

Live and work on the Moon

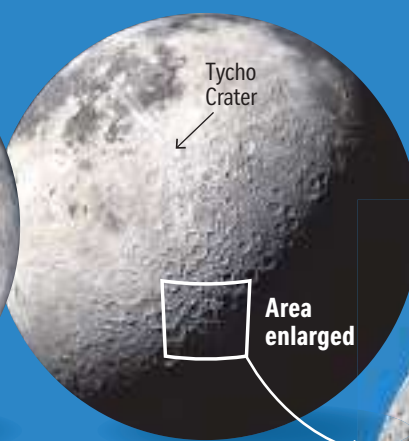
For the first time in more than 50 years since Apollo, Nasa is edging closer to returning astronauts to the Moon under the Artemis programme where it hopes to establish – by putting a space station in orbit and building a base camp on the lunar surface – the first long-term human presence on the Moon. These, if executed successfully, will serve as a stepping stone to another first in the near future – putting man on Mars. **Lim Yong and Bryandt Lyn** take a look at what a Moon base entails

APOLLO LANDING SITES (1969–1972)



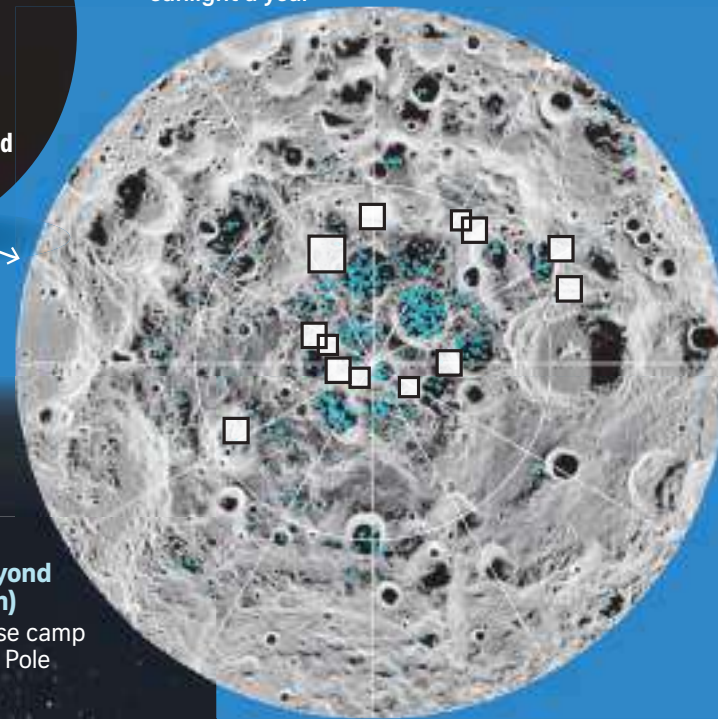
All six landing sites are near the Moon's equator

PROSPECTIVE ARTEMIS 3 LANDING SITES



LUNAR SOUTH POLE

- Unexplored but rich in resources such as rare earth minerals
- Extreme and contrasting conditions
- Receives up to two months of continuous sunlight a year
- The base of some deep craters is shrouded in perpetual darkness where the coldest temperature in the solar system, -240 deg C, was recorded



NASA'S AMBITIOUS DREAM

Several missions have been planned, with the ultimate goal of having habitats and roving vehicles on the Moon.

2022

Artemis 1 (uncrewed test flight)

- Originally planned for a 2016 launch
- 42-day mission will test the rocket and the capsule in which future astronauts will travel

2024

Artemis 2 (crewed flyby)

- Astronauts will complete a lunar flyby, entering the Moon's orbit and returning to Earth in eight to 10 days

Earliest by 2025

Artemis 3 (crewed landing)

- The first woman and the first person of colour will set foot on the Moon and stay there for a week

2026 and after

Artemis 4 and beyond (human habitation)

- Nasa will build a base camp in the Moon's South Pole

WHY GO BACK TO THE MOON?

- A lunar outpost serves as a pit-stop to support astronauts on long-term space missions
- A place for astronauts to test and refine exploration methods in situ to prepare for future missions
- The Moon serves as a platform from which to observe the universe and to study how planets began

LUNAR BASE CAMP

The key objectives of the base camp are to attain self-sufficiency and to serve as a resupply station for Mars-bound spacecraft in time to come.

Polar craters a source of water

- Ice deposits, if present, could be extracted and processed into usable water
- Its elements, oxygen and hydrogen, can be used as breathable air and rocket fuel

Lunar terrain vehicle

- A buggy that transports crew around
- It can also be controlled remotely, enabling astronauts to explore the Moon without leaving base camp

Portable life support system

- Replenishes oxygen and removes carbon dioxide, odours and humidity inside the spacesuit
- Cooling system manages wearer's thermal comfort

Space suit

- It will have to be of a one-size-fits-all design
- Able to tolerate frigid environment

LUNAR GATEWAY

A small, manned space station that orbits the Moon. Its role is to support Nasa's Artemis campaign.

- Equipped with docking ports for visiting spacecraft
- A place for crew to live, work, and conduct research
- A platform for the development of technology and capabilities that would contribute to future Moon and Mars exploration

Human landing system

- A commercial transfer vehicle that will carry astronauts from the Lunar Gateway to the lunar surface and the return trip back to it.

Cluster of modular buildings/dwellings

- Each has a lightweight inflatable shell supported by a rigid frame and reinforced by 3D-printed regolith walls which shield occupants from cosmic and solar radiation
- Mobile 3D-printer rovers fabricate bricks out of Moon dust, eliminating the need to bring materials from Earth

Vertical solar panels

- Open up automatically and retract easily to be relocated
- The Sun hugs the horizon on the Moon. This means solar panels have to be tall and vertical to capture unobstructed sunlight
- Preferably store power for up to eight days

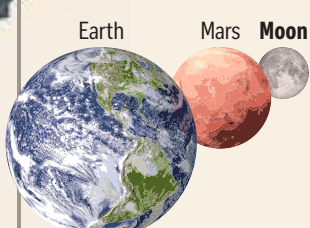
Food production

Scientists have succeeded in growing plants in lunar soil brought back from the Apollo missions. They found that soils from geologically older sites are more toxic to the plants

Habitable mobility platform

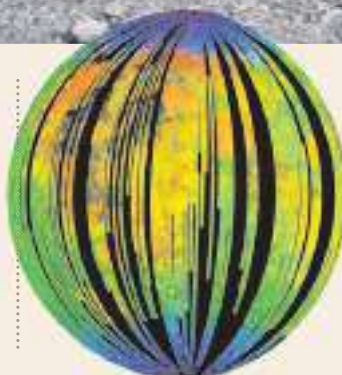
- A mobile "home and office" built for trips away from the base camp lasting weeks on end
- Passengers do not need to don spacesuits as its interior is pressurised with life support systems
- Powered by fuel cell and can travel up to 10,000km

MOONSTRUCK



17 Number of days it would have taken a commercial plane to fly there – non-stop

The surface area of the Moon is **85%** the area of the Asian continent



Nasa's composite image of mineralogy on the Moon's surface.

Blue areas are confirmed water ice on the lunar surface

About 230ml of water can be extracted from 450kg to 900kg of lunar soil

Apollo astronauts' footprints on the lunar surface are likely to be still intact today due to the Moon's **lack of atmosphere and weather**



Scan the QR code to view a video on what a Moon base entails