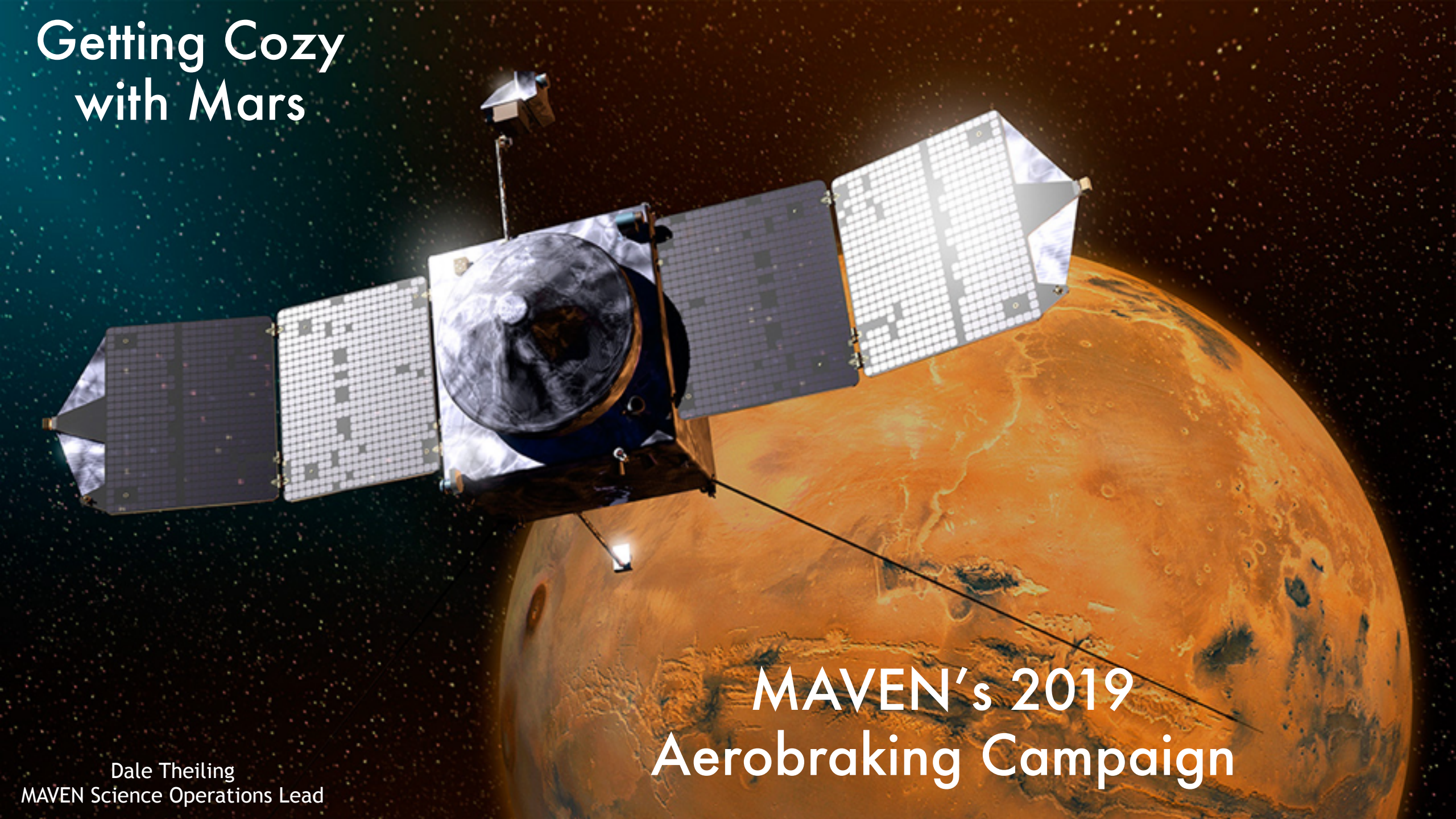
Getting Cozy with Mars



MAVEN's 2019 Aerobraking Campaign

Dale Theiling
MAVEN Science Operations Lead

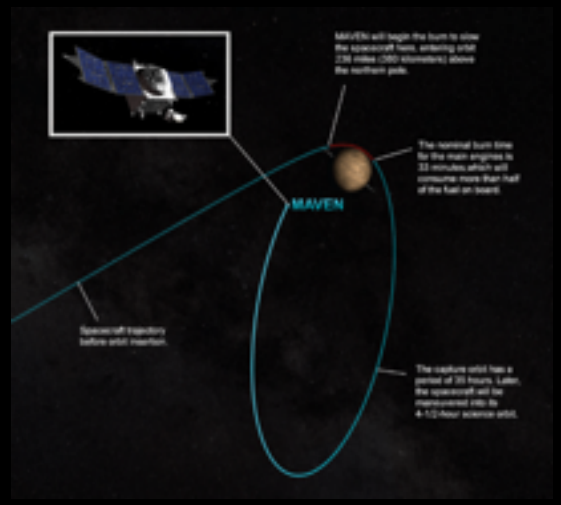
Presentation Overview

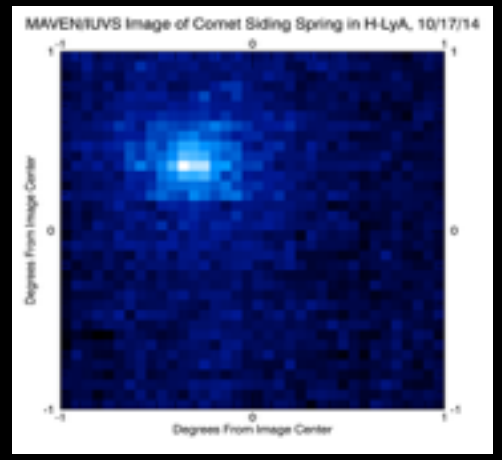
- A Brief History of MAVEN
- Science Operations
- Relay Operations
- Aerobraking
- Science Impacts
- What's Next?

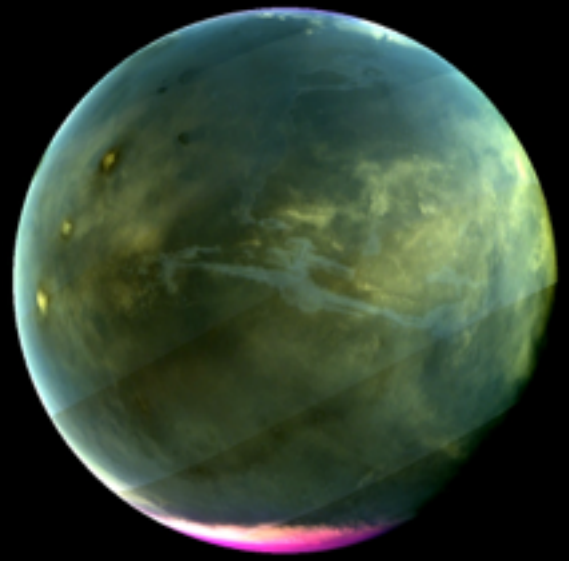
A Brief History of MAVEN

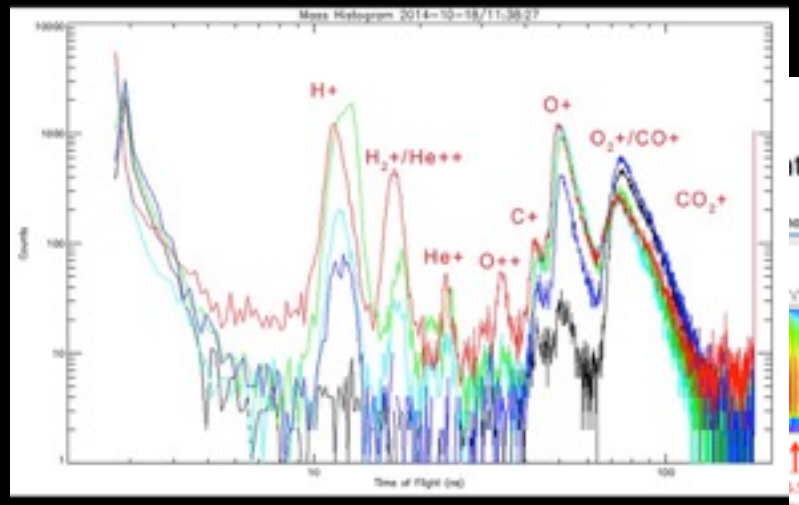
MAVEN:

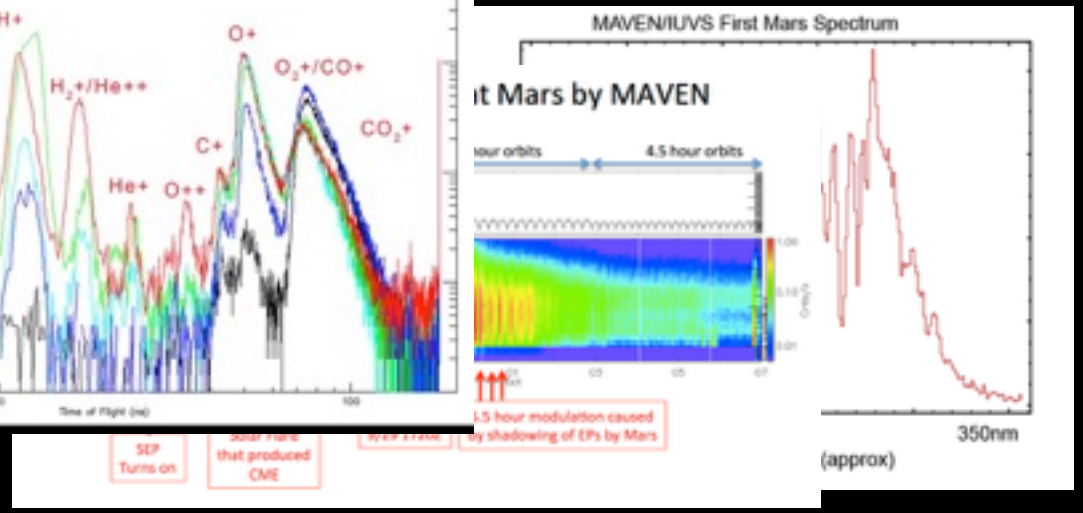
Mars
Atmospheric and
Volatile
EvolutioN





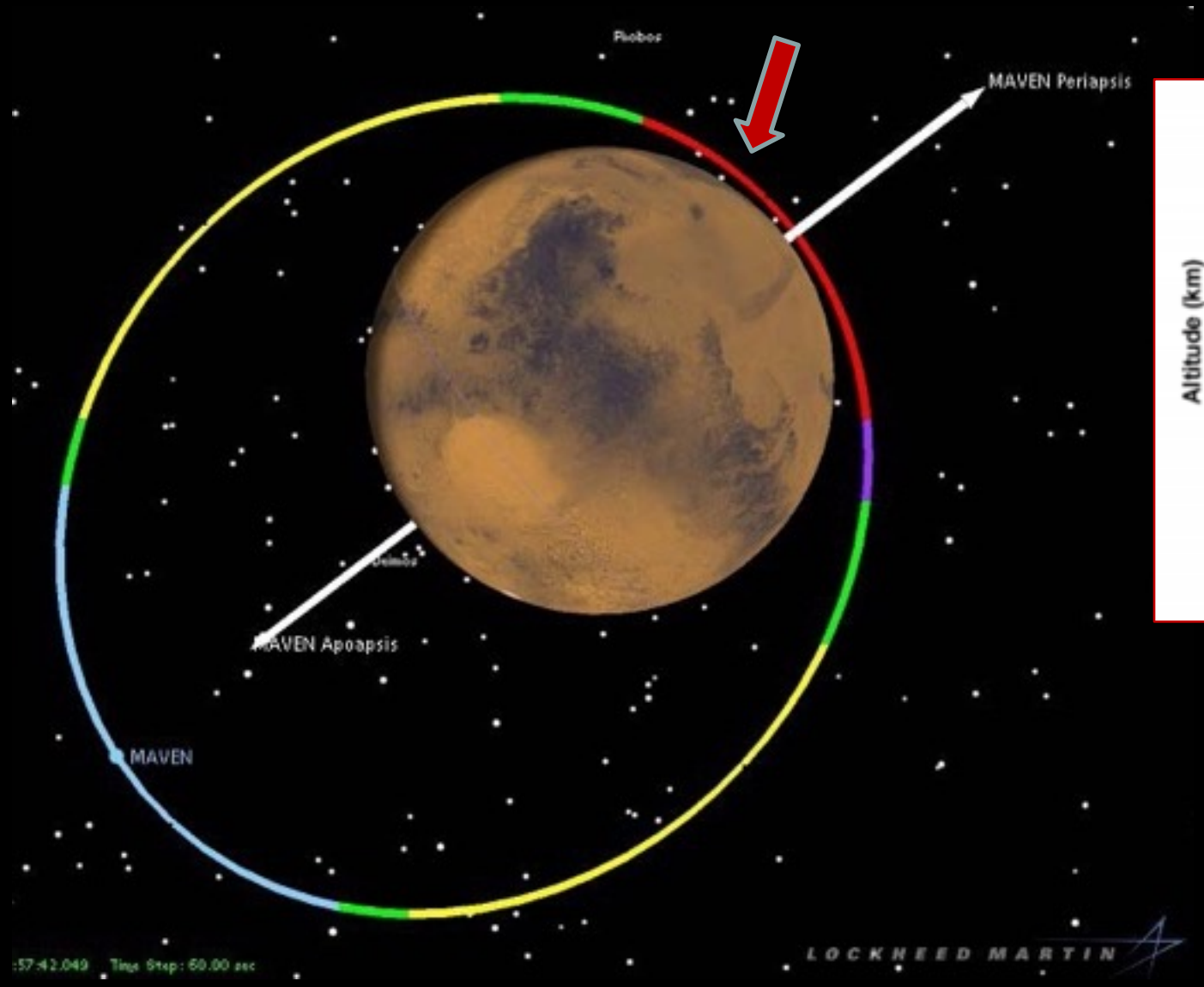


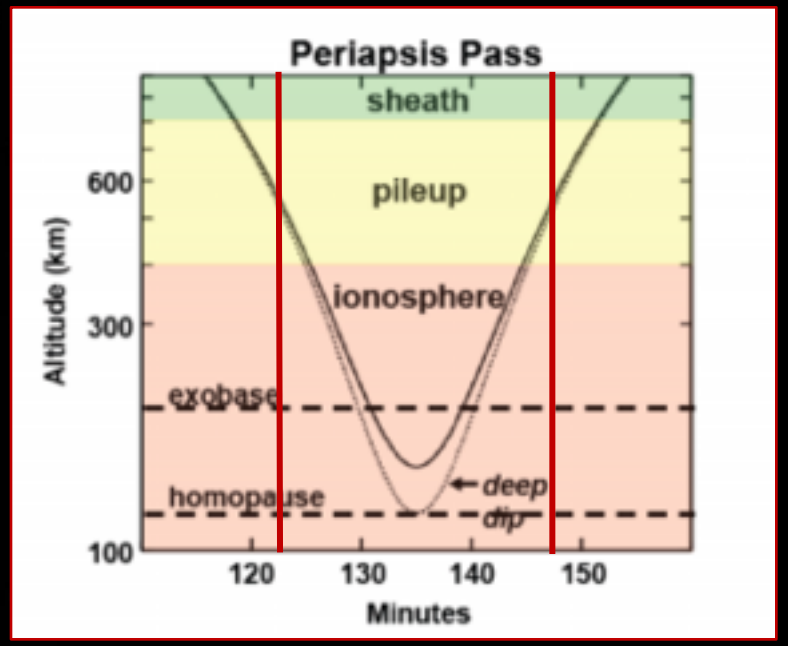




Images courtesy NASA, GSFC, CU Boulder LASP, UCB-SSL, Davin Larson, Jim McFadden

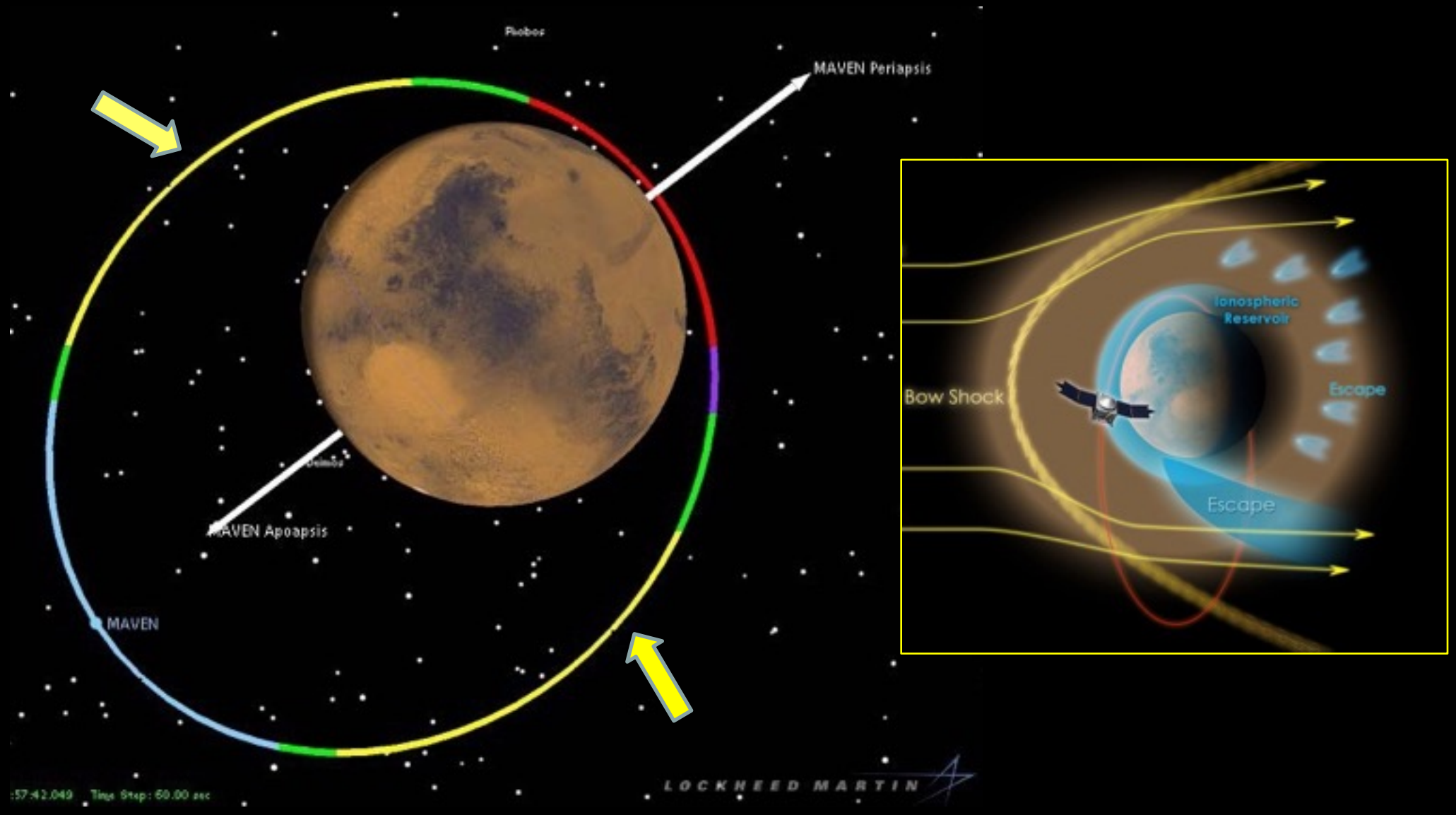
Science Operations





