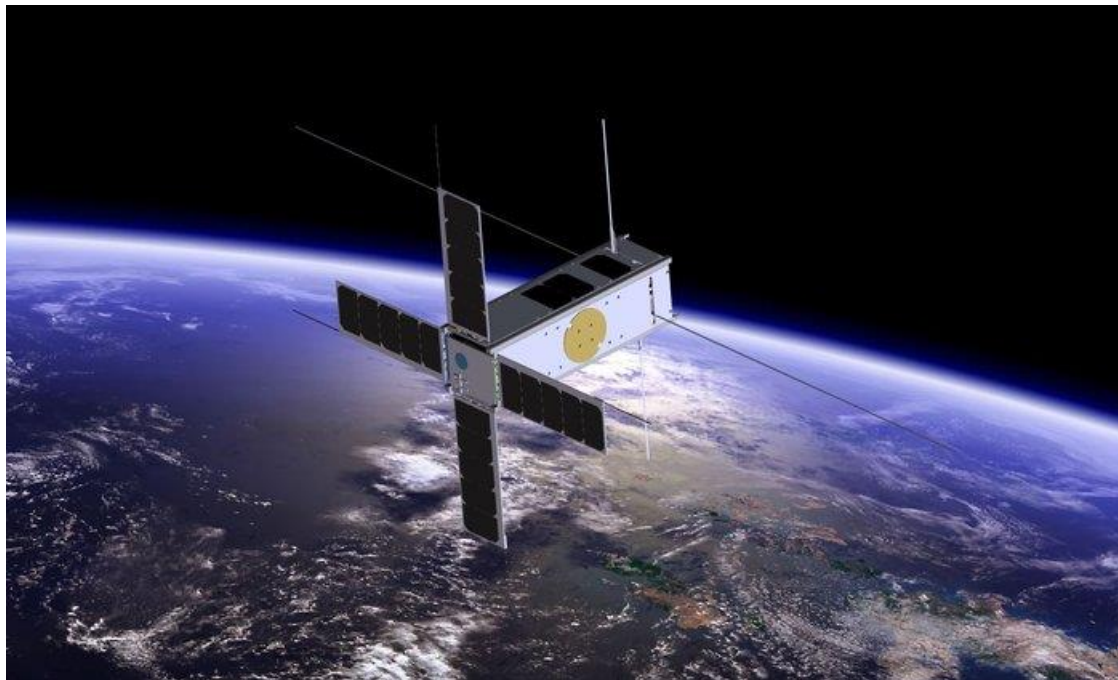
- GOMX-4B (led by Gomspace, Denmark): a 6-unit CubeSat mission to demonstrate Inter-Satellite Link and propulsion technologies when flying in tandem with the GOMX-4A (developed by Gomspace for the Danish Ministry of Defence). The mission will also carrying additional technology payloads: the HyperScout compact hyperspectral imager (Cosine, The Netherlands), a new star tracker (Innovative Solutions in Space, The Netherlands), and the ESA CHIMERA experiment exposing new electronic components to space. The satellites are scheduled for launch in February 2018.





# Picasso

- Picasso (led by Belgian Institute of Space Aeronomy with VTT Finland and Clyde Space, UK): a 3-unit CubeSat mission to measure Stratospheric Ozone distribution, Mesospheric Temperature profile and Electron density in the ionosphere using a miniaturised multi-spectral imager for limb sounding of solar disk, and a multi-Needle Langmuir Probe, due to be launched in 2019 on the Vega Small Satellite Mission Service (SSMS) Proof of Concept flight



