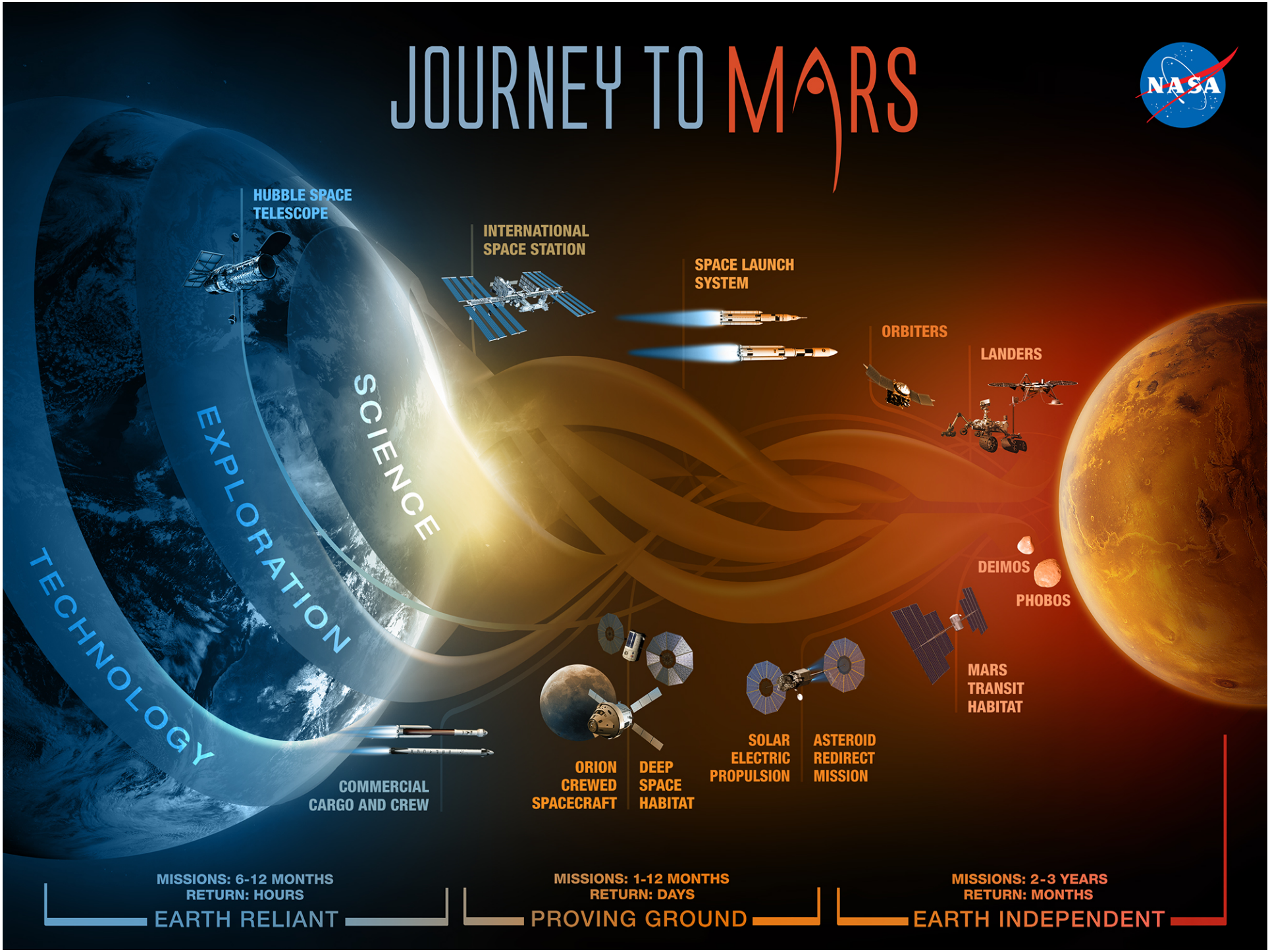