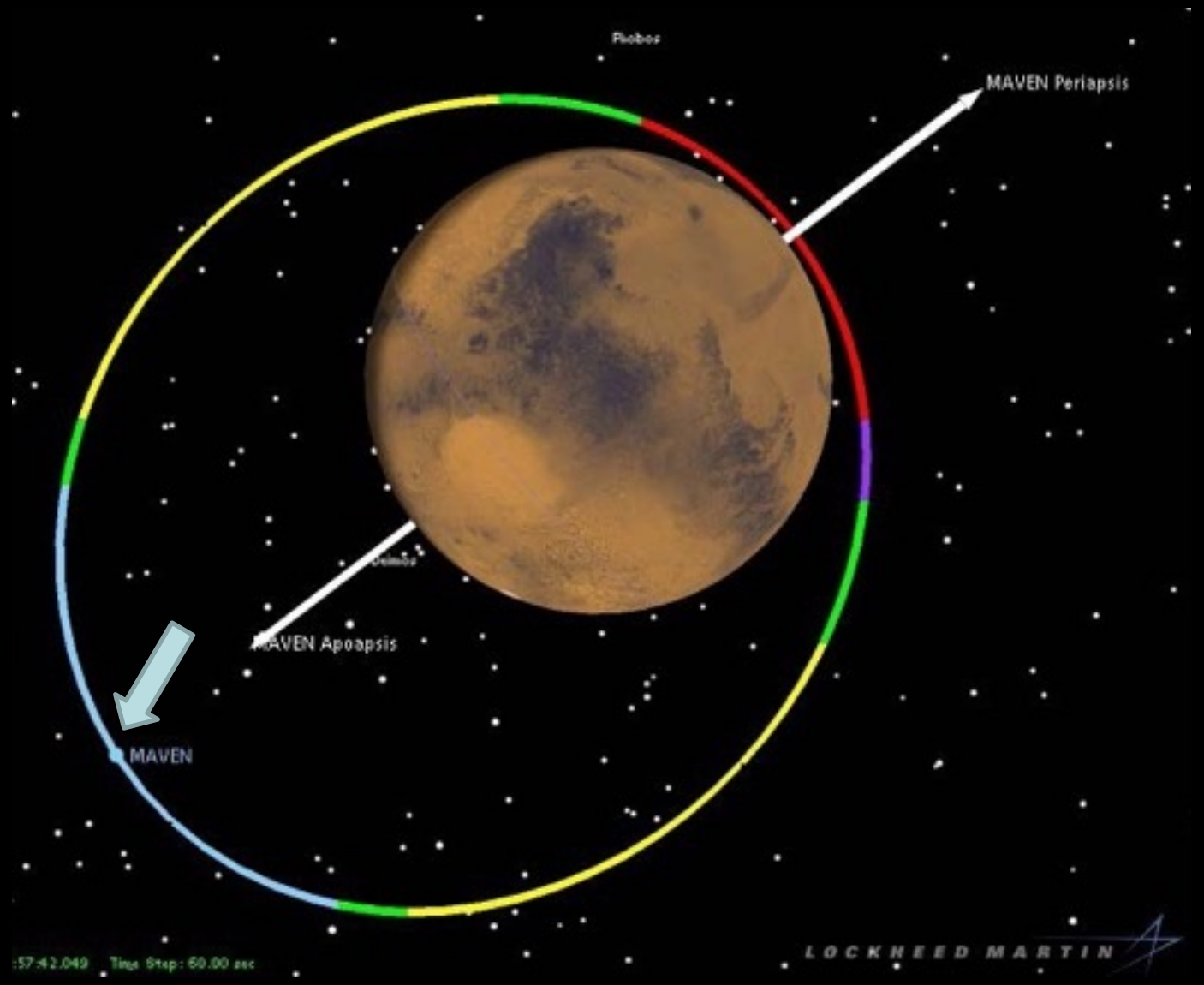
Images courtesy NASA/LASP/LM

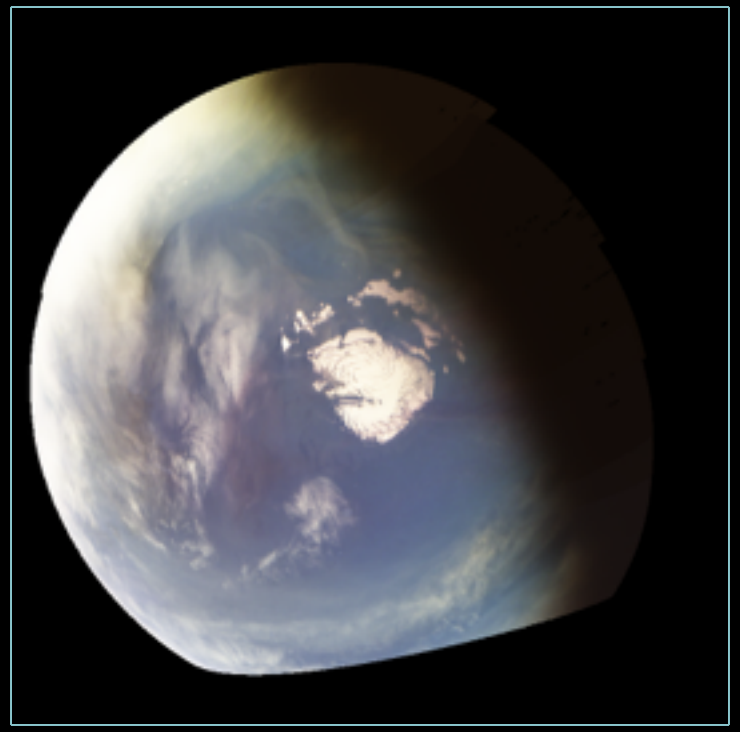
Science Operations



Images courtesy NASA/LASP/LM/GSFC

Science Operations





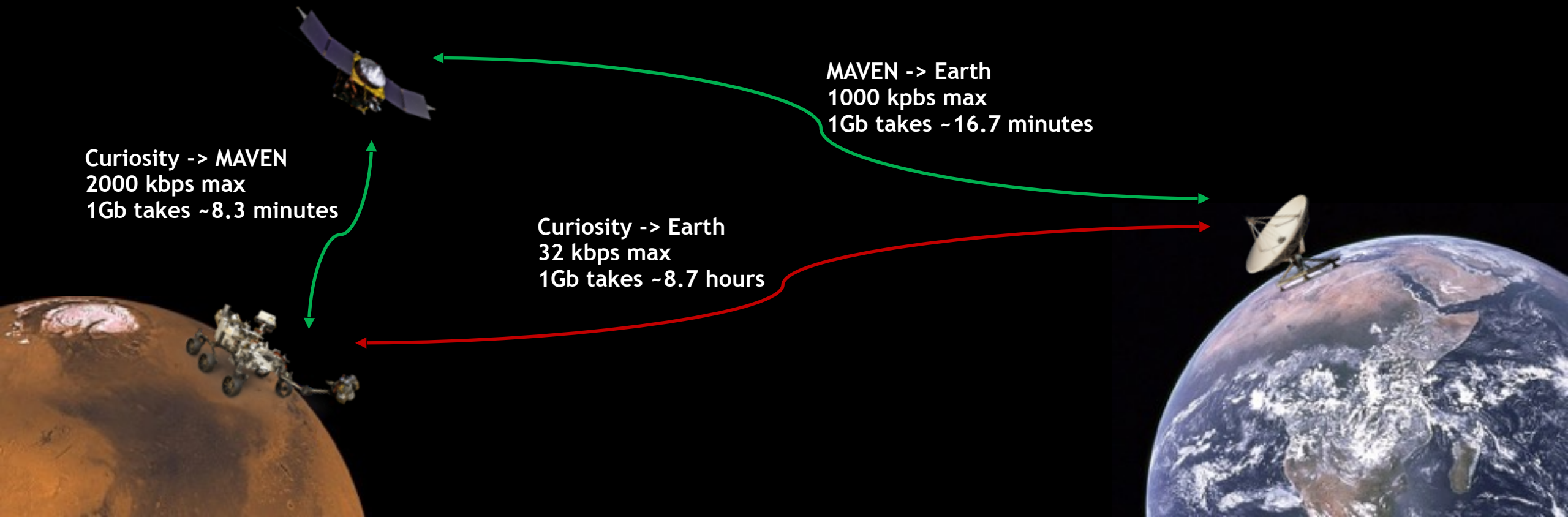
MAVEN Science Orbit

Images courtesy NASA/LASP/LM

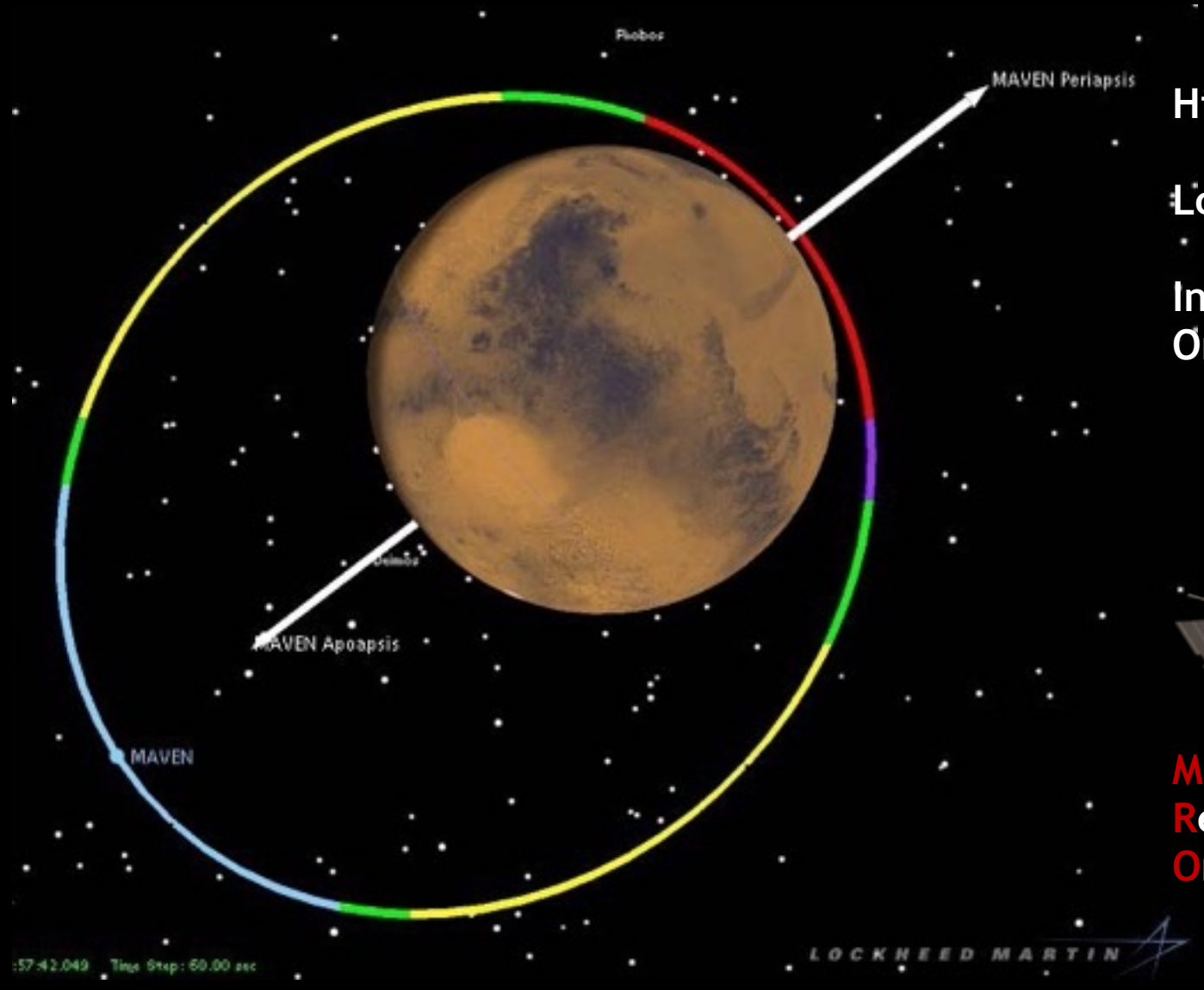
Relay Operations

