

# THE NEW RACE FOR THE MOON

**Elizabeth Pearson** asks if China really will be the next nation to send a man to the Moon

**I**t's been 45 years since Neil Armstrong took humankind's first step on another world and the US 'won' the Space Race. But only three years later, the Apollo programme was abruptly cancelled. For the next few years, Russia continued to send sample-return probes, but after a successful mission in 1976 they too ceased their programme and the Moon remained unvisited for nearly 40 years.

Now that's all changing. In December 2013, China's Chang'e 3 lander touched down on our nearest neighbour, the first of many planned missions. The surface of the Moon is about to get a lot busier as a new Space Race begins to heat up.

China is not the only Asian country with lunar ambitions. India, Japan and South Korea are already racing forward to make a soft landing before the end of the decade. They have a lot to catch up on; China is currently over halfway through its five-part Chang'e mission programme of robotic lunar exploration.

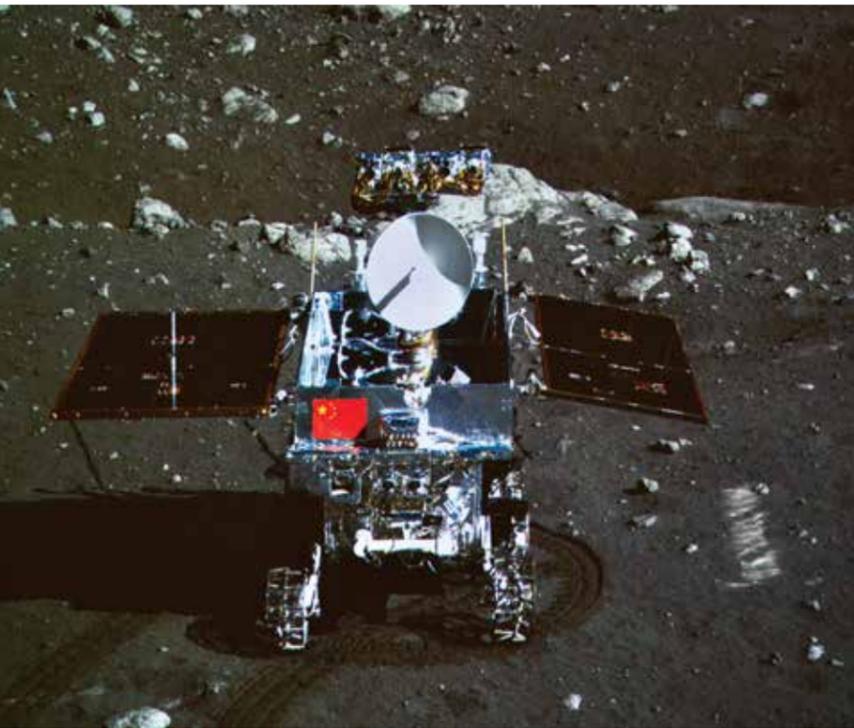
The first two probes were orbital missions launched in 2007 and 2010, followed by Chang'e 3, which landed on the Moon in December last year, releasing its Yutu rover. The fourth installment was initially created as a back up for the Chang'e 3 lander mission, but after the latter's success it is being reconfigured to test for the fifth and currently final ▶

A new Space Race appears to be upon us – and it's a very different contest



#### ABOUT THE WRITER

Dr Elizabeth Pearson is BBC *Sky at Night Magazine's* staff writer. She gained her PhD in extragalactic astronomy at Cardiff University.



other nations with concerns of being outpaced. But one country in particular is keen to keep up.

“I think the current Space Race that’s going on is between India and China,” says Johnson-Freese. “It’s pretty much a one-way race. China, very smartly, just doesn’t even acknowledge it. But India is playing a very hard game of catch up.”

### Indian ideals

In October 2008 the Indian Space Research Organisation (ISRO) sent its first mission, Chandrayaan-1, to orbit our lunar companion. Now it is preparing to launch a lander before the end of the decade. ISRO has already proven that it can launch massive space missions on a limited budget: last year it successfully launched a mission towards Mars at a fraction of the cost of previous spacecraft.