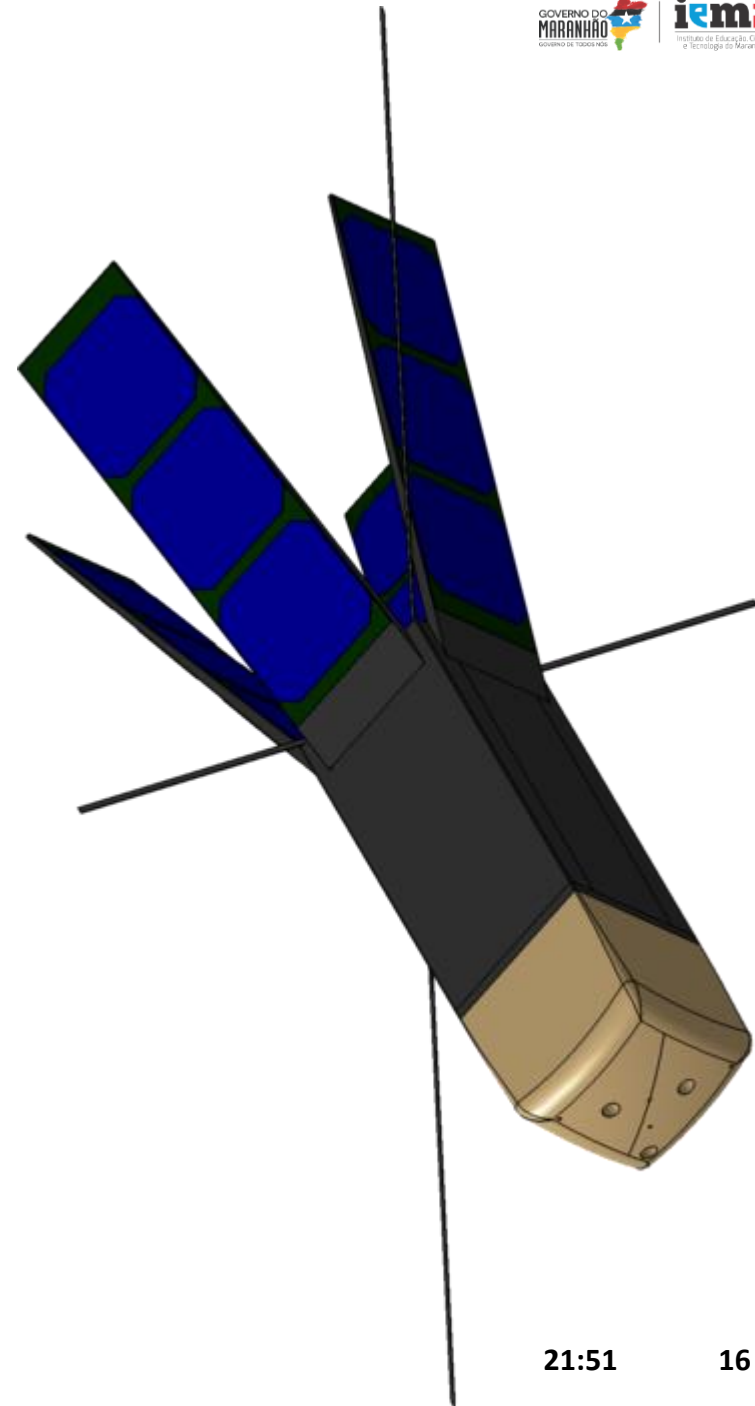
# NanoSatC-BR2

- microssatélite do Programa NANOSATC-BR, Desenvolvimento de CubeSats, em execução no âmbito do Convênio do Instituto Nacional de Pesquisas Espaciais, através de sua subunidade o Centro Regional Sul de Pesquisas Espaciais com a Universidade Federal de Santa Maria - Convênio MCTIC/INPE-UFSM e suas Parcerias no Estado, com a Universidade Federal do Rio Grande do Sul, Instituto de Informática, Grupo de Microeletrônica - UFRGS/II-GME e com a Santa Maria Design House - SMDH-UFSM. Parceria INPE/MCTIC - UFSM, desde Janeiro de 2013, utiliza a plataforma, CubeSats - 2U: (i) o seu Modelo de Voo (MV) na sala 100.000 do LIT/INPE-MCTIC está no momento (Agosto 2017) aguardando sua integração final, com planejamento para lançamento em 2018, estando ainda por finalizar o desenvolvimento de uma de suas placas de Cargas Úteis: Científica & Tecnológica; e (ii) o seu Modelo de Engenharia (ME) no LABSIM/ETE/INPE-MCTIC, que esta sendo utilizado para uma gama de testes de software de bordo e de solo e de Sistemas e Subsistemas, com a participação ativa de alunos de Graduação da UFSM, de seus alunos egressos hoje nas Pós-Graduações do MCTIC/INPE, MD/DCTA-ITA e UFRGS, de Professores da UFSM e da UFRGS, e de Pesquisadores e Tecnologistas do INPE/MCTIC, sendo alguns deles ex-alunos egressos da UFSM que foram devidamente contratados pelo MCTIC/INPE via concursos públicos.



