

What will China's space station mean for international cooperation? **Mark Williamson** reports from the 66th International Astronautical Congress (IAC) held in Jerusalem, Israel, in October.

SPACE:

THE IN-ORBIT NEIGHBOURHOOD WATCH SCHEME

IN MANY COMMUNITIES, when new neighbours move in it is customary to pop round and welcome them. When the China National Space Administration (CNSA) starts building its space station in low Earth orbit in 2018, will US astronauts pay a visit from the International Space Station?

It seems unlikely. The ISS and China Space Station (CSS) could coexist for a decade, but Nasa is a US government agency obliged to follow government policy, so Chinese astronauts are not welcome on the ISS. And that, in a nutshell, is why China has developed its own space station.

Once again, American fears about technology transfer have resulted in China developing its own equivalent technology. So where does this leave international cooperation in space?

If we take at face value what CNSA head Xu Dazhe told the 66th International Astronautical Congress (IAC) in Jerusalem this October, the future is bright. "China supports international cooperation in all areas of space and is fully open to whoever is interested".

Zhou Jianping, chief designer of the China Manned Space Programme, added substance to the rhetoric by revealing that cooperation agreements with Esa and Roscosmos had already been signed and China was "in discussion" with the United Nations. The broad objectives of the CSS mission, Zhou explained, were to build a national space laboratory and encourage international and regional cooperation. More specifically, he announced that an expanded station could host modules from other nations, manned by foreign

crews and supplied by their own spacecraft. If this transpires, it could make the CSS the new *de facto* international space station.

After launching its first astronaut, Yang Liwei, in October 2003, China followed the typical path of longer missions, larger crews and more complex technical demonstrations such as docking. This led to the launch in September 2011 of the Tiangong-1 space laboratory, which welcomed its first crew in June 2012. At the IAC, Zhou confirmed that Tiangong-2 will be launched in 2016 to continue China's development of manned spaceflight techniques, including in-orbit propellant resupply and other preparations for the CSS.

The CSS itself will have three main modules: a core and two for experiments. Zhou's team plans to launch the core in 2018 and complete the basic station in orbit by 2022. He explained that Experimental Module I and II would allow a crew of up to six to perform "science, applications and technical demonstrations" for at least 10 years, the station's design lifetime. Moreover, the baseline station could be expanded to six modules, the additional three supplied and crewed by foreign nations, and joined in orbit by a free-flying space telescope that would be able to dock with the CSS for maintenance. Zhou gave precious little detail on the telescope – not even the fundamental dimension of its main mirror – but this will doubtless be released in due course by an appropriate CNSA official. Unless the money runs out and the free-flyer is cancelled.

This begs the question of how real the CSS programme itself is, but western observers should not

be fooled by the parlous state of Chinese public relations. Once details of launch vehicles, launch sites and launch dates are announced at an international event such as IAC, we may be assured that they are officially planned, funded and almost certain to go ahead. China has so far not adopted the western habit of announcing PowerPoint stations and paper satellites that never see the light of day.

Collision avoidance

According to Zhou, the CSS core module will be launched by a Long March 5B, from the newly developed Wenchang Satellite Launch Centre on Hainan Island, to a 340-450km orbit at a 42-43° inclination. The ISS orbits at an average height of 400km and an inclination of 51.6°. The orbital altitude of both stations is dependent on friction with the Earth's upper atmosphere, which varies with atmospheric density (itself affected by solar activity).

So, even though the stations will orbit in different planes, there will be times when their orbital heights become close, and two points where those orbits cross. The issue of collision in orbit is real, with a probability dependent on cross-sectional area. Thus two large space stations (the ISS is as big as a football pitch) are more likely to collide than two relatively small satellites (which has occurred).

However, it is extremely unlikely that the stations would be allowed to move close enough for their occupants to discern their shapes, let alone to collide.