“India is still a relatively new player in lunar exploration,” says James Clay Moltz, a professor at the Naval Postgraduate School in Monterey, California, and author of *Asia’s Space Race*. “It may not have the budgetary resources to compete one-for-one with China, but it wants to be seen as still in the race.”

It is this desire to be ‘seen in the race’ that has most countries aiming for the Moon, as they



Japan’s SELENE was a success, but more recent projects have stalled

try to keep up with China even if there isn’t a realistic chance of matching it. One country that is particularly worried about being overtaken is Japan, says Moltz. “Officials in Tokyo worry that China’s space accomplishments could translate into the future loss of sales of Japanese high-tech goods outside of the space field,” he explains. “They fear the consequences of being left behind.”

In 1990, Japan launched the Hiten orbiter, then the first lunar mission in almost 15 years. More recently, however, the Japanese programme has been plagued with delays and funding problems. Following on from the success of its SELENE orbiter in 2007, Japan hoped to follow up with a lander, but budget cuts have pushed the launch date further back and the project is struggling to move from planning to development.

While many countries find their space agencies are constantly fighting their governments for the funding they need, the same is not true in South Korea. The country’s space agency recently unveiled its plans to land on the Moon in the next 10 years but the government, keen to promote the idea, has moved the target launch date forward to 2020.

### The unintentional racers

As many nations clamour to keep up, the Chinese government’s official stance takes pains to make clear that it is not attempting to outrun anyone when it comes to space travel. “The international community should work together to maintain the everlasting peace and sustainable development of outer space,” says Chinese foreign ministry spokesman Hong Lei.

Johnson-Freese notes that China has “repeatedly voiced its welcoming of international participants”. And it’s not the only nation that is keen to work with others to achieve its goals. Lunar missions are hugely expensive, and spreading the load between nations is one way of easing this cost. “If you talk about going back to the Moon it would be logical to go as an international venture,” she adds. “Unfortunately logic and politics are very often not used in the same sentence.”

If getting your own government to work on a lunar mission is difficult, the challenges are amplified when two or more are involved, and many attempts at joint lunar missions have already fallen flat. The Russian Federal Space Agency’s

## WHY SHOULD WE GO BACK?

During the first Space Race, the prime motivation for lunar missions was political posturing. Though international prestige is still important, it is no longer enough to justify the huge expense. Increasingly space agencies have to provide long-term plans for the Moon.

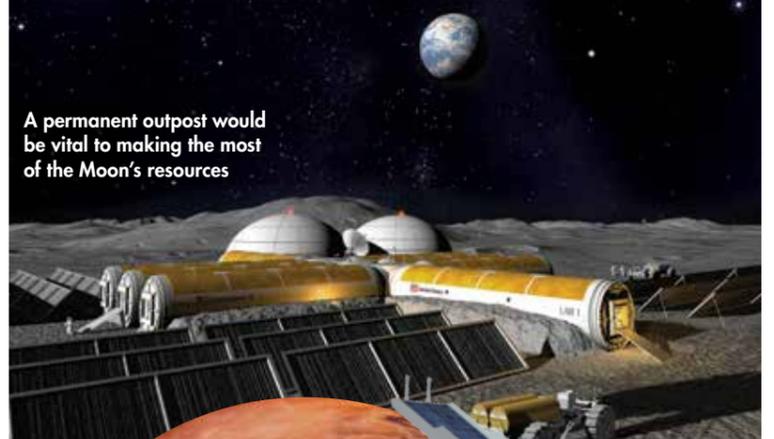
The idea of using the Moon as a waypoint for travel to Mars or even deep space has been around for decades. A geologist numbered amongst the last of the Apollo astronauts, and more were due to fly before the project’s cancellation. Even now, orbiters have been searching for vital resources that could be used for future travel.

