



All About The Chinese Space Programme

GO TAIKONAUTS!

龙腾太空

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Along the Rocket Road

Visiting Laogang - the Cradle of the Chinese Space Programme



Editor's Note

You may have noticed a strange place-name - Laogang - and a strange site on the cover page of this issue. Few people know it, even those who have followed China's space activities for many years. ... page 2

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On the Spot

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Along the Rocket Road

Visiting Laogang - the Cradle of the Chinese Space Programme

A Legend Close to an Urban Area

China is now a major space faring country. It is able to send people to outer space, build a space station in orbit, land a rover on the Moon, and launch second highest number of sophisticated imaging, communication and navigation satellites in the world within a year. However, more than half a century ago, China, the inventor of the rocket, was far behind developing countries. China's "most advanced" rockets by that time were ... page 8

Summary

Commitment at the global level for increasing the role of space

The 2014 session of the Committee on the Peaceful Uses of Outer Space COPUOS took place from 11 to 20 June at the Vienna International Centre. It was the 57th meeting since its existence. The body of 76 delegations united in COPUOS meets once a year to promote international cooperation in the peaceful uses of outer space. It is an un-paralleled platform to serve the global promotion of space as a tool for progress, peace and sustainable development. This year's agenda stretched out over 10 days, comprised topics like long-term sustainability of space activities; space debris, ... page 14

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Thread of the Silkworm

First published in 1995, this rigorously researched book tells the story of Qian Xuesen (sometimes known as Hsue-sen, which means "study to be wise") referred to in China as "the father of Chinese rocketry". ... page 33



Editor's Note

You may have noticed a strange place-name - Laogang - and a strange site on the cover page of this issue. Few people know it, even those who have followed China's space activities for many years. It is actually the starting point of the Chinese space programme. We can call it 'China's Peenemunde' in imitation of the location from where the world's first rocket that reached space was launched. Laogang is claimed as the place where China's first modern rocket, the T-7M, took-off. Unlike other Chinese launch sites for example Jiuquan and Xichang, visiting Laogang is much easier. It is located in suburban Shanghai, China's largest city, and can be accessed by the world's fastest ground transportation system. It takes less than 40 minutes from downtown Shanghai to the site, which is now preserved as an historic relic. The Go Taikonauts! Team had a little adventure excursion to the site last October. That's what the cover story is about.

The Go Taikonauts! Team had two other activities in May. Two of the team members were able to attend the 35th Chinese/Soviet Technical Forum at the British Interplanetary Society's headquarters in London. We are giving a summary of the presentations of the whole day's conference and describe in more detail the content of our own talk. In late May, the twice-a-year ILA Berlin Airshow was held. We have a report in this issue searching for any traces of China's visibility and also included interviews with some actors.

In the following month, the 57th session of the Committee on the Peaceful Uses of Outer Space - COPUOS took place from 11 to 20 June at the UN's Vienna International Centre. The 2014 agenda stretched out over 10 days and comprised during the technical part, four presentations by China on space law, lunar exploration, space policy and the Chinese Space Station. We are summarising those presentations. Also, we are giving a short report on the Chinese donation of a Yutu rover model to the UN space exhibition. Our article about the 57th COPOUS session is completed with an interview with Simonetta Di Pippo, the new Director of the UN's Office for Outer Space Affairs.

It is an interesting fact that business opportunities in the space sector with China are not as rare as one might think. In particular in Europe there are some small companies going the brave and future-oriented path of establishing commercial relations with Chinese enterprises. While those endeavours are demanding more in time and effort to set up, they are also harbouring interesting business experiences, as explained by Stefaan Serlet, Product Manager of Antwerp Space N.V., an OHB company. Read our interview for details.

At last, upon recommendation we got hold of the book "The Thread of the Silkworm" to review it for our readers. This unique account of one of the leading persons in China's space programme, Qian Xuesen, is more than a worthwhile reading and provides crucial clues for understanding the current situation in the U.S.-China context.

(Chen Lan, Jacqueline Myrrhe)

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Chinese Space Quarterly Report

April - June 2014

by Chen Lan

Highlights

- China carries out a scale model test of reusable rocket booster
- First component of the 200-tonne class cryogenic engine tested
- SJ-15 and SJ-7 rendezvous in space
- China provides outlook on second generation manned spacecraft
- Re-entry capsule of Chang'e 5 (Pathfinder) made an appearance
- China builds ground test field for Mars missions
- Yuegong (Lunar Palace) 1 closed cycle test completed successfully
- China and U.S. issue joint statement on global navigation systems
- Russia to cooperate with China on human spaceflight after 2020
- China's first private rocket company hit the road

Launch Event

There was no space launch in this quarter, making the first half of 2014 the least busiest in 8 years, with only one flight at the end of March.

Space Transportation

2014 is key for development of China's new generation launch vehicles CZ-5, 6 and 7. On 17 April, the YF-75D cryogenic engine, to be used on the CZ-5 second stage, completed a review on reliability and technical status for its maiden flight. In early May, it was reported that the engine had completed all development tests and had entered the phase of certification and delivery. So far, the engine has accumulated 32,000 seconds of test firing. At the same time, the bottom section of the CZ-5 booster, developed by SAST, completed a flight mode static load test.

On 19 April, the auxiliary propulsion system of CZ-6 made a successful full-system hot test firing.

In addition to CZ-5 and 6, there was also more news on CZ-7 in this quarter:

- On 25 April, the coordination meeting for the first launch site rehearsal of the CZ-7 launch vehicle and the TZ-1 cargo ship was held in Hainan. The rehearsal is scheduled for the second half of 2014.
- In early May, the first fairing of CZ-7 was completed and will be integrated with the second stage for later testing.
- On 19 April, the propulsion system of CZ-7's first-stage made a successful hot test fire. The two YF-100 engines worked stable for 188 seconds. The first stage used in this test has a length of 20.08 meter and mass of 170 tonnes. On 16 June, it made a second successful test fire.
- On 23 June, the first flight model of the YF-100 engine, probably to be used in the maiden flight of CZ-7, completed a certification test fire. According the engine's builder AALPT, all liquid oxygen / kerosene engines used on the new generation launch vehicles will have made a certification test fire before delivery.
- In June, the YF-115 staged combustion LOX/kerosene engine made a 1,500-second long duration test fire, setting a new record for itself. YF-115 will be used on the second stage of CZ-6 and 7.

Some interesting news which appeared in mid-June was about the planned 200-tonne class cryogenic engine (allegedly named YF-220), to be used on the future super-heavy launch vehicle. It was reported that the large flow single nozzle of the engine had made a successful hot test, showing extensive work is on the way, though the engine and super-heavy launch vehicle have not been officially approved by the government.

Another interesting development was revealed in mid-June. China Space News reported that China's RLV (reusable launch vehicle) technology had made a breakthrough recently. CALT is working on a fly-back booster using a parafoil. They were building a 1:4 scale model and will make a flight test in the near future.

In January, a C/C-SiC (carbon-carbon, silicon carbide) exit cone of the nozzle for liquid fueled rocket engines passed a hot test fire lasting 780 seconds. It was the first time China had made a long duration hot test fire for a high temperature composite nozzle.

There was also little-noticed news about launch vehicles in operation. A new type of fairing for CZ-2D made a separation test in early May. At the same time, a new CZ-3C, to be integrated with the first Yuanzheng 1 upper stage, began assembly. It will be used to launch the first Beidou experimental satellites planned for later in 2014.

Satellites

From mid-April, the Object C, and one of the SJ-15 satellites launched in July 2013, started another rendezvous with the SJ-7 satellite, launched in 2005. During 29 May to 1 June, the two satellites' orbits were coincided. One of the SJ-15 satellites carries a robotic arm (no confirmation if it was carried by the Object C), but it is unknown if the two satellites made contact. The same Object C made its first rendezvous with SJ-7 in August 2013.

In May, two satellites realised in-orbit delivery. On 28 May, the delivery ceremony of SJ-11-06, launched on 31 March this year, was held in Beijing. CAST, China Spacesat (DFH satellite, a child company of CAST), an anonymous user and an anonymous operator attended the event, implying the satellite's purpose is probably defense related. In contrast, the ceremony on 5 May for the FY-3C delivery was very open. The FY-3C was launched on

23 September 2013 and was China's 13th weather satellite from 1988 (4 FY-1, 6 FY-2 and 3 FY-3). It will replace FY-3A and work with the FY-3B to form a morning satellite - afternoon satellite system. On 10 June, FY-3C was formally put into service.

With new satellites being put into service, other Chinese satellites have demonstrated a long working life in space. The above-mentioned FY-3A passed the 6-year mark on 27 May. The HY-1B oceanic satellite celebrated its 7th anniversary in space on 11 April, immediately after completion of a series of inclination adjustments. On 25 April, TL-1, China's first data relay satellite, completed its primary mission lasting 6 years. However, the longest-living Chinese satellite was not built by China. ChinaSat-5A, formerly known as ChinaStar 1, built by Lockheed Martin and launched on 30 May 1998, has passed its 16th anniversary and will continue its service.

Meanwhile, a batch of new satellites were in development and made progress in this quarter:

- At the end of April, the payload module of the Beidou experimental satellite, to be launched by the end of the year, completed a navigation sub-system test and an antenna interface test.
- China is developing a new FY-3 satellite equipped with rainfall radar. In April, the requirement specification for the radar satellite was completed.
- On 5 May, the high-resolution cartographic satellite, supposed to be GF-7, completed a review on its requirements and mission objectives.
- In June, the launch crew for the GF-2 satellite returned to the launch site. The satellite, together with Polish smallsat BRITE-PL, was to be launched at the end of 2013 but was rescheduled after the CBERS-3 launch failure. The satellite also passed a quality review after long duration storage at the launch site. GF-2 is a civil imaging satellite with a ground resolution of less than 1 m and a designed working life of 5 years.
- During 21-24 April, an interface test for the ground-satellite link of the GF-3 satellite was completed in Sanya, Hainan. GF-3 is a one-metre resolution C-band SAR satellite.
- The CBERS 4 (ZY-1-04) satellite had completed electrical testing and will carry out some other major tests, according to Chinese reports in mid-June. It is expected to complete the Final Design Review in September and then be transported to the launch site. The launch date is now set for December.
- In April, a plastic scintillation detector array and a power controller used on the dark matter detection satellite was delivered to a payload sub-system of the satellite.
- On 20 May, the SJ-10 microgravity (recoverable) satellite completed the electrical integration test for its payload system. It included 33 payload support system units from 12 suppliers and 37 ground equipments. The test started on 3 January.
- At the end of May, CAS signed an agreement with China Great Wall and CASC for the launch vehicle development for the SJ-10 satellite. It was the 4th launcher developed for CAS's Space Science Pioneer Programme. In October 2012, CAS signed an agreement for three Long March vehicles.

Manned Space Flight

The 3rd issue of Science China Press published a paper entitled "Research on the portfolio development of spacecrafts in China", by authors from CAST. The paper suggests that future Chinese manned spacecraft need to cover requirements from Earth orbit transportation to lunar and deep-space exploration. It would still use a capsule design, but would need to accommodate 3-7 people, to increase down cargo capability to 500 kg and have a docked working life of 2-3 years. A "push" launch escape system is also proposed by the authors. All these messages are consistent with the vehicle graph shown at IAC 2013. As all authors are from CAST, information in this paper was considered as a serious clue to China's next generation manned spacecraft.

Lunar and Deep-Space Exploration

On the Moon, the Yutu rover survived three more lunar days at its final position. It woke up three times from hibernation on 14 April, 13 May and 13 June. It reportedly worked normally, but there were few details revealed by official media about the status of the rover and the Chang'e 3 lander during these three months.

At the same time with less and less Chang'e 3 news, news of Chang'e 5 appeared more and more, indicating smooth progress of China's first lunar sample return vehicle:

- On 30 April, there was a successful test firing of the 3,000 N engine to be used by Chang'e 5.
- By the end of May, the electrical model of the electric motor at the joint on the robotic arm of Chang'e 5 was delivered.
- In June, the pyrotechnical lock to be used between the re-entry module and the service module of Chang'e 5 made a series of successful tests and proving its reliability in low, normal and high temperatures.
- The Chang'e 5 Pathfinder spacecraft completed a thermal

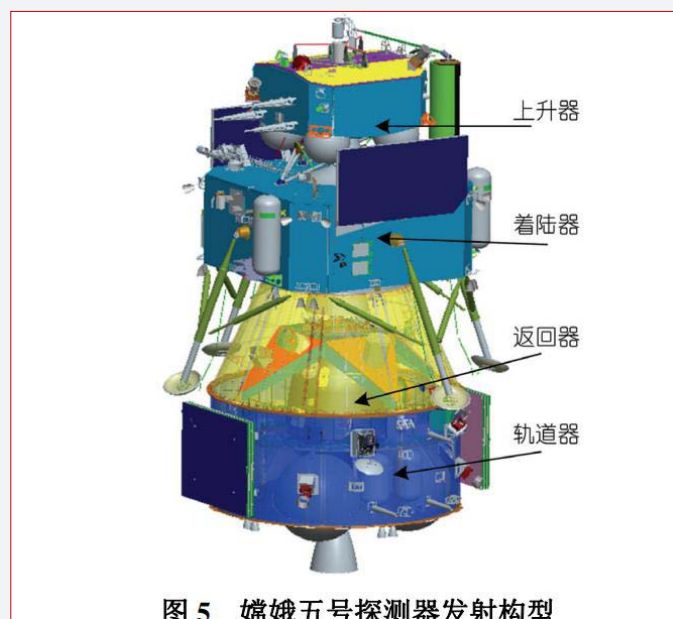


图5 嫦娥五号探测器发射构型

Stack of the Chang'e 5 lunar spacecraft. From top to bottom: lunar ascent stage, lunar lander, re-entry capsule, orbiter. (credit: CAST)

vacuum test in early June. The news included a photo showing the re-entry capsule of the test vehicle for the first time. It has almost an identical appearance to the Shenzhou manned capsule, and looked like a scaled-down version of the latter. However, its size appears much larger than is reasonable to bring back just 2-10 kg of samples.

In the June issue of the *Scientia Sinica Technologica*, Ye Peijian, Chief Designer of China's lunar exploration programme, and co-authors published a paper entitled "The process and experience in the development of Chinese lunar probe" and disclosed details of the Chang'e 5 mission. The sample return spacecraft will have a launch mass of 8 tonnes and consist of 4 modules stacked in launch configuration - from top to bottom are the ascent stage, the lander, the re-entry capsule and the orbiter. It will be launched by the CZ-5 heavy launcher and the mission will last about one month with the following steps:

- Launch, trans-lunar and lunar orbit insertion. It will take about 5 days, and the spacecraft will enter a circular orbit of 200 km.
- Spacecraft separation and landing preparation. The orbiter-re-entry vehicle combination will stay in the same orbit, while the ascent stage/lander combination will be lowered to a 15 x 200 km orbit to prepare for the landing.
- Landing and surface operations. Samples will be collected and transferred to the canister in the ascent stage.
- Lunar ascent and lunar orbit docking. The ascent stage will lift-off on top of the lander. It will enter a 15 x 180 km initial orbit and then rendezvous and dock with the orbiter-re-entry vehicle combination. After the sample canister has been moved to the re-entry capsule, the ascent stage will be discarded.
- Return preparation and lunar orbit. The combination will stay in lunar orbit for 10 days. Then the engine on the orbiter will be fired putting the combination into a trans-Earth trajectory. It will take 5 days on course to the Earth.
- Earth re-entry. At 5,000 km above the ground, the orbiter will be jettisoned. 20 minutes later, at about an altitude of 120 km, the re-entry capsule will enter the atmosphere semi-ballistically. At about 60 km altitude, it will bounce back to about 100-140 km above ground, and then make a second

re-entry. At 10 km altitude, a series of parachute releases will begin, and the capsule will land in Siziwangqi, Inner Mongolia - the same landing zone as Shenzhou.

In early April 2014, in the Hi-Tech Fair in Chongqing, conceptual extra-terrestrial rovers including a Mars rover and a manned lunar rover, were displayed. The rovers were developed by the Joint Deep-Space Research Centre of the Ministry of Education. The manned lunar rover adopts a foldable design.

