



Divanet

Mars Communication Network

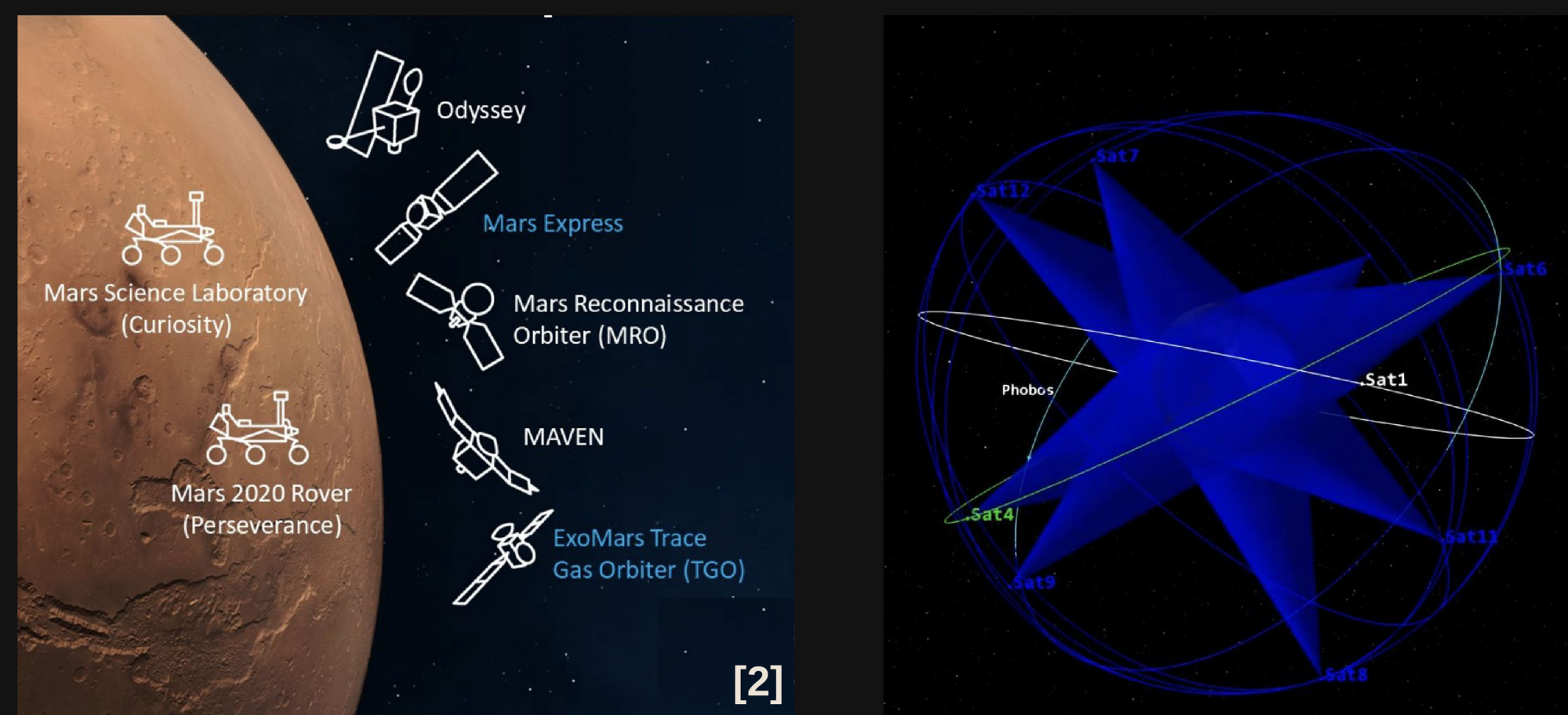
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Introduction

- Mars exploration requires reliable, continuous communication infrastructure
- A satellite constellation enables scalable, global communication capability
- This mission proposes a deployable Mars relay network using an aerocapture maneuver for final orbit insertion + satellite constellation targeting

