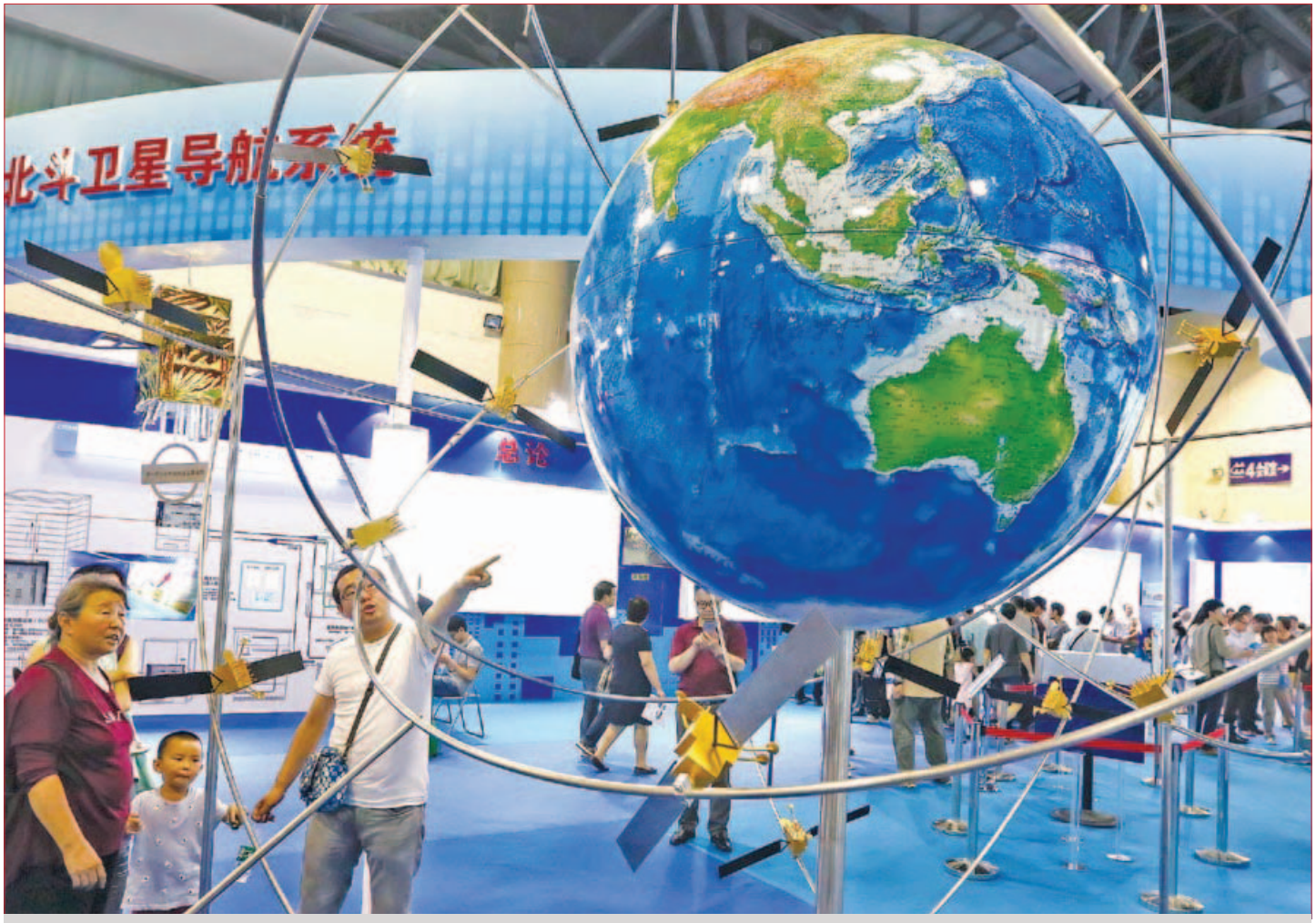
All About The Chinese Space Programme

# Go TAIKONAUTS!

龙腾太空

Issue 19 | November 2017




A model of the Beidou satellite navigation system attracts visitors in Beijing. credit: China Daily

## Content

Chinese Space Quarterly Report
January - March 2017 ..... page 02

Space Policy – two White Papers for China's space programmes:
White Paper on China's Space Activities 2016 ..... page 08

Space Policy – two White Papers for China's space programmes:
China's BeiDou Navigation Satellite System ..... page 10

Mamma I Made It! How I Ended Up Exploring FAST -
China's Massive Five-Hundred Meter Aperture Spherical Telescope in Guizhou ..... page 12

## Preview for Issue no 20

- Quarterly Report
  April - June 2017
- Visit to the Qian Xuesen Library in Shanghai
- Belt-and-Road Forum and China's Space Silk Road

expected publishing date: end of December 2017

## Preview for Issue no 21

- Quarterly Report
  July - September 2017
- Report from the Wuhan International Commercial Forum
- Touristic impressions from the 2nd Long March 5 launch

expected publishing date: January 2018

# Chinese Space Quarterly Report
## January - March 2017
**by Chen Lan/Jacqueline Myrrhe**

## SPACE TRANSPORTATION

### TIANZHOU 1

On 12 January, the readiness review meeting for cargo craft Tianzhou 1 (TZ-1) took place successfully. TZ-1 left the factory in Tianjin on 17 January and departed on 5 February from Tianjin port for Hainan Island, where it arrived on 13 February for assembly and testing. The launch date on-board the Long March-7 Y2 carrier (CZ-7 Y2) was given as mid-April. Tianzhou 1 has a take-off weight of approx. 13 t, of which 6 t are payload capacity. The CZ-7 Y2 carrier rocket arrived at the launch centre after one week of sea and rail transportation on 11 March for assembly and testing.

At the beginning of March, the mission objectives for TZ-1 were published: three rendezvous and docking manoeuvres with Tiangong 2 (TG-2), two-months of flight in combination with TG-2, three refuelling operations, autonomous flight for a duration of three months, together with experiments and tests.

Tianzhou 1 during processing. credit: China Spaceflight.com

Tianzhou 1 during preparation for space environmental testing. credit: China Spaceflight.com

### LONG MARCH

Li Tongyu, the Head of Rocket Development at the China Academy of Launch Vehicle Technology (CALT) said on 27 February that the development of the next generation modular, medium-lift Long March 8 (CZ-8) rocket carrier is about to start and that a first test-flight may be expected by 2018. CZ-8, CZ-5 and CZ-7 use a similar engine design.

CZ-8 is supposed to serve as a low-cost, commercial LEO launcher for the satellite market, capable of sending a 4.5 t payload to sun-synchronous orbit, or 2.5 t to geosynchronous transfer orbit. The Academy plans to produce 100 CZ carrier rockets over the next three years to meet the demand.

At the beginning of March, Wu Yanhua, the Deputy Director of China National Space Administration (CNSA), said that the early-study phase for the heavy-lift launch vehicle Long March 9 (CZ-9) has started. Its first flight is planned for around 2028/2030.

Qin Xudong, Director Designer of CALT (China Academy of Launch Vehicle Technology), said the project is labelled: “One Overall - Three Big”. “One Overall”, relates to the optimisation of the overall system, “Three Big”, refers to the design, manufacturing and testing of big-calibre rockets; 480 t of high-thrust (big power) liquid oxygen and kerosene engines; and 220 t of high-thrust (big power) hydrogen and oxygen engine. The CZ-9 is projected to lift 3,000 t of take-off weight. Payload capacity to LEO is 140 t and the lunar transfer capacity is planned to reach 50 t, which meets the needs of future crewed lunar missions, lunar habitats, Mars exploration and further deep-space exploration.

### AIR LAUNCH

China intends to develop a new generation of air launch rockets, able to launch from an aircraft and capable of carrying satellites of 100 to 200 kg into LEO, Li Tongyu, the Head of Rocket Development at CALT told media. The Y-20 strategic transport plane, with a take-off weight of 200 t and a maximum payload capacity of 66 t, would be the carrier airplane. It requires only 12 hours of preparation.

### YUANWANG

Yuanwang 5 left port on 29 March and Yuanwang 6 started its journey on 27 March.

## SATELLITES

China’s first commercial high-resolution Earth observation satellite network, developed by China Aerospace Science and Technology Corporation (CASC), has begun to operate. Images taken by Gaojin (GJ or SuperView) 1A and 1B, the first two satellites of the 24-satellite Gaojin system, were released. They show the Potala Palace and a local convention centre in Lhasa, Tibet and the Hong Kong Convention and Exhibition Center. The Gaojin system, to be completed by 2022, will consist of 16 optical satellites like the Gaojin 1A and 1B, four optical satellites that are more advanced, four radar satellites and several mini-satellites.