On 18 May, CAST and Huailai County, Hebei Province, signed an agreement to build the "Mars Landing Test Field" in Huailai. It was reported that the project will cost one billion RMB and will start construction later this year.

Advanced Technology

On 20 May, three volunteers stepped out of the Yuegong 1 (Lunar Palace 1) simulated cabin, successfully completing the 105-day shakeout mission - not on the Moon, but on Earth. Yuegong 1 is a Bioregenerative Life Support System laboratory developed by Beihang University. It consists of three cabins - one for living and two for growing plants - and has a total area of 160 square metres and a volume of 500 cubic metres. It is able to regenerate 100 % of oxygen and water, and 55 % of food. Three crew members, Xie Peizheng (captain, female), Wang Minjuan (female) and Dong Chen (male), planted 5 grain crops, 15 vegetable crops and one fruit crop. They also kept Yellow Mealworms to produce food. The project was started in 2004 by Professor Liu Hong (female). After 10 years of continuous efforts, it finally achieved success, paving the way for the lunar base of the future.

It was reported in early April that the Micro-propulsion Technology Team was founded within CAST. It will focus on micro-thruster arrays, micro high-pressure cool gas propulsion systems and lightweight low-power thrusters, etc., on which CAST has already made some progress.

China also made progress on an electric propulsion system. A magnetic focusing Holzer thruster completed a performance test in CAST lasting 1,000 hours. It is planned to be tested in space on a technology verification satellite.



Re-entry capsule of the Chang'e 5 Pathfinder mission. (credit: spacechina.com)



The crew of the Lunar Palace 1, after completion of the 105-day isolation test. (credit: Xinhua)

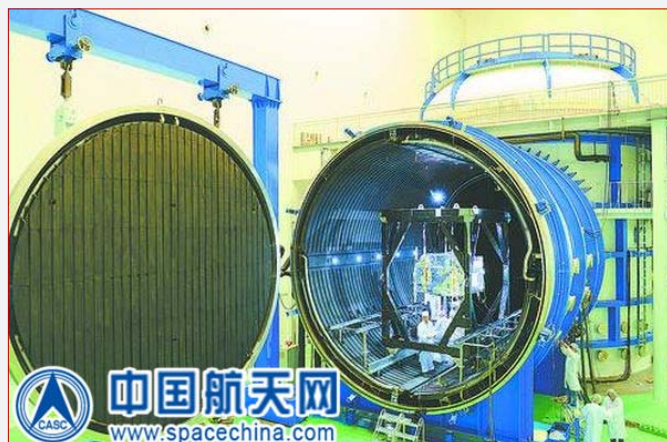
International Cooperation

On 19 May, delegations from China and the United States met in Beijing and discussed cooperation on civil global satellite navigation systems, for the first time. Topics discussed at this meeting included compatibility and interoperability of civil signals between China's Beidou navigation system and GPS, their respective augmentation systems and civil aviation applications, monitoring and assessment, spectrum protection, interference detection and mitigation, ICG (International Committee on Global Navigation Satellite Systems) and associated Providers' Forum activities, and activities related to other international multilateral forums. The two sides issued a joint statement after the meeting. Both sides agreed to establish a regular exchange, with continued cooperation through regular meetings. A Working Group will be established to further discuss these topics, and additional topics of mutual interest may be added in the future.

In comparison with the U.S., Russia is more active in cooperation with China in the field of satellite navigation. On 30 June, a round-table meeting on Sino-Russian satellite navigation cooperation was held in Harbin. Wang Yang, Vice-Premier of China, and Dmitry Rogozin, Deputy Prime Minister of Russia, attended the opening ceremony and witnessed the signing of a memorandum of understanding (MoU). Earlier, the Russian side had revealed that China and Russia plan to build three ground stations of their own systems on the territory of the other country.

Russia and China have historically had a broad space cooperation, and it appears that the two countries are pushing for broader cooperation in space as a consequence of the current Crimea Crisis. Satellite navigation is just one of the new fields being considered. Another notable message was that Rogozin revealed to media that Russia and China are discussing cooperation in human spaceflight after 2020, when Russia has possibly withdrawn from the ISS programme. It leaves a large imagination space for a possible link of two space stations - the CSS and the Russian segment of ISS.

On the other side, Russia will not be the first country that the Beidou system stretches out to. In mid-May, China announced that the phase 1 construction of the CORS (Continuous Operational Reference System) for Pakistan has been finished.



KM-5B thermal vacuum chamber, SAST (credit: spacechina.com)

It includes a processing centre and five reference stations covering Karachi, and became the first CORS system outside of China. It is able to increase positioning accuracy to two centimetres. In June, three model satellite stations based on the Beidou navigation system were shown to the public in an industrial estate in Thailand, the first step of Beidou into the ASEAN market. It is one part of a cooperative agreement signed between China and Thailand.

CNSA donated a 1:1 model of China's lunar rover Yutu to the public exhibition of the United Nations Office for Outer Space Affairs - UNOOSA at Vienna International Center, in Vienna, Austria, on 13 June. The lunar probe Chang'e-3 with rover Yutu onboard, landed on the Moon's Sinus Iridum in 2013, making China the third country to put a rover on the Moon after the United States and Soviet Union.

Commercial Space

On 1 April 2014, China Great Wall Industry Corporation (CGWIC), a subsidiary of China Aerospace Science & Technology Corporation (CASC), officially completed the in-orbit delivery of the Túpac Katari 1 (TKSAT-1) communications satellite and associated TT&C and application systems. The in-orbit delivery ceremony was held in Bolivia's capital, La Paz, and was attended by the Bolivian President Evo Morales and other high-ranking officials from the Bolivian government. TKSAT-1 was launched on 21 December 2013 from Xichang Satellite Launch Center, witnessed by Evo Morales.

China intends to take part in the upcoming satellite projects in Azerbaijan, the Ambassador of the People's Republic of China to Azerbaijan, Hong Jiuyin said at a meeting with the Azerbaijani Minister of Communications and High Technologies, Ali Abbasov. The first Azerbaijan satellite "Azerspace-1" was launched in early February 2013. The second communication satellite "Azerspace-2" is scheduled to be launched in 2017. Azercosmos's long-term plans also include the launching of a low-Earth orbit satellite in 2016.

On 7 June, China Great Wall (CGWIC) signed a framework agreement with CAST to procure 5 remote sensing satellites from the latter. CGWIC is CASC's commercial arm and provides commercial space products and services to the international market. It means that all 5 satellites are for international customers. One of them is believed to be Venezuela's VRSS-2. In April, CAST and the Venezuela customer agreed on the VRSS-2's camera design, that will be an off-axis TMA (Three-Mirror-Anastigmat) camera.

In June, Chinese media reported on China's first private space company - a start-up company called Lingke Aerospace. Hu Zhenyu, founder of the company, is a rocket hobbyist and has launched a few amateur rockets since 2012, when he was only a university sophomore. In January 2014, he registered his own company to produce commercial sounding rockets. He plans to sell his rockets with maximum altitude capability of 200 km and payload of 50 kg at 2 millions RMB, only two third of the price for the same product of the Fourth Academy of CASC, the only sounding rocket provider in China. His long-term plan is to provide a small satellite launch service using a 3.35 m diameter liquid fueled rocket by 2020.



Lingke Aerospace is not the only news on private space in China. On 9 June, Taobao Travel, a subsidiary of Taobao, China's largest e-commerce site, and SXC (Space Expedition Corporation) announced that they would sell sub-orbital space tour tickets on Taobao.com. It was put on sale on 12 June. The tickets were priced at RMB 599,999 for the 61 km altitude flight and 1,385,999 and 629,999 for altitude of 103 km (the former is the luxury package with more services). The paying tourist will take the XCOR's Lynx space plane to outer space for a short period to experience zero-gravity. By end of June, only one customer from Zhejiang Province had made full-payment for the ticket.

Miscellaneous

Ground Facility

There was news from three of China's four space launch centres. In June, in Wenchang Space Launch Centre, Hainan, the CZ-7 mobile platform completed its first driving test. In Xichang, the steel structure of the launch tower of Pad 3 was topped-out on 27 June, representing major progress of the Pad 3 upgrading

project. In the same month in Jiuquan, an "intelligence building" upgrading project for the "central building" (supposed to be the VAB) was completed.

On 6 June, Asia's largest Assembly, Integration and Testing (AIT) Building was topped-out in Tianjin, where China's new generation launch vehicles and space station modules will be assembled. It is now also Asia's tallest single-story building. The AIT building is key for the Chinese Space Station (CSS) programme.

In April, a large-scale facility of SAST, the dual-satellite movement simulation system, completed its acceptance review. It is able to simulate two satellites' rendezvous, docking, accompanying flight, and in-orbit maintenance. In mid-June, SAST's other large facility, the KM5B thermal vacuum chamber, completed its first whole-satellite test. It is the largest such facility owned by SAST and is able to support large spacecraft, such as the FY-4 weather satellite in development.

(Chen Lan)

Along the Rocket Road

Visiting Laogang - the Cradle of the Chinese Space Programme

by Chen Lan



A Legend Close to an Urban Area

China is now a major space faring country. It is able to send people to outer space, build a space station in orbit, land a rover on the Moon, and launch second highest number of sophisticated imaging, communication and navigation satellites in the world within a year. However, more than half a century ago, China, the inventor of the rocket, was far behind developing countries. China's "most advanced" rockets by that time were still those powered by black gunpowder mostly appearing in celebrations - the 'cannon crackers'.

In the late 1950s, the science and technology of modern rocketry reached China through two totally different paths, one from Qian Xuesen who was one of the early U.S. rockery pioneers and who returned to China in 1956, and the other from the Soviet Union which sent some rocket samples to China according to an agreement between the two countries. Interestingly, both

originated from German's V-2 missile. And shortly afterwards, China had its own modern rocket.

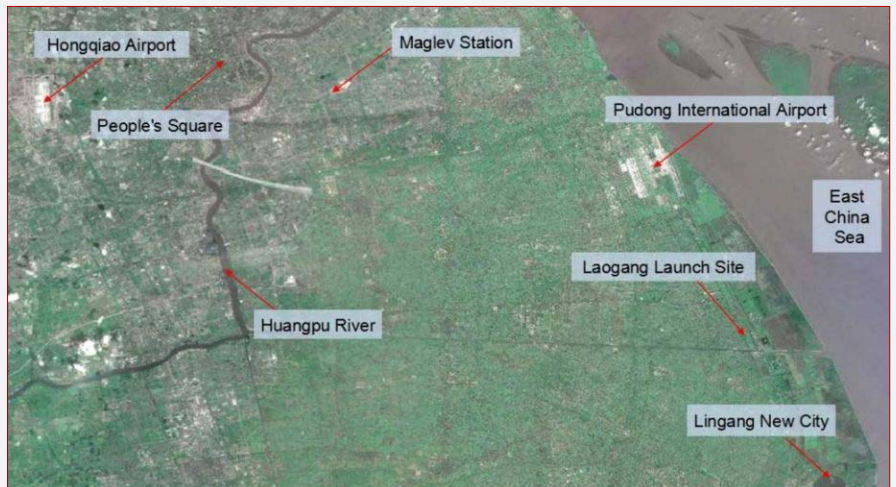
In many historic files, it is indicated that China's first modern rocket took-off from a simple launch facility at the sea coast near Shanghai in February 1960. The T-7M, a test model of a sounding rocket powered by liquid propellant, successfully launched into the sky, and made history. The most popular story circulated for many years is that Chairman Mao visited the rocket factory after the launch, saying that 8 km altitude was already a great achievement but it needs to be increased to 20 and 200 km and finally to launch a satellite. Since China has launched more and more rockets and satellites, this early small rocket has been forgotten by most people, not to mention the launch site itself.

Shanghai is China's largest city and among one of the largest in the world. There are about 24 million permanent residents living in the city and its suburban area according to a census of the population in 2010. It is estimated that in total, more than 30 million people are living in Shanghai including short-term visitors. The city has expanded at a crazy speed over the last 20 years. Previous suburban areas became downtown, remote countryside became suburban, and old satellite towns joined together with the downtown area. Nanhui County, where reportedly the launch site is located, was once one of the farthest administrative regions of Shanghai. It was later renamed to Nanhui District and finally merged into the Pudong New Area recently. Many large-scale projects like Pudong International Airport, Shanghai Disneyland and Lingang New City, are in this area. It is hard to believe a rocket launch site was once there, so close to a world-class metropolis.

It was an impulsive decision to visit the site when all Go Taikonauts! Team members met in Shanghai, China, after attending the International Astronautical Congress 2013 in



Shanghai Maglev train, parking at the Longyang Road Terminal Station. (credit: Go Taikonauts!)



Satellite map of Shanghai, showing location of the Laogang launch site and other major places (credit: Tianditu)

Beijing in late September 2013. However, there was too little known about its precise location. The only information was that it was at the sea coast, and near a small town called Laogang in the former Nanhui County/District, southeast of downtown Shanghai. Fortunately, today we have a very powerful tool – the internet. Search results on Baidu (sorry, Google) show that the site had been visited by only a few people during recent years. They had posted photos and a detailed traffic guide leading to the site on the web. With help of these online maps, the site was readily spotted in the satellite images.

A Countryside Adventure

On the satellite map, the remains of the Laogang launch site was about 45 km southeast of Shanghai's centre (People's Square, the Bund), and 15 km south of the Pudong International Airport. So, the fastest way to the site was to take the Maglev Train to the airport, and then switch to a taxi to find the site. The map and the satellite images showed that an elevated expressway to the west and a country road to the east, ran parallel to the location of the site. As there seemed to be no exits from the expressway to get directly to the site, the only way was to go through the country road. It was not difficult to find a route from the airport to the site. In fact, none of the team members had been there previously, even one of whom (Chen Lan) is a local Shanghainese. We had to trust the electronic map, but of course, we were very confident.

On the morning of 6 October 2013, three of the Go Taikonauts! Team (Jacqueline Myrrhe, William Carey, Chen Lan) arrived at the Maglev terminal station in downtown Shanghai. The 30 km long line from Longyang Road to the airport is the world's first and the only commercial Maglev line, and has been running for more than 10 years. As it is reportedly still losing money, it is no surprise that the train runs at its maximum speed of 430 km/h for only a short period each day. Fortunately, the train we took hit the maximum speed - a good sign for the adventure ahead.

After the 7-minute smooth ride, we arrived at the airport and reached the taxi stand quickly. It was about 10:30 a.m. and not many people were queued there. We got into a taxi and told the driver of our destination - Laogang. To our surprise, the driver

said that he was from Laogang where he grew up. So he is very familiar with the roads there. But there was one more surprise - he said he had never heard about the launch site in Laogang. He could drive us there, but we needed to tell him where the location was. He was very happy that we booked a return trip and looked quite interested in our adventure. He told us that it was the first time for him to take his customers to find this mystery launch site.

Shortly after leaving the airport, we were on a small two-lane country road, preventing us from speedy driving. The farther we drove, the more green we saw, and the fewer vehicles on the road. Along the road are all tall trees. We started to see farmland, with small rivers and ponds sparsely located in the fields. The taxi driver told us that the road was originally a sea embankment. When more and more land was reclaimed from sea, new embankments were built and old embankments became roads. We looked to the left, where the sea could be dimly seen.

After about 30 minutes of leisurely driving, we saw a small bridge across a river that runs parallel to the road on the right, recognisable from the satellite images. The launch site should be there, on the other side of the bridge! The bridge was very small but had steep slopes on both sides - actually it looked like a pedestrian bridge. We proposed to stop before the bridge and walk to the launch site, but our driver insisted to have a try to cross the river. The brave man made it with success, witnessed by us standing at the end of the bridge.

After the bridge, the road (or more exactly a country lane) entered empty land with high fences at the roadside. Just about one hundred metres after the bridge, the car had to stop again, as the road ended close to an expressway. There was a path through under the expressway. We walked along that path and crossed under the expressway. Then we saw buildings and people. It looked like a village. However, when asked about the launch site, none of them were aware of it. What a disappointment!