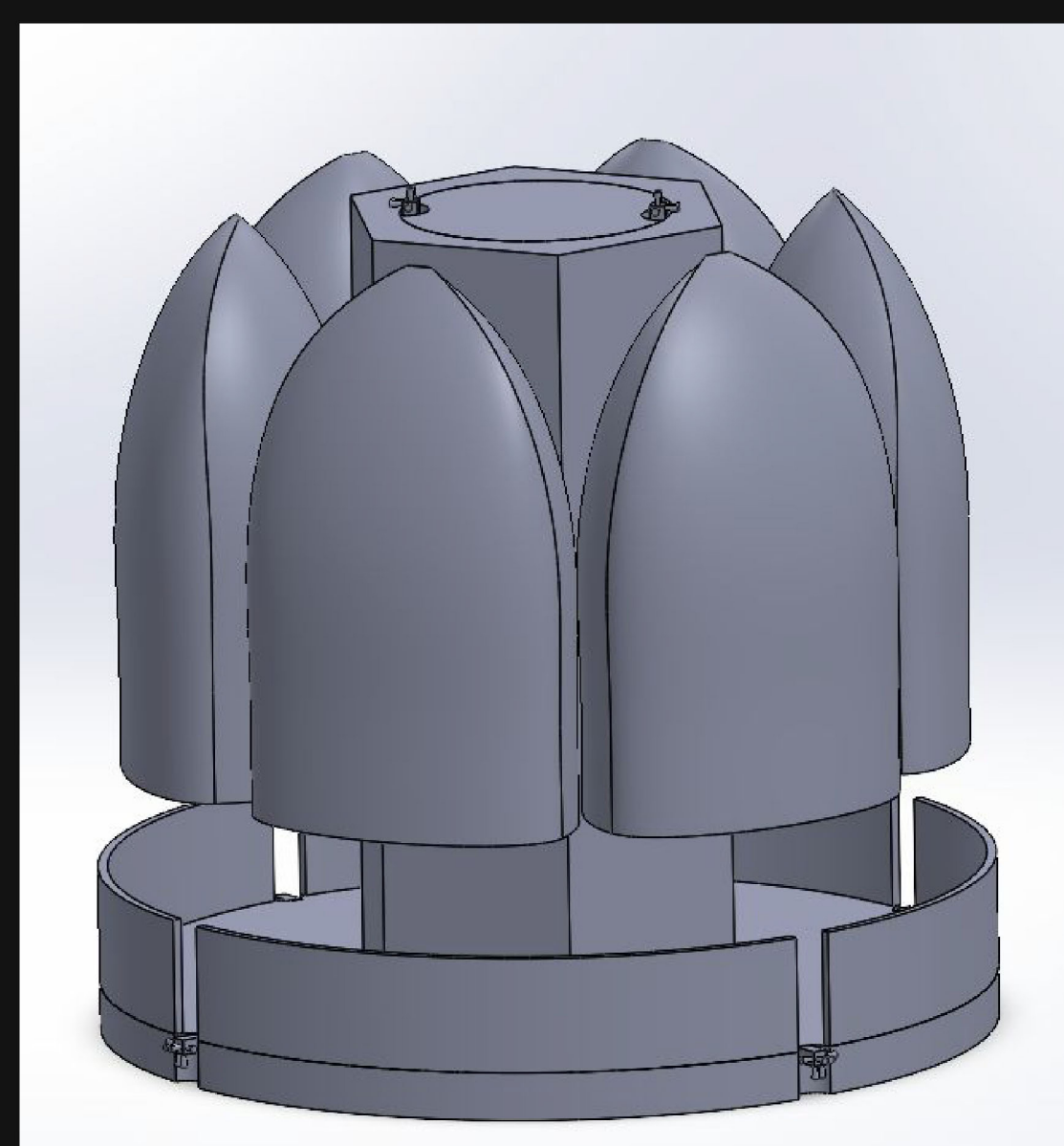


Mission Overview

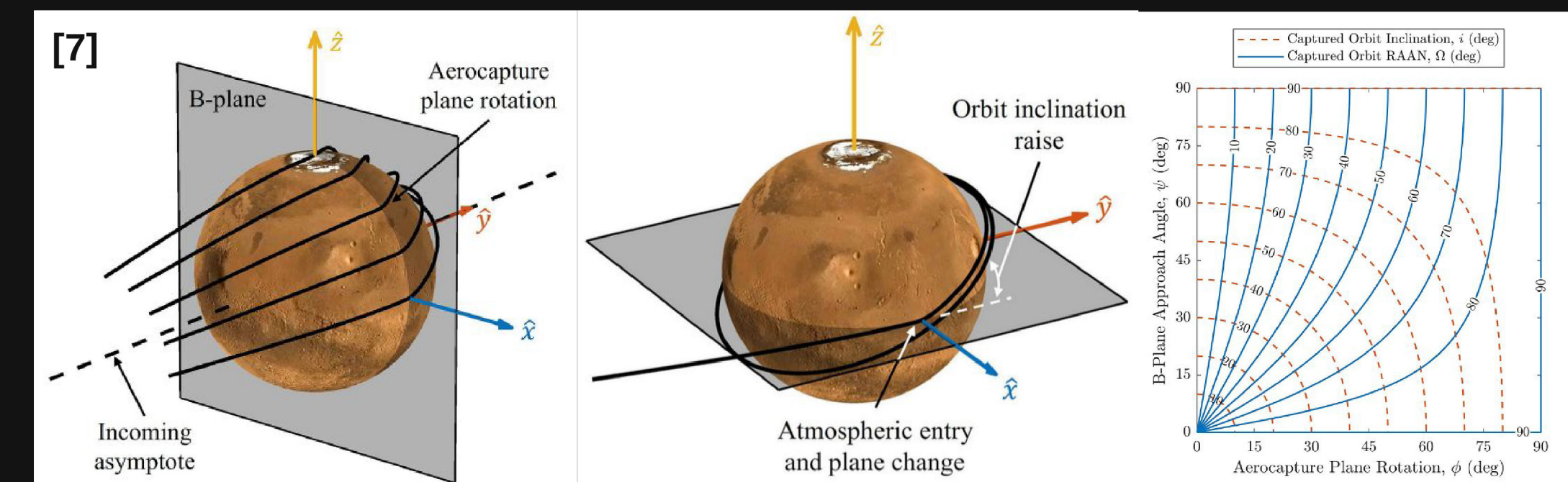
- Deploy a 12-satellite constellation into Mars orbit using aerocapture
- Provide surface ↔ orbit ↔ Earth communication relay
- Enable 100% Mars surface coverage and >70% uptime req.
- Support
 - Scientific data transmission, weather monitoring, & navigation (GPS)