# QARMAN

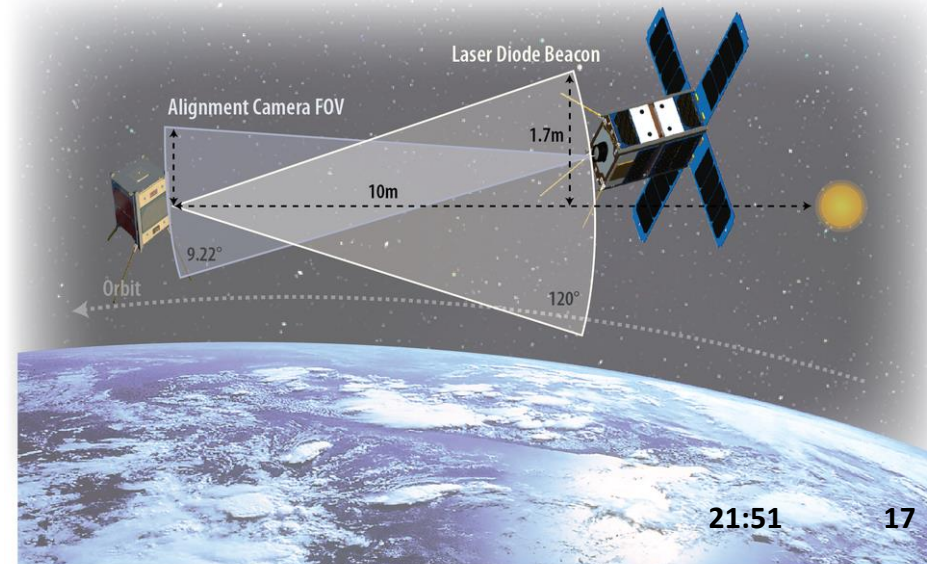
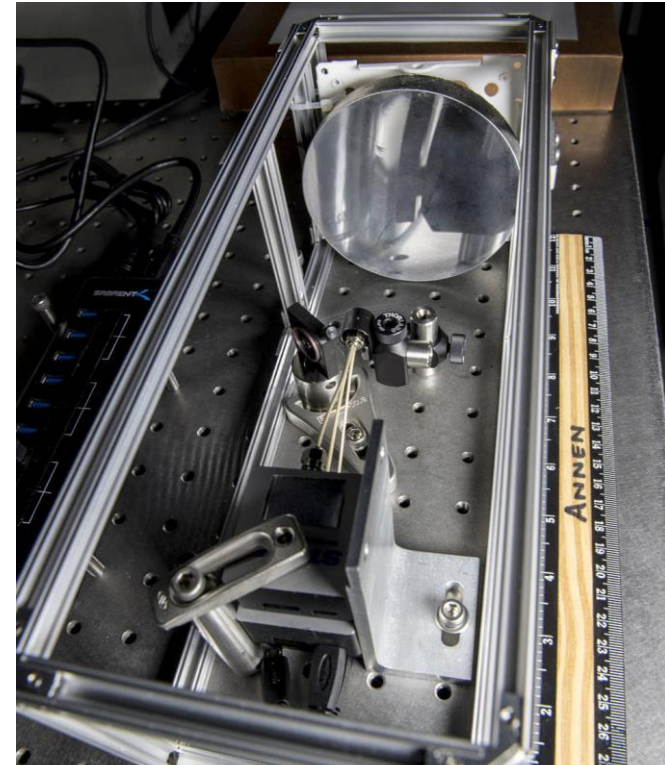
- QARMAN (led by the Von Karman Institute, Belgium): a 3-unit CubeSat mission to demonstrate re-entry technologies, particularly novel heatshield materials, a new passive aerodynamic drag stabilisation system, and the transmission of telemetry data during re-entry via data relay satellites in low-Earth orbit, due to be launched to/deployed from the International Space Station in 2018