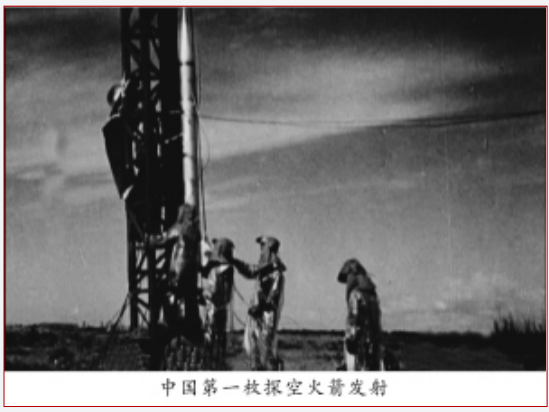
We had to turn back to the other side of the expressway and continued looking. Suddenly, we saw through small trees a small



The country road to the launch site. (credit: Go Taikonauts!)



The Gate of the empty park. The monument was seen at the far end. (credit: Go Taikonauts!)



中国第一枚探空火箭发射

Launch preparation of T-7M. It is difficult to find launch photos of T-7M. This very low-quality photo is probably the only one available on the internet. (credit: Chinese internet)



Shelter near the launch site, used for commanding the launch. (credit: Chinese internet)

first. That's the T-7. To further reduce risk, T-7M, a scaled down test model of the T-7, was put on the table. In September 1959, T-7M's preliminary design was completed. It was a 0.25 m diameter, 4.21 m long single-stage sounding rocket. It had a launch weight of 122 kg. Its engine was powered by nitric acid, aniline and sugar alcohol, generating a thrust of 2.2 kN. According to the design, it was able to reach a maximum altitude of 8 km. There

tip of something from inside the empty land. That's a model of T-7M. We had found it!

Fading History

The T-7M story actually started in October 1957 when the Sputnik launch shocked the whole world. China, inspired by the event as well, decided to develop its own space technology. In November 1958, the Shanghai Mechanics and Electrics Design Bureau was formed. Its mission was to engage in rocket and satellite research.

The first project of the Bureau was the 10-metre long T-5 sounding rocket, using liquid propellant for the first time in China. Its preliminary design was finished in December 1959 and assembly completed one year later. However, some key components had not been delivered on time and the gyro failed to meet the requirements. As a result, the project was suspended - forever. Both the whole rocket test and engine hot test firing did not happen as planned.

In July 1959, according to suggestions from Qian Xuesen, it was decided to develop a smaller and less difficult sounding rocket

was also an enhanced version, formed by adding a 1.14 m long solid booster (as the first stage), increasing the maximum altitude to 10 km.

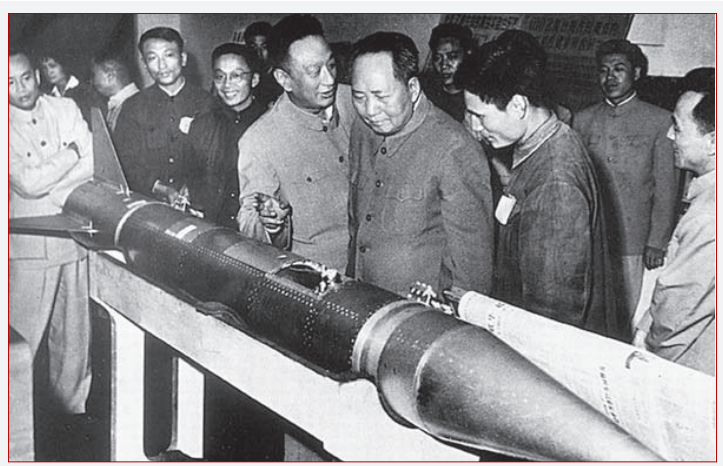
On 27 December 1959, the first engine hot test firing was made, followed by another 9 tests in January, and 5 more from February to July. Three of these tests failed, but most were successful. At the end of 1959, the rocket completed assembly.

To support the development of the rocket, several facilities were built at the same time. The engine test stand was built within the Jiangwan Airport, and the launch site was decided to be located on the coast of the East China Sea, in Nanhui County. Construction started in October 1959. The launch facility was very simple. At the launch pad, there was a 20 m tall single-track launch tower.

The first launch of T-7M took place on 25 January 1960. The rocket was only filled with 3/4 of full propellant. Unfortunately, it exploded when ignited. The second try on 11 February aborted even before ignition - a valve problem prevented the fuel loading normally. The third launch on 29 February achieved the first success, with the rocket reaching an altitude of 4-5 km. Although



Qian Xuesen in Laogang launch site. (credit: Chinese internet)



Mao Zedong inspected the T-7M rocket factory. (credit: Chinese internet)



the planned recovery of the rocket body failed, it had made history. China's first modern rocket (as it is declared officially) took-off and soared to a new height that those gunpowder-powered cannon crackers were never able to reach.

Three more launches were made after the 29 February success. In the last two attempts, the parachutes were successfully deployed and the rocket recovered. In the last launch on 29 April, the rocket reached about 5-6 km, which was within the design expectation, as all these rockets were only 3/4 loaded with propellant.

It was a great achievement if one considers China's technology basis by that time. During the T-7M launches, conditions were incredibly poor. There was no communication equipment - people had to rely on their own voice for commanding and coordination. Manual pumps as used for bicycles served as pressure pumps for fueling. Only in the 5th launch were gas-bottles used, replacing those manual pumps. But everyone involved in the project kept a high morale and worked wonders.

Encouraged by the first success, the team made three fully-fuelled launches during late September to early November. This time they were unlucky. Only the last of the three rockets achieved a partial success. It reached 5.1 km but failed to be recovered. However, the setback did not stop the launch plan. On 30 November, a rocket combined with a solid booster and mock-up main rocket was launched to an altitude of 1.1 km, verifying the booster and the new configuration. From 5 December, in a three year time period, 6 launches of the two-stage configuration were made. All were launched successfully, and last three also achieved successful recovery. The maximum altitude the rocket reached was 11.2 km. In the last launch on 18 December 1963, aviation kerosene was used as a fuel.

The 16 launches in 4 years rounded-off the project successfully and paved the way for a larger sounding rocket – the T-7. Those Chinese scientists and engineers involved had mastered the modern rocket technology through the project, which helped them to pick-up Soviet missile technology later more quickly, and finally led to the birth of the Chinese space programme.

Due to too many limitations of the launch site in Shanghai, since 1960, launches of the T-7 models moved to Guangde, Anhui Province. In the following years, T-7, T-7A and several variants were developed. On 21 November 1965, a T-7A(Y1) sounding rocket reached an altitude of 90.5 km. In August 1968, the T-7A(Y5), a T-7A with a third-stage installed with CZ-1's solid motor to verify China's first space launcher, launched from Jiuquan and flew to a height of 312 km above ground. These two T-7 series launches marked China's first presence in space, which had originated in the simple and crude launch site in Laogang.

Rebirth of the Forgotten Remains

The empty land we saw after the bridge is actually a planned park, in the centre of which are the remains of the launch site. We entered through a gate in the high fence and walked a few dozens of metres, then saw the monument. A stone plaque at the place is written with text as follows:

Preserved Historic Relics

Launch site of the first experimental sounding rocket designed and manufactured in China

12 October 2010

By Government of Pudong New Area

The monument looked very simple. On a bare concrete base, there is the main part of the monument made by black marble. On the top of which there is a model of a T-7M rocket. On the front of the monument, there is an inscription saying: "Monument of Successful Launch of China's First Experimental Sounding Rocket". On the rear side, there is detailed text about the launch site and the rocket:

The experimental launch site for the T-7M rocket is located in Dongjin Village, Laogang Town, Nanhui County, Shanghai. The launch tower has a height of 22 metres. The T-7M rocket consists of the liquid fueled main rocket and solid fueled boosters, and has a length of 5,345 millimetres, diameter of 250 millimetres and weight of 190 kilograms. Its flight altitude is 8,000 metres.



The monument as seen from the gate. (credit: Go Taikonauts!)



The stone plaque which was set up by the local government. (credit: Go Taikonauts!)



Overview of the launch site and the monument. (credit: Go Taikonauts!)



right: Text on the rear of the monument. (credit: Go Taikonauts!)



The T-7M model on the top of the monument. (credit: Go Taikonauts!)

The rocket data is obviously of the two-stage T-7M. The launch tower height has a slight difference with the figure in the above section that is from the official history book of SAST. It is left to us, or other historians, for future clarification.

In the center of the area, there is a concrete base at ground level, with a size of about one metre by one metre - obviously the launch pad. About 20 metres from this base, there are nearly a dozen similar concrete bases in the shape of rectangle, which formed a circle around the launch pad. There is no description for these bases, which seem to be the only remains of the launch site, apart from the launch pad itself. It is believed that the rectangular bases are for cables to fix the tower to keep it stable.

Except for the monument, there were neither any other people nor any buildings in the park. As now known, the site is planned to be an educational base with more facilities. But when we visited, it was just a fenced area, looking like an unfinished park. A plane flew overhead reminding us that the Pudong International Airport is nearby. Wouldn't it be amazing if the passengers on the plane

knew they are flying over a rocket launch centre?

It was a little disappointing that there was little new and interesting information to be found from the remains. However, we were more or less comforted to have found the site and saw it well preserved. Back to the end of the small bridge, a road sign caught our attention - it reads "Rocket Road". Yes, this narrow, unnoticeable country road starting from the bridge does have such a great name. Maybe it is the only road in the world named after "rocket"?

Before starting our return journey, we took a group photo with the hospitable driver and his taxi. He also left us a note with his phone number and asked us to publish it in our article in the hope that people who read our article would one day contact him to book his taxi. So, this article should have fulfilled our promise.

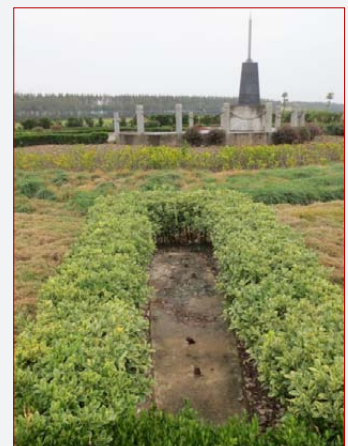
On the way back to the airport, the driver brought us to the seashore. Strong winds blew from the sea. Big waves were beating the newest concrete embankment. Looking south along



Alleged launch pad. (credit: Go Taikonauts!)



One of the rectangular bases encircling the launch pad. (credit: Go Taikonauts!)



Another rectangular base. (credit: Go Taikonauts!)



Road sign of "Rocket Road" at the end of the bridge.
(credit: Go Taikonauts!)



Group photo of the Go Taikonauts! team members and the taxi driver.
(credit: Go Taikonauts!)

the seashore, buildings in distance could be dimly seen. This is Lingang New City, a new satellite city with a planned population of one million citizens. It may be imagined that in a foreseeable future, many buildings and people will surround the launch site. It will not be lonely any more.

Controversy

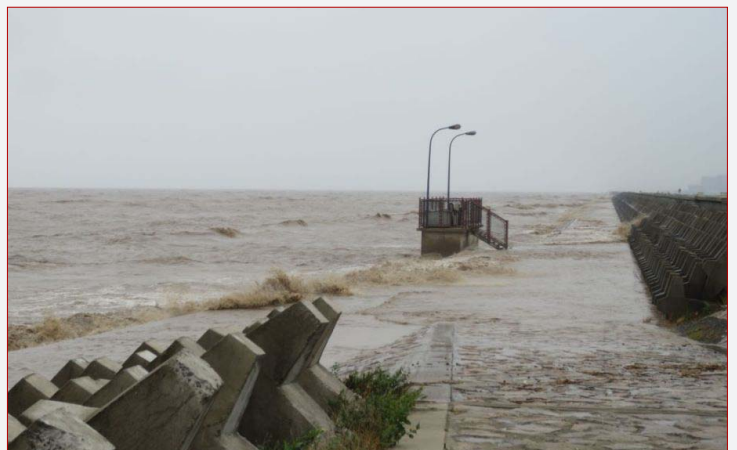
The Laogang launch site is always declared as the place where China's first sounding rocket took-off. But in recent years, some people have begun to question this almost-official conclusion. Their evidence is that two universities had launched modern rockets prior to the T-7M. Beijing University of Aeronautics and Astronautics (BUAA, now renamed to its English name as Beihang University) developed the BJ-2 (Beijing 2) sounding rocket and launched it successfully for the first time on 22

September 1958. While Beijing Polytechnical University achieved a success even earlier. They launched two DF-1 (Dongfang 1) rockets on 8 September 1958. Both the rockets were solid fuelled. It was also reported that BUAA developed a liquid version of Beijing-2 and launched it on 2 October 1958.

The launch sites of BJ-2 and DF-1 have not left any traces that can be found anymore. Probably they have no permanent launch sites at all. It should be safe to claim that the Laogang launch site is China's first rocket launch site. On the other hand, no matter whether these claims are true or not, the T-7M was the only sounding rocket leading to the further development of practical sounding rockets and having a connection to space launch vehicles. It deserves the fame of the starting point or the cradle of the Chinese space programme - like Peenemunde in Germany.



The note the taxi driver left on the back of a receipt, with his mobile phone number. (credit: Go Taikonauts!)



Seashore near Laogang. (credit: Go Taikonauts!)

Commitment at the global level for increasing the role of space

Reflections on the 57th session of the Committee on the Peaceful Uses of Outer Space - COPUOS

by Jacqueline Myrrhe
including interview with Simonetta Di Pippo

The 2014 session of the Committee on the Peaceful Uses of Outer Space COPUOS took place from 11 to 20 June at the Vienna International Centre. It was the 57th meeting since its existence. The body of 76 delegations united in COPUOS meets once a year to promote international cooperation in the peaceful uses of outer space. It is an un-paralleled platform to serve the global promotion of space as a tool for progress, peace and sustainable development.

This year's agenda stretched out over 10 days, comprised topics like long-term sustainability of space activities; space debris, space operations and tools to support collaborative space situational awareness; space and climate change; the use of space technology in the Basic Space Technology Initiative BSTI and the spin-off benefits of space technology. The Committee also discussed the work plan of the Network of Regional Support Offices of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response for 2014 and 2015, the application for membership of Luxembourg, several General Assembly resolutions and related documents and COPUOS reports.

In her opening speech, Simonetta Di Pippo, Director of the UN Office for Outer Space Affairs UNOOSA, said that "the Committee, its subsidiary bodies and the Office have together a unique opportunity to mobilise support and commitment at the global level for increasing the role of space-based technology and information as an enabler of the goals and objectives of the post-2015 development agenda".

During the technical part of the 57th session of the Committee on the Peaceful Uses of Outer Space, China reported on four topics: on the Chinese Lunar Exploration Programme, on China's Space Policy, Legislation and International Cooperation, on the topic of Research of Space Law in China, and about

the latest status in the Chinese Space Station programme and the involved options for international cooperation. We would like to reflect in more detail on two of the four presentations: "China's space policy, legislation and international cooperation" and "Chinese Space Station and International Cooperation" and would like to give a short summary on the talk about the lunar exploration programme.

Chinese Lunar Exploration Programme

In the afternoon of the 12 June, Ms. Zhao Wenbo, the Deputy Director of the Lunar Exploration and Space Programme Centre within the Chinese National Space Administration CNSA, gave a technical talk on the Chinese Lunar Exploration Programme.

She provided the audience with an in-depth explanation of the wealth of scientific results from Chang'e 2 and in particular the Chang'e 3 mission.

Especially interesting was her description of "Selenographic Patrolling". With the help of photos and graphics she illustrated in detail the several steps necessary to verify before the Yutu lunar vehicle would get the "Go!" for roving around the Moon's surface.

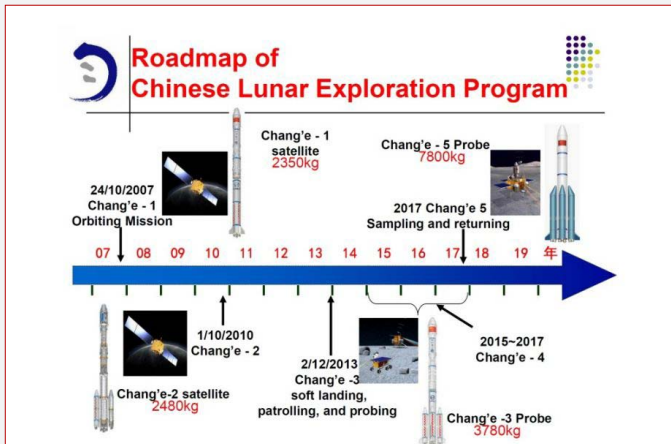
She also pointed out that "for the first time in the world, Chang'e 3 obtained the Earth's wide field image of 15E-R plasma layer from the surface of the Moon. The image accurately shows the outline of the Earth, the Earth's shadow, the range of Earth plasma layer, the profile of ionospheric airglow, and the apex of the Earth's plasma layer, etc. Chang'e 3 obtained more than 600 images in total." Another highlight of the mission was the deployment of the first unmanned automatic lunar-based astronomical telescope in the world.