The Moon is also a source of minerals that are in short supply on Earth. The growing electronics market has driven up prices of rare metals such as gold,

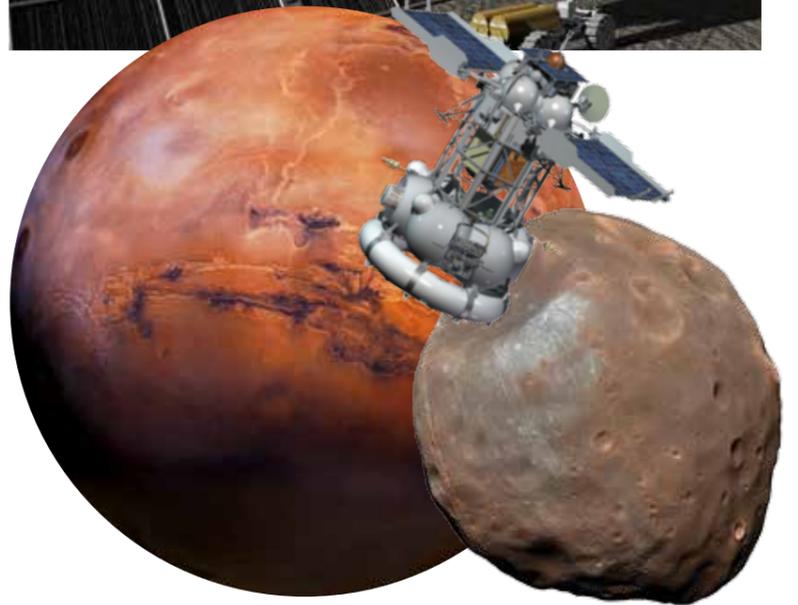
platinum and palladium, and they are rapidly becoming hard to find. Our neighbour is also a bountiful source of helium-3, the main fuel for fusion reactors that scientists hope will one day supply the world with clean power.

However to fully exploit the Moon’s potential resources a permanent outpost would have to be built on the surface.

Though at first this seems like the stuff of science fiction, it might not be far off. Though a manned colony is unlikely to be established any time soon, several nations have considered setting up a robotic base. Japan hopes to begin work on such a venture by 2020, while NASA and ESA are both investigating the possibility of using 3D printers to build the mechanical workers in situ out of the lunar dust.

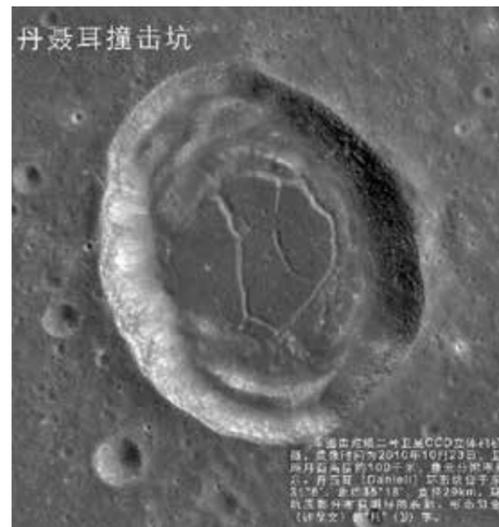


A permanent outpost would be vital to making the most of the Moon’s resources



▲ Not all collaborations work well; the failure of Phobos-Grunt had a knock-on effect for India

(Roscosmos) current Moon effort, the Luna-Glob programme, was originally meant to carry India’s Chandrayaan-2 rover. Unfortunately, after the failure of Russia’s Phobos-Grunt mission to Mars in 2011, Roscosmos pushed the launch date back, leaving India in the lurch. Now ISRO is building ▶



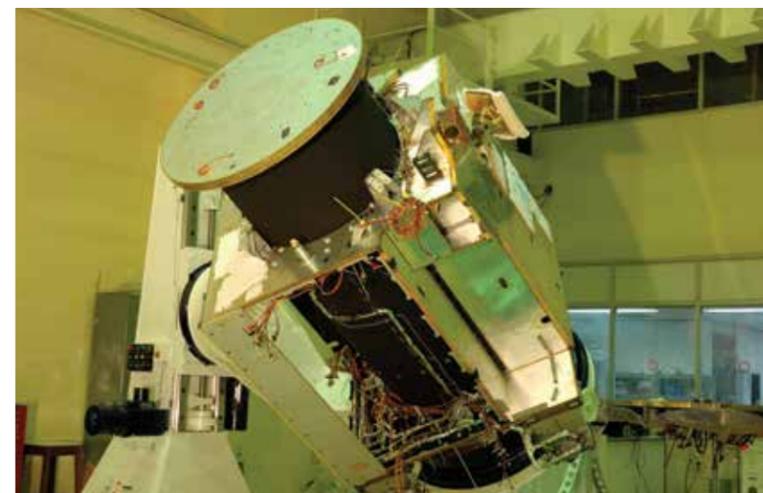
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▲ The Chang’e 3 lander dropped a new lunar rover to the surface: Yutu

◀ China’s second lunar probe, Chang’e 2, produced good images

▶ India’s first orbiter likewise delivered exceptional results

▼ Chandrayaan-1, seen here during development, was India’s first lunar probe



▶ Chang’e mission, a sample-return probe slated for launch in 2017.