An image of the Potala Palace in Lhasa, Tibet Autonomous Region, taken by the Gaojin satellite. credit: CASC; China Daily

Fengyun 4, the first of China’s second-generation GEO orbiting weather satellites, has transmitted its first collection of images and data. The images were obtained by the multi-channel scanning imagery radiometer and the atmospheric sounding interferometer. The data, obtained by the lightening imaging

sensor, contains information on the distribution and intensity of lightening, according to Tian Yulong, Chief Engineer of the State Administration of Science, Technology and Industry for National Defence (SASTIND). Fengyun 4 is expected to be fully operational by June/July.

## MANNED SPACE FLIGHT

### TAIKONAUTS

On 20 January, a ceremony was held to honour the two crew members of the Shenzhou 11 space mission for their outstanding contributions to the country's space project. Jing Haipeng, Commander and a third-time space traveller, was honoured with a first-class aerospace achievement medal, and Chen Dong, a first-time space traveller, was awarded a third-class medal and the honorary title "heroic astronaut".

On 31 March, both were honoured for being 2016's top influencers. The award was given by Hong Kong-based Phoenix TV to those who have greatly influenced people in the country and beyond. They were hailed by the public as the best presentation of the Chinese spirit.

During the annual Spring Festival CCTV Gala, China's 11 taikonauts made an appearance. They hoisted the Chinese flag and left their hand-prints in moulds which are going on display in the Aerospace Objects Exhibition at the National Museum of China in Beijing.

On the side-lines of the annual sessions of the National People's Congress, Liu Yang, who is also a deputy to the National People's Congress, told media: "The main plan for this year is that the entire second batch of Chinese astronauts shall focus on studying and training for extravehicular activity and extravehicular maintenance." She also stressed that China needs more female astronauts to join the team.

### CSS

At the National People's Congress, it was confirmed that China will launch the core module Tianhe 1 for the Chinese Space Station (CSS) in 2018 as the first step in the station's assembly. It will be carried by the new-generation Long March 5 heavy-lift rocket, said Bao Weimin, Director of China Aerospace Science and Technology Corporation (CASC) and a member of the National Committee of the Chinese People's Political Consultative Conference (CPPCC). The assembly of the core module is completed and tests are currently under way. According to Bao, the CSS's life-time is expected to be "dozens of years" and that it can cope with the impact of space debris smaller than 10 cm. All key parts of the CSS will be serviceable and replaceable.

### NEXT GENERATION CREWED SPACECRAFT

At the beginning of March, Zhang Bainan, engineer with CASC said that China is working on a new manned spaceship that can fly into LEO, as well as for Moon-landing missions. The spacecraft is planned to be recoverable and has a larger capacity than the new generation crewed spacecraft of other space nations. Last year, the re-entry module of the new spacecraft was tested aboard a CZ-7 rocket.

## LUNAR AND DEEP-SPACE EXPLORATION

### MOON

Ouyang Ziyuan, Chief Scientist of China's Lunar Exploration Programme (CLEP), said at the beginning of January that five universities and research institutes have set standards for digital mapping and drawing of the Moon's geological structure. They are compiling a 1:2.5 million scale geological map of

### Chang'e 5 – a brief overview

Chang'e 5 is designed for launch on top the heavy-lift carrier rocket CZ-5 from Wenchang Space Launch Center in Hainan province. Initially planned for 30 November, the launch needed to be postponed until 2019 because of problems with the CZ-5 in July 2017. The mission's objective is to bring 2 kg of lunar soil and rock samples back to Earth. It will be the first lunar sample return mission since Luna 24 in 1976. The complete mission is planned to take one month, becoming China's most sophisticated lunar expedition with demanding flight manoeuvres and challenging conditions on the landing site in the region of Mons Rümker.

The 8.2 t probe is composed of 4 units: orbiter/service module, lander, ascender and re-entry module. After Chang'e 5 reaches lunar orbit, the 4 components will separate into two sections, with the orbiter and re-entry module staying in lunar orbit while the lander and ascender descend to the Moon's surface. The lander and ascender, aided by small retro-rockets, will soft-land at Mons Rümker. On the Moon, a driller will collect sub-surface samples from a depth of 2 m and a mechanical arm will be deployed to scoop the surface regolith material. The samples will be stored in the ascent unit.

After two days, the ascent unit is scheduled to launch back into lunar orbit to rendezvous and dock with the re-entry module. There, the collected lunar samples will be transferred to the Earth return-module, for transport to Earth. The return vehicle will then separate from the orbiter/service module unit and re-enter Earth's atmosphere using a manoeuver known as a 'skip re-entry'.

Like China's Shenzhou crewed spacecraft, Chang'e 5 is expected to land in Siziwang Banner, Inner Mongolia Autonomous Region.

The samples are intended for research and investigation in China and for the world-wide science community.

A successful Chang'e 5 mission would conclude the 3rd phase of CLEP and pave the way for China's future manned Moon exploration. The cost for the Chang'e 5 lunar sample return mission is estimated at 20 billion RMB (3 billion U.S.$).

Chang'e 4 is scheduled for 2018. The mission profile includes the world's first soft-landing on the far side of the Moon. China also plans to explore the two lunar poles in the near future, marking the extended phase of CLEP around 2020.

### Chang'e 4 – the most important facts

The Chang'e 4 mission was originally planned as the back-up of Chang'e 3. But the successful Chang'e 1 to 3 missions provided the opportunity to give Chang'e 4 a new mission profile. The updated Chang'e 4 mission requires two launches. Around May 2018, a relay communications relay satellite will be launched and placed at the Earth-Moon L2 point. In December 2018 the actual mission, consisting of a lander and rover for deployment on the far side of the Moon, will follow. The landing unit will potentially touch-down near the Von Kármán crater in the Aitken Basin at 45.5 S, 178 E.

For the first time, China considered private investments for a space mission. Also, 4 of the 11 scientific payloads will be delivered by foreign institutions from Germany, the Netherlands, Sweden and Saudi Arabia. The main mission objectives are the study of geological conditions and topography on the far side, low frequency radio astronomy observations, radiation environment characterisation and the interaction between solar wind and lunar surface.

the Moon. A sketch version of the map, 4.36 meters by 2.2 meters, will be finished by 2018, and released by 2020.

### CHANG'E 5

At the end of January, it was announced that the launch of the Chang'e 5 lunar sample return mission is planned for the 30 November 2017 from the Wenchang Space Launch Center in southern China's Hainan Province, aboard the heavy-lift carrier rocket CZ-5. Designers and engineers are carrying out tests of simulated launch, landing, sampling, and take-off of the lunar probe and work is proceeding well.

### CHANG'E 4

On 20 March 2017, a Memorandum of Understanding between the King Abdulaziz City of Science and Technology (KACST) and CNSA was signed. Saudi Arabia will contribute with a micro-imager to the lunar far-side lander mission Chang'e 4, scheduled for launch in 2018.

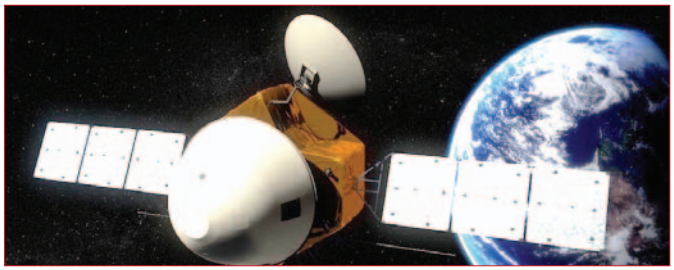
(Saudi Arabia also intends to participate in the One Belt - One Road (OBOR) initiative.)

### MARS

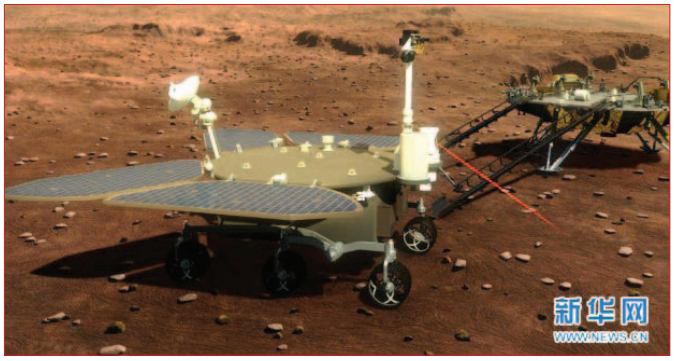
China has released a short-list of eight names, out of 35,900 proposals from people from all over the world, for China's first Mars spacecraft.

**1.** Fenghuang (phoenix)
**2.** Tianwen (ask heaven)
**3.** Huoxing (Mars)
**4.** Tenglong (soaring dragon)
**5.** Qilin (Kylin)
**6.** Zhuque (rose finch)
**7.** Zhuimeng (chasing dreams)
**8.** Fengxiang (flying phoenix)

The eight names were selected by a jury and via online polls. The final choice will be announced around the Chinese National Space Day, on 24 April.