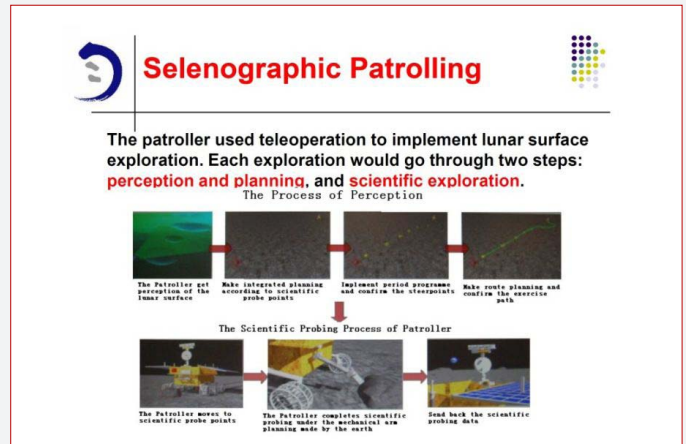
View into the conference room of the 57th session of the Committee on the Peaceful Uses of Outer Space – COPUOS.
(credit: United Nations Information Service Vienna)



Director Simonetta Di Pippo opens the 57th COPUOS session.
(credit: United Nations Information Service Vienna)



The roadmap of Chinese Lunar Exploration as presented by Ms. Zhao Wenbo during the 57th COPUOS session. (credit: Zhao Wenbo/CNSA)



China's Yutu rover was teleoperated while exploring the Moon's surface. The vehicle had to undergo several verification steps before moving forward. (credit: Zhao Wenbo/CNSA)

At the end of her presentation, Ms. Zhao invited everybody to join the handover ceremony of a Yutu real scale model next day in the rotunda of the UN building in Vienna.

link to the presentation:

<http://www.oosa.unvienna.org/pdf/pres/copuos2014/tech-06.pdf>

China's space policy, legislation and international cooperation

On the morning of the 16 June, Ma Xinmin, Counselor of the Department of Treaty and Law, within the Ministry of Foreign Affairs of the PR China gave a technical presentation on the topic:

"China's space policy, legislation and international cooperation".

On behalf of the Chinese government, Mr. Ma reported on the latest development in Chinese efforts with respect to space policy, legislation and international cooperation.

He started by giving an overview on China's Space Policy and explained that China's Space Policy consists of two dimensions: the first being that the purposes of China's space industry is bound to explore space, gain knowledge, benefit mankind and serve the nation. The second dimension is China's fundamental position on space activities like serving the interest of States and all people: "China upholds that the exploration and use of Outer Space should be carried out for both – the interest of States and the benefit of all people. In the exploration and use of Outer Space, a State should, apart from serving its economic development, scientific and technological development, national security and social progress, take account of interest of other States and maintain the common interest of the international community."

But also the peaceful use of space, international cooperation, as well as non-appropriation, equal access, freedom of exploration and use of space are important to the Chinese government, reminding the audience that China and Russia drafted a treaty on the prevention of the placement of weapons in Outer Space.

In the part of his presentation dedicated to China's Space Legislation, Mr. Ma pointed out that China has accessed the Outer Space Treaty in 1983, the Rescue Agreement, the Liability Convention, and the Registration Convention in 1988 and that those legislations have been transformed into China's domestic law.

With respect to Space Debris Mitigation Measures, China has established and improved relevant rules and regulations. In August 2005 China issued requirements on space debris mitigation and is committed to the inactivation of Long March stages and removing GEO satellites at the end of their lifetime out of orbit.

The third part of Mr. Ma's presentation gave interesting information on China's Judicial Practice Concerning Outer Space. Using the example of the "Moon Embassy Case", it became obvious that China might be the only country in the world to take a strong position against private claims on the Moon and actively prevents the commercial sale of so called lunar plots of land by private individuals. Mr. Ma reported: "In September 2005, a Chinese citizen registered Beijing Lunar Village Space Technology Corporation and called it 'Moon Embassy'. In October 2005 he started selling land of the Moon. The selling was called off urgently three days later. During the days a total of 49 acres of land on the Moon were purchased from the company by 34 individuals at the total price of RMB 14.000.

In December 2005, the Beijing Administration for Industry and Commerce rendered administrative sanctions on the company including revocation of its business licence and refunding all sales income.

The 'Moon Embassy' initiated legal proceedings at Beijing Intermediate People's Court claiming that the Outer Space Treaty only provides that Outer space is not subject to national appropriation but does not regulate it by companies and individuals.

In March 2007, the Beijing Intermediate People's Court dismissed the claim of the 'Moon Embassy'. The court stated

that China is a State Party to the Outer Space Treaty. According to the Treaty, Outer Space including the Moon is not subject to the national appropriation including the claim of the ownership of the Moon by citizens and non-state entities.

The judgement showed that the Chinese government strictly complies with international treaties on Outer Space and is firmly against the appropriation of Outer Space by any State or other entity or individuals.”

In the last part of his lecture, Mr. Ma spoke about the aspect of international cooperation.

He stressed that “China holds international cooperation as one of the principles of exploration and use of Outer Space. Based on that principle, the Chinese government actively participates in and carries out bilateral and multi-lateral space cooperation. As regards multi-lateral cooperation: under the framework of the UN, the UN Spider Beijing Office has been established in 2010 and the regional centre for space science and technology education in East Asia and Pacific is taking off at Beihang University. China is also actively participating in activities of other organisations in the framework of the UN, such as ITU and WMO. China is also participating in other multi-lateral mechanisms outside the framework of the UN such as: ICG, RADC, IAF, GEO, The International Charter on Space and Major Disaster, ISECG, and so on.

At a regional level, in 2008 the Asia-Pacific Space Cooperation Organisation was established in Beijing with a joint effort of the Asia-Pacific nations with its headquarters in Beijing.

With regard to bilateral cooperation: China has over 80 bilateral cooperation agreements with 29 States and international organisations. The bilateral cooperation could be divided into two categories: general cooperation agreements between two governments to provide the legal framework, the scope and the areas of cooperation; and cooperation agreements for specific programmes agreed to by governmental departments of two States concerning specific programmes of cooperation.”

link to the presentation:

<http://www.oosa.unvienna.org/pdf/pres/copuos2014/tech-14.pdf>

Chinese Space Station and International Cooperation

Two days later, in the afternoon of the 18 June, Mr. Ji QiMing, Deputy Director of the Technology Planning Bureau in the China Space Station and International Cooperation Planning Division of the China Manned Space Agency CMSA spoke about the Chinese Space Station CSS and International Cooperation.

He started with an overview on the three phases of the manned space programme which will culminate in the space station project. At the time of the presentation, Mr. Ji summarised that, 11 space flight missions have taken place, 10 astronauts have flown into space, 2 of them flying twice. China made breakthroughs and mastered key technologies of human space flight, mastered manned space flight launch and re-entry technology, EVA, rendezvous and docking. In the process, China has carried out extensive cooperation with more than 10 countries and regions, including Russia, Germany, France and others.

Currently the Chinese manned space programme is in the phase of space station development and construction. The CSS will consist of a Core Module and two Lab Modules in a synthetic t-shape topology.

The Core Module provides control and guidance for the CSS with living quarters and a service section. The Lab Modules are mainly used for space scientific experiments, and application and technology tests. Lab Module 1 is composed of a working section, an airlock and an instrumentation section. It also provides back-up functions for the Core Module.

Experiment Module 2 is composed of a working section and an instrumentation compartment.

The general scenario of the space station architecture is illustrated in the slide from Mr. Ji’s presentation – see below.

Mr. Ji went on to explain the construction and options for the extension of the CSS. The first launch would be dedicated to the Core Module followed by docking of Lab Modules 1 and 2. Experiment Modules 1 and 2 will be moved by a quadrant to and fro around the node module through position adjustment operations

in order to make a rigid connection with the Core Module and constitute the three module basic configuration. The CSS reserves extension ports and support capability and reserves mechanical, electrical and thermal extensions ports capable of docking with new modules.

The Shenzhou spaceship will serve



General scenario for the Chinese Space Station CSS. (credit: Ji QiMing/CMSA)



Graphic and basic function of the Core Module of the future CSS. (credit: Ji QiMing/CMSA)

for crew transportation to and from the CSS. Shenzhou would remain docked for 180 days on the Station. After undocking from the CSS, landing would occur within one day.

For cargo transport to the CSS a dedicated space craft consisting of cargo module and propellant module would be used. The cargo section can be designed as a fully pressurised module for the delivery of goods, it could be semi-pressurised for the transport of extravehicular large payload or it could serve as an unpressurised experiment bed.

Based on Feitian EVA space suit in the Shenzhou 7 mission, the next generation Feitian EVA space suit is under development. For the purpose of in-orbit construction and maintenance, the Core Module is equipped with one large robotic arm and the Experiment Module is equipped with a small robotic arm. The two robotic arms can work separately or collaboratively or can also be assembled together to extend the working area.

China will use three different types of launcher for the CSS assembly: The Long March 2F with a LEO capability of approx. 8 t will shuffle the crews on-board the Shenzhou spaceships to the Station. Its launch site should remain in Jiuquan. The Long March 7 with a LEO capability of roughly 13 t would be used from the newly built Hainan launch site for lifting the cargo spaceships. The big modules for the CSS assembly would also lift-off from Hainan island but on board the heavy-lift Long March 5B capable of 20 t to LEO.

The three launchers are built to meet the requirements of compatibility, modularisation and serialisation; are equipped with cryogenic engines, and will be based on non-toxic propellants.

The CSS will be built in 2 phases: The first step is the space lab-phase. Around 2016 will see the launch of the Tiangong 2 module to be visited by a manned spaceship and cargo spaceship. Tiangong 2 will be used to gain operational experience, conduct space science experiments and technology tests which are expected to make breakthroughs in key technologies such as in-orbit refilling of propellant.

The second phase is the actual Space Station assembly. Around 2018 the Core Module should be launched, followed

by the Experiment Module 1 and Experiment Module 2. It is expected that the in-orbit assembly with the addition of a 20 t module should be completed around 2022. The outpost would be in full operation for astronaut long-duration missions and large-scale experiments in space science and applications. The idea is to use the CSS for all relevant areas of space research and scientific application.

China may help other countries to select and train astronauts

When Mr. Ji came to the part of his presentation covering “Visions of international cooperation related to CSS” he made some remarkable statements:

“Progress of human space exploration results from the collective efforts and the comprehensive wisdom of humanity. For that reason all countries in the world deserve the opportunity to participate in it and share resources with others. Any country in the position to do so should shoulder the obligation and responsibility to promote the technical results of human space exploration to other countries and share space resources with them. During the construction of the CSS we will adhere throughout to the principles of equality, mutual benefit and the peaceful utilisation and common development in conducting extensive cooperation with the UNOOSA and other space agencies and organisations all over the world.”

He went on by explaining that there are mainly 4 areas of potential cooperation for the space station utilisation:

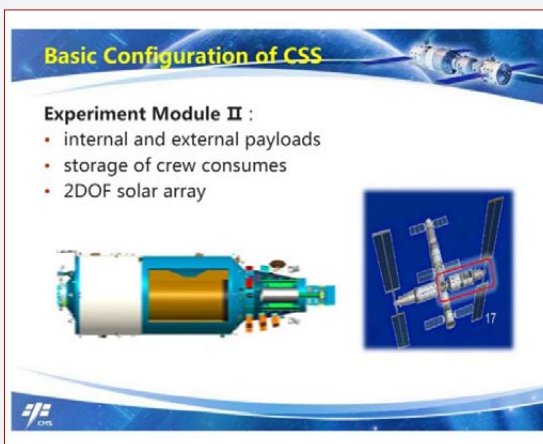
1. Cooperation in platform technology: it can be technical cooperation in individual facilities or assemblies or cooperation in the development of sub-systems or modules.
2. Cooperation in space applications: joint research or on-board experiments to cooperate in fields of space science and applications, space medicine, etc.
3. Astronaut selection and training: exchange and cooperation in astronaut selection and training methods. There might be a time where China may help other countries to select and train astronauts to fly alongside Chinese astronauts.

4. Promote and share technical know-how: China will promote the technical knowledge and results to other countries especially the developing countries and regions.”

Mr. Ji concluded his speech by saying: “In 2010 the United Nations launched the Human Space Technology Initiative HSTI with the objective to



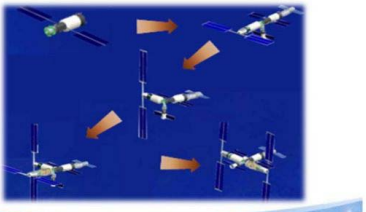
Graphic and basic function of the Experiment Module no 1 for the future CSS. (credit: Ji QiMing/CMSA)



Graphic and basic function of the Experiment Module no 2 for the future CSS. (credit: Ji QiMing/CMSA)

Assembling plan

- Experiment module I RVD
- Experiment module I transposition
- Experiment module II RVD
- Experiment module II transposition
- Core module



Plan for the assembly steps of the future CSS.
(credit: Ji QiMing/CMSA)

promote international cooperation in human spaceflight and space exploration and related activities, which has provided an excellent platform for the development of human space exploration. Since then, UNOOSA has organised numerous practical and fruitful activities enabling this platform to play an increasingly important role and exert more significant influence. The CMSA fully supports promoting international cooperation within the framework of the HSTI. In particular we will carry out more cooperation and exchange with the developing countries, share experience and resources of China's manned space programme, and work with other countries to promote human exploration of Outer Space.

In terms of cooperation channels it could be bilateral or multi-lateral cooperation. As for most cooperation, on a basis of peaceful development and win-win cooperation we can explore and find a flexible mode of cooperation through discussion and negotiation.

Human space exploration is the common dream and wish of all countries. Looking up at Outer Space, we feel the significance of this great course. Standing on Earth, we are more convinced of its future prospects. I hope that all countries committed to the

peaceful use of outer space can work together to make more contributions to a brighter future of human space exploration.”

Link to presentation:

<http://www.oosa.unvienna.org/pdf/pres/copuos2014/tech-24.pdf>

Yutu now in the hands of the UN

On Friday, 13 June 2014, the space exhibition at the United Nations' location in Vienna, Austria, received another addition. The China National Space Administration CNSA donated a 1:1 replica of Yutu, China's first rover on the Moon, to the permanent UN space expo. After a model of the Beidou satellite, now also the Jade Rabbit has found a home in Vienna. In Europe, Friday the 13th, is not really considered to be a lucky day. But on the occasion of the Yutu handover, the little ceremony attracted a lot of attention and UNOOSA's new Director, Simonetta Di Pippo, was very happy about the latest model for the UN's space showroom, when she said that for the first time the UN is including a rover into its collection: "The space exhibition attracts around 50,000 visitors every year. This fine example of Chinese space engineering will, I'm sure, attract more and more people, helping our office to promote the benefits of space for humankind."