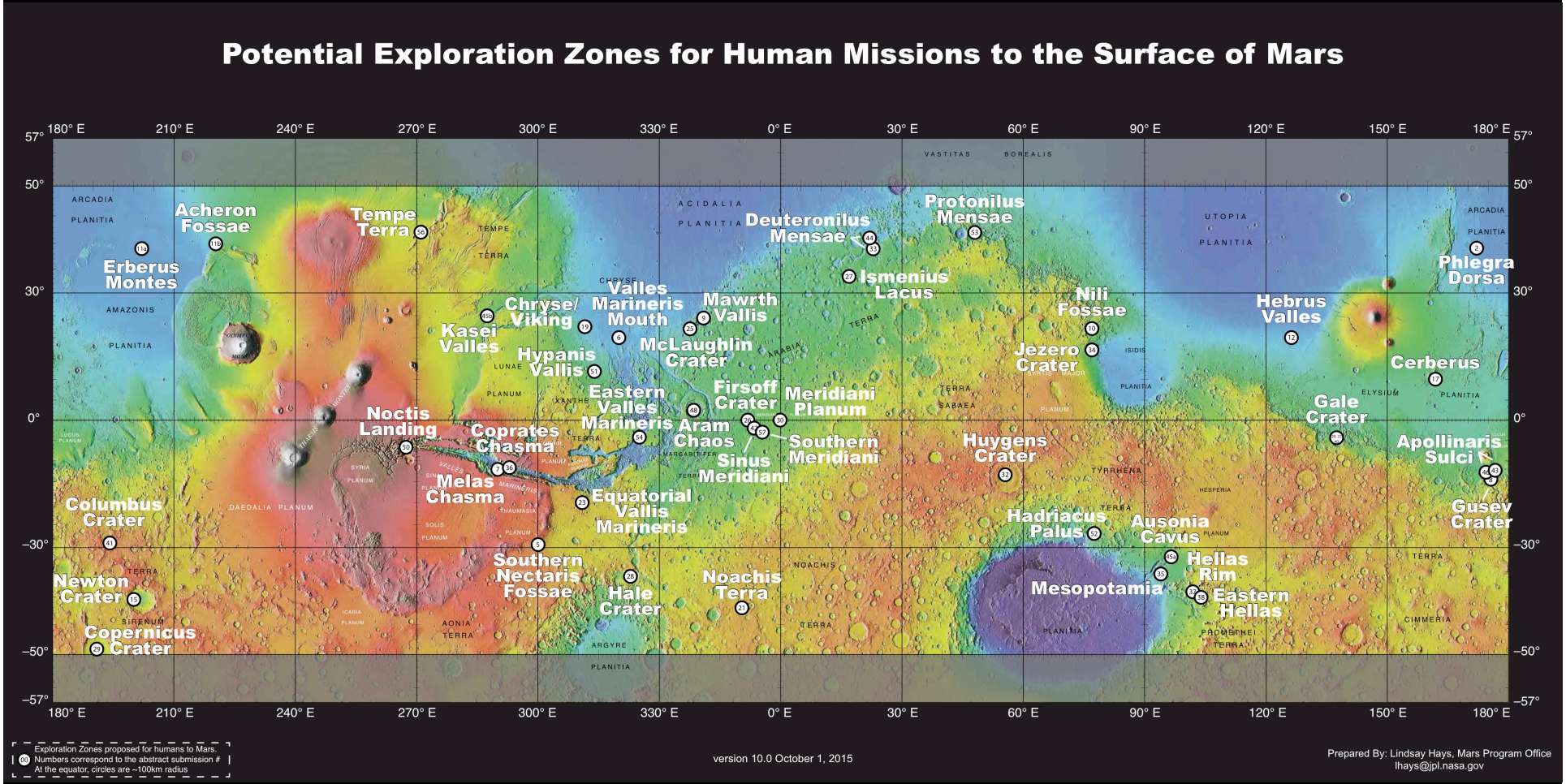
Mars Human Landing Site Workshop