Artists concept of the Chinese Mars orbiter. credits: SASTIND/www.news.cn




Artist impression of the Chinese 2020 Mars rover, driven off the lander unit and with deployed solar panels. credits: SASTIND/www.news.cn

### Mars mission – first facts

China's Mars mission was approved in early 2016 and is scheduled for launch in July or August 2020. The mission plan comprises an orbiter, lander and rover. The probe will be launched with a CZ-5 rocket from Wenchang Space Launch Center on Hainan island. After a 7-month-long journey of 400 million km, the probe will first enter Mars orbit, then release the lander which should soft-land, aided by parachutes and retro-rockets, in the Northern Hemisphere, between 5° and 30° North of the Mars Equator in 2021 (the 100th anniversary of China's Communist Party). The lander deploys the 6-wheeled, 200 kg rover, equipped with 4 solar panels, camera and radar and autonomous roving capability. The life expectancy of the lander unit is one Martian year (about 375 Earth days) while the rover's life-time is projected to be 92 Earth-days (3 Martian months). The orbiter will provide a data-relay service and remote sensing of the Mars surface. The main mission objectives of the Mars mission are: all-round exploration and high-precision scientific probing, studying the inner structure, soil, environment, atmosphere, ionosphere, water ice distribution, topography and ambient space of Mars. If successful, a Mars Sample Return mission could follow in the late 2020's.

In the meantime, the development of the model prototype of the Mars probe is proceeding smoothly. Preparations for satellite probes, ground-data application, rocket launches and monitoring and control systems have begun, and some revisions have been made to the initial design, optimisation and rounds of tests.

### FUTURE MISSIONS

By mid-March, China's National Space Science Centre (NSSC) selected 80 proposals for future innovative space science missions after assessing 136 submissions following a December 2016 Call for Proposals. The proposals cover space-based astronomy, astrophysics, solar physics, planetary science, microgravity science, life sciences and others. The selected ideas come from 39 organisations, research centres, universities and a few from industry. After an initial evaluation by 30 academicians, a review panel of 15 experts, headed by Ouyang Ziyuan, decided on the 80 finalists.

After an experts' discussion on the main scientific goals of China's deep-space exploration in the next two decades, the group decided to conduct expeditions to Mars, asteroids (NEOs) and then Jupiter and one of its moons. The scientists recommended to conduct a fly-by of an asteroid, then fly side-by-side with asteroid Apophis to conduct close observation, and after that, to land on a third asteroid, the asteroid 1996 FG3, to conduct in-situ sampling analysis on the surface. The whole mission would last around six years. Scientists believe, investigation of asteroid 1996 FG3 might contribute to the search for the origins of life on Earth. Spectral analysis shows that it is a carbonaceous asteroid, so likely to contain organic components.

## ADVANCED TECHNOLOGY

The Chinese Academy of Sciences (CAS) confirmed on 18 January that China's quantum communication satellite QUESS-Micius (Quantum Experiments at Space Scale) is officially operational after four months of in-orbit testing of the satellite, payloads and space-to-ground links. Pan Jianwei, QUESS Chief Scientist, said that the research team has begun to carry out experiments and preliminary data has been obtained.

Composite photo taken on 9 December 2016. It shows a satellite-to-Earth link between "Micius" and the quantum teleportation experiment platform in Ali (Tibet) credit: Xinhua/ Jin Liwang

## INTERNATIONAL COOPERATION

### FRANCE

On 17 January 2017, NOVESPACE, the French provider for parabolic flight campaigns in Europe and a CNES subsidiary, signed an agreement in Beijing with China's Technology and Engineering Center for Space Utilisation (CSU), a sub-ordinate of the Chinese Academy of Sciences for the operation of parabolic flight campaigns. The contract is initially for one year with two options of extension. CSU has already flown two experiments during campaigns in 2015 and 2016 on campaigns organised by the German Aerospace Centre DLR. During the upcoming flights, Chinese researchers intend to test hardware for experiments on the future CSS. For the time being, flights will be conducted from Bordeaux in France but might take-off from China in the future.

### BELARUS

Belarus and China started cooperation on a space exploration project. Deputy Head of the Belarus President Administration, Nikolai Snopkov, made the statement on 19 January during an event, dedicated to the 25th anniversary of Belarus-China diplomatic relations. It is not known which project was meant. China launched the first Belarusian communication satellite BELINTERSAT 1 in January 2016. On another occasion – at the end of March, Andrey Abramov, BELINTERSAT 1 Project Director, said Belarus sees huge prospects for mutual beneficial cooperation with China in the space field. He confirmed that the satellite operates successfully, providing broadcast service for domestic users but also for customers in other European countries, Asia and Africa.

### BRICS

The space agencies of the five BRICS Member States (Brazil, Russia, India, China, South Africa) agreed to share spatial data and images of natural resources from their remote-sensing satellites for utilising space assets optimally, said Indian Space Research Organisation (ISRO) Director Mylswamy Annadurai at an international seminar on aerospace technologies as part of "Aero India 2017" in Bangalore on 13 February. The BRICS nations also plan to share similar data for tele-education, tele-medicine and societal applications, utilising the excess capacity of their respective satellites for their mutual benefit.

### EGYPT

On 21 March 2017, China and Egypt signed a new cooperation agreement which includes a Chinese contribution of 64 million U.S. $ to the Egyptian Earth observation satellite programme EgyptSat. It was not clear whether the money would be used for building the replacement of EgyptSat 2 that failed in 2015 or whether it would be invested in a new satellite programme. A second agreement states that China gives a 23 million U.S. $ grant for an Egyptian satellite test, integration, and assembly facility. This facility could make Egypt self-sufficient in the manufacturing of satellites and satellite hardware.

### EUMETSAT

On 15 March 2017, Alain Ratier, Director-General of EUMETSAT and Wu Yanhua, Vice Administrator of CNSA signed an agreement for the continuation and expansion of the cooperation in the field of weather and climate monitoring. The agreement comprises "data exchange, scientific cooperation and coordination of respective observation systems in the context of the World Meteorological Organisation, the Global Architecture for monitoring climate from space, the Coordination Group for Meteorological Satellites and the Committee for Earth Observation Satellites".

### ITALY

Wang Zhaoyao, Director of the China Manned Space Agency (CMSA) and Roberto Battiston, President of the Italian Space Agency (ASI) signed a framework agreement on cooperation in the area of human space flight. It aims at flight opportunities for scientific experiments on-board the CSS. The signature ceremony on 22 February in Beijing was attended by Chinese President Xi Jinping and the Italian President Sergio Mattarella.

The agreement foresees also the establishment of a Joint Cooperation Committee which will meet at least once a year to discuss the modalities of the partnership, aiming at access to scientific data, joint scientific publications, exchange of staff and joint participation in technical reviews on human space flight.


Wang Zhaoyao (right) and Roberto Battiston (left) signed a framework agreement on space cooperation. credit: CMSA

### RUSSIA

Russia's southeastern Zabaikalsky Territory, in the Far East, could become home to a Russia-China Joint Space Studies Centre for cooperative work on space studies. This regional aerospace industry centre could provide support to the Vostochny cosmodrome. The initiative is part of the comprehensive plan of the region's social and economic development.

Russia and China intend to set-up a joint Differential Corrections and Monitoring (SDCM) High-Precision Satellite Navigation System, which would be achieved by expanding the two countries' network of SDCM system stations working with the Russian GLONASS and Chinese BeiDou satellite navigation systems. The system, intended for use by the BRICS group of countries and the Shanghai Cooperation Organisation (SCO), is planned to have a positioning accuracy of around 1 m and will start with the creation of 3 Russian stations in China and 3 Chinese stations in Russia. 46 more SDCM ground stations are planned to be constructed in Russia and 8 more on its neighbouring countries' territories.

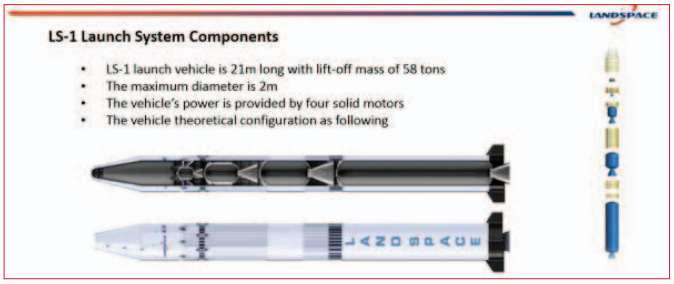
## COMMERCIAL SPACE

Landspace Technology Corporation, a private aerospace company based in Beijing, signed a contract with Danish company Gomspace on 14 January, to launch in 2018 a series of satellites on board its Landspace 1 rocket. It is the first time for a private Chinese company to provide satellite launching services to the international market.