Although UNOOSA is already in place since the late 1950s, China only joined this UN organisation in 1980. But since then, explained the Secretary General of CNSA, Tian Yulong, "CNSA has established a long-term cooperative relationship with UNOOSA. The Chinese government also supports the UN's activities in outer space." China and UNOOSA have agreed on a series of projects to strengthen its ties. "UNOOSA has already decided to set up a UN outer space technology education centre, which would likely be initiated at the Beijing University of Aeronautics and Astronautics by the end of this year," said Ma Xinmin, Counselor of the Department of Treaty and Law in the Chinese Foreign Ministry. Simonetta Di Pippo expressed: "I do believe more and more that the relationship between China and UNOOSA will be reinforced thanks to these interesting new agreements." The Jade Rabbit lunar rover is a suitable symbol of flourishing cooperation between the two sides. (also see interview with Simonetta Di Pippo)



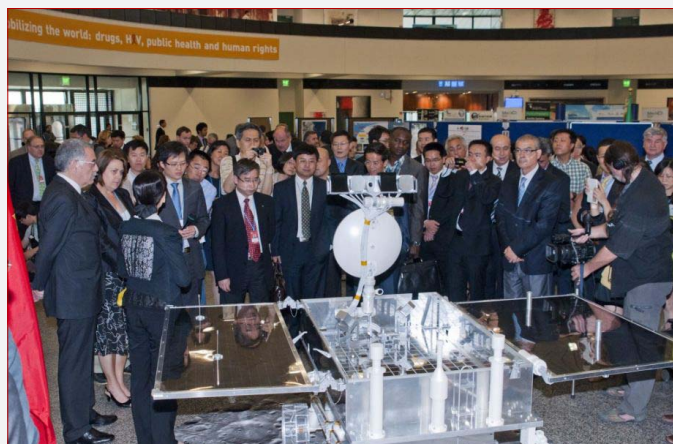
Welcome words by Cheng Jingye, Ambassador and Permanent Representative of China to the United Nations and other International Organisations in Vienna. (credit: Maria Pflug-Hofmayr)



With joint effort, the Yutu is getting uncovered. (credit: Maria Pflug-Hofmayr)



A staff member of the Chinese Delegation is explaining the features of the Yutu rover. (credit: Maria Pflug-Hofmayr)



A staff member of the Chinese Delegation is explaining the features of the Yutu rover. (credit: United Nations Information Service Vienna)

**Interview with
Ms. Simonetta Di Pippo,
since March 2014 Director of the Office for Outer Space Affairs (UNOOSA)
at the United Nations Office at Vienna (UNOV)**

GoTaikonauts!: Only recently you took over the Office from your predecessor Mazlan Othman. How do you feel in your new assignment and how is the work going?

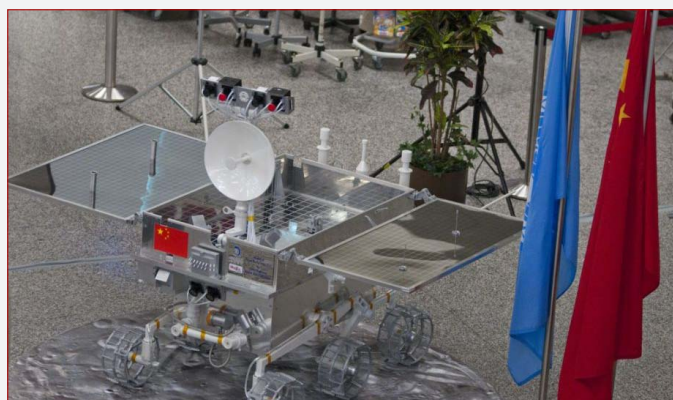
Simonetta Di Pippo: The United Nations Office for Outer Space Affairs (UNOOSA) is an exciting, busy and interesting place to work. The Office, with staff numbering around 30, has the mandate of bringing the benefits of space to humankind and this translates into a varied workload! We maintain the register of all objects launched into space. We are the secretariat of the Committee on the Peaceful Uses of Outer Space (COPUOS), and its two Subcommittees. There are 76 member States in COPUOS, making it one of the biggest and oldest intergovernmental bodies dealing with space, being established shortly after the launch of Sputnik 1. We also run many activities under the umbrella of the Programme for Space Applications, where we deal with a lot of technical activities ranging from

capacity-building in developing countries, to expert meetings to discuss how to better implement activities in space. We have also a programme which is called “UN-SPIDER” [United Nations Platform for Space-based Information for Disaster Management and Emergency Response] which works to ensure the equal access of all types of space-based information to support the full Disaster Management cycle. We are also running an initiative in human space technology. This is a recent activity that was started in 2010, but it is already well perceived, also by the contributors and delegations.

Aside from our office in Vienna, UNOOSA also has two secondary offices in other countries, one is in Bonn, Germany, and the other one in Beijing, China. The reason is that Germany and China are great contributors to the activities of the Office, and in particular to the UN-SPIDER programme.



Group photo of the UN staff with the Chinese delegation. During her short speech, Simonetta Di Pippo stressed: “The exploration of the Solar System, in my opinion, will be for sure a pillar in the cooperation for space activities in the future.” (credit: Maria Pflug-Hofmayr)



A close-up view of the Yutu rover for the UN in Vienna. (credit: United Nations Information Service Vienna)



GoTaikonauts!: *Prof. Othman was a strong supporter for the involvement of China into UNOOSA projects. What is your position on that? Where do you see China within the projects of your office?*

Simonetta Di Pippo: China is one of our biggest contributors. They cooperate with the Office in different areas, for example, as I mentioned, on Disaster Management within UN-SPIDER in the Beijing Office. Currently, I'm discussing potential new cooperation between OOSA and the Chinese Delegation. I've been visiting China beginning of July and a variety of their most important organisations dealing with space, including CNSA, CMSA and the Harbin Institute of Technology. In addition, the Beihang University - the astronautical and aeronautical university in Beijing - is working to build up a Regional Center. Plans are expecting me to be in Beijing again in November 2014 to inaugurate it. These are also few examples of the Chinese interest to become more and more important in the space arena, but also to strengthen the relationship with the Office that is already quite good.

GoTaikonauts!: *What in particular, do you think, can your UN office gain from China's progress in space? or in other words: How could your office and your work benefit from China's efforts in space?*

Simonetta Di Pippo: The mandate of the Office for Outer Space Affairs is to promote international cooperation for the peaceful use of outer space for the benefit of humankind. What is most important is to gather more and more support from more and more countries, as this will enable us to work towards promoting the use of space and to coordinate international activities in space to focus on its use for socio-economic sustainable development. Space is innovation, it is research, it is a catalyst for socio-economic development. The more countries cooperating in space activities and with our work, the more we can reap the benefits of international cooperation. In the future it would be very difficult if there was only one country able to explore the solar system or embark on big space projects. Furthermore, the more we cooperate, the better it is for developing countries and this is the main objective of our activities. Our work in promoting cooperation between developing nations and those space-faring ones that have already developed a lot of expertise in building and developing space systems, improves the equality in access and utilisation of space for the benefit of humankind. It improves democracy in space, and through space.

GoTaikonauts! wishes to thank Maria Pflug-Hofmayr for conducting this interview for us and reporting from the Yutu handover ceremony in Vienna.

Links to all presentations during the 57th session of the Committee on the Peaceful Uses of Outer Space from 11 - 20 June 2014:
<http://www.oosa.unvienna.org/oosa/en/COPUOS/2014/presentations.html>

In March 2014, the Secretary-General appointed Ms. Simonetta Di Pippo (Italy) as Director of the Office for Outer Space Affairs (UNOOSA), United Nations Office at Vienna (UNOV). In an interview with the UN Information Service in Vienna, Ms. Di Pippo talks about her views on what inspires her about space, about her first days at the Office and her vision for the time ahead.
<http://www.oosa.unvienna.org/oosa/en/UNOOSA/mod.html>

United Nations Office for Outer Space Affairs - Bringing the benefits of space to humankind
<https://www.youtube.com/watch?v=T0cOFMgKUFw>



The Director of UNOOSA, Ms. Simonetta Di Pippo visited APSCO Headquarters in Beijing on 10 July 2014. The Secretary-General of APSCO, Mr. Celal Unver, and its international staff welcomed the UNOOSA delegation. Both sides exchanged views on the existing activities of APSCO; and possible fields of cooperation between OOSA and APSCO. (credit: APSCO)



On 11 July 2014, Wang Zhaoyao, Director General of China Manned Space Agency CMSA, met with Simonetta Di Pippo, Director of the United Nations Office for Outer Space Affairs UNOOSA at Beijing Aerospace City. They exchanged views on the future cooperation. Prior to that meeting, Simonetta Di Pippo was invited to tour around China Academy of Space Technology, Astronaut Center of China and Beijing Aerospace Control Center. (credit: CMSA/Yu Yanjuan)



“We may have different cultures but ... we can learn from each other.”

Searching for Chinese traces at the International Air and Space Exhibition ILA2014 in Berlin

by Jacqueline Myrrhe

including interviews with Marc Jochemich and Hans-Georg Tschupke



View into the ILA 2014 Space Pavilion.
(credit: GoTaikonauts!)

Once every two years, Berlin becomes the centre for the international aerospace community when the International Air and Space Exhibition, ILA, opens its doors. In 2014, the ILA Berlin Airshow attracted 1,203 exhibitors from 40 countries and almost 230,000 trade and public visitors in the week from 20 to 25 May. The ILA is the longest-standing and most firmly established airshow in the world. The first ILA took place 105 years ago in Frankfurt/Main. But since the German re-unification, the Berlin location, with its generous space and facilities at the rear side of the Berlin-Schönefeld airport - which will become in the near future the Capital airport - is the new fashionable “place-to-be” when it comes to aerospace.

Although the fair is clearly dominated by aeroplanes, among them numerous military exhibits, a dedicated hall, the Space Pavilion, is always reserved for promoting space. Traditionally, there is a strong presence by Russian space industry, as in the years before, accompanied by Ukrainian space enterprises side-by-side. And of course, all German-based space companies show a strong presence along with the main European actors.

Considering that this year’s partner country was Turkey, the ILA Berlin Airshow is still lacking a visible amount of Asian or Chinese exhibitors. Just two Chinese booths could be found: one by the Shantou Wanchengfeng Craft Co. Ltd., advertising airplane model fabrication, and the other one representing Xian Space Star Technology Group Corporation and CAST Xian Institute of Space Radio Technology.

Behind closed doors, the German Aerospace Industries Association (BDLI) organised a round table forum with a delegation of Aviation Industry Corporation of China and signed a Memorandum of Understanding (MoU) with the Chinese Society of Astronautics.

But China was a topic of two interviews, GoTaikonauts! could conduct during the ILA week in Berlin. ILA Berlin is not just an exhibition, it is also a meeting place for career development, education, media and workshops. The organisers pay a lot of attention to versatile opportunities for the exhibitors to get in contact with the interested public. During one of those ILA Business Workshops, we met Marc Jochemich who gave a presentation on the possibilities within the European Union’s Horizon 2020 programme. Horizon 2020 is the European Union’s main financial instrument for funding research in Europe. It comprises a financial envelope of nearly €80 billion from 2014 to 2020. Since the beginning of the 7th Framework Programme for Research and Technological Development in 2007, the EU has been funding Space as an independent theme. In parallel to the programme, the EU established a network of National Contact Points (NCP) to inform potential participants about the programme and to assist them in the application procedures – providing a kind of helpdesk function. In Germany, the National Contact Point Space is established at the German Space Agency DLR, located in Bonn. Marc Jochemich is filling that function in person.

GoTaikonauts!: What is the intention of the European Commission, to link countries like China or other non-European nations with the European research community?

Marc Jochemich: The intention is to draw a mutual benefit from the projects conducted under the umbrella of the EU programme Horizon 2020. In the past, China has enormously invested in space to catch-up with other leading space nations. Currently, China is about to develop ambitious plans for space research. We hope that European institutions can take advantage of that. The most important criteria and basis for this type of international cooperation is the mutual benefit for all partners participating in a project. In principle Horizon 2020 is a programme targeted towards European companies and institutions. The aim is to provide them with the financial support for their research. But if the project is advantageous for all partners - something one would always expect when big space nations cooperate - then the projects, financially supported by the European Commission,

make sense. This also means that the project support is not limited to cooperation with China. The European partners can also work together with counterparts in Russia, the U.S., in Ukraine, or others. What is important is the expected mutual benefit and this must be clearly explained in the proposal. If this is convincingly described, then the EU will be in favour of supporting projects with international participation.

GoTaikonauts!: Has the European Commission already identified a special focus on potential areas where China is in a leading position and where Europe could learn from China?

Marc Jochemich: “Planetary Protection” is one area which was identified for international cooperation. This could be of interest for a cooperation with China because China is about to make progress with surface vehicles in the robotic exploration of the Moon. There are not many nations capable of flying to other celestial bodies, land there and maybe return samples. “Planetary Protection” is an aspect which needs to be very well thought through before you fly to other places in space and before you - in the worst case - bring in terrestrial organisms or before you end up introducing microbes from extra-terrestrial bodies on-board a sample return mission to Earth. I think, this is the reason why this particular topic is addressed in international cooperation with the big space-faring nations.

What concerns technologies, there are no limitations. It is important to have a good reason for cooperation with another space-faring nation or especially with China on one of the different topics offered in the programme Horizon 2020. The better the partner can explain in the application documentation, what exactly the Chinese partner is contributing what is not available elsewhere, the better are the chances for an approval and support. Each application is treated on a case-by-case basis. They are evaluated according to excellence and at the end there is a ranking. This means clearly, that a project - including one with China - will not be approved if it does not meet the selection criteria.

GoTaikonauts!: Are there already projects with China on-going?

Marc Jochemich: Up to now five projects with China derived from EU space research funding, mainly in the field of Earth observation, especially climate research. In the precursor programme FP7, the EU already made a start with international cooperation projects. By that time, representatives of the Chinese space organisations have been participating in events and have introduced China’s competencies in the different areas. Moreover the European Commission started discussions with China’s Space Agencies to identify possible topics. However, I think there is still space for improvements with respect to information on the potential of the programme and also what is possible outside this programme - in other words: who can do what? - a kind of meeting place for both sides. At the same time the question arises who is willing to expose what? Because in Europe, the topic of “Intellectual Property Protection” immediately comes up when talking about China. Is it possible at all to cooperate with Chinese partners and at the same time protect your own intellectual property rights? This is something each partner has to take responsibility for. The programme has no ready-made answers to that, but it is obligatory that the partners are thinking about this matter beforehand and come up with solutions before the project starts. This aspect is not neglected, rather it is an integral part of the programme.

GoTaikonauts!: Is the Horizon 2020 programme here in a leading role?

Marc Jochemich: These rules have already been in place since the FP7 programme for all projects. One has to keep in mind that the European Commission is giving financial support as a grant and therefore will not become the owner of the results. Because of that, the Commission regarded it as important, that straight from the beginning the project partners - who will subsequently become the actual owner of the property rights - think about how the results will be used. The support is not a support for the sake of supporting European entities, but the Commission wants to see results which will strengthen the



The joint ILA booth by the Xian Space Star Technology Group Corporation and CAST Xian Institute of Space Radio Technology. (credit: Raumfahrt Concret)



The joint ILA booth by the Xian Space Star Technology Group Corporation and CAST Xian Institute of Space Radio Technology. (credit: Raumfahrt Concret)



European economy. You have to look at the whole set-up from the perspective of European economic competitiveness. It is about key and enabling technologies, those technologies that will drive Europe's economy. Therefore it is important that at the end, the results will be used commercially. This is the reason why the European Commission attaches great importance to the fact that the ownership of the intellectual property rights is clear, and that the owner will utilise the results later on.

GoTaikonauts!: Where do you place the strategic importance of the programme Horizon 2020?

Marc Jochemich: The special characteristic of space missions and technology development is that many projects cannot be tackled by an individual state. Therefore, since many years, ESA exists. Since a few years, the EU is another player in this area offering financial support through the framework programmes. If the incorporation of space competencies from outside Europe is enabled within the frame of its programmes, it is simply an attractive idea to cooperate with China or the U.S. for mutual benefit. This is a chance Europe doesn't want to miss. The European Union programme covers a wide range of topics. This broad base is an advantage and supplements bilateral cooperation, which often can only target a narrow scope of topics. Still also bilateral projects between European and Chinese organisations are important steps forward, like for example the SIMBOX project between DLR - the German Space Agency and the China Manned Space Engineering Office.

home page Horizon 2020:
<http://ec.europa.eu/programmes/horizon2020/en>

For centuries, the German city of Bremen has been rather famous for giving name to the fairy tale of the Bremer Stadtmusikanten - The Town Musicians of Bremen. Not many would associate the Northern town close to the Baltic Sea with space. But looking back at more than 1000 years of settlement, the Bremen citizens are also famous for being world-open traders and free-spirits. Therefore it should not come as a surprise that Bremen has established its own little Horizon 2020 programme, just tailored and adapted to the needs of its economic situation and for securing a sustainable future for the city, to become famous for a "Home of Innovation".

