



National Aeronautics and
Space Administration

EXPLORE MARS SAMPLE RETURN

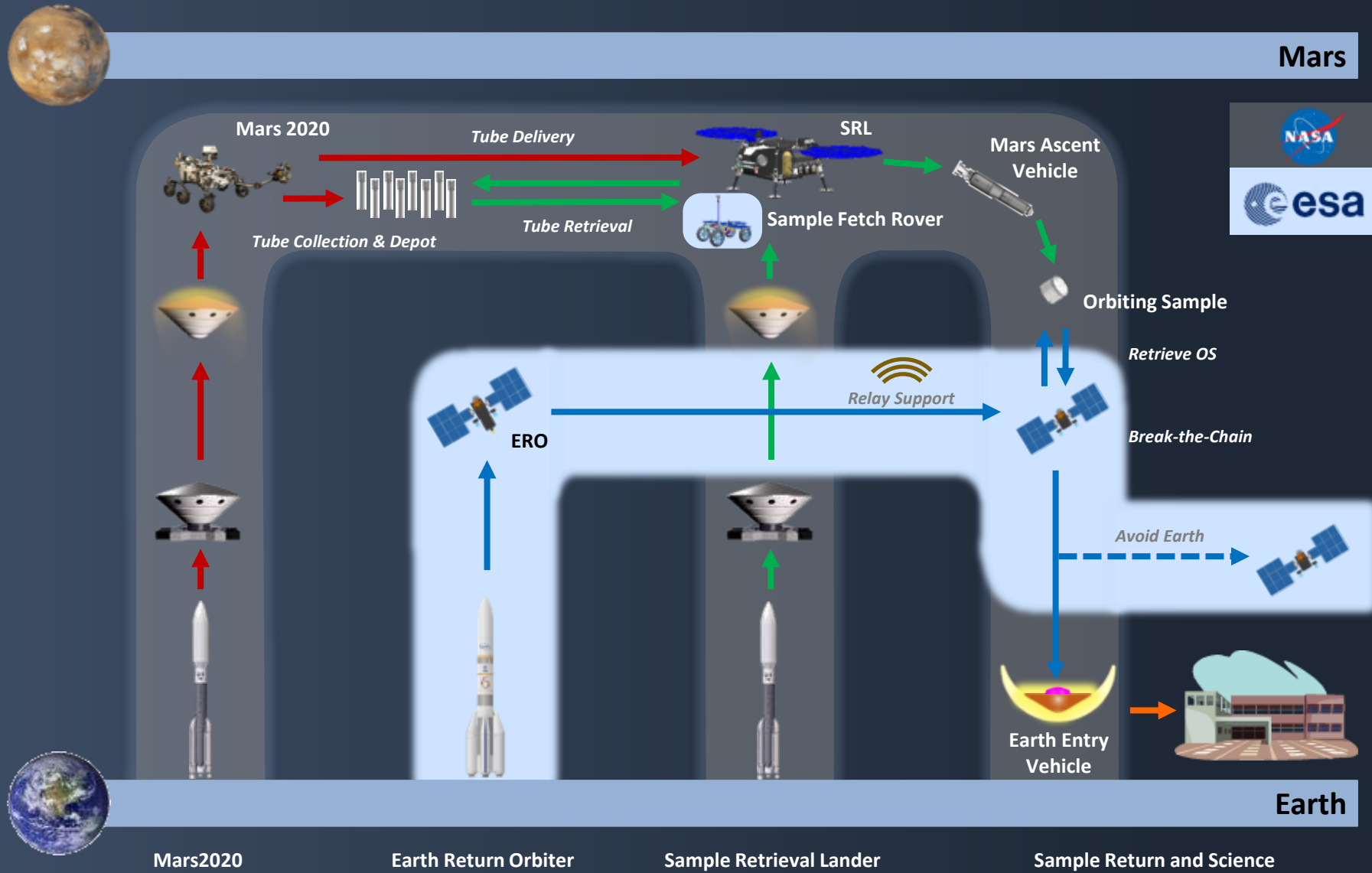
Jeff Gramling, MSR Program Director
Michael Meyer, Mars Lead Scientist
NASA HQ

Presentation to the MEPAG

June 21, 2021



MSR Architecture Overview



Mars2020

Earth Return Orbiter

Sample Retrieval Lander

Sample Return and Science

A composite image showing a satellite in orbit above a Mars lander on the surface. The satellite is in the upper left, and the lander is in the lower left. The background is a dark blue gradient.