Cruise Stage

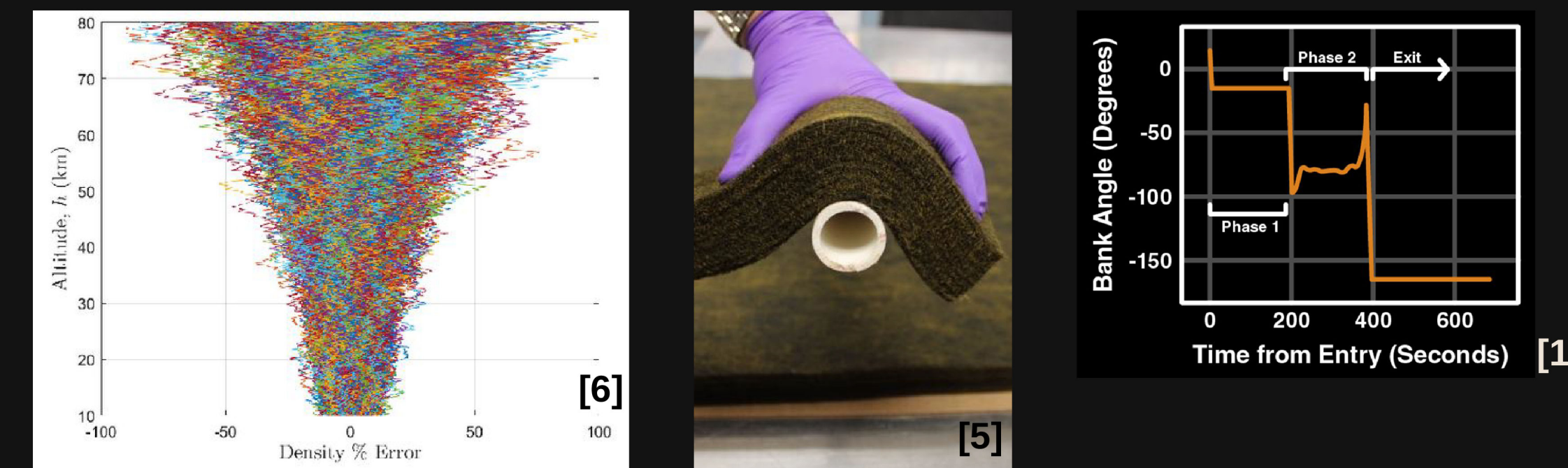
- Transfers payload from Earth to Mars (~210 day flight)
- Launched via Falcon Heavy (13.2 m fairing)
- Provides
 - Attitude control (RCS + ADCS)
 - Power (solar arrays + batteries)
 - Communications during transit