Hans-Georg Tschupke is Department Head for Innovation Promotion in the Bremen Economic Development GmbH (Wirtschaftsförderung Bremen GmbH). In a wider context, he aims at the all-round and worldwide promotion of the town of Bremen, always with the objective of securing jobs and the economic prosperity of the Bremen area. In the closer context he is looking for business opportunities in the field of aerospace, wind energy and in the maritime sector. His team is organising workshops, providing information, maintaining networks, and is looking for new attractive cooperation or is participating in fairs, like ILA Berlin. We talked with him about Bremen's activities in China.

GoTaikonauts!: What actually is your task?

Hans-Georg Tschupke: I am Head of the Innovation Department in the Bremen Economic Development GmbH. In Bremen we are focussing on three innovation strategies and clusters. The most important of the three clusters is the cluster for aerospace. This is one of the reasons why we are here at the Berlin Airshow, ILA2014. On the one side, on the aviation side, everything concerning the Airbus production belongs to the cluster. On the other side, the Bremen area is the only location in Germany hosting aviation and space companies. On top of that Bremen is the home of the two most important European space enterprises. It is Airbus Defence and Space with responsibilities in the European launcher programme, in the ATV project - soon the MPCV-ESM, in the operation of the ISS. And it is OHB - a Bremen success story of a family company which started 30 years ago with merely five staff, and became an international group of space companies, being the prime for the series of Galileo satellites.

Our task is not only to be there for the big companies, but also to optimise the conditions in Bremen in general. In particular it is important to keep a close relationship with international activities, with ESA, with international authorities, institutions, financial sources and project partners. Together with our companies, we extend and maintain this network.

GoTaikonauts!: In this context you have put out your feelers to the space area in China?

Hans-Georg Tschupke: Since more than 10 years we are present in China. We, as the Bremen Economic Development GmbH, have our own office in Shanghai. Similar to Shanghai, we have offices in Atlanta in the U.S.A., and in Izmir in Turkey. We are often accompanied by other companies or science institutes from Bremen. No matter which country, we always work together with local colleagues, because we are convinced that you need native speakers, who preferably speak German



Hans-Georg Tschupke (outermost right) is opening the Women in Aerospace roundtable on "How can we get more Women in the Aerospace Sector in Europe into Leadership Positions?" from the left: Johannes von Thadden, Head of Political Affairs, Airbus Defence & Space Germany; Simonetta Di Pippo, President Women in Aerospace Europe; Claudia Kessler, moderation; Brigitte Zypries, Parliamentarian Secretary of State Germany; Jean-Yves Le Gall, President CNES. (credit: GoTaikonauts!)



and/or English too, to set-up the right contacts. In China we focus on our three clusters: maritime economy, aerospace and wind energy.

Throughout the past 10 years we have learned that the build-up of trustful cooperation takes time. In particular in China, nothing happens overnight. Nothing happens by itself. Only a few things work directly between companies. Therefore it is important to establish a combination of political, official and entrepreneurial support. This constellation, by the way, is typical in the space sector.

GoTaikonauts!: Do you focus on certain activities in the area of spaceflight?

Hans-Georg Tschupke: Of course we have a certain focus in the area of spaceflight which corresponds to the profile of our companies. It does not make sense for us to invent something new with an international partner, no matter whether this partner is from the U.S. or from China. We rather concentrate on the interest of our companies in Bremen. Important is also: what is the interest of the cooperation with science partners? At the moment it seems that it is easier to count on scientific cooperation. Among companies there exists, on both sides a big competitive spirit. So, often it is easier to start with a scientific cooperation. Even scientific cooperation does not start by itself. You see, not so simple either. Although, we orient ourselves on regional needs, I am convinced, that through the international market orientation of our companies we contribute to the further development of European astronautics.

GoTaikonauts!: Do you have already examples of cooperation?

Hans-Georg Tschupke: We work in close coordination with the German Aerospace Center DLR. Together, we have conducted joint talks and workshops. For example, last year before the IAC2013 Beijing, the management of CAST has been visiting us here in Bremen. Among the approximately 20 guests, was also the Director General of CAST. We have met him again during the Paris Airshow and there we have deepened our contact. During the IAC2013 in Beijing, accompanied by representatives from Bremen scientific institutions and companies, we have paid a return visit. We could continue our talks to sound-out options for cooperation, until today, this has not led to any concrete projects. But we are working on it to keep the many possible options open.

GoTaikonauts!: To my knowledge there was also a visit to the drop tower in Beijing. Which impressions could you take home from there?

Hans-Georg Tschupke: We had very open talks. We were accompanied by colleagues from the ZARM Drop Tower in Bremen and representatives from companies and other scientific institutions. I had the impression that the drop tower in Beijing has a different function than ours in Bremen. The experiments are different from the microgravity potential. The Beijing colleagues work very pragmatically. For most of the experiments, the drop tower as it is, is suitable.

GoTaikonauts!: Could you establish possibilities for cooperation with ZARM during your visit in Beijing or is it too early to talk about it?

Hans-Georg Tschupke: Since many years ZARM and the Beijing drop tower maintain contact for scientific exchange. Both institutions belong to the international community for microgravity research. From that point of view, it is important to us to contribute to the further development of the international microgravity research where not only contacts to China, but also to other locations are of relevance.

GoTaikonauts!: What are the next steps?

Hans-Georg Tschupke: At the beginning of the week, there has been a BDLI workshop at ILA2014 on the topic of cooperation between China and Germany. We have been participating in this workshop. The same delegation will visit us tomorrow in Bremen. Together with institutions and companies from Bremen we will conduct further talks. The institutional structures in China and Germany are very different. In China there is an enormous diversity. In particular in the field of space, many academies and scientific institutions exist. It needs a certain orientation before one knows with whom to deepen contacts. Therefore I was very pleased, that the Chinese side got back to us to continue our relationship. Like many things in business life also, this does not work overnight.

GoTaikonauts!: What do you wish for the future? In five years from now, which results would you like to see?

Hans-Georg Tschupke: In five years from now, indeed, I wish another "first fruit" became ripe. There have been experiments from Germany flown on Chinese rockets. This was a project by DLR. I think that we can go on from here. Essentially, it is not about either working with NASA or with China, but it is about finding further perspectives for joint aims in space.

GoTaikonauts!: Has Bremen a twin town in China?

Hans-Georg Tschupke: Yes, since many years a city partnership with the town of Dalian exists. This partnership was also a catalyst for the topic "space", although our twin town Dalian has not always been the starting point for all activities. In the meanwhile we have been in many Chinese cities and it is not always about space, but many other areas of interest. As you know, Bremen is a town with a more than 1000 year-old tradition as a trading place, a member of the Hanseatic League. Many companies in Bremen have a partly 100 year-old trading relationship with China. We want to develop this as well.

webpage:

<http://www.wfb-bremen.de/de/wfb-innovationscluster>

Another highlight of the Berlin Air and Space Show, ILA 2014, was the panel discussion "Opportunities for Global Space Cooperation" on 20 May 2014 in the ILA Space Pavilion. Moderator Ulrich Bobinger who guided also the IAC2013 plenary session "Heads of Agencies", was joined in Berlin by Jean-Jacques Dordain, ESA Director General; Charles Bolden, NASA Administrator; Johann-Dietrich Wörner, Chairman of the Executive Board of DLR; and Evert Dudok, Head of Airbus Defence and Space.

Ulrich Bobinger kicked-off the discussion by giving the four panellists the opportunity for an opening remark on cooperation. ESA's Jean-Jacques Dordain made the start by saying: "If there

is one field on which ESA can teach the world it is certainly space cooperation. This is our daily life. We are 20 Member States cooperating within ESA. ... But ESA is also cooperating with the ESA Member States - one-by-one. ... We are cooperating with the European Union. ... We are cooperating with the industry and the operators. ... And we are cooperating with international partners. What did we learn from that? Number One: Cooperation is difficult but successful. Number Two: Cooperation must be open. If it is a closed club you may not survive. Number Three: You cannot cooperate on all topics altogether. You must have a flexible way to cooperate. This is what we call 'Optional Programmes' at ESA." Jean-Jacques Dordain ended his opening remarks by saying that for ESA the best areas to cooperate are science, human spaceflight and ISS and exploration.

NASA Administrator Charles Bolden was also in favour of international cooperation and he considers Mars as the ultimate goal for humans to go in an international effort.

Evert Dudok, Head of Airbus Defence and Space stressed: "We are very well used to cooperation. Cooperation is in our genes. One plus one can be three - most likely it is two-and-a-half - because you might have losses on the way.", and he added: "I want to be extremely clear: Global challenges cannot be tackled with national budgets. Global challenges need international cooperation."

Johann-Dietrich Wörner, Chairman of the Executive Board of DLR presented his perception of cooperation when he pointed out: "We have to realise that international cooperation is not trivial. It is nice but of course it means to work sometimes under very special political situations. This is a challenge - a personal challenge as well as an institutional challenge. We are right now in such a phase. I am sure that space can do more than just following what is said at other places. We always quote the 1975 rendezvous and docking of Apollo and Soyuz in times which were much more difficult than what we see right now. It was possible back then and it led to more cooperation and I hope we will be successful in the same way right now."

Moderator Ulrich Bobinger then tried to challenge the four men on stage with the question: "When looking at your International Space Exploration Roadmap, including 12 national agencies. In a team of 12, who will be the captain?" to which Charles Bolden instantly replied: "I am a leader. I do not mind to be the captain if this is what is necessary. The U.S. is willing to do it. We have the biggest budget and that generally directs where everybody goes.

Whenever we talk with our international partners, and ask where we want to go, we get together and decide and this is the purpose of the international global exploration roadmap. We take a joint decision on where to go and then we see who brings what to the table. We generally tend to bring a bit more to the table than everybody else. By default this makes me the captain, if you want to look at it this way. I have to defer to the Dean Jean-Jacques. I have learned a lot from him. I may be the captain but Jean-Jacques is the Dean. Jean-Jacques has taught all of us how to do international relations." Those remarks left the floor to Jean-Jacques Dordain, who replied to that: "In any cooperation we need a leader - or two leaders. I think cooperation can only work if there is a leader or two leaders. ... We are ready to accept NASA as a leader. Because they have the biggest resources."

Evert Dudok then reminded the panellist and the audience that "Leadership is not for fun. It comes, unfortunately, with a lot of responsibilities. You take the good times, but also the bad times and you have to go through." His words got the blessing by Jean-Jacques Dordain: "We have no choice but to work together."

Reaching this point in the discussion, the moderator took questions from the audience which were written down on paper beforehand. Somebody from the audience wanted to know: "Can we talk about international cooperation without the representatives from Russia and China? What about the industry side? You are still talking with Russia and China, don't you?"

Evert Dudok, Head of Airbus Defence and Space had a quick



ILA 2014 panel discussion "Opportunities for Global Space Cooperation" from the left: moderator Ulrich Bobinger; Evert Dudok, Head of Airbus Defence and Space; Johann-Dietrich Wörner, Chairman of the Executive Board of DLR; Charles Bolden, NASA Administrator and Jean-Jacques Dordain, ESA Director General. (credit: ESA-P. Sebirot, 2014)



Charles Bolden, NASA Administrator (left) and Jean-Jacques Dordain, ESA Director General are taking part in the ILA 2014 panel discussion "Opportunities for Global Space Cooperation". (credit: ESA-P. Sebirot, 2014)

answer: “Yes, of course. And I would say we are keeping the ball flat. We are trying to be not too visible on topics like this. Political relationships develop – have ups and downs. Industrial relationships don’t follow that speed of change. Thank god! We have many good cooperation with the U.S. We have the same with Japan - be it BepiColombo or others. Of course, we are working together with Russia on things like Eurockot, where we serve together a launcher market. We are trying to make sure, that whilst we may not go very public on some cooperation that today are politically not opportune, we are making sure that we keep our network going and hoping for better times to come.”

Johann-Dietrich Wörner, who revealed three months after ILA 2014 that he applied for the job vacancy for the Director General of the European Space Agency gave his insight to that question: “Of course international cooperation is a must - is a must. However, I think we should make a point - you can call it ethical boundary or political boundary - we should also consider questions like IPRs, intellectual property rights, and even human rights. We should not be too naive to say, whoever is participating and cooperating with us is a nice guy automatically in the next second. And therefore I think we have to be a little bit cautious also with regard what to do. Again, I am for international cooperation. I think international cooperation especially in space can pave the way for more peace in the World - as it did in the past. But sometimes we have to be a bit cautious. This is no contradiction.”

Wörners words were re-inforced by Evert Dudok who said: “I fully, 200 % agree. Let say 100 % - fine. Talking about compliance and ethical norms. Our compliance norms are our norms. They are not necessarily those of other countries. And if we come to certain conclusions that culturally, we are too far apart with the one or the other country than we shall not cooperate. I fully agree with that.”

Fortunately, the moderator did not give up on this very important subject and picked another question from the audience, asking: “Real international cooperation needs the respectful incorporation of China in the ISS project. Is there any progress on that?”

Charles Bolden took that question and answered: “Jean-Jacques mentioned it before: ISS is about a lot of things. I think people tend to dwell on Chinese participation in the ISS and they miss the fact that even the U.S. has collaboration activities with China - whether it be military, or space. We have some very strict things we have to do with the U.S. Congress, that allows us then to go and collaborate with the Chinese, and I do not want people to miss that fact that if you talk about the area of Geodetics - which is really important: looking at the Earth and how it moves, trying to understand earthquakes - we are working now, and it is a growing relationship, with the Chinese Academy of Science and our Science Mission Directorate our Earth Science Division on collaboration on Geodetics. We are trying to help the Chinese to understand the importance of putting their data into the international data system, so that everybody has access to it. For example: we are working with China in the area of glacial characterisation in the Himalayas, an area that most people do not think about when talking about water, but water is a critical need there. And it is something they

have to figure out how do you get it. They are also a partner in aeronautics. What we are looking for now is an international collaboration when it comes to in-route air traffic management. How do we get our planes from point A to point B smoothly. How do we incorporate systems that allow a pilot to take-off, climb to his desired cruise altitude without intermediate level holds, and then how to descend to an airport without intermediate stops. And how do we let the airplanes talk to each other and figure out the best way to go there. Industry is doing that. It is all of us in the government that have to come along and utilise the capability that industry has given us. But we will get there.”

Interestingly, the China topic received a lot of attention because also the next question for Jean-Jacques Dordain was also about China: “What is the path forward in cooperation with China in order to bring different cultures closer together. I know an ESA astronaut that is learning Chinese.”

ESA's Head of Agency gave an affirmative answer: “Yes, we have even two astronauts learning Chinese. We are cooperating with China that is very clear. We are especially cooperating in the science domain. I wish to recall, that the very first scientific Chinese mission has been made in cooperation with ESA. It was Double Star. Double Star was made with the spare parts of Cluster. On the success of Double Star/Cluster we are discussing with China on how we can join forces for some science mission. We even plan to have in the next month the joint call for proposal for an ESA-China mission. We are also exchanging data on Earth observation. Exactly what Charlie was saying, we are sharing our data with our Chinese colleagues. We have also some discussion on human spaceflight and exploration. We are discussing with them on how we can have a Chinese call as PI on some experiments on board the International Space Station. This is totally in full transparency with the other partners. We are looking at how we can use their own Space Station for making some experiments. So yes, we have discussed this with them.

I think, speaking of culture I can tell you that even at ESA we have to reconcile some different cultures between Nordic European countries and South-European countries. I can tell you that the culture is not exactly the same. Just to say that the Nordic countries are taking their vacations in July and the South countries in August, meaning that I am always on duty. The problem of culture is not only between the Europeans and the Chinese. But this is certainly one of the interests to cooperate: to learn from each other. Because we may have different cultures but I am sure that we can learn from each other.”

One might conclude that even without China being really physically present at ILA2014, the subject of international cooperation with China is permanently on the agenda. This indeed is a satisfying sign and maybe the next Berlin Airshow will see more contributions from the Middle Kingdom showcasing in the middle of Europe.