Phase A Status

- MSR entered Phase A in December following Independent Review Board and Standing Review Board Review of mission concept and technology plans
- Program has been staffing up
 - Have benefited from staff transitioning from M2020
- Partnership with ESA established
 - Second Joint Steering Board planned for June 17th
 - Review of Proposal for Sample Transfer Arm
- Review Status
 - ESA Earth Return Orbiter (ERO) – PDR 4/15
 - ESA Sample Fetch Rover (SFR) SRR – 4/29
 - Capture, Containment, and Return System (CCRS) SRR – 4/22
- Focusing on developing and refining architecture
 - Ensure alignment with Class A mission requirements
 - Mission Timeline (LRD and Sample Return date)
 - One vs Two landers



Phase A Status, cont'd

- Agency Delta Acquisition Strategy Meeting, 5/13
 - Consistent with IRB Recommendations, MAV, SRL Cruise Stage, and EEV will be system procurements
- Near Term Strategic Procurements:
 - SRL/EEV Thermal Protection System (TPS) material, Contractor: FMI
 - MAV Solid Rocket Motors, Contractor: Northrup Grumman
 - Aeroshell, Contractor: Lockheed Martin
 - EEV
 - MAV
 - SRL Cruise Stage

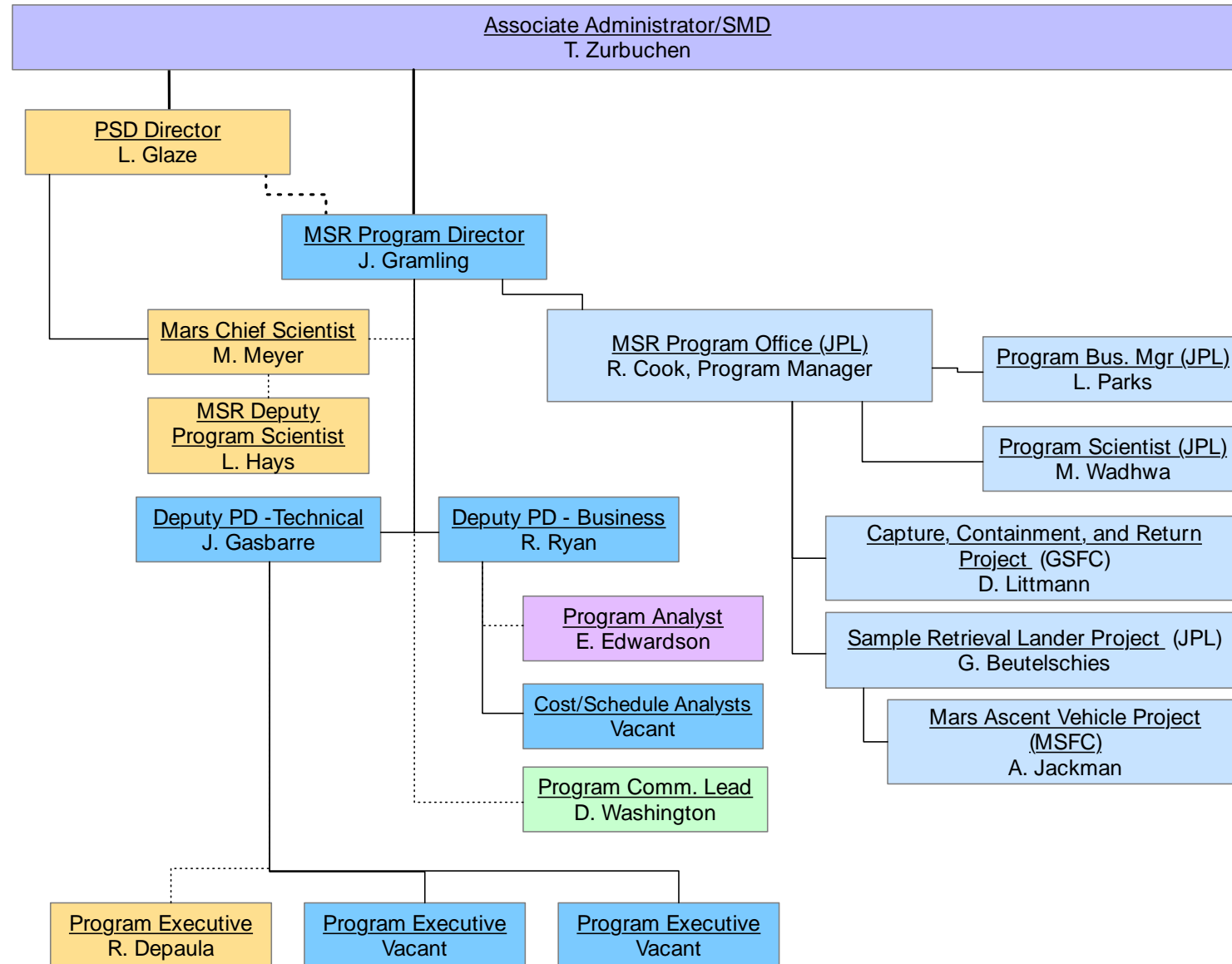
A satellite is shown in orbit above a Mars rover on the surface of Mars. The rover is on the left, and the satellite is on the right. The background is a dark blue gradient.