Given the huge gap since the last soft-landing Moon mission – Russia’s Luna 24 in 1976 – China’s progress may seem rapid, but it has been a long time in the making. The initial plan for the programme was laid down almost 25 years ago in 1990, but rather than speed through development as Russia and the US did in the 1960s, China has had the luxury of taking its time to get things right.

“The Chinese didn’t decide six years ago to make this happen,” says Joan Johnson-Freese of the US Naval War College and advisor to US Congress on China’s space programme. “They are nothing if not prudent and they want success.”

This ‘slow and steady’ tactic has meant that the Chinese lunar programme is progressing well, leaving

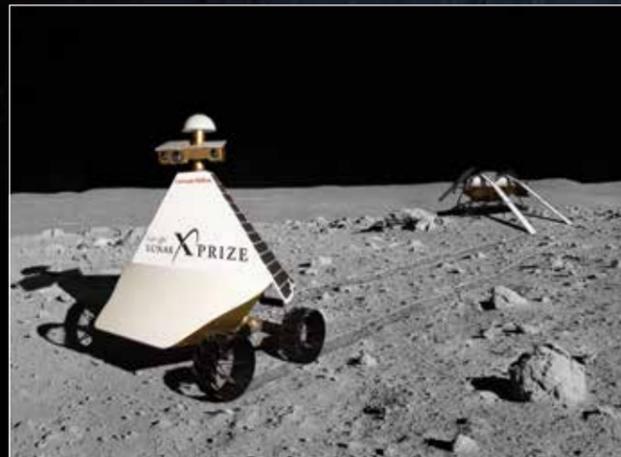
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# Google LUNAR X PRIZE

Out of the 18 entrants for the prize, only a few are closing in on a 2015 launch

## Astrobotic

US-based Astrobotic has already developed a lander capable of delivering a 260kg payload to the surface, including one of two rovers they have designed. As well as the equipment needed for their own mission, Astrobotic plan on transporting other people's experiments to the lunar surface with the help of a SpaceX Falcon 9 in October 2015.



## Team Indus

The only Indian entrant to the competition, Team Indus has already designed a lander, currently named HHK1. The team plans on sending not one, but three rovers, each of which will perform a different task needed to meet the prize's requirements. The emphasis is on low cost yet reliable hardware, building a rover to last rather than relying on back-ups to succeed it.



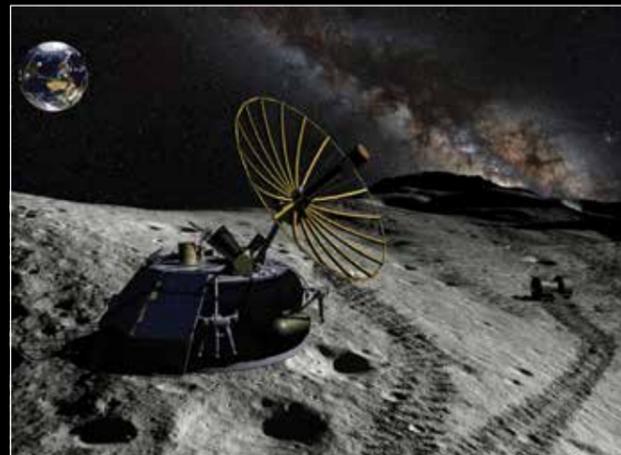
## Part-Time Scientists

Including members from all around the world, the Part-Time Scientists are a group of over 100 scientists, engineers and computer specialists. They plan on building a fully autonomous rover, capable of driving itself with no interference from the ground. While such technology has been used on the Martian rovers, no one has ever sent a similar rover to the Moon.



