National Aeronautics and Space Administration

NASAfacts

Utah Test and Training Range:
The Proposed Landing Site for Mars Sample Return

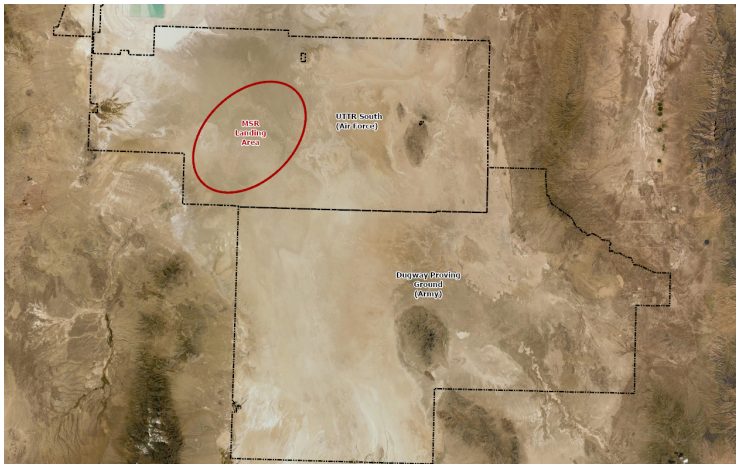
NASA has baselined the Department of the Air Force (DAF)-managed Utah Test and Training Range (UTTR) in northwestern Utah as the proposed landing site for samples from the surface of Mars. These samples would be gathered by a Mars Sample Return (MSR) campaign being planned jointly by NASA and the European Space Agency (ESA).

UTTR emerged as the baseline for the landing site for MSR after a review of more than 500 potential sites across the United States, based on more than a dozen specific selection criteria. These criteria include: being a remote site on land in the United States, with restricted access and special use airspace, and a recovery area free from roads, structures, and hazardous terrain such as trees or steep hills. A landing in the ocean was considered but eliminated because losing the spacecraft during or after an ocean landing has the potential for irretrievable loss of the samples leading to eventual loss of sample containment.

The recovery area must offer a large, flat surface with minimal slope, and soil properties that would aid in softening the landing of the MSR Earth Entry System (EES). The site should also provide the capability to track the EES during its landing process, and then allow quick access to the EES after landing to enable its prompt recovery and secure transportation to a state-of-the-art sample receiving facility elsewhere in the U.S.

Located primarily in Tooele County, UTTR provides the largest overland contiguous block of supersonic-authorized restricted airspace in the continental United States. This airspace covers 2,675 square miles (6,930 square kilometers) of land area. UTTR is administered and maintained by the Department of the Air Force, with some operations being conducted in conjunction with the U.S. Army at the adjacent Dugway Proving Ground.

MSR would utilize a portion of the UTTR South Range referred to as the West Desert, with a target landing zone of approximately 146 square miles (379 square kilometers) in area. The planned landing area at UTTR is predominantly a dry lakebed with seasonal variations between wet and dry conditions. It is anticipated that the MSR EES would land during the fall months of the year when the soil conditions and weather are typically favorable for recovery operations.



The proposed landing zone for the Mars sample return mission is shown in the red ellipse.

NASA has previously used UTTR as the landing site for space missions that have returned samples of comet dust and the solar wind, and it is the planned location for the return of samples in 2023 from the asteroid Bennu that have been gathered by NASA's OSIRIS-REx mission.

MSR represents the first "restricted" sample return in U.S. solar system exploration since the early Apollo lunar landings over 50 years ago. Restricted sample return means that the samples come from a place with local environmental conditions that, based on scientific understanding at the time of the mission, could potentially support past or present life. Several different panels of scientific experts from around the world have found that the likelihood that samples of Mars could contain a hazard to Earth's biosphere is extremely low. For example, the Mars samples being gathered by NASA's Perseverance Mars rover for potential return are from the first few inches of a surface that is very dry and exposed to high levels of solar and galactic radiation. These harsh conditions are not compatible with active biology.

MSR is different from recent NASA sample return missions in that it does not plan to use a parachute for landing. This approach simplifies the design of the EES and removes a potential failure point, while maintaining a significant safety margin. It is expected that the cone-shaped EES, roughly the size of a tire on a semi-trailer truck, would land at UTTR with a speed of about 90 miles per hour (144 kilometers per hour); simulations and ground-based testing have shown this speed would be low enough to keep the Mars rock cores intact inside the Orbiting Sample container. The landing would create a depression in the soil with a diameter about the same as the EES (four feet or 1.3 meters), with soil being ejected from the crater to a distance of approximately 49 feet (15 meters).

The samples from Mars would be returned to Earth in the early 2030s. Ahead of the landing, a mobile containment system (or "vault") would be positioned adjacent to the Michael Army Airfield runway location on Dugway Proving Ground. Just prior to landing, one or more recovery teams would move closer to the landing zone to await the landing. After landing, these teams would travel to the landing site by helicopter, or land vehicles in the event of inclement weather conditions. After reaching the landing site, the EES would be placed first into a sterile, particle-tight bag, and then into a light weight travel case, and then transported to and contained within the vault.

NASA is conducting drop tests at UTTR using realistic prototypes of the MSR EES at speeds comparable to what would occur during an actual landing event. Photo credit: U.S. Air Force/NASA

To help ensure a safe recovery, the site recovery teams would handle the landing event with caution as though a release has occurred, which may involve the decontamination of both the landing site (impact area and extent of ejecta from the crater) and the EES.

The MSR Campaign team is developing specific transportation, storage, and curation protocols for the Mars samples, including transportation from the UTTR point of recovery to the yet-to-be-determined site of an MSR sample receiving facility. The ability to ensure prompt and secure transport of the contained samples to a receiving facility is another reason for the recovery area to be on land versus the ocean.

NASA, in cooperation with the Department of the Air Force, U.S. Army, the U.S. Department of Health and Human Services -Centers for Disease Control and Prevention, and the U.S. Department of Agriculture, has prepared a Programmatic Environmental Impact Statement (PEIS) that analyzes the potential environmental impact of the overall MSR program, including landing and recovery at UTTR. Decisions regarding specific methods of sample transportation from the landing site to a receiving facility will be addressed in a subsequent environmental analysis, once the requirements for such activities have been fully identified. Both decision processes will include opportunities for public review and comment.