- ✓ Bigger High Gain Antennae
- ✓ More Power
- ✓ Longer Earth Visibility
- ✗ Terrible for MAVEN Science

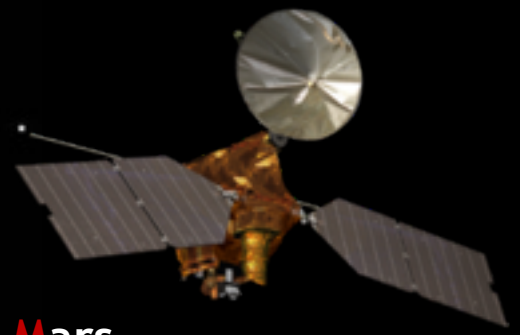
  …and vice versa



Relay Operations

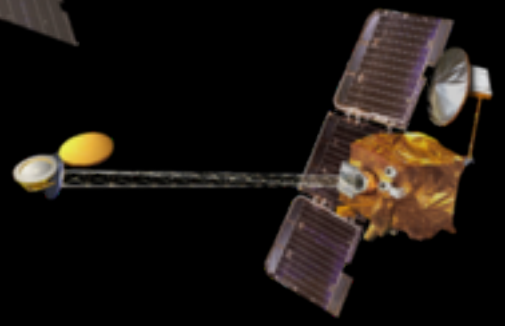


	Science	Relay
High Altitude Apoapsis	✓	✗
Low Altitude Periapsis	✓	✗
Instrument-Driven Orientations	✓	✗