John M Grunsfeld PhD

NASA Associate Administrator for Science/Astronaut

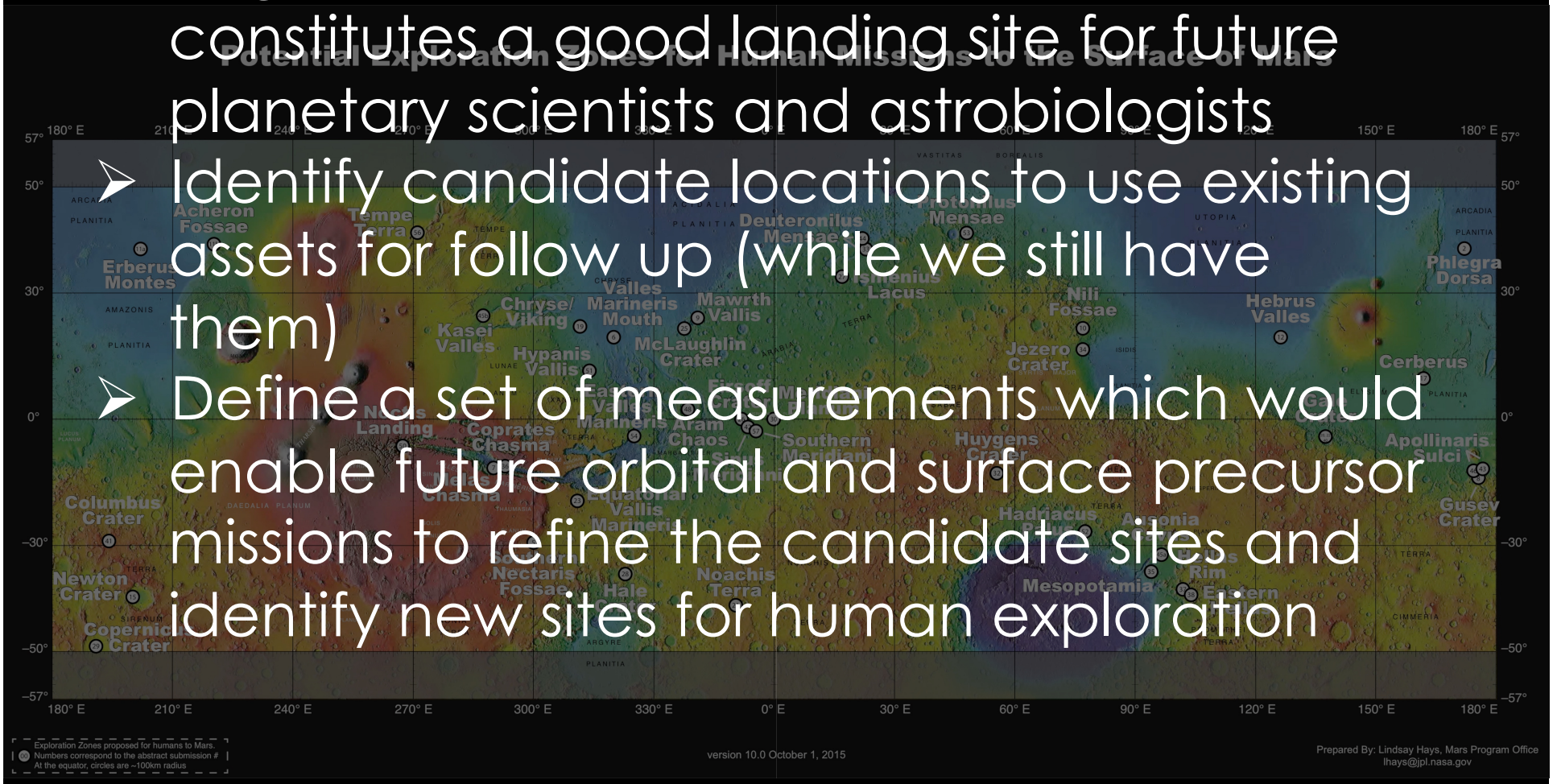

JOURNEY TO MARS
NASA
HUBBLE SPACE TELESCOPE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM
ORBITERS
LANDERS
SCIENCE
EXPLORATION
TECHNOLOGY
DEIMOS
PHOBOS
MARS TRANSIT HABITAT
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
ORION CREWED SPACECRAFT
DEEP SPACE HABITAT
COMMERCIAL CARGO AND CREW
MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1-12 MONTHS
RETURN: DAYS
PROVING GROUND
MISSIONS: 2-3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT

Why Are We Here?



Why Are We Here?

- Begin the conversation about what constitutes a good landing site for future planetary scientists and astrobiologists
- Identify candidate locations to use existing assets for follow up (while we still have them)
- Define a set of measurements which would enable future orbital and surface precursor missions to refine the candidate sites and identify new sites for human exploration