## Moon Express

With ambitions to one day mine the Moon for its resources, Moon Express is led by president Dr Andrew Aldrin, son of Apollo 11 astronaut Buzz. In December 2013 Moon Express unveiled its MX-1 lunar lander, designed to be a multipurpose craft that would not only take them to the Moon, but could also be used to deploy cubesats, service satellites and many other tasks as well.



Private tech such as SpaceX's Falcon 9 may be used to launch future Moon missions



► its own lander. Phobos-Grunt also had a Chinese orbiter on board, which failed along with it. China and Russia had been in talks for many years to mount a joint Moon mission but this setback meant that the mission failed to materialise.

"Chinese scientists at this point take the very pragmatic view of 'why would we want to work with anybody else? We're doing very well and working with anyone else would just slow us down,'" says Johnson-Freese.

However the two nations still co-operate. Russia sold many of its outdated rockets and research to the Asian nation, helping Chinese progression. Similarly, ESA played a supporting role during China's latest Moon landing by supplying tracking data and telemetry to Beijing mission control.

## Political indecisiveness

Lending aid to other countries is pretty much the limit of Europe's lunar dreams. "Europe does not have any very well-defined plans for the Moon at the moment, either robotic or human," says Chris Welch, a professor at the International Space University in Strasbourg.

Instead, ESA is focusing more on helping other nations that wish to pursue the Moon, staying in the race without actually running in it. The agency did have ambitions to launch a lunar lander, but these were put on hiatus in 2012 due to financial problems as member states changed their minds about the project and pulled their support.

The ever-changing face of government policy means that lunar missions are often the victim of party politics. In the US, President George W Bush set up the Constellation programme to send a man back to the Moon by 2020, only to have it scrapped by his successor. To avoid the uncertain world of government-funded agencies, where entire departments can be cut at a stroke, potential space explorers are increasingly looking towards the private sector.

## THE NEXT MAN ON THE MOON

The first Space Race was centred around putting a man on the Moon and returning him safely to Earth. It was this goal that caught the imagination of the world then, and it still grips many now.

Unfortunately, going back to the Moon is a minefield of political and financial pitfalls. For every politician who dreams of returning, there is another who sees it as a waste of time and resources. This is true in every country with lunar ambitions. As manned missions cost 10 times that of unmanned missions, the mountain of bureaucracy is 10 times as high.

It's possible that such a mission could be mounted as an international effort, with each nation bringing not only extra funding but different expertise

and technologies. It is possible that a project akin to the International Space Station could one day set us back on our celestial companion. It would, however, only exacerbate the bureaucratic challenges that come from organising a lunar mission.

The only country on track to landing a man on the Moon by itself is China. Its Shenzhou manned flight programme has shown the nation has the know-how to support humans in space and in Chang'e it has demonstrated its capability of delivering missions to the Moon. But the programmes are run separately and are funded by different agencies, so there could still be quite a wait to find out who will be next to walk on the Moon.



The evolution of world politics brings new challenges to a manned return

## FUTURE LUNAR MISSIONS AT A GLANCE

-  **China**  
Chang'e 4 and 5  
2015 and 2017
-  **India**  
Chandrayaan-2  
2017-2018
-  **Japan**  
SELENE 2  
2017
-  **US**  
Lunar X contestant  
2015
-  **Russia**  
Luna-Glob  
2018

A new field of lunar missions are appearing from these new players, spurred on by the Google Lunar X Prize, a \$30 million award to the first non-government agency that can land on the Moon by 2015. The aim of the competition is to send a lander carrying a rover capable of travelling at least 500m above, below or on the lunar surface. The teams do not need to be able to launch their probes themselves, instead relying on launches from other private companies such as SpaceX.

It's hoped that the prize will spur on the nascent lunar travel industry, and it seems to be working. Many of the teams are backed by companies that hope to set up new businesses based on the Moon. As such, most are taking their time to establish sound business strategies and reliable hardware, making sure they can not only get to the goal once, but can get there again afterwards. Though the Lunar X Prize may be a competition, who wins the race is largely irrelevant. It's who makes it to the finish line at all that matters.

A new Space Race is mounting, on both a private and a national level, and over the coming years we can expect to hear much more news from the surface of our nearest neighbour. **S**