Baidu Chief Executive Officer Robin Li, addressed the governmental regulators to create more favourable conditions for private enterprises to collaborate on research. He proposed to the Chinese government to enact policies to encourage

private investment in rocket and satellite production and launch technology to promote the evolution of Chinese private enterprises into space-exploration leadership.

The signature ceremony between GomSpace and Landspace. credit: Landspace



Landspace 1 rocket system components. credit: Landspace

## RESEARCH AND DEVELOPMENT

The Institute of High Energy Physics, the National Astronomical Observatories, and the Shanghai Institute of Microsystem and Information Technology initiated the construction of the world's highest altitude gravitational wave telescopes at 5,250 m above sea level. The first telescope, code-named Ngari No.1, is currently built 30 km south of Shiquanhe Town in Ngari Prefecture in the Tibet Autonomous Region. Once Ngari No. 1 is operational in 2021, it is able to detect and gather precise data on primordial gravitational waves in the Northern Hemisphere. The second construction phase will install a series of telescopes, code-named Ngari No. 2, at 6,000 m above sea level.

China Academy of Launch Vehicle Technology (CALT) in Beijing has achieved progress in key technologies for the development of re-usable rockets. The system would bring the rocket engine and booster back to the ground by either parachute-airbag landing or propulsion-aided landing. Both technology variants have gone through partial experimental validation. Each of the recovered rockets must be capable of carrying out 30 to 50 launch missions. Already two years ago, a large-scale field test for the parachute landing technology was completed. It involved a set of multiple parachutes, stored in the first stage of the rocket. The parachutes deploy after the first stage separation and additionally, an airbag inflates under the discarded part of the rocket, which cushions the impact upon hitting the ground. A final decision, on which technology will be viable for the future, will be made before 2020. Besides saving operational costs, the recovery would also reduce the threat of debris falling to the ground.

## EDUCATION

81 school students from Auckland, New Zealand teamed up with 120 students from Auckland's twin city in China, Ningbo, to do joint research on hydroponic plants and their capability to feed astronauts during a long journey to Mars or on the ISS. During a workshop in Auckland, the students used iPads to listen to interviews with scientists from China and hydroponics experts from New Zealand, then selected three seedlings to plant in a hydroponic set-up at Birkdale Intermediate School's technology centre. After the Chinese students returned home, they were kept informed about the plant's status via weekly reports and photographs from their project partners.

From March to June, an educational space exhibition for school students was shown at China's Wenchang Space Launch centre on Hainan Island. Exhibits included the Shenzhou 10 re-entry capsule, a Chinese made space suit, a model of the Yutu lunar rover, the 2020 Mars lander with rover, scale models of the future Chinese Space Station and models of Chanzheng rocket family. VR space experience and a two-seater gyroscope simulating astronaut training complete the exhibition, which will grow into a space theme park to be finished by the end of the year.

## MISCELLANEOUS

Ren Xinmin, who contributed significantly to China's aerospace industry, died on 12 February in Beijing at the age of 102. Ren was an expert in missile and rocket technologies who helped build China's first missile and first artificial satellite. In 1992 he pushed for China's manned space flight programme. Alongside Tu Shou'e, Huang Weilu and Liao Shounie, he was regarded as one of the "Four Elders of China's Aerospace", only exceeded by the founder of China's aerospace industry, Qian Xuesen.

CALT's space-spin-offs: By using cutting-edge technologies from rocket development, CALT designed a high-performance air purifier for almost half the price of its competitors. To date, 10.000 Alpha-blue air purifiers have been sold only to space industry or hospitals by its subsidiary Beijing Ares Technology Co., but it will enter now the public market. Alpha-blue air purifiers are designed with nanoplatinum particle coated filter screens, adapted from rocket production. Also, knowledge of aerodynamics, composite materials and remote-control technologies known from the rocket development have been used.

The Ministry of Environmental Protection said in February that it will build by 2020, a space-and-ground observation system with satellite remote sensing technology to monitor ecological changes and activities inside nature reserves, as well as to implement its ecological "red line" strategy. From 2017, authorities will conduct remote sensing monitoring on all national-level nature reserves twice a year.

## TELECOMMUNICATION

By the end of March, China Aerospace Science and Industry Corporation (CASIC) announced its plans to build a LEO satellite network of 156 mini-satellites in 1,000 km orbits. The intention is to launch the first satellite before 2018, and 4 more by 2020 to form the initial constellation. By the end of the 14th Five-Year Plan (2021-2025), all 156 satellites will be in operation to enable global broadband coverage.

## NAVIGATION

**Navigation – BEIDOU**

On the sidelines of the 5th session of the 12th CPPCC National Committee, Yang Yuanxi, Deputy Chief Designer of the BeiDou satellite navigation system (BDS) explained the plan of launching 6 to 8 BeiDou-3 (12-year lifespan) satellites in 2017. 35 BeiDou satellites are supposed to form an orbiting satellite network and offer worldwide navigation services by 2020. The aim is to accelerate its expansion into economies along the Belt

and Road Initiative by 2018.

Du Li, General Manager of Wuhan Optics Valley BeiDou Holding Group Co., intends to build a China-ASEAN science and technology city in Thailand for promoting BDS applications. Wuhan Optics Valley Beidou also cooperates with Sri Lankan related authorities to develop at least 10 Continuously Operating Reference Stations (CORS) in the South Asian country, extending BDS's coverage approx. 3,000 km towards Southeast and South Asia. Du Li stated that his company will continue to explore models for international scientific and technical cooperation on BDS, including the joint construction of base stations, joint technical development and research, personnel training and exchanges, and others.

### ABBREVATIONS

| | |
|---|---|
| ASI | Italian Space Agency |
| BDS | BeiDou satellite navigation Systems |
| BRICS | Brazil, Russia, India, China, South Africa |
| CALT | China Academy of Launch Vehicle Technology, 1st Academy of China Aerospace Science and Technology Corporation CASC |
| CAS | Chinese Academy of Sciences |
| CASC | China Aerospace Science and Technology Corporation |
| CASIC | China Aerospace Science and Industry Corporation |
| CLEP | China's Lunar Exploration Programme |
| CMSA | China Manned Space Agency |
| CNSA | China National Space Administration |
| CSS | Chinese Space Station |
| CSU | Technology and Engineering Center for Space Utilisation |
| CZ | Long March, Changzheng |
| GEO | Geostationary Orbit |
| ISS | International Space Station |
| ISRO | Indian Space Research Organisation |
| LEO | Low Earth Orbit |
| NSSC | China's National Space Science Centre |
| NEO | Near Earth Asteroid |
| QUESS | Quantum Experiments at Space Scale |
| SASTIND | State Administration of Science, Technology and Industry for National Defense |
| SCO | Shanghai Cooperation Organization |
| SZ | Shenzhou |
| TG | Tiangong |
| TZ | Tianzhou |
| VR | Virtual Reality |

## LAUNCH EVENTS

2017-001A
5 January 2017 - 15:18 h UTC

**Launch site:** Xichang Satellite Launch Center – XSLC; LC2
**Launcher:** CZ-3B/G2 (Y39)
**Payload:** Tongxin Jishu Shiyan 2 (TJS-2; TXJSSY-2)

China's first orbital launch of the year took place from the Xichang Satellite Launch Center in southwest China's Sichuan Province on 5 January 2017 at 23:18 h Beijing Time. The Long March CZ-3B/G2 rocket delivered the experimental, new generation, high-capacity communications and broadcasting satellite, designed for satellite communications and data transmissions, Tongxin Jishu Shiyan 2, to a geostationary transfer orbit (GTO). Later, the satellite reached the GEO orbit by means of its own propulsion. The satellite was built by the Shanghai Academy of Spaceflight Technology (SAST) and will also demonstrate multi-spectral broadband high-speed data transmissions. Not much is known about the satellite which is also named TXJSSY-2 or TJS-2. Video images showed a six-sided body with two solar panels. It is probably a military 'signals intelligence - SIGINT' early-warning satellite.

The launch from Xichang had been expected for 30 December 2016 and was postponed on 4 January 2017 by another 24 hours due to bad weather.