Nasa flight rules for the ISS already stipulate what it refers to as a 'pizza box' and others might call a *cordon sanitaire* around the

station. Its dimensions of 50km by 50km by 1.5km provide a safety zone for the ISS, in that any spacecraft or piece of orbital debris predicted to pass within that zone effectively triggers an alarm. Depending on the situation, flight controllers can then decide whether to move the station slightly to avoid the object or instruct the astronauts to shelter in a more protected part of the station or head for the 'lifeboat' return capsule.

So far so good, but you don't have to see many space movies for the question of mutual rescue capability to spring to mind. The UN Rescue Agreement of 1968 requires that "States shall take all possible steps to rescue and assist astronauts in distress and promptly return them to the launching State".

Although the ISS is funded until 2024, technical reviews have suggested that it could easily operate until 2028, ten years after the core of the CSS is planned for launch. So there could be a decade of co-existence, and at least potential mutual support.

Apart from the usual legal and policy agreements, the show-stopper is the incompatibility of docking mechanisms. Asked whether China would subscribe to the international docking standard being developed by ISS partners, Zhou seemed unsure. "It's possible", he said. "Some details need to be discussed". Which is a way of saying 'it's above my pay-grade'.

While it seems illogical to have two space stations that can't exchange crews even if lives are at stake, the fact remains that the barriers against international docking standards have been built in America, not in China,

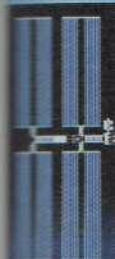
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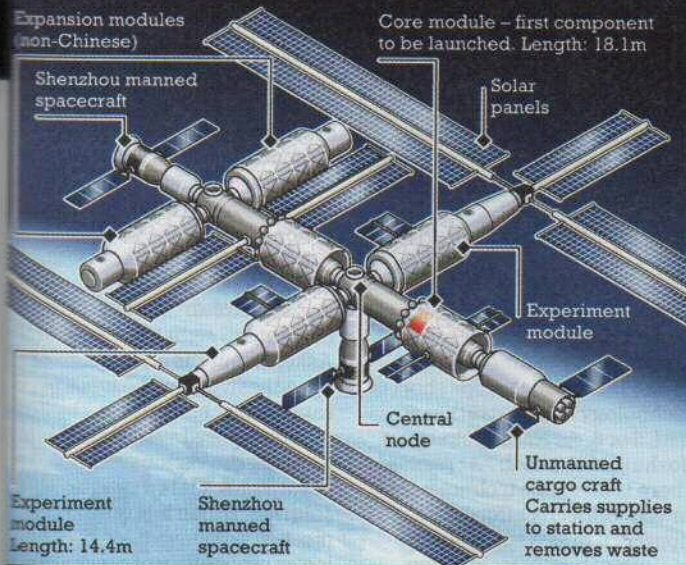
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China Space Station mock-up in the China Science and Technology Museum, Beijing



China's national space agency is forging ahead with ambitious plans to launch a manned space station by 2023. The orbiting outpost will support up to six crew and provide room for international modules



International Space Station (ISS)	Chinese space station	Mir space station (Russia)
Weight: 420 tonnes	90 tonnes	130 tonnes
Maximum length: 109m	37m	31m
Operational lifetime: 1998-2020/2028	2023-	1986-2001

China is planning to launch its first space station

and will require a good deal of political will to resolve.

Space neighbours

The first notable cross-border manned mission was the Apollo-Soyuz Test Project of 1975, when Russian and US astronauts performed a historic 'handshake in space'. A special adapter allowed the Apollo capsule to dock with the Soyuz. Later political accords led to Russia's critical involvement with the ISS – so critical that Soyuz became the only way for American astronauts to access the station. Cooperation was alive and well.

The ISS has been permanently occupied for 15 years, but none of the 220 people from 17 nations that have served on it have been Chinese. One could surmise that had the US agreed to cooperate with China, there would be no plans for a China Space Station today. At IAC, Nasa administrator Charles Bolden acknowledged the prospect of the USA being left out of future international space collaboration: "We will be on the outside, looking in," he said.

If the docking standard fails to become universal, Bolden's fear may become the literal fate of Nasa's astronauts.



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