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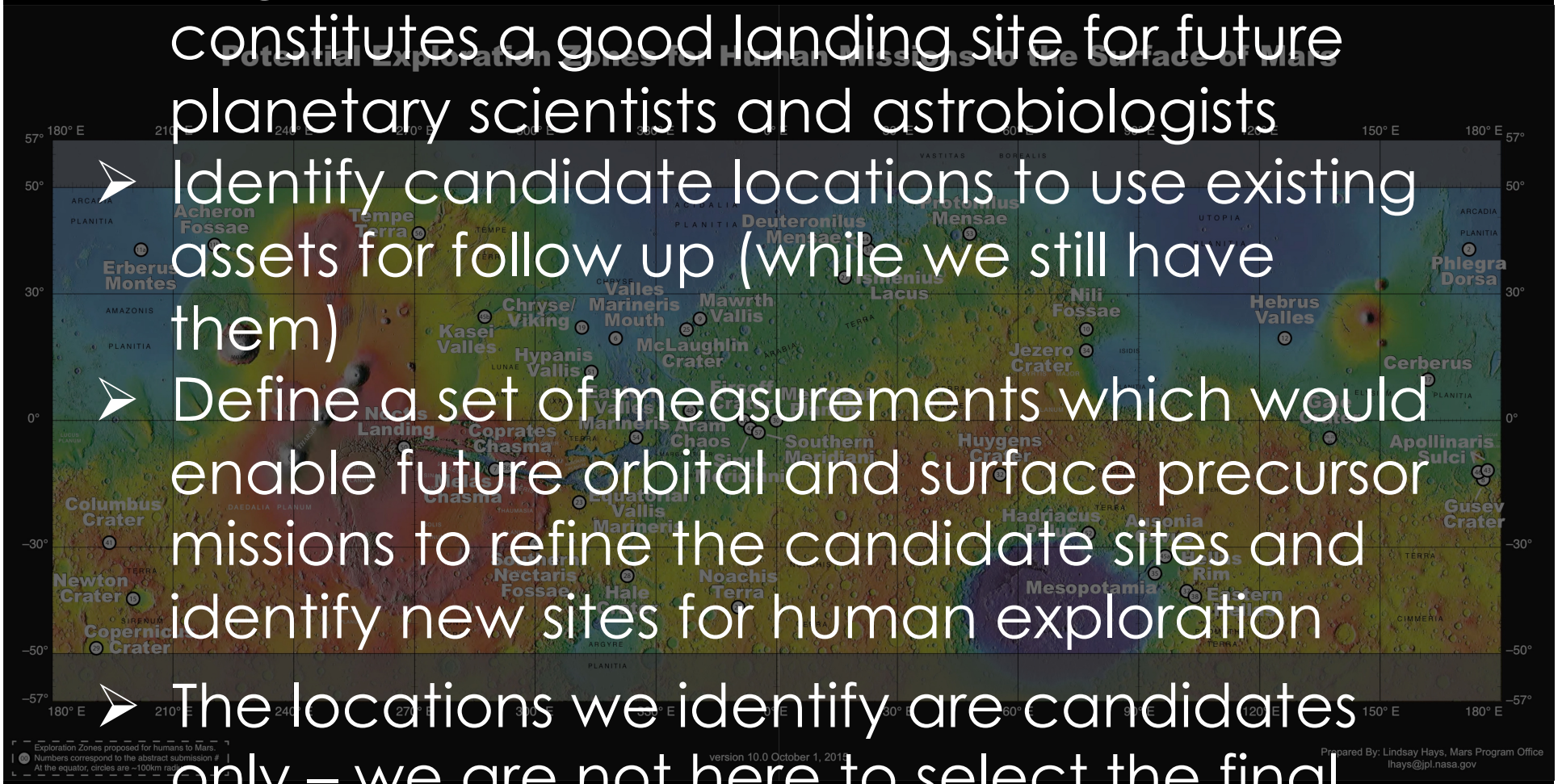
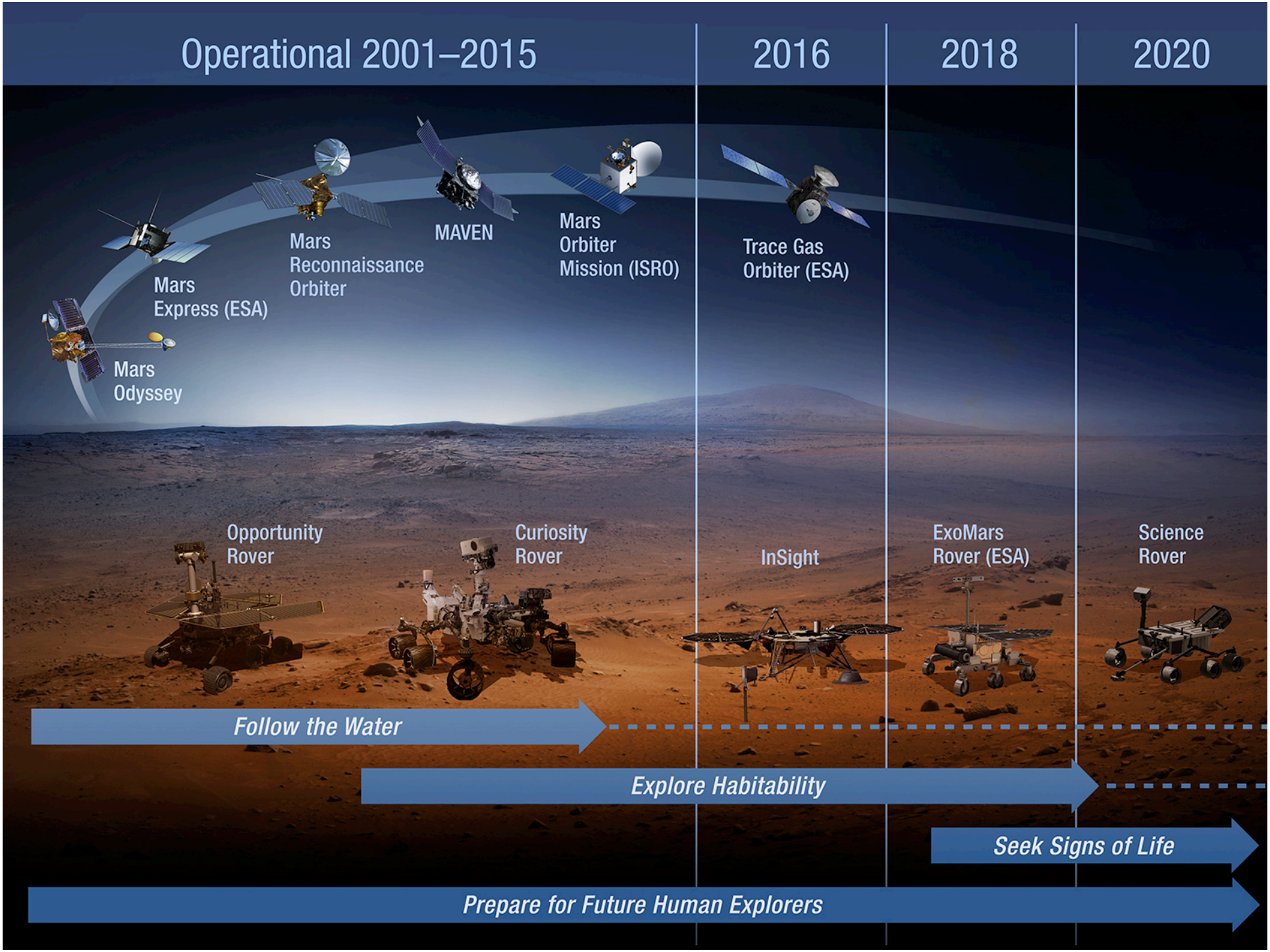
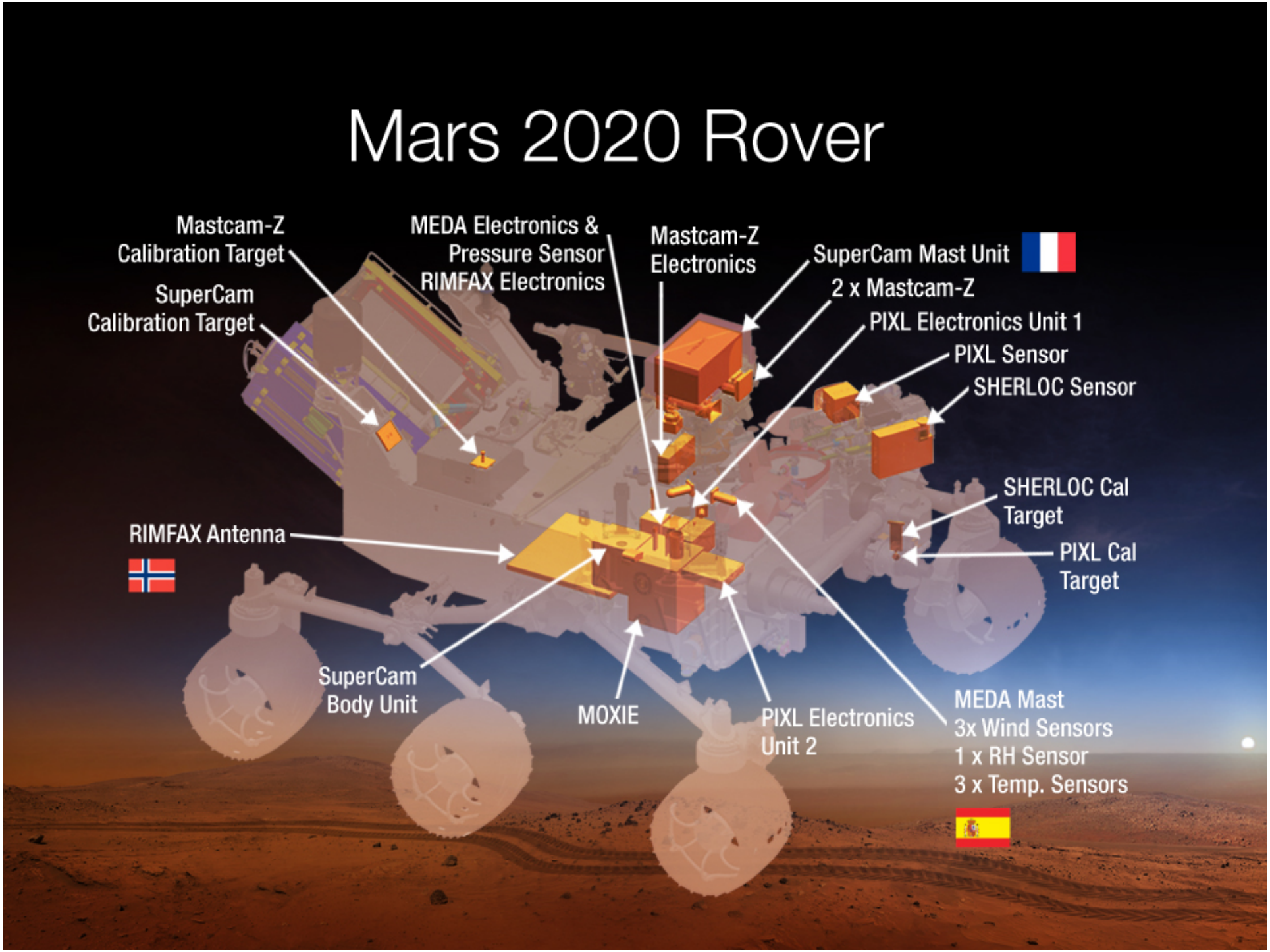
- Identify candidate locations to use existing assets for follow up (while we still have them)
- Define a set of measurements which would enable future orbital and surface precursor missions to refine the candidate sites and identify new sites for human exploration
- The locations we identify are candidates only – we are not here to select the final landing sites



