THE JOURNEY OF A PAYLOAD

This map describes a typical journey for a research payload that travels to space and back to Earth aboard a launch vehicle. The "payload" is the load or research experiment that is being carried to space. In this case, the payload is autonomous and self-operating. The research may explore a range of scientific topics like healthcare, materials science, or fluid dynamics.

	Envision	Build & Integrate	Travel	Review	Load	Launch	Microgravity	Land	Unload	Travel	Analyze	Share
Description	Research team identifies and designs an experiment to fly to space: A payload is born!	Payload is built, assembled and tested to ensure its safe integration and operation	Payload travels to launch site	Payload is reviewed to ensure it is ready for flight	Payload is installed/ loaded into the vehicle	Payload takes flight as the vehicle is launched	Payload experiences microgravity, the condition where gravity is minimal (nearly 0 g)	Payload returns to Earth as the vehicle lands	Payload is removed from the vehicle	Payload returns to home	Experiment results are analyzed	Experiment results are reported and shared
Timeline (L = Launch)	L-months to years		L-days to weeks		L-hours	L-0, Flight			L+hours	L+hours to weeks		L+weeks to months
What happens to the payload?	**Selected for flight** Research team ideates and selects an experiment for flight **Designed by research team** Details of the experimental design and requirements are discussed and documented by the research team **Manifested** Onboards with a launch services provider; the research team enters into a contract with the provider	**Documented** Completes documentation (e.g., requirements, mission planning, timelines, testing, hardware, software, launch, return of results) **Built & tested** Hardware and software components are built, assembled, and tested **Reviewed & checked** Completes safety reviews and hazard analyses, identifying potential risks and ensuring hazard controls comply with safety requirements	**Packaged & shipped** Ships to launch site (via courier service, travels with a researcher, etc.) **Received** Arrives at its destination in advance of the flight	**Final checks** Undergoes final reviews and checks	**Loaded** Loaded/installed inside of the vehicle; this may take place at the launch pad **Go for launch** The vehicle undergoes final preparations for flight	**Activated & operational** Payload hardware/ software is operating **Endures g forces** Feels the forces of liftoff including hypergravity (the force of gravity exceeds that on the surface of the Earth or > 1 g)	**Experiences microgravity** Everything is in free fall and appears weightless in microgravity as the spacecraft reaches apogee, the point at which the spacecraft is the farthest from the Earth during its flight **Operational** Hardware/software is operating	**Endures g forces** Feels the forces of landing including hypergravity (the force of gravity exceeds that on the surface of the Earth or > 1 g) **Operational** Hardware/software is operating **Powered down** Systems are turned off	**Unloaded** Unloaded/uninstalled from the vehicle; this may take place at the launch pad	**Packaged & shipped** Ships back to its home or research facility (via courier service, travels with a researcher, etc.) **Received** Arrives at home	**Analyzed** Results from the experiment are gathered, examined, and synthesized	**Shared** Results from the experiment are documented, reported, and possibly published
What is important to the payload?	Has a feasible, desireable and viable design Funding is available to support the mission (e.g., grants, crowdfunding, sponsorships) A team and additional resources (e.g., services, facilities, tech) are dedicated to the mission	Meets all requirements Rigorous testing ensures it can manage environmental stressors Operates as expected Poses minimal safety risk to itself or anything in its environment	Can withstand travel Has all paperwork and clearances required to travel, particularly if crossing geographic borders Sensitive materials (e.g., biology) receive special care and/or transport, as needed	Meets all requirements for flight Operates as expected	Has a backup plan in case of a delayed or scrubbed launch Sensitive materials (e.g., biology) are prepared and loaded for flight; backup samples are available in case of flight delays	Powers on and operates as expected Research data is collected	Operates as expected Research data is collected	Operates and powers down as expected Research data is collected	Results are analyzed in a timely manner (immediately following flight vs. hours/days/ weeks after) Sensitive materials (e.g., biology) are retrieved and analyzed immediately after landing, if needed	Can withstand travel Has all paperwork and clearances required to travel, particularly if crossing geographic borders Sensitive materials (e.g., biology) receive special care and/or transport, as needed	Maintains its integrity so that results can be properly analyzed Appropriate data has been collected	Research results are communicated, inspiring future experiments and contributing to the field of space science and research