Staffing Updates

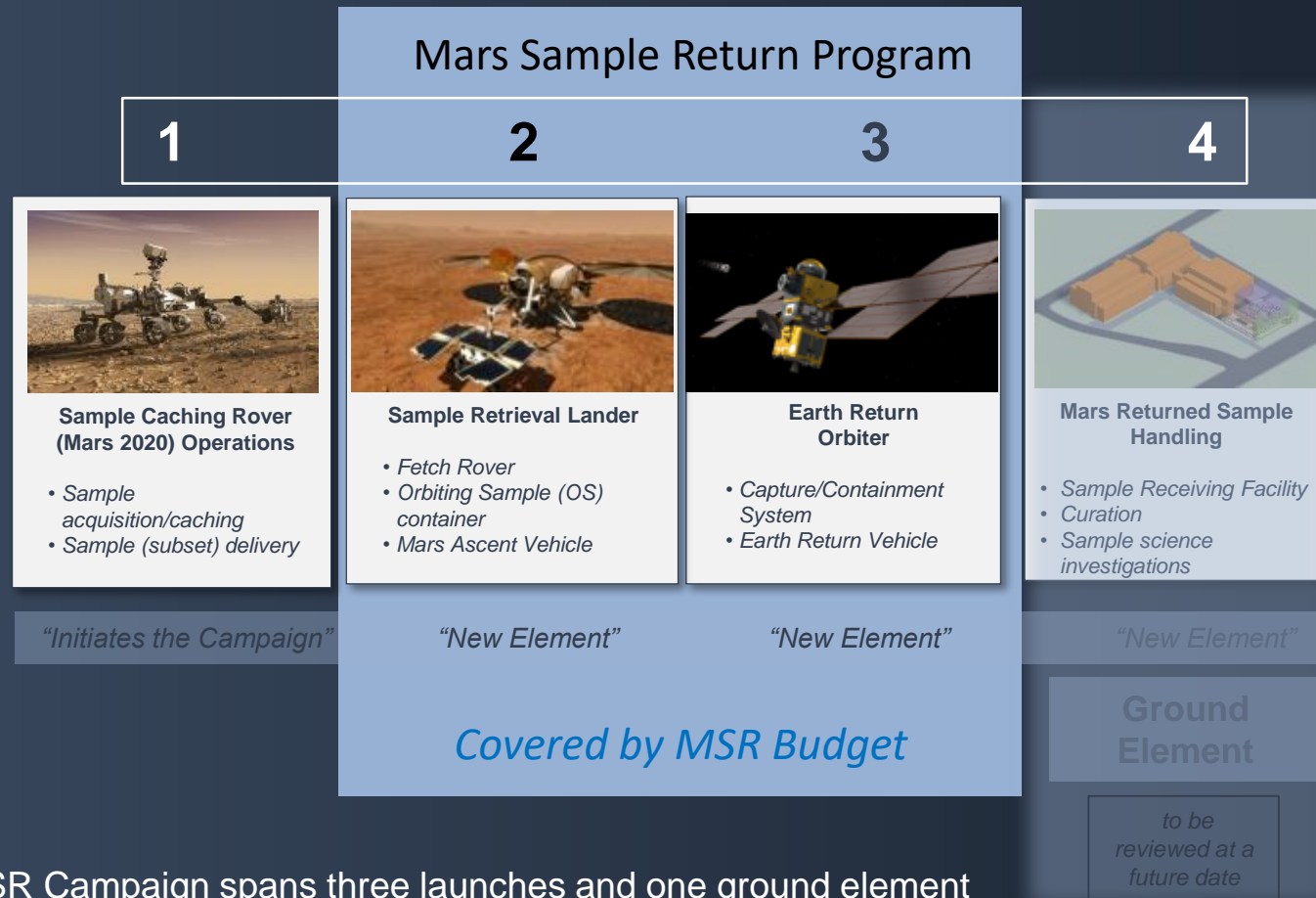
- Richard Cook named MSR Program Manager (JPL)
- Joe Gasbarre selected as permanent Deputy Program Director/Technical
- Dewayne Washington joins team as HQ Communications Lead
- Mini Wadhwa joins team as Program Scientist (JPL)
- Guy Beutelschies named SRL Project Manager (JPL)
- Dave Littmann named CCRS Project Manager (GSFC)
- Larisa Parks joins team as Program Business Manager (JPL)
- Randy Blue joins team as Program Mission Assurance Manager (JPL)



Mars Sample Return



MSR Campaign



- The MSR Campaign spans three launches and one ground element
- The MSR Program manages development and operations of elements 2 and 3 above and interfaces to elements 1 and 4; program concludes with recovery/containment of samples for transfer to SRF
- The MEP Program manages M2020 Phase E operations & will be the home of the future SRF Project

MSR Budget Status

President's FY22 Budget request

Budget Authority (in \$ millions)	Op Plan	Enacted	Request	FY 2023	FY 2024	FY 2025	FY 2026
	FY 2020	FY 2021	FY 2022				
Total Budget	0.0	246.3	653.2	772.3	800.0	700.0	600.0

- We are pleased that the President's FY22 Budget request funds us at levels consistent with the recent IRB recommendations and the presentations made to the Planetary Science and Astrobiology Decadal Survey
- Program Cost Commitment established at KDP-C, following completion of Phase B

The background of the slide features a composite image. In the upper left, a satellite with solar panels is shown in orbit against a dark sky. In the lower left, a Mars rover is on the reddish, rocky surface of Mars. A large, semi-transparent blue circle is overlaid on the right side of the image, containing the text.

MSR Cost Control

- Cost Control and reduction measures
 - Partnership with ESA reduces cost & risk to both partners
 - Increased use of independent review starting in Pre-Phase A
 - Two independent cost and schedule assessments in Pre-Phase A
 - Standing Review Board (SRB) for the Mission Concept Review prior to entry into Phase A
 - Deputy Director-Business position created at HQ to ensure rigorous cost and schedule management processes are established for the program
 - MSR will be the first SMD program to perform a Joint cost and schedule confidence exercise for KDP-B
 - MSR will begin Earned Value in Phase B
- Descopes
 - The only cost/complexity reducing descope identified has been the draft requirement for a dedicated Atmospheric Sample in the OS, which is being studied in Phase A

A satellite with solar panels is in orbit above a Mars rover on the surface of Mars. The rover is on the left, and the satellite is on the right. The background is a reddish-brown Mars landscape.