ESA posted the replay of that panel discussion on the web:
http://www.esa.int/esatv/Videos/2014/05/Panel_discussion_on_Future_Challenges_for_Global_Space_Cooperation
 or
http://www.esa.int/spaceinvideos/Videos/2014/05/Panel_discussion_on_Future_Challenges_for_Global_Space_Cooperation

Antwerp Space N.V.:

“One has to learn to ‘read’ the non-verbal communication”

by Jacqueline Myrrhe

Mid-July, Antwerp Space N.V. reported that it successfully delivered 2 Omnisat equipments to two institutional customers in China.

Antwerp Space N.V. is part of the European-wide operating OHB Group and belongs to OHB’s Space Systems Business Unit. Throughout its 50 years of existence, the small company of currently 55 staff at its Belgium establishment in Hoboken, in the South-Western part of Antwerp, has gained a respectable expertise in satellite communication equipment. Over 30 years of experience in satellite data reception made it a top provider for data receivers such as the Omnisat data acquisition system for Earth observation and scientific satellites ground stations.

The latest Omnisat device, as sold to China, is a third-generation product of the Belgian space experts resulting in a highly flexible receiver, adaptable to the needs of the end-user. The device can manage frequency conversion, data demodulation and data acquisition in a single unit, and it can receive several channels in parallel, fully independently of each other. Omnisats are already successfully and reliably used on satellites like CBERS, Ikonos, Envisat, Pleiades or Landsat, to name only a few.

With generous workshop space, test and production facilities, Antwerp Space N.V. “develops systems and equipment for European space programmes and commercial space applications worldwide. Antwerp Space provides expertise and system solutions for broadband access systems via satellites, satellite ground control stations for the reception of data from observation satellites and for the control of spacecraft, as well as test systems used during the integration of satellites.”

The official press release by Antwerp Space N.V. on the sale to China reads: “The equipment will be used for the checking out of high-speed satellite transmitters and on ground stations for the reception of Earth observation data. The Omnisat of Antwerp Space has won the international tender because of its unique capability to deliver up to 3 independent high-speed satellite receivers in a single chassis at any given intermediate frequency. This allowed the customers to have a very flexible receiver, at a competitive price.

Antwerp Space staff spent 2 weeks in China, together with its partner AA SYSTEL and its local Chinese partner. During this fortnight, extensive training was given to the customers’ team. Following the training, the Omnisat equipment was integrated into the system of the customer, which then led to a successful acceptance testing campaign.

Mrs. Wang Huiqin, Asia Area Sales & Marketing Director of AA SYSTEL, comments: ‘It was one of our most important projects with Antwerp Space up to now. The success in the delivery of 2 OG3 units is the result of the Antwerp Space team’s hard work and end user’s excellent cooperation.’

Guy Van Dijck, Antwerp Space’s General Manager, comments: ‘This is a major step for Antwerp Space to re-introduce its Omnisat data acquisition system in the market. We are excited to be able to demonstrate our capabilities in the domain of Earth observation modems.’

The new generation of Omnisat will allow Antwerp Space to offer a unique multichannel solution to its customers at an attractive price.”

GoTaikonauts! wanted to know more and was happy to get answers from Stefaan Serlet, the Product Manager of Antwerp Space N.V.

GoTaikonauts!: Was the delivery of the 2 Omnisat devices your first cooperation with China? If not, which projects could you already realise in cooperation with Chinese entities?

Stefaan Serlet: It was not the first time we delivered products to China, we have already sold products of our previous generation of demodulators in China. However, it was the first time we sold our new version in China.

GoTaikonauts!: What is your impression of your cooperation with China? Is it difficult or easy and what are the specifics of doing business with China?

Stefaan Serlet: Our impression of the co-operation with China was very good. People are professional, and interested to learn. Sometimes there were some language problems, which we solved with a dedicated interpreter, but most of the time people



Antwerp Space’s Omnisat is the third-generation of a modular solution for satellite Earth observation and scientific data reception. (credit: Antwerp Space)



understood and spoke English very well. We also experienced that good relationships with the customers are very important to do business. There is also more interaction after the work, e.g. we eat more together in the evening than in Belgium. All this to tighten the relationship with each other. Luckily we have a partner which knows both the Western culture and the Chinese culture, it helped a lot to make the link.

GoTaikonauts!: What is your experience in cooperation with Chinese colleagues, what means: what - from your point of view - are the differences in business practice and culture?

Stefaan Serlet: As mentioned before, the interaction with my Chinese colleagues was very good. People work hard, are eager to learn and work late. A clear difference I found was that, as an instructor, one has to learn to “read” the non-verbal

communication in order to see if people understood completely each topic of the training. People will not tell that they did not fully understand a topic, the trainer has to “detect” it in the way people behave.

GoTaikonauts!: Is Antwerp Space going to take part in future tenders issued by Chinese institutions? If yes, why and if not, also: why not?

Stefaan Serlet: We are, and will be participating to Chinese tenders, through our partner AASystem.

Company website:
<http://www.antwerpspace.be>

About Omnisat:
http://www.antwerpspace.be/sites/default/files/products/as-spe-110234-02-00-omnisat-g3_leaflet.pdf



The Chinese-Soviet Technical Forum 2014 of the British Interplanetary Society (BIS)

by Dr. William Carey and Jacqueline Myrrhe

The 35th annual Chinese-Soviet Technical Forum took place at the BIS headquarters in London on 7 June this year, to present and discuss various aspects of the Russian and Chinese space programmes. This year's event was probably unique for two reasons: it was the first time that a Russian, Oleg Sokolov of the Air Launch Corporation, had presented a paper at the forum; and (probably) the first time that two papers were presented by women. The session was split into two, with the morning session chaired by Bert Vis, and the afternoon session by Brian Harvey. Traditionally, the talks are each limited to 25 minutes, including questions - a practice that is rigidly enforced by the chairmen - ensuring that all speakers are treated equally, and that the meeting keeps to its overall schedule. Many larger and more prestigious conferences/seminars should take note.

The introduction was given by Dave Shayler (organiser of the forum) who summarised several notable anniversaries occurring in 2014-2015, which included the 40th anniversary of Apollo-Soyuz, or as the Russians would have it, Soyuz-Apollo, in July next year. And also in June 2015, the 20th anniversary of the Mir-Shuttle docking, or as the U.S. would have it, Shuttle-Mir docking. And incredibly, October next year also marks the 10th anniversary of Shenzhou 6!

The morning session was kicked-off by Gurbir Singh who spoke about cooperation between India and the USSR amidst the political context of the Cold War, including the establishment of the Indian Space Research Organisation (ISRO), and the launching of India's first satellite, Aryabhata in 1975.

This was followed by Jacqueline Myrrhe and William Carey's presentation (see below) on the latest developments in the international cooperation with China that was because of its lengthy content, split into two parts, the second part given in the late afternoon.

Dominic Phelan then gave a summary of Sir Bernard Lovell's

trip to Moscow in 1963, which provided an intriguing encounter between Lovell and Alla Masevitch – she was head of Soviet satellite tracking – involving an assumed (by Lovell himself) death threat and invitation to defect to the USSR. Lovell's strong connection with Moscow ended when he published the first image from Luna 9 ahead of the Soviets.

Brian Harvey then provided a pictorial history, scenes from the early Chinese space programme, from the return of Qian Xuesen in the mid-fifties to the late 1990's. Images included rare or unpublished photos, like the first indigenous Chinese rocket (based on the German A4 and the Soviet R-2), the early missile Dong Feng 2, the T-7 sounding rocket, a particularly interesting photo showing President Lui Shaoqi, and the 1979 taikonaut trainees, among others.

Nadjeđa Vicente gave a very entertaining and interactive talk on the selection criteria for cosmonauts (USSR and Russia) and taikonauts (China). Members of the audience were asked if they wanted to fly into space, most of course did, and then were assessed against the various criteria – all fell quickly by the wayside – primarily, but not only because of age! The only way for the forum members to fly it appeared, was to have around 50 M\$ to spare and become a space "tourist".

Oleg Sokolov presented an overview of how partially re-usable launch systems are now being developed in Russia. Relating the history from completely expendable launchers through various re-usable designs - e.g. Lapotok, Spiral, Buran, Energia-2 – to the current project, MRKS-1 (conducted by Khronichev), utilising "fly-back boosters" – expected to be realised in the current decade.

Dave Shayler provided an insight into how the crews are exchanged on the ISS. A short history provided the introduction, starting from Soyuz EVA transfers in the period 1966-1969, Salyut operations between 1971-1986, and Mir operations



David Shayler (organiser of the annual Chinese/Soviet Forum) highlighting one of the important space anniversaries occurring in 2015 – 10 years since Shenzhou 6. (credit: Go Taikonauts!)



One of the interesting photographs, showing Qian Xuesen, in Brian Harvey's presentation on the early Chinese space programme. (credit: Go Taikonauts!)

between 1986-2000. The ISS has been in a permanently manned status for 14 years, since 2000, the crew exchanges being based on the Russian concept of "Expedition". At the time of the presentation, Expedition crews 40 and 41 were currently manning the Station.

The afternoon session began with Bart Hendrickx who presented new information on past Soviet manned space missions.

Andrew Knight recounted how his interest in the Soviet space programme was sparked by various news sources in the early 1980's.

Bert Vis presented the history and current status of the fleet of maritime vessels used to track Shenzhou spacecraft outside of China.

George Spiteri highlighted the career of Soviet cosmonaut Nikolai Rukavishnikov who despite eventually having three spaceflights (Soyuz 10, 16 and 33), never managed to make it onboard a Salyut space station, despite several assignments to do so.

An informal paper was then presented by David Woods from the U.S., on the launch abort of STS-41D in 1984 – due to human contamination, a cough or sneeze during circuit board processing! This was of particular interest to one of the Go-Taikonauts! team, as he was present at the "non-launch" – and now 30 years later – finally understood what caused the problem.

Phil Clarke completed the day's meeting by presenting a detailed and well-researched paper on the Russian photo-reconnaissance programme in the period 1991-2014.

As always, the atmosphere of the meeting was warm and friendly, with sufficient time to exchange ideas, despite the tight schedule of talks, and discuss current topics in spaceflight with the other participants who are all experts in their chosen domains. And as in previous years, a broad range of topics were covered, although the event is still heavily biased towards Soviet/Russian rather than Chinese.

The 36th Forum will take place next year on 6 June at the same venue, and to celebrate its 35th anniversary.

Go-Taikonauts! Presentation

Latest Developments in the International Cooperation with China - Challenging the West

What if the future of space exploration would happen without the U.S., and without Europe? This was the provocative hypothesis that we introduced to the BIS Forum on Soviet-China Space Technology in London in June 2013.

The hypothesis was drawn out of two major observations:

1. The last decades have seen a change from the dominance of two space-faring nations to a highly diverse space exploration landscape of numerous new and emerging space nations.
2. China has intensified its engagement with space developing or non space-fairing countries as well as with the United Nations.

Still, this was a brave and bold statement and after the forum we were asking ourselves whether we went a step too far. Who would doubt the leading position of U.S. or Western space technology? On the other hand, the facts we took into consideration were real. As a consequence, we decided to follow further developments.

In 2013 as well as 2014, China has been incredibly busy to invite other nations for meetings, workshops and political summits. The overarching objective has always been the promotion of space cooperation and cooperation in general.

Throughout the past 18 months, China has signed several agreements for launching other nation's satellites, e.g. Cambodia, Sri Lanka, and did launch satellites for Bolivia and Brazil. China is even building a satellite assembly plant in, and for, Egypt.

2013 has been the year when China used several opportunities, in particular during UN events, to call for international cooperation on its future Chinese Space Station CSS. (compare GT! no 9 and "Commitment at the global level for increasing the role of space" in this issue)



Nadjejda Vicente outlining the conflicting requirements of 'secrecy' versus 'public image' of taikonauts and cosmonauts. (credit: Go Taikonauts!)



Bert Vis during his presentation on the Yuan Wang fleet of ships used by China to track Shenzhou spacecraft. (credit: Go Taikonauts!)

With the inauguration of an International Cooperation and Exchange Centre in Beijing in April 2013, the inauguration of the International Space Science Institute-Beijing ISSI-BJ also in Beijing, and hosting the 7th Meeting of the Council of Asia-Pacific Space Cooperation Organisation APSCO in July in China's capital, as well as hosting the 5th CSA-IAA Conference on Advanced Space Technology in May 2013 in Shanghai (compare GT! no 9), China strengthened its position in the international arena of space exploration. Jean-Michel Contant, President of the influential International Academy of Astronautics IAA stressed in Shanghai the importance of a concept of a truly global roadmap for robotic and human space exploration for international cooperation for the next decade in advance and independently of today's cooperation scenarios.

IAC2013 - China welcomes the world's space community

For sure, the ultimate highlight has been the 64th International Astronautical Congress IAC2013 at the end of September in Beijing, uniting 3,600 participants from 74 countries. The IAC2013 was preceded by the UN-IAA-China Workshop on Human Space Technology. (compare GT! no 10 and 11). China used this get-together of the global space community to schedule a few more bilateral meetings along with the first tripartite talk between CNSA, ESA, and Roscosmos.

Shortly after the IAC, the Asia-Pacific Economic Cooperation Organisation, APEC as well as the Association of South-East Asian Nations, ASEAN, met for their summits. U.S. President, Barack Obama should have participated in the APEC summit, but because of the U.S. government's shutdown, he remained absent. The APEC-Communiqué stated: "As our region increasingly becomes the main engine of global growth, we are called... to look ahead, to adapt to our changing needs, and to reinvigorate the path toward progress." Interestingly, the next APEC-summit will take place in China.

In October 2013, SAST and NPO Lavochkin discussed further cooperation in the field of deep-space exploration, and Major General Ahmed Bilal, chairman of the Pakistan Space and Upper Atmosphere Research Commission claimed: "If China starts taking foreign astronauts to outer space, we would like to be the first candidate." It is worth mentioning that Pakistan is also cooperating with China on the Beidou Navigation System.

Even space tourism arrived in China with Space Expedition Corporation SXC signing an agreement with Dexo Travel, a Chinese travel agency to sell sub-orbital space flights to Chinese citizens.

2013 concluded with the worldwide-noted launch of the Chang'e 3 lunar mission, which marked the start of the cooperation between the International Lunar Observatory Association ILOA of Kamuela, Hawaii, and the Beijing-based National Astronomical Observatories of China NAOC. ESA's network of Deep-Space Tracking Network ESTRACK provided crucial support for Chang'e 3's five-day lunar cruise.

On Chang'e's launch day, the UK and China signed an MoU on space cooperation in the fields of space science, space applications and education, witnessed by Premier Li Keqiang and Prime Minister David Cameron. David Willetts, UK's Science Minister, spoke upon returning from Beijing of Britain's deepening relationship with China and its role as the "trusted partner" of the U.S., which puts the UK in a strong position to coordinate a manned mission to Mars by the world's great powers within 30 years.

Additionally, an agreement was signed by Surrey Satellite Technology Ltd SSTL and DMCIi, with their Chinese partners 21AT, for the launch of a high-resolution Earth observation service, the Beijing 2 smallsat. SSTL also signed an agreement with the China Academy of Space Technology CAST for potential collaboration on satellite applications and training.

2013 was a good year for the Chinese space programme, the Chinese efforts for international space cooperation and despite some hiccups, for the incorporation of China in the global space community. And 2014 was about to make a kick-start ...

Washington gives hope

In January 2014, a big Chinese Delegation participated in ISEF, the International Space Exploration Forum in Washington DC. The ISEF was followed by the Head of Agencies Meeting, organised by the International Academy of Astronautics, IAA. Four extensive panel discussions with all Heads of Agencies revealed important aspects of the current approach to international space cooperation:

- NASA is objecting less to cooperation with China, and leaves it open to all ISS partners to cooperate with China on the ISS. But still the opening-up of the IGA, the Intergovernmental Agreement for the ISS remained a "no-go zone".
- Capacity building, giving developing space countries the chance to catch-up with developed nations as promoted by the UN and the IAA, is key when space exploration becomes global, sustainable and a peace-keeping factor. (compare: GT! no 11)

One month later, in February 2014, ESA's Director for Human Spaceflight and Operations, Thomas Reiter confirmed during a press conference that ESA is in continuous talks with its Chinese counterparts and is looking for versatile cooperation options.