- Performs trajectory correction maneuvers throughout cruise and to ensure aerocapture targeting



Aeroshell



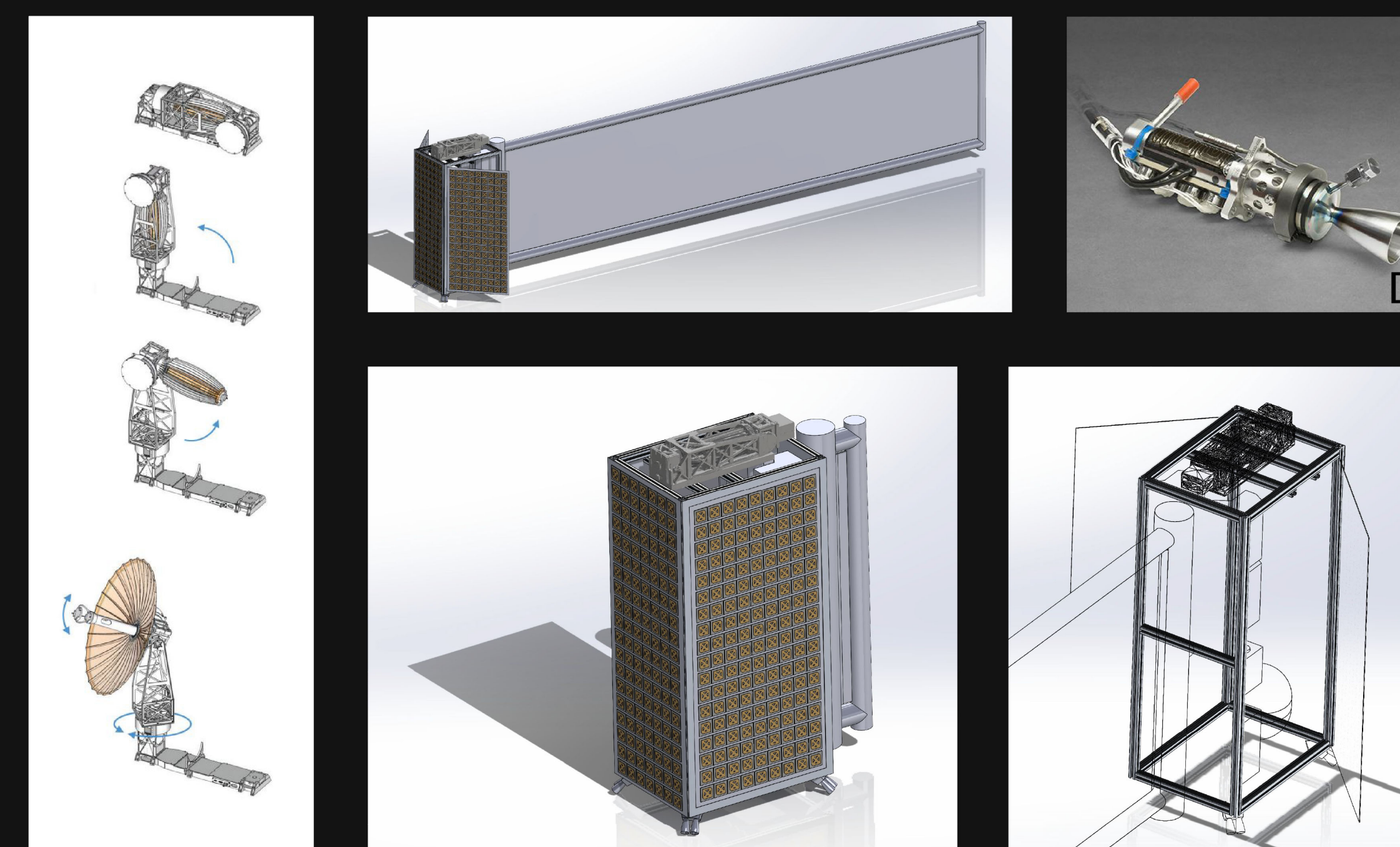
- Enables aerocapture for fuel-efficient orbit insertion and constellation targeting in one atmospheric pass
- Ellipsled geometry (L/D = 0.8)