Science Involvement in Sample Return

- MSR Program Staff
 - Dr. Meyer, Lead Mars Scientist (HQ)
 - Dr. Hays, Deputy Program Scientist (HQ)
 - Dr. Gerhard Kminek (ESA Chief Scientist)
 - Dr. Wadhwa, JPL Program Scientist
 - Scientific leadership in the execution of MSR Program activities
 - Responsible for the scientific integrity and overall scientific success of the MSR Campaign
 - Provide a science voice in MSR Program decision making
- Key stakeholders/authors of Level 1 Requirements and Mission Success Criteria
- Agency Standing Review Board scientists for MSR Program
 - Chaired by Dr. Zuber
 - Members include Drs. Grotzinger and Lunine
- Community inputs via working groups (typically with competed membership)
 - Established by the Mars lead scientists at NASA HQ and ESA for targeted activities (such as the Caching Strategy Steering Committee & MSPG2)
- MSR Science Plan being developed jointly with ESA

Summary

- Perseverance is progressing towards initiation of sampling science operations
- Organizational responsibilities and Make/Buy decisions have been aligned consistent with recommendations by the IRB
- Team continues to mature architecture in Phase A
 - Close trades
 - Demonstrate viability on technology and engineering developments
 - Refine cost and schedule estimates with institutional commitments
 - Continue refinement of mission design and planning
- The President's FY'22 budget request funds the program consistent with IRB recommendations
- The program has benefited from addition of experienced staff from M2020 and other missions

Acronyms

- CM: Containment Module
- CCM: Capture and Containment Module
- CCRS: Capture, Containment and Return System
- CONOPS: Concept of Operations
- CP: Chemical Propulsion
- CS: Cruise Stage
- DOF: Degree of Freedom
- EE: End Effector
- EES: Earth Entry System (includes OS)
- EEV: Earth Entry Vehicle
- EP: Electric Propulsion
- ERO: Earth Return Orbiter
- ERM: Earth Return Module
- GNC: Guidance, Navigation and Control
- HEEET: Heatshield for Extreme Entry Environments Technology
- IRD: Interface Requirements Document
- IDRA: Interface Definition and Requirements Agreement
- ITT: Invitation to Tender
- JMIP: Joint Management and Implementation Plan
- LMO: Low Mars Orbit
- LRD: Launch Readiness Date
- LV: Launch Vehicle
- MAPS: Mars Ascent Propulsion System
- MAS: Mars Ascent System
- MAV: Mars Ascent Vehicle
- MPA: MAV Payload Assembly
- MEL: Mass Equipment List
- MEP: Mars Exploration Program
- MMOD: MicroMeteoroid and Orbital Debris
- MRSH: Mars Returned Sample Handling
- MSR: Mars Sample Return
- OS: Orbital Sample
- PICA: Phenolic Infused Carbon Ablator
- PLV: Propulsion Landed Vehicle
- PP: Planetary Protection
- PPO: Planetary Protection Officer
- QPM: Quarterly Progress Meeting
- RSTA: Returned Sample Tube Assembly
- RTA: Robotic Transfer Arm
- SEP: Solar Electric propulsion
- SFR: Sample Fetch Rover
- SRL: Sample Retrieval Lander
- SRF: Sample Receiving Facility
- STA: Sample Transfer Arm
- STS: Sample Transfer System
- SOI: Statement of Intent
- TAA: Technology Assistance Agreement
- TGO: Trace Gas Orbiter
- TM: Transfer Module
- TPS: Thermal Protection System
- TVC: Thrust Vector Control
- TRN: Terrain-Relative Navigation
- VECTOR: Vertical Ejection, Controlled Tip-off Rate launch mechanism
- UTTR: Utah Test and Training Range



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