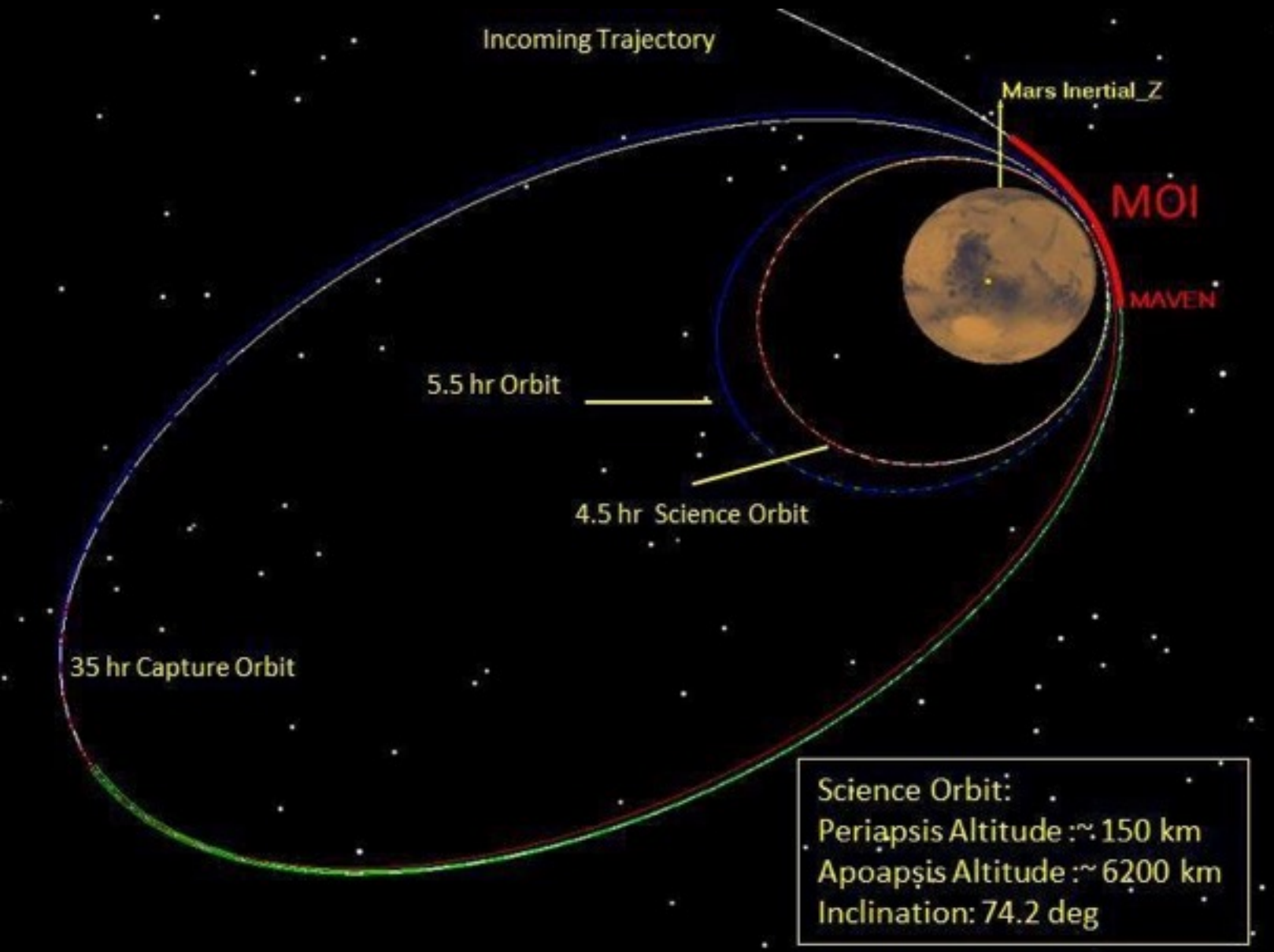


Mars
Reconnaissance
Orbiter

Odyssey



Aerobraking

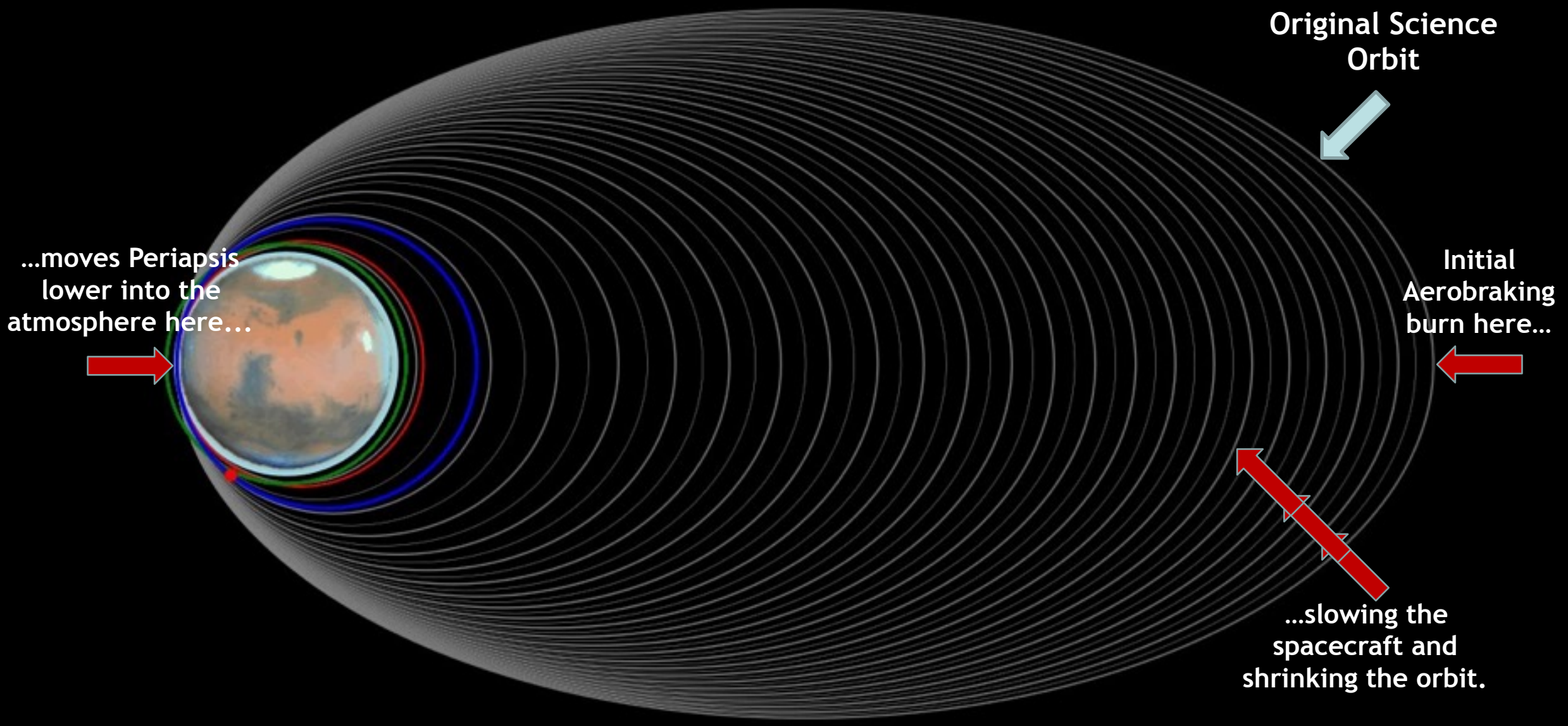


PRM-1: 35-hour -> 5.5 hour
Used approx. 257kg of fuel

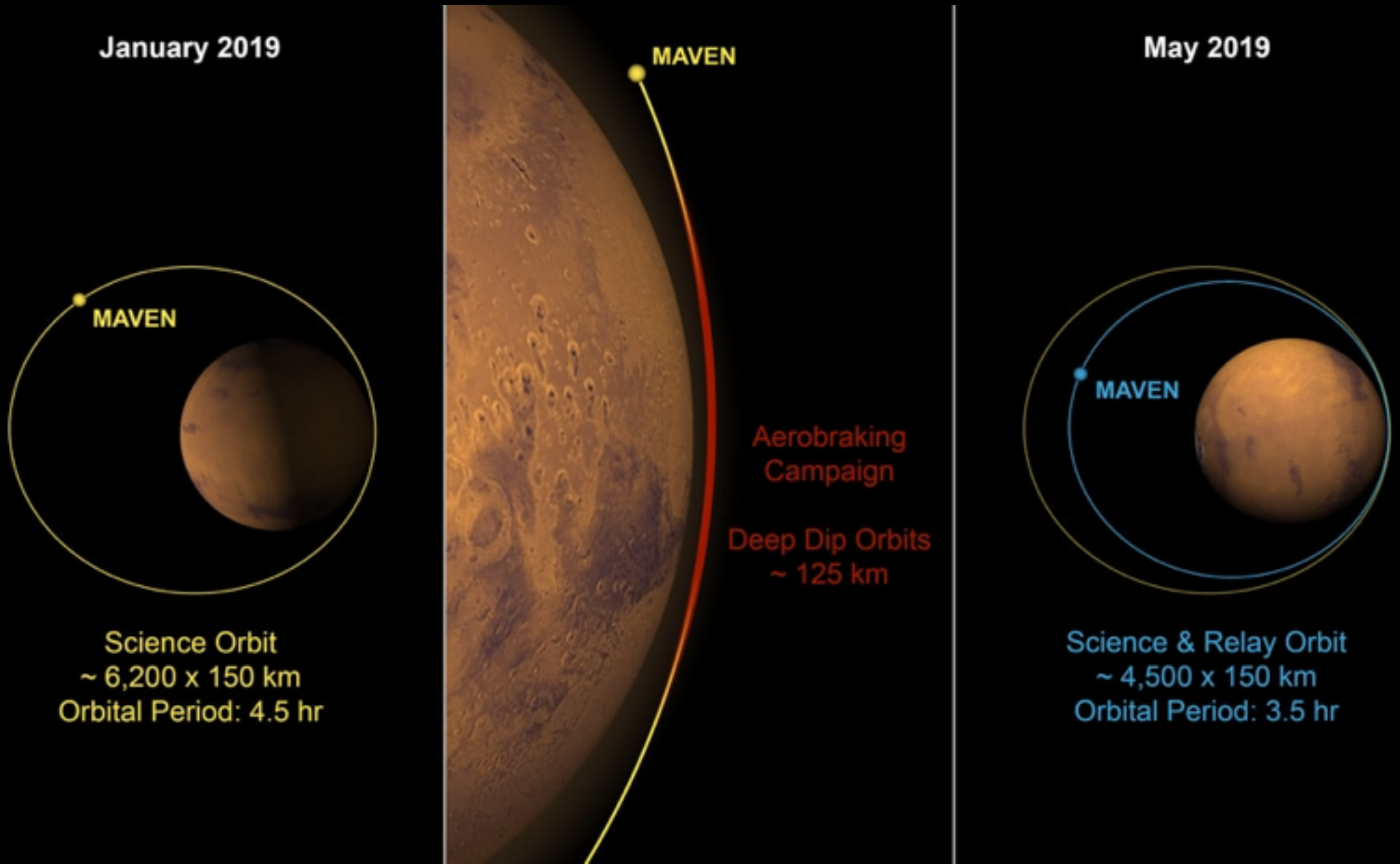
PRM-2: 5.5 hour -> 4.5 hour
Used approx. 41kg of fuel

4.5 years of Science & Relay Operations!