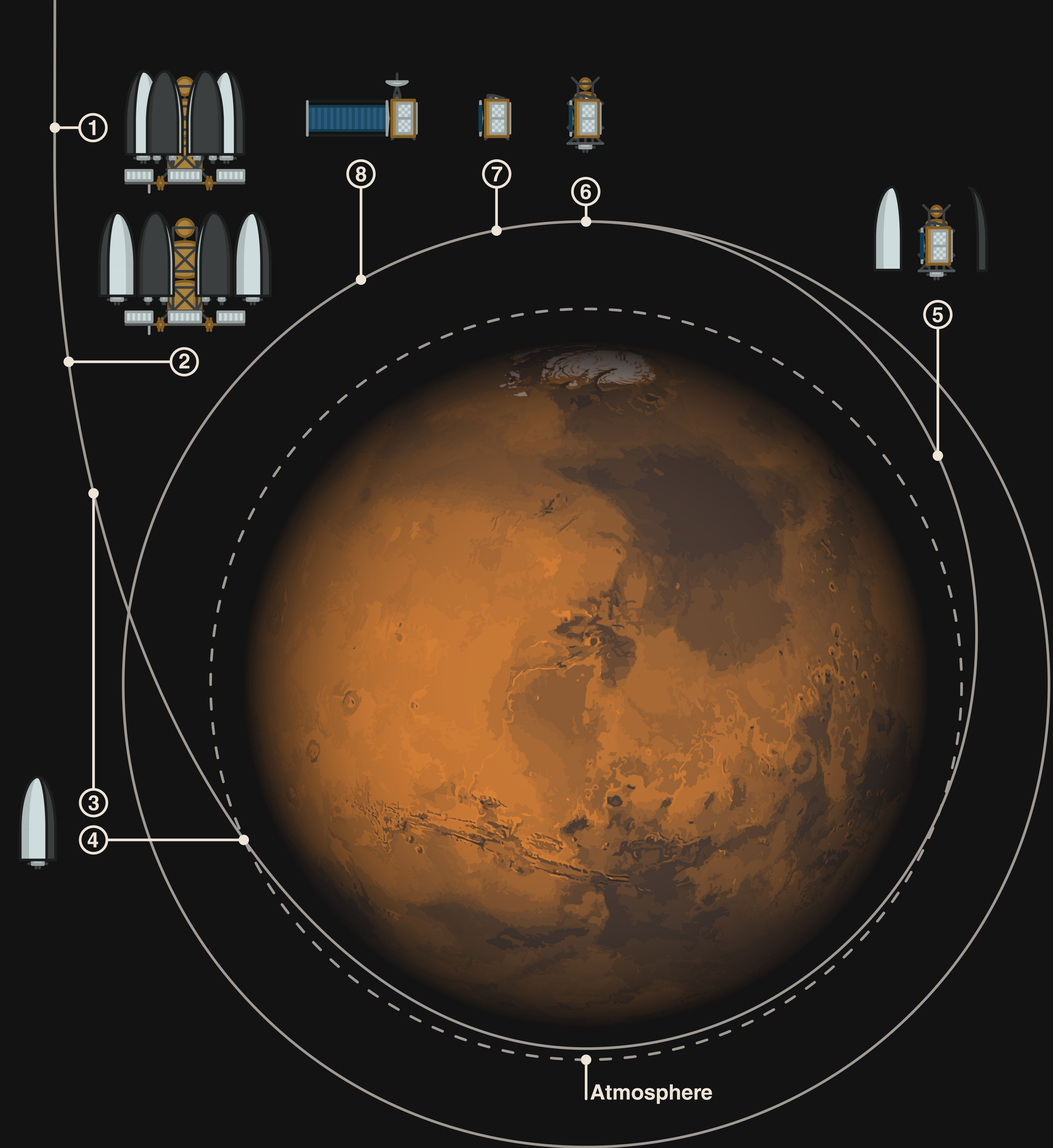
- Protects spacecraft during Mars atmospheric entry
- Thermal Protection System (TPS):
 - PICA-Flex (felted) for high heat flux during entry
- Guidance algorithm (FNPAG)
 - Bank angle control
 - Orbit targeting under uncertainty