2017-002A
2017-002B
2017-002C
9 January 2017 - 04:11 h UTC

**Launch site:** Jiuquan JSLC, Mobile Launch Platform
**Launcher:** Kuaizhou 1A - KZ-1A (Y1)
**Payloads:**
2017-002B: Jilin 1 Smart Video 03 (or: Jilin 1 Lingqiao Shipin 03, "Lingqiao" means "smart"; "Shipin" means "video"), also called: Linye 1 (Forestry 1);
2017-002A: Xingyun Shiyan 1 (Xingyun Test 1);
2017-002C: Kaidun 1 "Caton 1"

With the first launch of the improved Chinese Kuaizhou 1A rocket on 9 January 2017, three satellites reached their orbits. The rocket's payload capacity for polar orbits is 300 kg. In contrast to the former variant, the payloads do not remain attached to the upper stage. Developed by CASIC, the launcher is commercialised by the China Space Sanjiang Group Corporation (EXPACE).

The Jilin 1 Lingqiao Shipin 03 satellite is a multi-functional remote-sensing satellite, providing high-definition video images which is expected to be used over 3 years for land resource and forestry surveying, environmental protection, transport and disaster prevention and relief purposes. It belongs to the Jilin commercial Earth observation programme and produces 1.3 m resolution videos with a swath of 11 km × 4.5 km, mainly for forestry purposes. With its 1.1 x 1.1 x 1.3 m box-shaped body and the two 5.5 m wingspan solar panels, it weighs 95 kg (other sources say: 165 kg).

The original launch date from Jiuquan had been 31 December 2016 and was delayed from 6 January 2017.

**2017-002A and 2017-002C: Double Cubesat Mission: Xingyun Shiyan 1; Kaidun 1 "Caton 1"**

There were also two 2U 10 x 10 x 20 cm large cubesat satellites on board the Kuaizhou 1A rocket that have not been assigned their respective COSPAR designations yet.

The Xingyun Shiyan 1 (XY-S1) and Caton 1 are experimental satellites to test technologies of low-orbit narrow-band communication and VHF Data Exchange System (VDES) respectively.

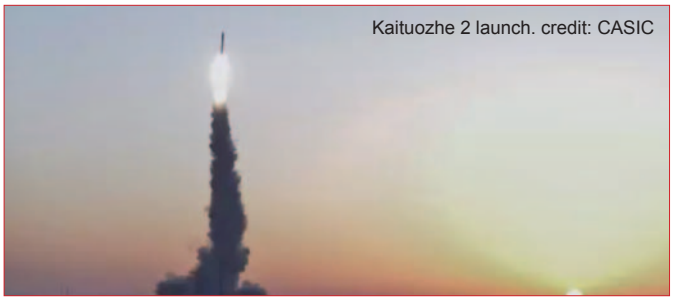
The technology satellite Xingyun Shiyan 1 (XY-S1) was built by the Northwestern Polytechnical University, is covered by solar cells and weighs 2.79 kg. It performs communications experiments within the L-band. It is paying the way for CASIC's Xingyun narrowband LEO constellation.

The second 2.72 kg heavy cubesat Caton1 (also named Kaidun 1) was built by the Beijing Kaidun Universal Technology Co. Ltd. in cooperation with the MSI Technology Department and the Nanjing University and Technology Ltd. It shall test a VHF data exchange system (VDES) to transmit long-distance marine traffic automatic identification system (AIS) signals via Inmarsat satellites.

2017-012A
2 March 2017 - 23:53 h UTC

**Launch site:** Jiuquan Satellite Launch Center (JSLC)
**Launcher:** Kaituozhe 2
**Payload:** Tiankun 1

The three-stage solid-fuel rocket Kaituozhe 2 (also named: Kaituo 2; KT-2) lifted-off on 2 March 2017; 23:53 UTC (3 March; 7:53 h BJT) from the northwestern Jiuquan Satellite Launch Center for its maiden flight. Its main purpose is to launch commercial payloads up to 350 kg into LEO. Original plans called for a launch on 28 February 2017.


Kaituozhe 2 launch. credit: CASIC

KT-2 launched CASIC's first ever satellite, the technological experimental satellite Tiankun 1 (TK-1). It is box-shaped, has two solar panels and weighs approximately several hundred kilograms.

Its main task consists of testing a new satellite bus with its different components. Among other things, a visual/infrared Earth observing camera, a special communications payload and a microwave radiation detector are on board. This mission serves the preparation of the Hongyun program of commercial internet satellites, similar to OneWeb. The first test satellite is to follow by 2017. The Hongyun network shall comprise 40 satellites by 2019 and be completed with 156 satellites in 2021.

# Space Policy – two White Papers for China's space programmes

**by Jacqueline Myrrhe**

Since President Xi Jinping took up duty, he has repeatedly stressed the far-reaching importance of science and technology and the need of an innovation-driven strategy for the further successful economic and societal development of the Chinese nation. To that end, specially targeted measures need to be and have been implemented. In his speeches, President Xi calls for a close interlocking between science, research and the economy as well as for a deep integration of industry, universities and research to increase the contributions of science and technology to economic growth.

Furthermore, it became obvious, that growth by purely extending economic production had reached its limit. China's economic and social development will largely depend on science and technology through scientific discoveries, through the realisation of so-called 'Mega Projects' such as the Beidou navigation system, the High-Resolution Earth observation network, the ground station network, and through new inventions and technological innovation.

Innovation and technology are the main pillars of the future and should become the indispensable hallmark of the modern Chinese society, President Xi said: "Innovation is the soul of a people and the source for a country's prosperity".

Key technologies of high importance for governmental support are: aviation engines, quantum teleportation, intelligent manufacturing and robots, deep-space and deep-sea probes, new materials, brain science and health-related science.

There is a clearly defined roadmap for the scientific and technological development of China. The projected milestone achievements are the following:

- Around **2020**, China belongs to the most innovative nations in the world;
- by **2030**, China is a leading innovator;
- by the centenary anniversary of the founding of the People's Republic of China in **2049**, the country will have become a world-leading science and technology power.

In the area of space, the programme for the

- BeiDou Navigation Satellite System;
- High-Resolution Earth Observation;
- Manned space flight;
- Moon exploration and,
- Space science;

are identified as the most suitable to support those milestones and objectives.

## White Paper on Space Activities 2016

On 26 December 2016, the "State Council Information Office of the People's Republic of China" published the document "White Paper on China's Space Activities" – the 4th of its kind. Since 2001 the 'White Papers on Space Activities' were published in parallel with the respective five-year-plans explaining the achievements and objectives of the national space activities.

The overall structure of the papers throughout this period has remained the same. i.e.:

**I.** Stating the principles and strategy behind the paper.

**II.** Summarising the current status and major events that occurred during the previous five years.

**III.** A review of the planning for the upcoming five years.

**IV.** A statement of the policies and measures defined to ensure completion of the goals and tasks.

**V.** The status of China's cooperation at international level.

And the guiding principle has remained consistent since 2001:

"The Chinese government takes the space industry as an important part of the nation's overall development strategy, and adheres to the principle of exploration and utilisation of outer space for peaceful purposes… In the next five years and beyond China will uphold the concepts of innovative, balanced, green, open and shared development, and promote the comprehensive development of space science, space technology and space applications, so as to contribute more to both serving national development and improving the well-being of mankind."

### Principles

- Innovative development - China takes independent innovation as the core of the development of its space industry.
- Coordinated development - All space activities are coordinated under an overall plan of the state to promote the comprehensive development of space science, space technology and space applications, and to improve the quality and efficiency of overall space development.

- Peaceful development - China always adheres to the principle of the use of outer space for peaceful purposes, and opposes the weaponisation of or an arms race in outer space.
- Open development - China persists in combining independence and self-reliance with opening up to the outside world and international cooperation... for mankind as a whole and its long-term sustainable development.

China's strategy has three major characteristics: 1. consistency, 2. consistency and 3. consistency.

Changes or improvements are done step-by-step and gradual. No big leaps forward! China is and remains open to international cooperation.

China's space activities are rationally arranged: Priority is given to the construction and application of space infrastructure, alongside support for space exploration and space science research, in China's ongoing efforts to expand its capacity to enter and utilise space and enhance the guarantee of space security.

**The road ahead - focal points for the next 5 years:**

- Enhance the basic capacities of its space industry,
- strengthen research into key and cutting-edge technologies,
- and implement manned spaceflight,
- lunar exploration,
- the BeiDou Navigation Satellite System,
- high-resolution Earth observation system,
- new-generation launch vehicles,
- start new key scientific and technological programmes and major projects,
- complete the space infrastructure system,
- expand its space applications in breadth and depth,
- conduct research into space science,
- Promote the integrated development of space science, technology and applications.

**Space transport system**
- Develop and launch medium-lift launch vehicles which are non-toxic and pollution-free;
- Research key technologies for developing heavy-lift launch vehicles and initiation of the heavy-lift launcher project;
- Research into the technologies for low-cost launch vehicles, new upper stages and the reusable LEO space transportation system.