Aerobraking

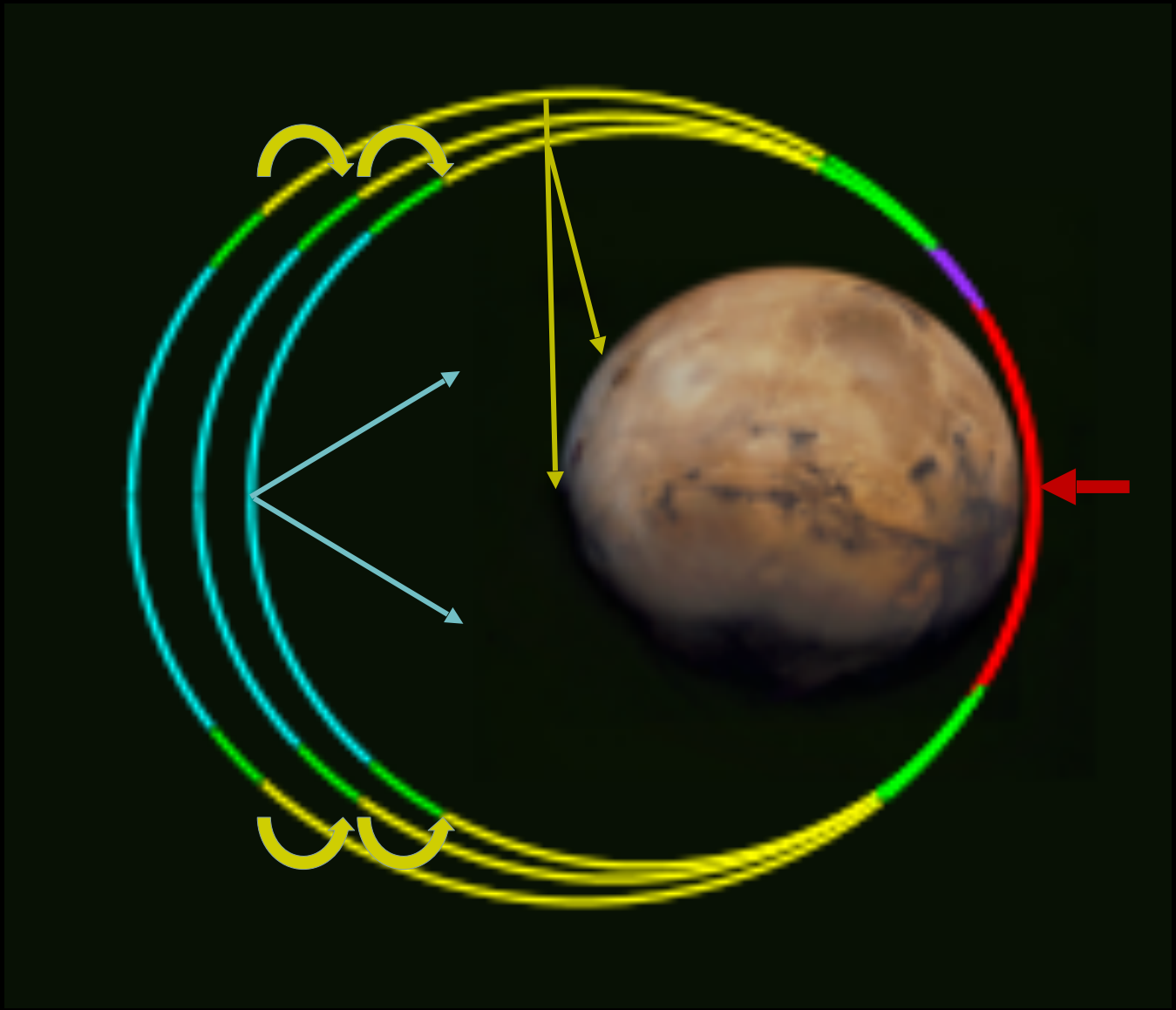


Aerobraking



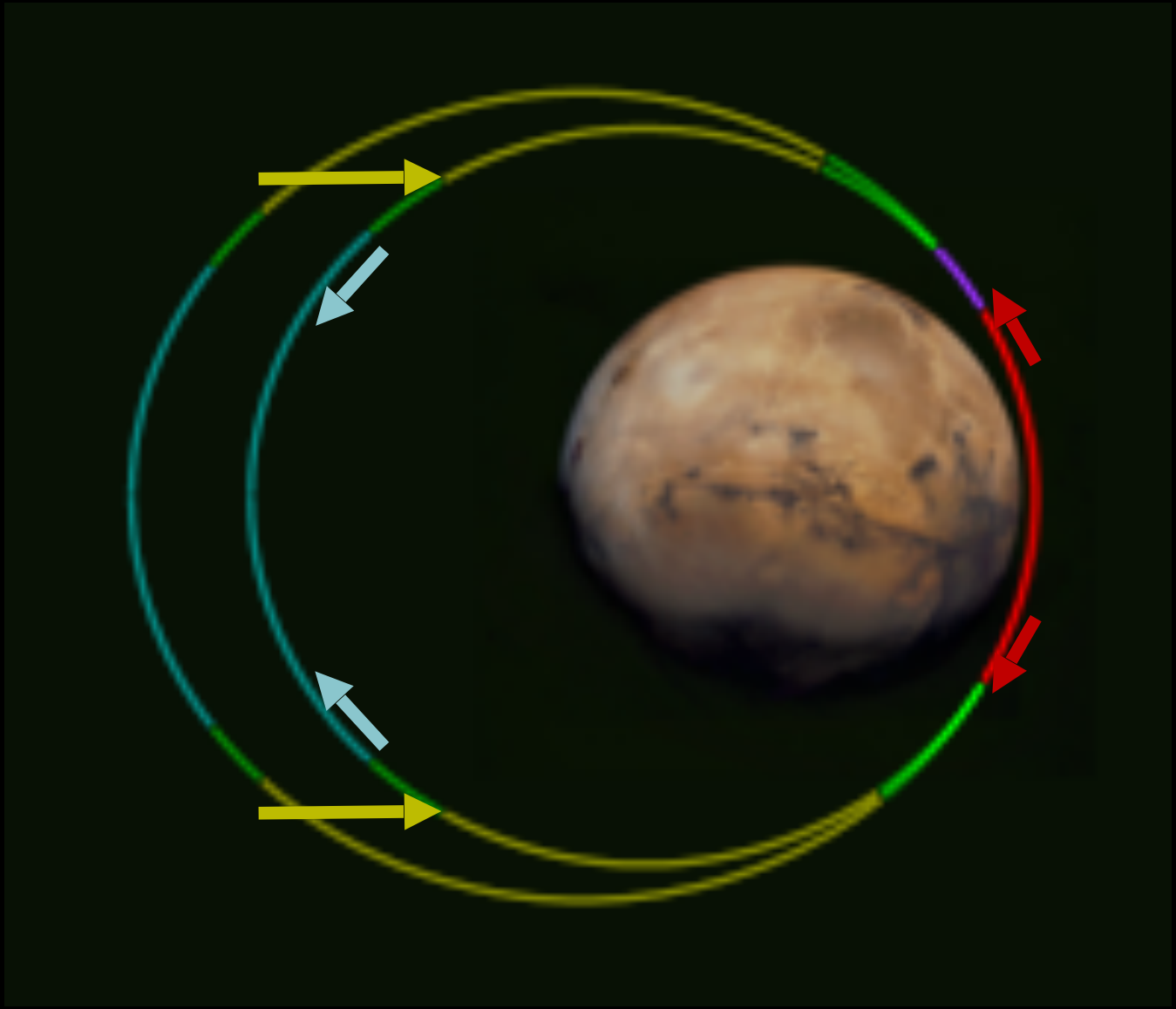
Science Impacts

- Shrinking side segments
  - Observation sequences built to self-shorten to match duration
- Ongoing adjustments to pointing and timing
  - Side segment views continuously changing
  - Apoapse segment view of disk grew bigger
- Periapse segment at a higher-than-usual density
