

Marshall Space Flight Center

Mission Operations Integration and Planning

Marshall Space Flight Center is the leader in conducting endto-end mission operations for science payloads in low-Earth orbit, in cislunar space, on the lunar surface and beyond.



Crew Member Performing Science Operations

Payload and Science Integration

With more than two decades of expertise in payload integration, our team of specialists works closely with payload owners to translate customer requirements into detailed mission plans. We are highly skilled in both prelaunch and on-orbit phases, developing comprehensive mission plans that address critical constraints such as spacecraft capabilities, payload life cycles, communication windows, and scientific requirements. With a deep understanding of mission intricacies, we ensure that all components work seamlessly together, maximizing mission success while adapting to evolving challenges. Additionally, we specialize in the development of operational concepts for both autonomous and crewed spacecraft science missions, ensuring robust, adaptable strategies for diverse mission types.

Our expertise extends to the development of operational concepts for both autonomous and crewed science missions. We carefully assess all available resources and system limitations. By transforming these requirements into detailed mission timelines, we ensure that every component is aligned and optimized. Our team excels in designing robust and efficient procedures for both crewed and uncrewed space missions, including complex Free Flyer missions. We specialize in developing comprehensive mission support products that ensure safety, reliability, and mission success. For crewed missions, we focus on human factors engineering and crew training, with an emphasis on safety and operational efficiency. For uncrewed missions, we leverage advanced automation techniques, autonomous systems, and remote monitoring to enable spacecraft to perform tasks independently in dynamic space environments. Our expertise spans the entire mission lifecycle, from concept development to operational execution.



Science operations on the Lunar Surface

Science Mission and Payload Operations Planning

Activities and resources are modeled in our planning tools to create an integrated timeline. Using these tools, we develop visual layouts that clearly depict the sequence of events required for a successful science mission. We incorporate all payload activities into a comprehensive timeline, ensuring that post-arrival and pre-departure timing constraints (e.g., unpacking/activation, deactivation/packing) are met.

We efficiently integrate competing priorities and resource demands, ensuring the mission progresses smoothly. Throughout the mission, we continually verify that planning and execution align with the science objectives, driving mission success.

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Integrated Science Timeline

Science Mission and Payload Logistics

When unexpected changes arise, our team thrives in dynamic replanning, keeping experiments on track despite unforeseen obstacles. We track experiment hardware throughout its full lifecycle, from manifest and launch to unpacking, usage, packing (with specific attention to temperature and orientation) and return or disposal. Our logistics services optimize the use of hardware, ensuring the efficient allocation of resources for the mission. Dynamic Replanning. When things don't go as planned, our team excels in dynamic replanning, ensuring experiments stay on track despite unforeseen challenges. We continually reassess constraints such as limited-life samples, time constraints, or resource updates, adjusting as needed to achieve mission success.

By proactively managing competing priorities and resource demands, we maintain mission continuity and efficiency. Throughout every phase, we verify that execution aligns with scientific objectives, driving mission success. We manage experiment hardware throughout its full lifecycle from manifest and launch to unpacking, usage, packing (with specific attention to temperature and orientation) and return or disposal. Our logistics services optimize hardware utilization, ensuring efficient resource allocation for the mission.

Dynamic Science Mission Replanning

When deviations from the scheduled plan occur, our team excels in dynamic replanning, ensuring that experiments stay on track despite unforeseen challenges. We continuously reassess constraints, including limited-life samples, time limitations, and resource updates, making the necessary



Crew Members Evaluating the Mission Plan

adjustments to ensure mission success. Utilizing advanced automated tools, we provide efficient mission planning solutions that streamline the planning process, optimize resource allocation, and ensure timely, effective execution of mission objectives.

National Aeronautics and Space Administration

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