**Space infrastructure**

Development of three major satellite systems of:
- Multi-functional, high-resolution, global networks for remote-sensing of land, ocean, atmosphere;
- Both fixed and mobile communications and broadcasting as well as data relay satellites;
- Continuously enhance the service capacities of navigation and positioning through serving Belt-and-Road users by 2018 and global users by 2020;
- Build synchronously, a space-ground integrated information network consisting of TT&C stations, gateway stations, uplink stations, calibration fields and other facilities for laying a foundation for exploring and developing cislunar space.

**Manned spaceflight**
- Launch the Tianzhou 1 cargo spacecraft to master key technologies for cargo transport and replenishment;
- Start assembly and operation of the space station;
- Acquire key technologies and conduct experiments.

**Deep-space exploration**
- Fulfil the three strategic steps of "orbiting, landing and returning" (Chang' e-5);
- Achieve mankind's first soft-landing on the far-side of the Moon, and conduct in-situ and roving detection and relay communications at Earth-Moon L2 point (Chang'e-4 - 2018);
- Accomplish China's first Mars exploration operation in 2020 for orbiting, landing and roving exploration;
- Return samples from Mars, conduct exploration of asteroids, the Jupiter system and through planetary fly-by.

**Experiments on new space technologies**
- Launch technology experiment satellites Shijian-13, Shijian-17 and Shijian-18, and a global carbon dioxide monitoring satellite;
- Conduct experiments on key technologies for new electric propulsion, laser communications and common platforms of new-generation communications satellites;
- Build in-orbit servicing and maintenance systems for spacecraft;
- In-orbit experiments on new theories, technologies and products by tapping various resources.

**Space launch sites**
- Improve existing space launch sites;
- Building of space launch sites that are open to cooperation and sharing;
- Integrated capacities and functions of space launch sites will be enhanced and exploited to meet various needs.

**Space TT&C**
- Operate a second-generation relay satellite system;
- Build a space-ground integrated TT&C network;
- Explore the development of commercial TT&C systems.

**Space applications**
- Consolidate the integrated application of space infrastructure, and enhance its ability to provide timely, accurate and steady services;
- Develop comprehensive satellite applications, such as new urbanisation layout, and smart towns and smart transport applications, to serve the coordinated development of its regions;
- Develop smart terminals of satellite applications and wearable electronics, improve space information fusion applications, and advance the industrialisation of space applications, fostering new growth points for the national economy.

**Space science**
- Implementation of a series of new space science satellite programs, establishment of a series of space science satellites featuring sustainable development, and reinforcement of basic application research.

*Space astronomy and space physics*
- Dark matter research;
- Hard X-ray modulation telescope;
- Research into large-scale structure and interaction models of solar-wind and the magnetosphere, and response to magnetospheric sub-storm change processes.

*Scientific experiments in space*
- Research in biology, life sciences, medicine and materials in the space environment.

*Quantum experiments in space*
- Research in the fields of quantum key transmission, quantum entanglement distribution, and quantum teleportation.

**Space environment**
- Improve the standardisation system for space debris, near-Earth objects and space climate;
- Enhance the space debris basic database and data-sharing model;
- Advance the development of space debris monitoring facilities, the early warning and emergency response platform

and the online service system, through integrated utilisation of resources.

**International Cooperation**
The Chinese government holds that all countries in the world have equal rights to peacefully explore, develop and utilise outer space and its celestial bodies. China maintains that international exchanges and cooperation should be strengthened on the basis of equality and mutual benefit, peaceful utilisation and inclusive development.

Since 2011, China has signed 43 space cooperation agreements or memorandums of understanding with 29 countries, space agencies and international organisations. It has taken part in relevant activities sponsored by the United Nations and other relevant international organisations, and supported international commercial cooperation in space.

**Priority** is given to activities:
- Within the framework of the United Nations;
- Of intergovernmental and nongovernmental space organisations' activities that promote development of the space industry;
- Strengthening the goals and serves the Belt and Road Initiative;
- Supporting the Asia-Pacific Space Cooperation Organisation (APSCO), BRICS and Shanghai Cooperation Organisation (SCO);
- For Moon, Mars and other deep-space exploration programmes;
- For the space station in China's manned spaceflight programme;
- In research and development of a space science satellite, a remote-sensing satellite, payloads;
- Construction of ground infrastructure such as data receiving stations and communications gateway stations;
- Satellite applications, including earth observation, communications and broadcasting, navigation and positioning;
- Exploration and research on space science;
- Launching and carrying (transportation) services;
- Space TT&C support;
- Space debris monitoring, early warning, mitigation and protection;
- Space weather cooperation;
- Import and export of and technical cooperation;
- Research on space law, policy and standards;
- Personnel exchanges and training in the space field.

*full text of "White Paper on China's Space Activities in 2016"*
*http://english.gov.cn/archive/white_paper/2016/12/28/*
*content_281475527159496.htm*

## White Paper on China's BeiDou Navigation Satellite System (BDS)

In June 2016, the "State Council Information Office of the People's Republic of China" published the document: "China's BeiDou Navigation Satellite System" – the first White Paper on the BeiDou navigation satellite system.

The document describes the aims and principles of the Chinese satellite navigation system, its development, applications and prospects for international cooperation.

**Goals of BDS development**
- The overall theme is: "The BDS is developed by China, and dedicated to the world." It is projected to provide continuous, stable and reliable services for global users.
- With BDS, China is building a world-class navigation satellite system to meet the needs of the country's national security as well as economic and social development of the nation. China has independently developed the BDS step-by-step with constant improvement.
- BDS serves the development of the Silk Road Economic Belt and the 21st Century Maritime Silk Road ("Belt and Road Initiative") and contributes through complementary use together with other global satellite navigation systems to international cooperation.

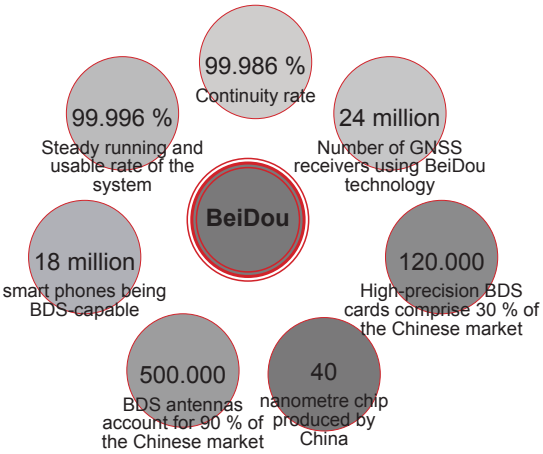
**Principles of BDS development**
- Independence in the construction, development and operation of the BDS.
- Openness in the provision of satellite navigation services free of charge (position determination is currently better than 5 m but a new chip will enable 1 - 2 m accuracy in positioning accuracy, velocity measurement accuracy of 0.2 m/s and time accuracy of 10 nanoseconds) and encouragement of all-scale, multi-level and high-quality international cooperation and exchange.
- Compatibility and interoperability with other existing global and regional navigation satellite systems.
- Gradualness in carrying out the BDS project step-by-step, enhance BDS service performance, and boost the development of the satellite navigation industry in a comprehensive, coordinated and sustainable manner.

**Application and Industrialisation**
"The Chinese government attaches great importance to the BDS application and industrialization, and promotes it as a strategic emerging industry. At present, China has built a complete BDS industrial chain comprised of chip modules, application terminals and operation services, and has set up three systems, including industrial supporting, application promotion and innovation."

**This objective includes:**
- Introduction of policies to improve the establishment of satellite navigation standard systems, promote the standards of verification and implementation and build a comprehensive service system of location data;
- Great efforts are being made to promote the application of BDS technologies and products, especially in key sectors related to national security and economy;
- Fostering an independent BDS industrial chain;
- Development of chips, modules, antennae, products based on BDS and other compatible systems;
- Promotion the integrated development of the BDS and Internet+, big data, and cloud computing, supports the integrated positioning and innovative utilisation of satellite navigation together with mobile communications, WLAN, pseudo-satellites, ultra-wide band and Ad Hoc Network signals, promotes integrated development of satellite navigation and emerging industries such as the Internet of Things, geographic information, satellite remote sensing and communication, and mobile Internet, and encourages people to start their own businesses;
- The most important application market is in the maritime field. More than 40,000 Chinese fishing vessels have BDS terminals installed. However, China is pushing forward close integration between satellite navigation and each industry in the national economy.

Since BDS is a project of national priority, the State Council published guiding policy documents:

*"Guidance on Promoting Information Consumption and Expanding Domestic Demands".*
*"Mid-to-long term plan regarding the national satellite navigation industry".*
*"Satellite Navigation Regulations of the People's Republic of China".*




**BDS characteristics**
**Space segment** - a hybrid satellite constellation.
**Ground segment** - ground stations, including master control stations, time synchronisation/uplink stations, and monitoring stations.
**User segment** - BDS basic products, including chips, modules and antennae, as well as terminals, application systems and application services.

