

Human space exploration gaining momentum

With the inauguration of China's new space station, the prospects for human space exploration look bright although a number of challenges must be overcome.

When the three taikonauts on board China's Shenzhou-12 spacecraft docked with the Tianhe space station's core unit on June 17, China joined a select group of nations that have boasted access to an operational space station at one time or another.

But that is also—mostly—where the parallels end. China is the junior member of an elite group. Whereas its counterparts in the West and in Russia have gained a lot of experience in long-duration space missions, China is just setting off on a long and undoubtedly arduous road to parity.

In fact, the current mission is only the country's first crewed launch since 2016. Nevertheless, China's achievements in both crewed and unmanned space exploration are remarkable and impressive. For instance, in recent years, we have seen a number of soft landings of robotic craft on the Moon, including on its far side, and on Mars.

Yet, the China National Space Agency's (CNSA) initial pace of development is lagging behind that of the traditionally dominant space-faring nations. It took almost 18 years between China's first orbital flight by Yang Liwei, in October 2003, and the current mission's inauguration of the country's first space station.

By contrast, the Soviet Union's Salyut space station hosted its first visitors a mere 10 years after Yuri Gagarin's maiden flight in April 1961. NASA, the US space agency, took 11 years and 3 months after John Glenn's first sojourn in Earth orbit in February 1962 to develop and operate its first space station, Skylab.

However, in the 1960s and 1970s the USA and the Soviet Union were engaged in what amounted to a space race. China's more deliberate pace reflects the country's carefully planned development of its technology-driven space programme.

And while a lot has been learned about long-duration space flight over the past five decades, China's direct experience is as yet non-existent. The current mission is intended to last for three months, with a follow-up mission of six months already planned.

The initial three-month mission will undoubtedly be challenging, if only from a psychological perspective. Consider the living arrangements of the three taikonauts. Although they will have their individual, private areas on board Tianhe, the entire space station is currently just 16.6 m long, with a maximum diameter of 4.2 m. The crew will live in very close proximity of each other for a long time.

The Salyut space station was similar in size—15 m long and at most 4.15 m in diameter—but the Russians' first few civilian missions were composed of only two crew members each. The exception was the very first manned Salyut mission, Soyuz 11, when three cosmonauts spent 23 days in space. China's first space station mission will last more than three times as long.

Skylab was significantly larger, at 25.1 m long and 6.61 m in diameter, so its crew had access to quite a bit more personal space.

I have no doubt that the Chinese crew are highly disciplined and psychologically stable. Even so, those tight living arrangements will likely challenge commander Nie Haisheng's fabled composure and people skills.

Another key difference between China's current mission and those undertaken by the country's more experienced counterparts to, say, the International Space Station, is the Chinese station's management.

The International Space Station is a truly international endeavour, although one from which China has been excluded by US law. The premise of its operation is genuine, interdependent collaboration by the international partners—19 countries so far.

The Chinese space station is first and foremost a domestic project, although CNSA representatives have suggested that they may eventually also include international partners. For the moment, that will unlikely go beyond running experiments developed by international teams and not extend to hosting astronauts, at least not any time soon.

A complicating factor is that the country's space programme is run by its military. That has led to limitations in what foreign partners can achieve in collaboration with their Chinese counterparts. I experienced this first hand, when I still worked at one of the country's leading universities.

The Chinese astronomical community is looking forward to launching the Chinese Space Station Telescope, CST, by 2024. This is potentially an exciting development, as the CST will rival the highly successful Hubble Space Telescope in some respects such as its operational field of view.

As a professional astrophysicist, I was excited about the scientific prospects. Yet, despite being affiliated with a top Chinese university as a permanent member of staff, my prospects as potential collaborator of the CST's science team were limited.

Obviously, I understand that any national security implications must remain classified, but pursuing basic scientific questions benefits from access to extensive brainpower, irrespective of political considerations.

I continue to collaborate successfully with my Chinese scientific collaborators, despite troublesome political developments at home and abroad—of which I

want no part, to be crystal clear. I indeed relish our productive exchanges and fruitful joint student supervision.

I thus truly hope that the promise and benefits of international collaboration as it pertains to the Chinese space station—in science and in exploring humanity's final frontier—will transcend political goal scoring to the benefit of us all.

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