On the Shoulders of Giants

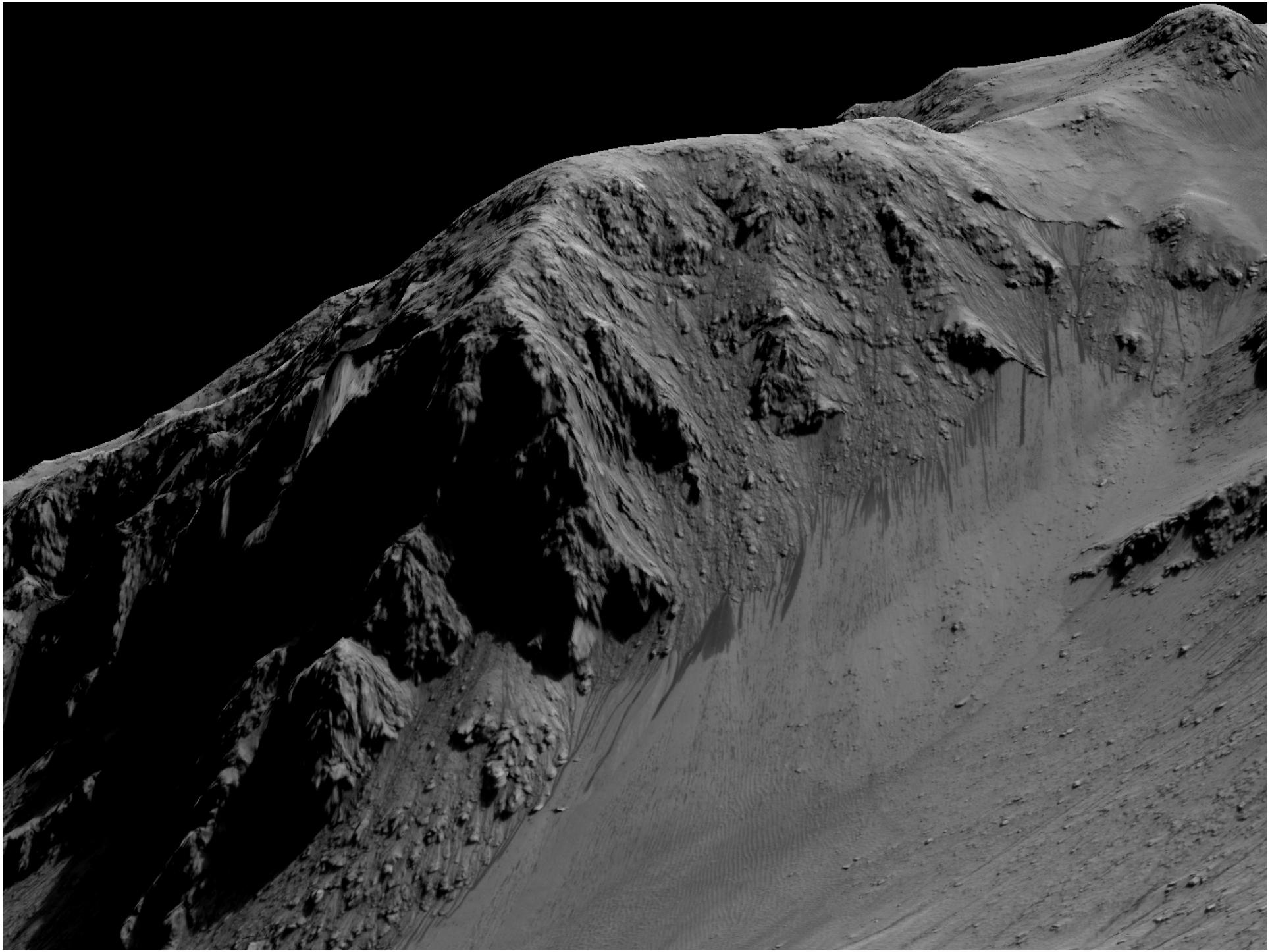
We are on Mars today!