Individual Satellite

- Designed for 10-year operational lifetime requirement
- Modular, lightweight structure for scalability



- Communications
 - X-band crosslinks (satellite ↔ satellite)
 - UHF relay (satellite ↔ Mars surface)
 - X/Ka-band deep space link (satellite ↔ Earth)
- Power
 - Solar array + Li-ion batteries
 - Designed for Mars' solar environment (~43% Earth flux)
- ADCS/Propulsion
 - Reaction wheels for precise pointing and thrusters for orbit maintenance and control
 - All RCS systems utilize the same thrusters + tanks from MOOG



① Interplanetary Arrival

- Probe in cruise phase
- GNC, power, and comms from cruise stage

② Aeroshell Separation

- Opposite pairs detached simultaneously to limit core acceleration and moments

③ Aeroshell Correction

- Each aeroshell burns to target its entry point

④ Aerocapture

- FNPAG guidance algorithm optimizes for energy and inclination targets

⑤ Aeroshell Jettison

- Front body and back shell separate to reveal kick stage and two satellites

⑥ Periapsis Raise

- Lift periapsis above atmosphere to constellation communications altitude

⑦ Satellite Separation

- Individual satellites detach from kick stage

⑧ Satellite Deployment

- Solar panels and antennas deployed to their final mission configurations

References

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 [7] Gochenour, D. C., Jones, M. P., Norheim, J. J., and de Weck, O. L., "Orbit Plane Rotation Using Aerocapture," Journal of Spacecraft and Rockets, Vol. 62, No. 5, 2025 (image).



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