  - Some instruments need to be in a protected mode



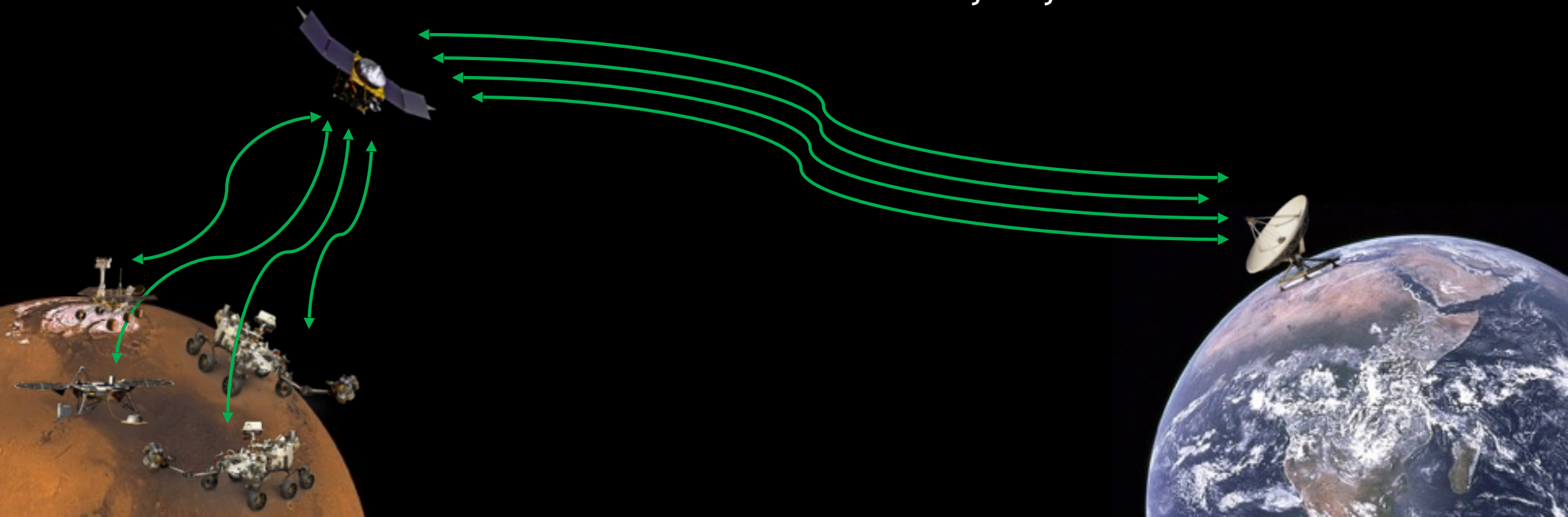
Science Impacts

- Shortened side observations
  - No more high altitude coronal observations!
- Apoapse segment observation shortened
  - Down to minimum required for full disk imaging
- Periapse segment observation lengthened
  - Necessary to continue to reach 500km altitude on each end

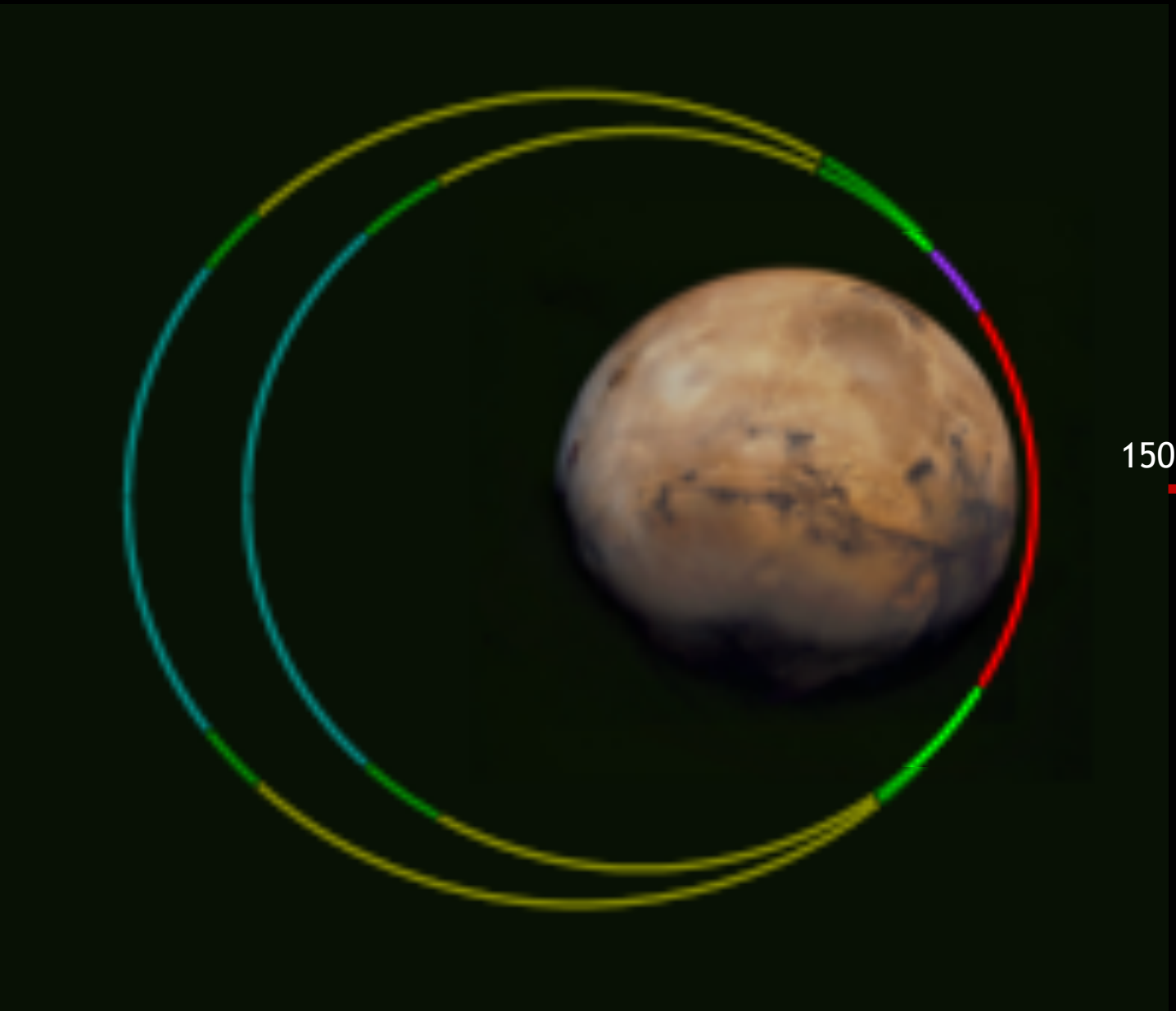


What's Next?