Operational 2001–2015
2016
2018
2020
Mars Odyssey
Mars Express (ESA)
Mars Reconnaissance Orbiter
MAVEN
Mars Orbiter Mission (ISRO)
Trace Gas Orbiter (ESA)
Opportunity Rover
Curiosity Rover
InSight
ExoMars Rover (ESA)
Science Rover
Follow the Water
Explore Habitability
Seek Signs of Life
Prepare for Future Human Explorers


Mars 2020 Rover
Mastcam-Z
Calibration Target
SuperCam
Calibration Target
MEDA Electronics &
Pressure Sensor
RIMFAX Electronics
Mastcam-Z
Electronics
SuperCam Mast Unit
2 x Mastcam-Z
PIXL Electronics Unit 1
PIXL Sensor
SHERLOC Sensor
SHERLOC Cal
Target
PIXL Cal
Target
RIMFAX Antenna
SuperCam
Body Unit
MOXIE
PIXL Electronics
Unit 2
MEDA Mast
3x Wind Sensors
1 x RH Sensor
3 x Temp. Sensors

Gale Crater/Mt. Sharp

L. Ojha et al., Nature Geoscience, 28 September, 2015



JPL
JPL

Planetary Protection

Sometime in the not too distant future, an email home from an astronaut on Mars:

Dear Sarah,
Wow, I miss you so much. We've been so buy I just haven't had time to write since we landed on the surface of Mars.

I hope your thesis defense preparation is going well. You know I wish I could be there, in person of course, or at least online, but the 20 minutes time delay just doesn't make that possible. The organics you've identified in the plumes on Europa are going to change the world--you know that don't you?
It's only been 4 days on the surface but already we've made a lot of progress. Our landing was right in the center of our ellipse, so we were able to make our first surface sortie over to the 2026 Rover and harvested the enhanced MMRTG with just a short walk. It's still providing 80 Watts of power, but more importantly it's keeping us plenty warm in the Hab. Now we can work without our down suits on, and I had to unzip my sleeping bag last night to stay cool. Much better than our trip to the Dry Valleys in those flimsy tents. So far no tardigrades though.

Also, no whining anymore about -40C, it got down to -80C the first night here. The winds were howling according to the Spanish Super-REM but we didn't feel or hear anything. Just not enough rho-v^2.

We also picked up the samples from the M2020 rover, and were able to get a core sample from 5 meters below one of the sample sites. Teri has already done one run on the Mass Spec and confirms the existence of organics in the deeper mudstone, and from the surface cores we'll be able to calibrate the degradation by cosmic rays as a function of depth. She's working on getting the scanning atomic force microscope up and running to study some really interesting black inclusions from the deep samples.

Yesterday on our second sortie, we commissioned the rover, and drove over to what we thought based on the overhead measurements was a lava tube in a volcanic dike intruding into the sedimentary basin. In fact we picked this site because the laser altimetry indicated a good ramp into the interior. However when we got there we indeed found the ramp, but it looks like it is a giant ventifact, or a kind of deep grotto excavated by wind and LOTS of time. We erected the inflatable shelter there to provide us an emergency Hab in case of a severe solar event. In the long run future crews can certainly make use of the grotto for protection on long stay missions.