The space segment is a hybrid constellation consisting of satellites in three kinds of orbits: Geostationary Earth Orbit (GEO), Inclined Geosynchronous Satellite Orbit (IGSO) and Medium Earth Orbit (MEO).
BDS provides navigation signals of multiple frequencies.
BDS integrates navigation and communication capabilities for the first time, and has five major functions - real-time navigation, rapid positioning, precise timing, location reporting and short message communication services.

**Three-Step Strategy of BDS Development**

**1st step**

**1994 - 2003** BDS-1 (BeiDou Navigation Satellite Demonstration System): installation of 3 GEO satellites for selected users within China

**2nd step**

**2004 - 2012** BDS-2: installation of a constellation of 14 satellites - 5 GEO satellites, 5 Inclined Geosynchronous Satellite Orbit (IGSO) satellites and 4 Medium Earth Orbit (MEO) satellites for users in the Asia-Pacific region (between 55 degrees North and 55 degrees South and 55 and 180 degrees East)

**Intermediate step 2/3:**

**until 2018**: placing 18 satellites into orbit for fundamental service to the countries along the Silk Road Economic Belt and the 21st-century Maritime Silk Road Project - Belt and Road Initiative

**3rd step**

**until 2020**: installation of a 35-satellite constellation for global service provision.

**BDS Improvements**
China is:
- Developing airborne atomic clocks with enhanced performance.
- Improving the performance and lifetime of satellites, and build more stable and reliable inter-satellite links.
- Enhancing the compatibility and interoperability with other navigation satellite systems.
- Building a national high-precision ground-based augmentation system network, with an operational accuracy aimed at the centimetre level.
- Prohibiting the production, sale and use of illegal interference devices, investigates and punishes in accordance with the law any hostile interference actions which affect the system operations and services.

credit: CNSA

Navigation satellite systems are the common wealth of the development of mankind, and also a space infrastructure which can provide all-time precise time and space information. They promote the development of emerging industrial clusters that are technology- and knowledge-intensive with huge growth potentials and sound comprehensive benefits, thus becoming critical support for national security, economic and social development, and increasingly improve the people' s production and living activities.

China will continue its BDS construction, improve the system performance, and fulfil its service commitments. It will persist in opening up and cooperation, promote the popularisation in this field, strive to advance satellite navigation applications worldwide, and make satellite navigation better benefit the wellbeing of the people and the progress of mankind.

*full text of "China's BeiDou Navigation Satellite System"*
*http://www.scio.gov.cn/32618/Document/1480601/1480601.htm*

# Mamma I Made It!
# How I Ended Up Exploring FAST
# - China's Massive Five-Hundred Meter Aperture Spherical Telescope in Guizhou!

**By Donovan - Don's ESL Adventure https://www.donesladventure.com/**

My trip to Guizhou's 500-meter Aperture Spherical Telescope, also known as FAST, was nothing short of an epic adventure. As a huge fan of any and everything that mega space agency NASA does and has done for as long as I can remember, hearing about China's unexpectedly bold participation in the search for extra-terrestrial life throughout the cosmos naturally caught my attention.

Made it! Donovan, the author, on the visitor's terrace of the FAST telescope. credit: Don's ESL Adventure https://www.donesladventure.com/

First, let's get to the facts: China's FAST telescope, dubbed the "Eye of Heaven", takes its place as the largest radio telescope in the world at a whopping 500-meters in diameter. Situated high above the ground in the natural karsts hill formations in Pingtang County, Guizhou, construction on the FAST telescope began in 2011 and it wouldn't become active until 2016. The telescope consists of 4,450 triangular panels, has a frequency of 70 MHz to 3.0 GHz, and is supported by six towers.

Its purpose? Pulsar observations, interstellar molecule detection, black hole emissions, and yada, yada, yada. Perhaps it is most renowned for serving as one of the strongest tools we have on this planet in the search for any signals from extra-terrestrial life hidden in the far depths of the universe. FAST telescope here I come!

It was March 2017 and China's Qingming Festival, commonly referred to as Tomb Sweeping Festival, was just around the corner. I was 100 % sure that I wanted to get out of Shanghai to make another exciting trip across the country, but I was 0 % certain as to where I wanted to go. After unsuccessfully settling in on a few ideal travel destinations - Yunnan, Dunhuang Crescent Lake, and Mongolia - I set my eyes on exploring the FAST telescope in Guizhou.

Visiting Guizhou's FAST telescope made perfect sense. Inexpensive roundtrip flight to Guizhou. Check. Located in a city brimming with beautiful natural scenery. Check. Something vastly different from the norm; a tourist attraction most people didn't know about that also aligned with my inner space geek. Hell-to-the-yeah! With that, I invited my friend - a local Chinese woman - to tag along on the journey and we'd set off on a fun 4-day adventure in Guizhou.

We landed in Guiyang, the capital city of Guizhou, on 2 April.


Guiyang. credit: Don's ESL Adventure https://www.donesladventure.com/

Honestly, the only thing we knew before arriving in Guiyang was where we'd sleep every night. THAT'S IT!

As for seeing the FAST telescope, we had no clue as to how to get there, how much tickets would cost, or if it'd even be open for tourism during the busy holiday. Likewise, we couldn't find any concrete information about bus lines or tourists shuttles to the FAST telescope on the internet in English or Chinese. Heck, we even went around the city by foot searching for travel agencies but came up empty, and angry. After more painstaking research we eventually settled on taking a high-speed train from Guiyang to Duyun, then hopping on a long-distance bus to Pingtang County. Sure, it was inconvenient, but it was our only solution.

Then it hit me: check in with the major hotel chains in the area about every possible way of getting to the FAST telescope. I remembered that every hotel in Guilin, for instance, had an arrangement with some travel agency about taking a cruise down Li River. It was worth a shot.

The first hotel we visited was the Sheraton Guiyang Hotel, which was located directly across from our 7 Days Inn. We walked straight up to the receptionist desk, inquired about the FAST telescope, and within minutes were booking our seat on a shuttle bus that would leave the next morning from Guiyang


Sheraton Guiyang Hotel. credit: Don's ESL Adventure https://www.donesladventure.com/

The ticket for the bus tour, lunch hotpot, access to the FAST Tourists Reception Center with visitor's observation deck, and the Pingtang International Experience Planetarium. credit: Don's ESL Adventure https://www.donesladventure.com/

directly to the FAST Tourists Reception Center in Pingtang. HAL-LE-LUJAH! HAL-LE-LUJAH! Did you see the bright light burst through the clouds too?

At 280 RMB a piece our tickets included round trip transportation to Pingtang, lunch, and entrance to the Pingtang International Experience Planetarium, which was also located at the site. We were pretty lucky to have found such a great deal, don't you think!?

The next day arrived and we took a taxi to the tour bus meeting point at DC Long Commercial Plaza in the early morning, where we'd depart promptly at 8:30 a.m.

FAST Tourists Reception Center.
credit: Don's ESL Adventure https://www.donesladventure.com/

By 11:30 a.m. we had reached Pingtang County and stopped to eat lunch - delicious hotpot - at a local restaurant. I was the only foreigner in the group so you can believe that I received all kinds of questions thrown at me about where I was from and what was I doing in China. I spoke as much Mandarin as I could but wasn't able to keep up with the extensive conversations going on. Nevertheless, I ... we, had a great time.

We reached the FAST Tourists Reception Center just after 12 p.m. The inside of the center was decked out with a decorative navy blue paint on the ceiling that was filled with colorful pictures of stars, planets, and other celestial objects.

On the 2nd floor lays a non-branded western restaurant that served burgers and fries, and towards the back of the 1st floor sat a large TV screen that showcased the construction of the FAST telescope. Awesome!

And thus, began the next process of getting to the FAST telescope. First off, if you've read anything about the telescope you should know that the rumours are true: the FAST telescope requires radio silence within a 5 km radius. What does that mean? That meant there was a zero-tolerance policy against taking any mobile phones, digital cameras, or tablets to the site - devastating news for a travel blogger like myself and for all of the local tourists that couldn't upload any photos or videos onto popular social media platforms in China such as WeChat, QQ, or Sino-Weibo.

And wait, that wasn't all! Additionally, tourists were prohibited from taking lighters, bringing along keys, and even wearing watches. Yep, it was back to the Stone Age where you'd actually have to guess what time it was by looking up at the sun.

Don't worry, though, all of those items were to be stored inside lockers located within the FAST Tourist Reception Center.

Next up was boarding a shuttle bus that would take us to the base of the FAST telescope, but before queuing up we'd have to go through a security check. Bags and purses went through a screening check and guests were thoroughly scanned for any electronic devices. Trust me, there was no chance of sneaking in a phone or camera, so don't even try it.

