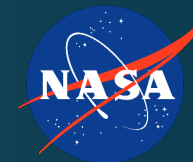




Distributed Science Observatories at NASA's Jet Propulsion Laboratory

Benjamin Donitz

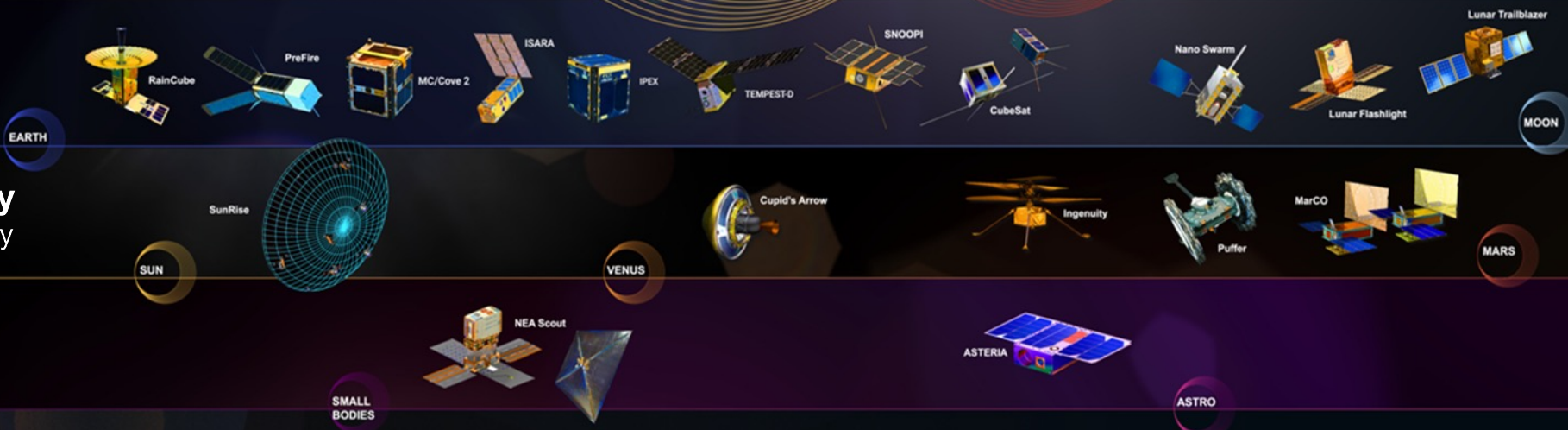
August 9, 2023



Jet Propulsion Laboratory
California Institute of Technology

A new scientific exploration paradigm

SmallSats are driving down the cost of space vehicles, enabling new mission classes by using multiple vehicles as a single observatory and/or to reduce risk of failure



 **Jet Propulsion Laboratory**
California Institute of Technology

Multiple spacecraft, one observatory



6 6U sats, one observatory



3 SmallSats, one observatory

Heliophysics

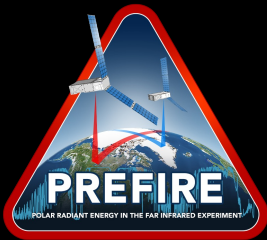
Coronal Mass Ejection
Coronagraph Image

SunR

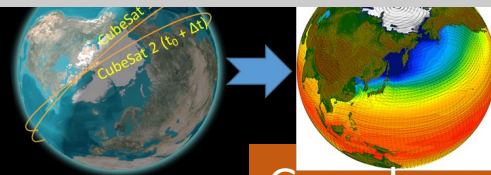
Atmospheric Earth science

6 6U CubeSats	3 ~130 kg SmallSats	2 6U CubeSats	3 small rovers
Helio	Earth science	Earth science	Tech demo / Lunar GPR

Threshold mission can lose one vehicle!



2 6U sats, one
observatory



Greenhouse gas
Earth science

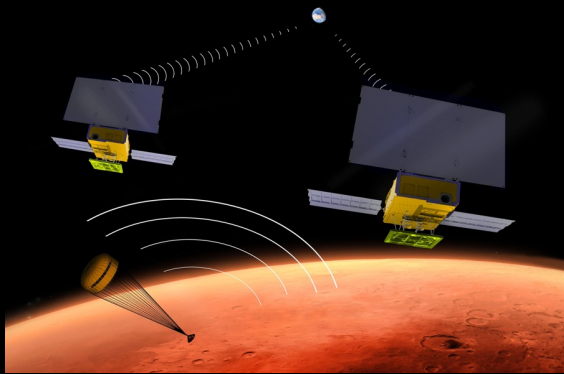


3 small rovers,
one observatory

Lunar ground
penetrating radar



Extra reliability at far away destinations



MarCO	SRH
2 6U Cubesats	2 ~1U helicopters
Planetary Science (Mars)	
Multiple vehicles provides block redundancy for reduced risk	



MarCO

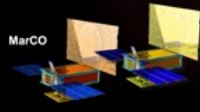
Supported relay for the InSight Mars

landing with two 6U CubeSats

Block redundancy ensured that MarCO would succeed in an unknown environment!

Sample Recovery Helicopter (SRH)

Would support Mars Sample Return by bringing samples from a nearby depot to the Sample Retrieval Lander
Block redundancy helps SRH gets the job done with high reliability!



MarCO



Ingenuity



Puff

NOW

NEXT



SMALL SATS



Jet Propulsion Laboratory
California Institute of Technology

The logo for the Jet Propulsion Laboratory (JPL) is rendered in a bold, red, sans-serif font. The letters 'J', 'P', and 'L' are stylized with thick strokes and sharp, angular terminals. The 'J' has a horizontal base that extends to the left. The 'P' has a vertical stem and a curved top that connects to the 'L'. The 'L' has a vertical stem and a horizontal base that extends to the right.

Jet Propulsion Laboratory
California Institute of Technology