Wind of Change

Despite China's enormous initiatives to lay the ground work for as broad an international cooperation as possible, some less-friendly signals came from the U.S. when the FBI arrested the 31-year-old former NASA contractor and Chinese national Bo Jiang in March 2013, suspected of spying for China. In November



Jacqueline Myrrhe (and William Carey) of Go Taikonauts! recounting the "No Space Between Us" moment which occurred during the 64th IAC in Beijing last year. (credit: Nadjeđa Vicente)

2013, NASA officials denied six Chinese scientists permission to attend the Kepler Science Conference at the NASA Ames Research Center. In February 2014, Virgin Galactic excluded Chinese nationals as well as North Koreans and Iranians, from sub-orbital flights offered by the Virgin Space company because of fears of spying.

In particular since the spring of 2014, some tendencies became visible which proved to be counterproductive to an intended global and unlimited cooperation for space exploration.

In April 2014 - merely three months after the ground-breaking ISEF, the U.S. State Department directed NASA to end all bilateral cooperation with the Russian government. The International Space Station, by far the largest collaborative effort between NASA and Roscosmos, was exempted from the policy along with other smaller scientific projects. The U.S. government expanded those sanctions on 28 April to include limitations on the export to Russia of defence-related hardware on the U.S. Munitions List, a broad index of items that includes many satellite components.

The interdependency in the ISS programme used to be the strength of the project. When looking back at the Space Shuttle Columbia accident in February 2003 and the retirement of the Space Shuttle in 2011, which was not foreseen in the initial Station planning, the robustness of the programme was admired. Since then, Roscosmos provides Soyuz manned transport and is responsible for periodically boosting the Station. NASA, on the other hand, provides energy generated by U.S. solar arrays for the Russian segment, and NASA's gyroscopes control the orientation in orbit. Although China is excluded from this hallmark of international human cooperation in low Earth orbit, the ISS has always been seen as a role-model for anything that would come after the ISS, and would also include China and other nations.

This certainty is now under threat. In May 2014, Oleg Ostapenko, Head of Roscosmos announced that "We can independently perform any task, even if it means replacing Western components." Russia is willing to continue its involvement in joint ventures, technology transfer and production, but only if such projects are "mutually beneficial" and not used as leverage.

Deputy Prime Minister Dmitry Rogozin, who said already in 2012 about the (by that time still partly sitting on the drawing board) Vostochny cosmodrome in Russia's Far East: "We have to create a new geopolitical centre in the East of the country and the cosmodrome will become its reference point.", stressed in May 2014, that Russia is working on a national manned space exploration programme for the time after the ISS. China and the European Space Agency are seen as the potential partners in the new strategy, but the key role will belong to Russia. Rogozin added that Oleg Ostapenko wants to allow "Chinese colleagues participate in some of the most interesting projects that can replace the ISS," but also wanted to discuss "projects such as cooperation in the field of rocket engine development," and cooperation in the growing market of space applications services which relates to the Chinese Beidou satellite navigation system and Russia's GLONASS constellation.

And indeed, Chinese Deputy Prime Minister Wang Yang and Russian counterpart Dmitry Rogozin signed in May 2014 "a protocol on establishing a control group for the implementation of 8 strategic projects" among them "cooperation in space and

in the market for space navigation".

At the same time, Russia's President Vladimir Putin paid a State Visit to China where he met with President Xi Jinping. Both countries agreed to strengthen cooperation in major projects in the peaceful use of nuclear energy, civil aviation, research on basic aerospace technologies, satellite navigation and manned space flight, and signed 49 agreements on energy, transportation and communications.

A few days later, on 1 June, Russia suspended the operation of 11 GPS stations on its territory because of lack of progress in Russia's talks with the U.S. on the construction of Russian GLONASS ground stations in the United States. Russia's Deputy Prime Minister Dmitry Rogozin said that the GPS stations on Russian ground would be closed if there is no agreement by 1 September. In parallel, Russia expects an agreement with China to build three ground operational stations on each other's territories. Since Beidou frequencies do not correlate with the GPS system, China foresees good prospects for cooperation with Russia's GLONASS on regional support and chipset development, which would promote the compatibility of both satellite navigation systems.

Reinforced hypothesis – but time will tell

Looking back at the events of 2013 and 2014, we are certain to see tendencies which might lead to a new space community nucleus centered around China. Despite hopeful and optimistic space cooperation with China, even some between the U.S. and China, the frequency of hostile signals from the U.S. against China, and currently against Russia, has increased. Such events are not leading to a strengthening of the position of the U.S. nor NASA, but quite the opposite, they are paving the way for a new Eurasian space coalition.

Therefore, we would like to reinforce our hypothesis from 2013:

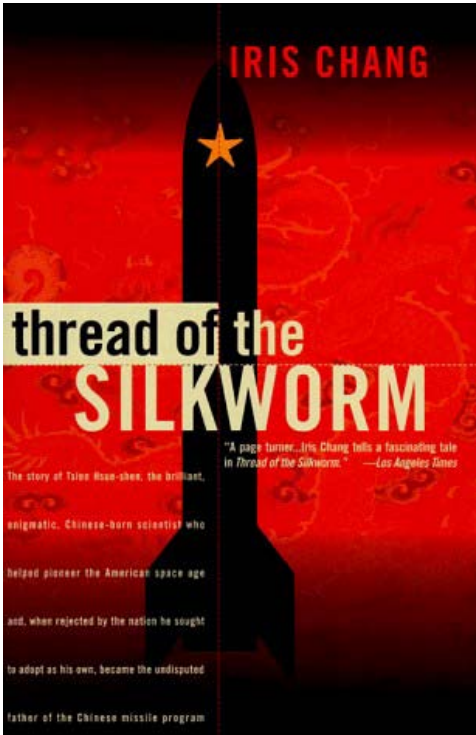
1. China lines up with the UN, the biggest organisation for space cooperation in the world and offers unique possibilities to space-developing or non-space fairing countries on a bilateral or multi-lateral basis.
2. China supports the APSCO organisation, a counterweight to Western space alliances that could easily convert into a global organisation.
3. Russia and China together could, indeed, form a geopolitical centre in particular if other Asian nations, such as Indonesia, Pakistan, or India are willing to join.
4. The so-called "Wolf Clause" prevents NASA from a decent and direct cooperation with China in a manner that would benefit U.S.-American national interests.
5. NASA's partners are afraid of - or in the lesser sense, passive in - open cooperation with China at a time when China is setting up cooperation with the rest of the world.
6. Space exploration in the global context, will require strong leadership, a consistent long-term vision, and a willingness to "share". China, maybe through the UN, is positioning itself to fill this role.

China, indeed is challenging the West. Whether the West is also losing its leading role in space may depend on its readiness to accept China (and indeed Russia, and emerging space nations) as equal and respected partners. For the moment, the sun is rising in the East ...



A Review of “Thread of the Silkworm” by Iris Chang

by Dr. William Carey



First published in 1995, this rigorously researched book tells the story of Qian Xuesen (sometimes known as Hsue-sen, which means “study to be wise”) referred to in China as “the father of Chinese rocketry”.

Living just two years short of a century, Qian Xuesen passed away at his home in Beijing on 31 October 2009. Xuesen was

born to an upper-class family in Hangzhou in 1911, in the same month that a group of revolutionaries in southern China led a successful revolt against the Qing Dynasty, establishing in its place the Republic of China and ending the imperial system. When Xuesen was three, his family moved to Beijing, which at a time when some provinces of China had 99 % illiteracy, was known as a “city of bookworms”. Always a brilliant student, on completion of his schooling he left Beijing for Jiaotong University in Shanghai to become a railway engineer in 1929, where he was remembered as a “loner” and of having a strong love of classical music. He excelled in his studies and gained a Boxer Rebellion Scholarship, and after changing his interest from railways to aviation, left for the Massachusetts Institute of Technology (MIT) in the U.S. in 1935.

At MIT he had considerable problems with practical work, but remained a quiet student keeping himself to himself. Classical music again became a refuge. The reasons why he left MIT after only a year remain unclear, although as the book highlights, MIT was more Edison than Einstein, and its professors “not so much scientists as they were adventurers and explorers”, not at all suited to the theoretically-biased Xuesen. Concluding that returning to China was not an option, he travelled to Caltech to see Theodore von Kármán who was immediately impressed by this bright young man, who shortly afterwards having obtained his Master’s, swapped Boston for Pasadena in 1936. The detailed pen-picture of von Kármán provided on pages 47-60 may seem at first reading to be too detailed an image in a book about Xuesen, but it does provide a clear understanding of why

the two men became such close colleagues and friends. Xuesen was always referring to von Kármán as “my revered teacher”. This period also saw the dawning of theoretical dynamics led by von Kármán.

At Caltech he became a member of the “suicide squad”, a small team led by Frank Malina (with whom he formed a close friendship) that pioneered the development of rockets. This chapter in particular provides interesting reading. Xuesen was not liked by his fellow countrymen at Caltech, remaining quiet and aloof, although at the same time, was defensive to any criticism of his homeland China.

Shortly after receiving his PhD in 1939, Xuesen received his first request to return to China – an obligation of his Boxer scholarship. However, he preferred to stay on to work with Malina, producing some of America’s first military missiles.

Xuesen became Assistant Professor of Aeronautics at Caltech in 1943, and a year later, the chief of the first research analysis section of the Jet Propulsion Laboratory (JPL), and was “fast becoming recognized as the world’s foremost expert on jet propulsion”.

In 1945 Xuesen left Caltech to join von Kármán in Washington, who had in the meantime become an Army Airforce Consultant, and had taken leave from Caltech to do so. In relation to this, Ms. Chang mentions in passing General Henry Arnold who led the Special Advisory Group (SAG) in the Pentagon, of which Xuesen became a member. Clearly a man of great vision, Arnold is quoted as saying “For twenty years, the Air Force was built around pilots, pilots and more pilots ... the next twenty years is going to be built around scientists”, and encouraged the group to look twenty years into the future. Encouraged by this brief, it was during this time that Xuesen wrote “Future Trends of Development of Military Aircraft”.

Invited by von Kármán on a visit to Germany to review their rocket development status (suggested by Arnold), enabled Xuesen to meet with, among other top scientists, Werner von Braun and Rudolph Hermann in March 1945.

In 1946 Xuesen returned to MIT where he was appointed to a fully tenured professorship in early 1947. As at Caltech, his students here also found him “... an egotistical loner”, a view shared by most of the faculty members as well.

1947 also saw him receive an offer from China to return to become President of Jiaotong University, his old alma mater in Shanghai. Against a background of massive famine, at this time in China the communists were winning the civil war. As he prepared to travel to China in July, he also applied for permanent residency in the U.S. (the first step to citizenship).

However, he was eventually considered “too young”, and the offer from Jiaotong University was withdrawn. But Xuesen



did have the opportunity to meet up again with his future wife Jiang Ying (they had known each other when both were very young), whom he married in Shanghai the same year. Ying like Xuesen, came from a privileged background, her father being a senior advisor to Chang Kai-shek, and at this time was an accomplished Chinese opera singer.

Attracted back to Caltech as the Robert Goddard Professor of Jet Propulsion in 1948, Xuesen applied for U.S.-American citizenship in 1949. Xuesen was now living the "American Dream", and on the road to becoming what we would now term "a celebrity".

Then, in June 1950 (precisely coincident with the start of the Korean War between the U.S. and China) the FBI arrived on his doorstep, and accused Xuesen of being a communist (surprising considering his "connection" to Chang Kai-shek). He decided to return to China at this point, and after a lot of confusing events, he was branded as a spy, and so denied permission to leave the US. He was arrested and spent two weeks in detention, and denied communication with the outside world. In another strange twist to the tale, the U.S. then determined that he should be deported! February 1950 marked the beginning of the McCarthy era in the U.S.

Xuesen was held under house arrest for almost the next five years. Eventually, on 17 September 1955 Xuesen and his family boarded the President Cleveland to return to China, and eventually Beijing.

The last three chapters of the book cover the period after Xuesen's return to China, and demonstrate the difficulties Ms. Chang had in obtaining information about Xuesen's activities. He was reticent to talk to reporters in China, his work was classified, and he would only allow a biography to be written after his death. From first-hand interviews in China however (excluding Xuesen himself though), Ms. Chang manages to outline four major contributions from Xuesen to the Chinese aerospace sector: confidence, inspiration, the importance of books, and capability to create an organisation through leadership – all elements of key importance in helping contribute to the rapid growth of China's space development since the 1950's.

Despite Ms. Chang's extensive and persistent attempts, the last four decades until Xuesen's death, are still cloaked in mystery, and at the time of writing, it is not known if an "official" biography has indeed now been written. The book is not an easy read, but does allow some understanding of the character of this complex individual and especially of the times in which he lived, and particularly in relation to the history of aerospace.

A film on Xuesen's life was made in 2011 in China entitled "Dr. Hsue-shen Tsien", it may be seen on YouTube at:
<http://www.youtube.com/watch?v=u0TVeM3HqU4>.

If you are interested, it is recommended to read the book first, and then watch the film. It seems highly likely that Ms. Chang's book was used as a reference for the film. One of the early scenes shows a dinner party in Pasadena after Xuesen and his wife have returned from China. It shows Xuesen as warm and friendly – in contradiction with most of those who had contact with him in Ms. Chang's book. However, it is also mentioned in the book that marriage "softened" him, and that for some colleagues and certainly those who became his friends, he showed a completely different side of this character than the normal "aloofness and arrogance" experienced by the majority of his students and colleagues. The film goes on to show most of the key moments mentioned in the book, with the last hour of the film concentrating on the time Xuesen spent in China.

References:

1. *Thread of the Silkworm*. Iris Chang, 1995. Published by Basic Books, a subsidiary of Perseus Books.
2. Film "Dr. Hsue-sen Tsien":
<http://www.youtube.com/watch?v=u0TVeM3HqU4>.

Two other books of interest, and from which Ms. Chang drew upon for her own work are:

1. *The Wind and Beyond*. Theodore Von Kármán and Lee Edson, 1967. Little, Brown and Company.
2. *The China Cloud*. William L. Ryan and Sam Summerlin, 1968. London Hutchinson.

Note: Iris Chang committed suicide in 2004. She was 36 years old.

Gallery Yuanwang Fleet



Yuanwang 1, the first space tracking ship of China. It was in service from 1978 to 2010. Now it is the highlight of the China Shipbuilding Museum. (credit: Chinese internet)



Yuanwang 2, sister ship of Yuanwang 1. It was also in service from 1978 to 2010. (credit: Chinese internet)



Yuanwang 3, put into use in 1994. It is still in service (credit: Chinese internet)

See database of Issue 10 of Go Taikonauts! for more information on the Yuanwang fleet.



Yuanwang 4, formerly the Xiangyanghong 10 scientific survey ship. It was converted to a tracking ship and delivered for use in 1999. On 5 August 2007, it was in a collision with a cargo ship at the Jiangyin Base, burnt and damaged. (credit: Chinese internet)



Yuanwang 5, one of two new generation space tracking ships of China. It was put into service in 2006 and is now the backbone of the tracking fleet. (credit: Chinese internet)



Another view of Yuanwang 5. (credit: Chinese internet)

See database of Issue 10 of Go Taikonauts! for more information on the Yuanwang fleet.



Yuanwang 6, sister ship of Yuanwang 5 and the newest in the fleet, put into service in 2007. (credit: Chinese internet)



Another view of Yuanwang 6. (credit: Chinese internet)



Yuanwang 21, the rocket transportation ship to service the Wenchang Space Launch Centre. This photo shows when it was under construction, just before its launch in November 2012. (credit Chinese internet)

See database of Issue 10 of Go Taikonauts! for more information on the Yuanwang fleet.



Yuanwang 22, sister ship of Yuanwang 21. This photo shows when it was at the Qinglan Port near Wenchang, transporting steel components of the launch tower. (credit: Chinese internet)



Yuanwang 1 and 3 anchored side by side. (credit: Chinese internet)



Retired Yuanwang 1 in the China Shipbuilding Museum located in the former Expo 2010 campus and Jiangnan Shipyard, Shanghai. The photo was taken from the other side of the Huangpu River. (credit: Go Taikonauts!)

See database of Issue 10 of Go Taikonauts! for more information on the Yuanwang fleet.