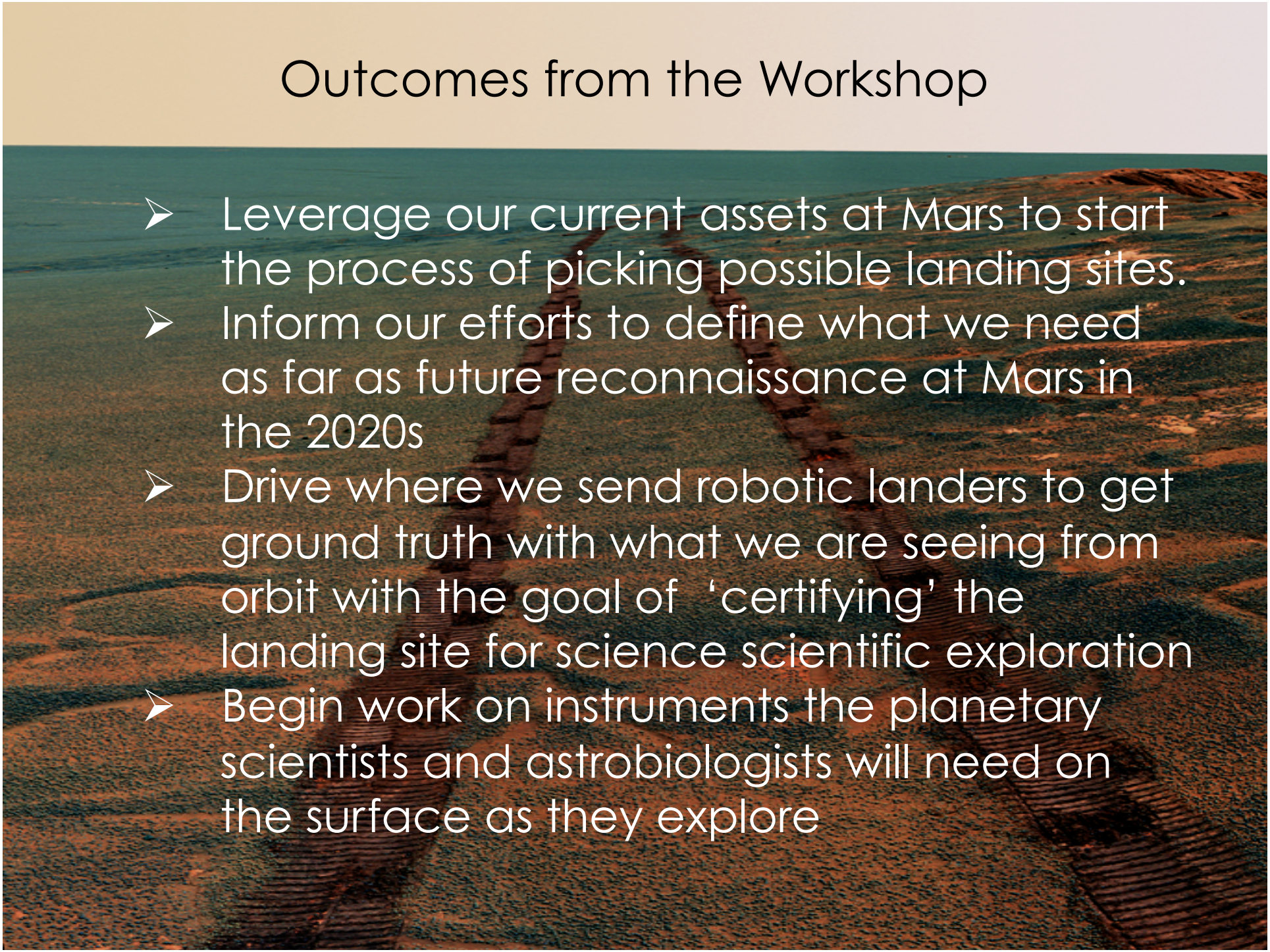
I did try out the new hyperspectral hololens projector in the helmet, and it didn't disappoint. There's no question that there are lots of hydrated perchlorates at this site. I picked up a couple of kilos of samples that we've got in the sample airlock now, ready to transfer to the glovebox. Funny that we came all this way to get samples and I won't be able to handle them with bare hands.

We're going out again in a couple of days to deploy the WATNI rover, silly acronym Water Acquisition Traverse Navigation and Interrogation rover. Don't know why JPL called it that. The plan is for it to climb up to the recurrent slope lineae above us on the crater rim.
I sure hope it doesn't get stuck. While I'd love to climb up and recover it, we're restricted on this trip due to planetary protection concerns. Don't want to contaminate Mars with us dirty humans before we find out if there's life here now.

We've only got another 2 weeks on the surface before we have to head back to orbit and then home. I can't wait to see you. We should be able to FaceTime again in about 6 months when we get close enough to Earth. I can't wait. I'll try to pick up a good Mars rock souvenir for you.

Love you,
Dad

Outcomes from the Workshop



- Leverage our current assets at Mars to start the process of picking possible landing sites.
- Inform our efforts to define what we need as far as future reconnaissance at Mars in the 2020s
- Drive where we send robotic landers to get ground truth with what we are seeing from orbit with the goal of 'certifying' the landing site for science scientific exploration
- Begin work on instruments the planetary scientists and astrobiologists will need on the surface as they explore

We have a long road ahead of us…