1 relay/week ->
1 relay/day ->
3-4 relays/day

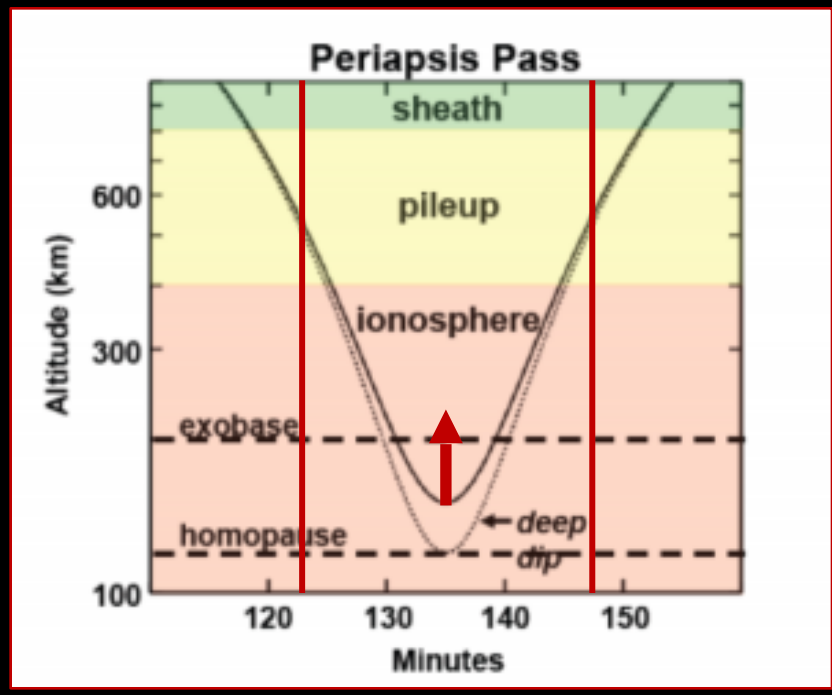


What's Next?



150km

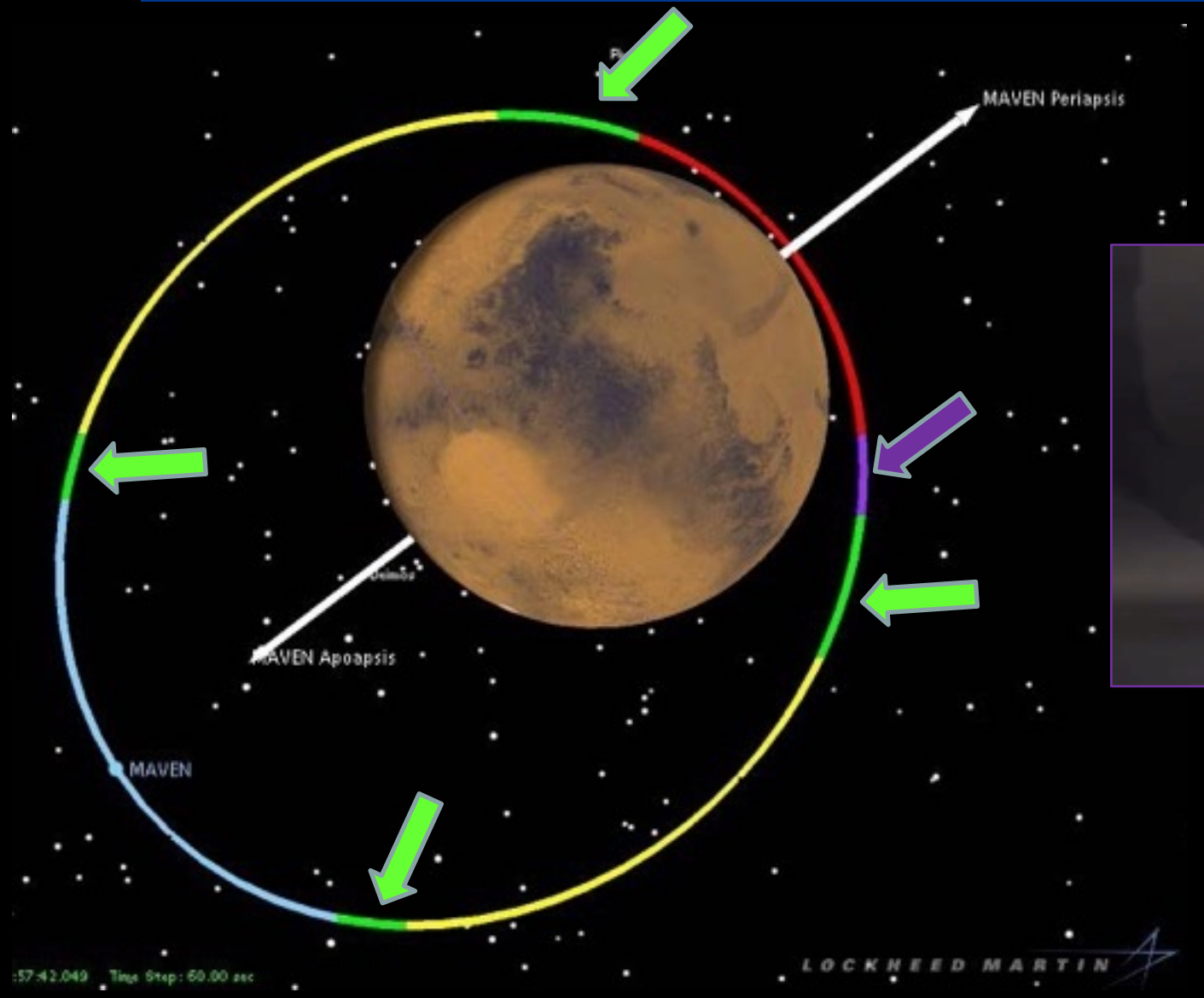
220km

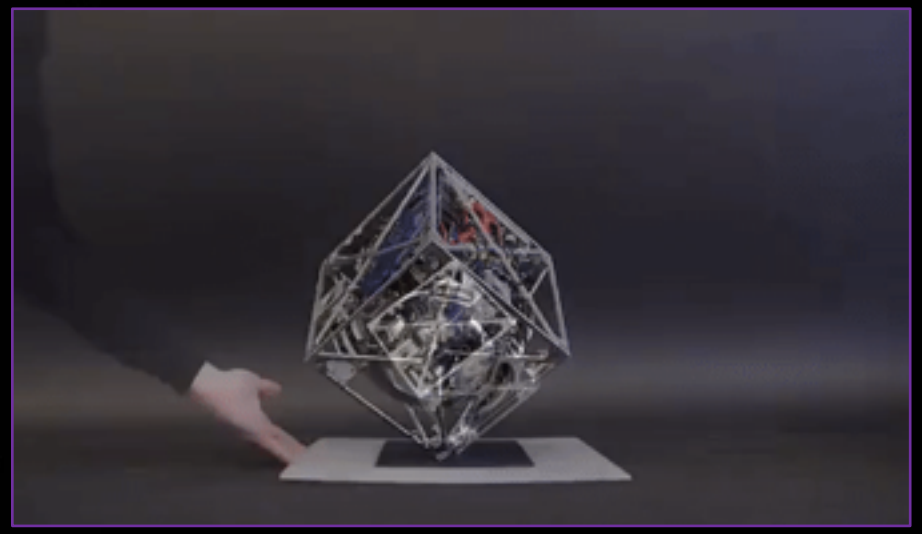


Questions?

Backup Slides

Science Operations





Images courtesy NASA/LASP/LM & ETH Zurich

MAVEN Science Orbit