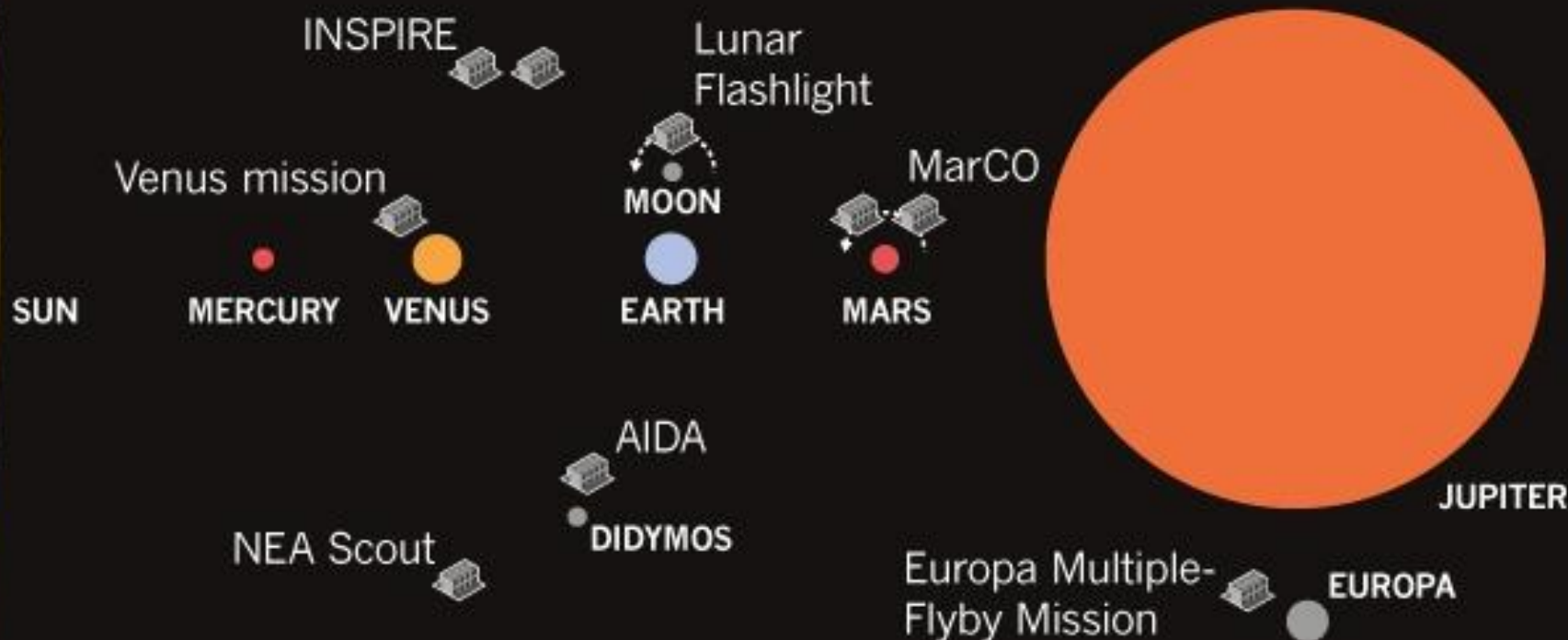
# CubeSat Virtual Telescope

- NASA engineers Neerav Shah and Phil Calhoun will realize a long-held ambition later this year when a Space-X launch vehicle deploys two tiny satellites that will fly in a precise **formation** to create, in effect, a single or “virtual” telescope benefitting a range of scientific disciplines.



# MINIATURE EXPLORERS

Previously limited to Earth orbit by their diminutive size, shoe-box-sized CubeSat spacecraft are now poised to invade the rest of the Solar System, with missions planned to carry these craft as far as Jupiter.



Size and distance not to scale

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