isspace Lunar Exploration Missions Beyond Google Lunar XPRIZE

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Origins

Selected down from 34 teams to just 5 teams

HAKUTO (Japan)
TeamIndus (India)
SpaceIL (Israel)
Moon Express (U.S.)
Synergy Moon (International)

Lightweight design via Japanese manuf. tech
Utilization of COTS
Agile Development

120kg yutu
30kg Astrobotic
4kg
900kg Curiosity
Camera Imaging Test in the field

Flight Model Vibration Testing

Flight Model Thermal Vacuum Testing
Current Collaborations

Signed an MOU to operate R&D mission to send a radiation counter (December 2016)

Signed an MOU to operate R&D mission to send a Neutron spectrometer (March 2017)
Future Lunar Missions, Phased Approach

Phase 1
- Validate micro robot technology

Phase 2
- Prospecting on the Moon
  - Obtain technology to access the Moon
  - Provide a frequent delivery service
  - Map resources with swarm systems
  - Develop ISRU systems

Phase 3
- Extraction, Process & Delivery
  - Extract, Process, and Deliver resources to customers on the Moon and in CIS-Lunar Space

Google Lunar XPRIZE
- Prospecting on the Moon

Prospecting on the Moon
- Validate micro robot technology
**Mission 0**
Taking on the Google lunar XPRIZE, the first international lunar exploration race in human history.
SRT: Google Lunar XPRIZE / HAKUTO

**Mission 1-2**
Japan’s first private lunar surface exploration project. Technology demonstration for the establishment of data and transportation services.
M1: Lunar orbiter
M2: lunar landing

**Mission 3-9**
Construction of an information and transportation service platform centered around water resource exploration of the polar regions.
Collection of data on water resources in the polar regions/Harvesting resources
Establishment of infrastructure for exploration of the polar regions
Exploration of skylights on the lunar surface

**Mission 10**
Construction of an industrial platform for the realization of stable lunar surface development.
- Provision infrastructure in permanently sunlit regions
- Collection of data on water resources across the lunar polar regions
- Exploration over wide areas outside of the polar regions
- Establishment of points of interest such as the largest craters, the highest peaks, and the impact site of Kaguya satellite (SHOIKO)
Japan’s First Commercial Lunar Exploration Project “Mission 1 & 2”

2019 ~ 2020
Mission 1: Lunar Orbit
Observation from the lunar orbit, Lunar resource mapping, Attempt of Lunar landing

Status
SRR / SDR passed in November 2017
PDR & CDR scheduled for 2018.
FM procurements have begun

2020 ~ 2021
Mission 2: Lunar Landing
Soft landing on the lunar surface, Observation from the lunar surface, Lunar exploration using rover
Lander Design Concept

The Lander is designed to carry 30 – 50kg of payload to the lunar surface.

Rovers are protected within the Spacecraft structure during Flight and then deployed once on the surface.

A precision of 100m is targeted for landing.

Avoid hazards: shadowed areas, slopes steeper than 15° and surface features - e.g. boulders - higher than 30 cm.

A deployable landing gear which is stowed during launch to maintain the compact envelope.

A high bandwidth Communications system is incorporated to support HD video downlink.

Precision Landing and Hazard Detection & Avoidance is needed to access all locations, and will be performed autonomously onboard during landing.

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Expand our planet. Expand our future.

Expand our living sphere into outer space, for the creation of a sustainable world.