The shuttle bus ride took around 20 min. to arrive at the base of the FAST telescope. The trip greatly reminded me of riding along Heaven-Linking Avenue - one of China's scariest roads - in Zhangjiajie. That is, we were once again stuck with a reckless local driver that seemed completely oblivious to the sharp turns and insanely steep cliffs we encountered on the road. Nevertheless, he did manage to get us there safe and sound. Thank God!

At the base of the FAST telescope was a building that was equipped with ... wait for it ... yet another security check point. Man, these guys didn't play around! Furthermore, therein also lied one special surprise: a table full of cameras available for rent. HAL-LE-LUJAH! HAL-LE-LUJAH! Did you see the bright light shine down through the clouds again?

That's right, on this table sat about 10 conventional Nikon cameras that used film rolls rather than memory cards. In layman's terms, they were non-digital, could not record video, and could not use bluetooth or connect to the internet. To use the camera at the FAST telescope, guests had to submit their ID and place down a 500 RMB deposit – you are only charged 150 RMB after safe return - and they'd be given a film roll that allowed for 36 pictures. As an avid photographer and blogger, I happily obliged, submitted my passport and ended up only paying 150 RMB cash up front.

The next step of getting to the FAST telescope was the most challenging. After the checkpoint, everyone was required to walk up 789 stairs to reach the top of the mountain. Seven-hundred-eighty-nine exactly, no kidding! My friend almost died after the first 100 or so but luckily, I had done a lot of Capoeira practice in the days leading up to the trip so I was well prepared. Did I also mention that I live on the 6th floor of my apartment building - there's no elevator you know!

Fortunately, we didn't need to climb the stairs all the way through.

Lockers for valuables and any electronic devices.
credit: Don's ESL Adventure https://www.donesladventure.com/

For experienced users: conventional Nikon cameras with photo film.
credit: Don's ESL Adventure https://www.donesladventure.com/

A professional photographer is on service for an electronic-free picture. credit: Don's ESL Adventure https://www.donesladventure.com/

Staircases for the reception building to the observation deck.
credit: Don's ESL Adventure https://www.donesladventure.com/

In fact, there were a dozen or so resting areas equipped with decorative statues detailing information about zodiac signs. And come to think of it, it might have been 789 stairs in total going up and down, but I digress.

And then it happened; we had finally reached the observation deck overlooking the FAST telescope in Pingtang County, Guizhou.

At the size of 30 football (soccer) fields it was absolutely massive. It's bright white and silver frame had shone brilliantly against the beautiful lush green karsts hills riddled across the backdrop.

At the edge of the dish, which my friend dubbed as a "giant hot-pot", were the six supporting towers that stood almost as high as the viewing platform we were standing on.

After fondling over the FAST telescope's technical prowess, the space geek in me kicked in and I couldn't believe that I was gazing out at this mammoth man-made structure as it peered out into the farthest depths of the universe in search for extra-terrestrial life. With the FAST telescope up and running, would China be the first to discover alien life? Would they be the champions of a major mind-bending discovery about the universe before the US?

Ok, ok, so I didn't really delve that deep into these theoretical questions, but what I did manage to do, however, was take a lot of pictures. Take a look!

After a while we landed on the 2nd floor of the observation deck where a service worker took professional pictures of tourists in front of the FAST dish.

He'd take the photo, then the picture would have to be physically mailed to an address that was given. Remember, no digital copies here.

With that we snapped a few more pictures in front of the karsts hills, made our way back down to the shuttle bus and finally arrived back at the FAST Tourist Reception Center.

The last stop on our trip was to the Pingtang International Experience Planetarium, which was located directly across from the FAST Tourist Reception Center.

The Pingtang International Experience Planetarium was the first museum I had visited in China that was solely dedicated to space observation.

From the entrance to the museum I could tell that we were in for a treat.

The museum hosted a wide variety of interactive displays covering information about the design, construction, and purpose of the FAST telescope in addition to facts about planets, our solar system, black holes, you name it.

We'd end our leg of the tour watching a space documentary inside the museum's planetarium, a dome shaped theatre that was filled to capacity.

Exploring the museum was pretty interesting and I would've had an even more fantastic time there if everything hadn't been in Chinese. And I mean EVERYTHING! C'mon man!

Well, that was it. We'd leave the FAST telescope in Pingtang at 4:00 p.m. and arrive back in Guiyang at 6:30 p.m. My friend and I would cap off the night with some delicious fresh fish on a nearby snack street and: Thank God! that we ended up actually making the trip. What an adventure!

I recommend visiting the FAST telescope in Pingtang, Guizhou.

**How to get to the FAST telescope in Pingtang, Guizhou, China?**

I found that there are several ways to get to the FAST telescope in Pingtang. First, let's review the actual route that I took to arrive there.

**1.** Fly into Guiyang, Guizhou. Next, pay a visit to the Sheraton Guiyang Hotel (We stayed at the 7 Days Inn hotel directly across from the Sheraton). Then, ask the receptionist if you could purchase tickets for a shuttle bus to go directly to the FAST telescope in Pingtang (In this case, I highly suggest having a local friend translate for you if you are a solo traveller or traveling with other foreigners). The receptionist will make a phone call to the travel agency. If there are spots available, you'll need to provide your phone number, passport, and pay 280 RMB. This price includes roundtrip travel to the FAST telescope via bus, lunch, and entrance to the Pingtang International Experience Planetarium museum. You will only need to pay an additional 50 RMB to the tour guide for the shuttle bus that takes tourists from the FAST reception center to the FAST telescope. That's it!

Later in the evening the tour guide will send you a text message with the details regarding where to meet and what time, so make sure to have an app like Google Translate ready for assistance.

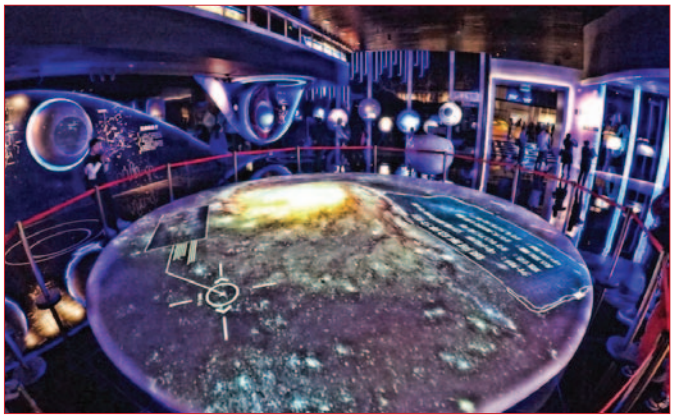
The next day you'll need to take a taxi to the tour bus meeting point, which is located at the DC Long Commercial Plaza (Google translates it as Da Changlong supermarket). The bus will depart promptly at 8:30 a.m.

You'll stop for lunch - a hotpot like meal - around 11:15 a.m. and arrive at the FAST Tourist Reception Center just after 12 p.m.

Next, the tour guide will assist you with getting a locker to place all of the prohibited items - mobile phones, cameras, etc. - in storage. Then you are on your own to explore the FAST telescope and Pingtang International Experience Planetarium for the next few hours. You'll need to meet back on the bus at 3:30 p.m., where you'll head directly back to DC Long Commercial Plaza in Guiyang. Done.

And now, here are some other ways I found through research on how to get to the FAST telescope. You're on your own should you try these:

**2.** Ctrip allows you to purchase tickets for a ride on a shuttle bus from Guiyang to Pingtang. You can arrange the date of your visit as well. The price listed as of April 5, 2017 is 198 RMB, but I believe it doesn't include the entrance fee to the Pingtang International Experience Planetarium museum. I



Inside the Pingtang International Experience Planetarium.
credit: Don's ESL Adventure https://www.donesladventure.com/

suggest calling Ctrip if you need help in English.

**3.** From Guiyang Railway Station, take a high-speed train to Duyun. From Duyun, take a long-distance bus to Pingtang County. I'm not sure if they'll have buses from Duyun that go directly to the FAST Tourist Reception Center or if you'll arrive in Pingtang but need to also take a taxi to the site. You'll have to do your own research.

The "Giant Hotpot" - Total view of the telescope bowl.
credit: Don's ESL Adventure https://www.donesladventure.com/

**Where to stay in Guiyang?**

We stayed at the 7 Days Inn Guiyang Railway Station Post and Telecommunication Building Branch located at the intersection of Zunyi and Zhonghua Road. It was a busy area and within a 10 min. walking distance from People's Square and about a 20 min. walk from Guiyang Railway Station.

The picture down below is of the hotel that is located directly next to the FAST Tourist Reception Center in Pingtang.


**For many more photos, more travel adventures and travel inspiration, please, consult Don's travel blog:**

www.Donesladventure.com

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