

Aerospace | High-Speed Rail | Bridges
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THE JEWELS IN CHINA'S CROWN



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FOREIGN LANGUAGES PRESS

图书在版编目 (CIP) 数据

中国新名片: 英文 / 陆仁编; 郦青, 李雪译. — 北京: 外文出版社, 2018.8
ISBN 978-7-119-11266-4
I. ①中… II. ①陆… ②郦… ③李… III. ①改革开放—成就—中国—英文
IV. ①D619

中国版本图书馆 CIP 数据核字 (2018) 第 197044 号

出版策划: 胡开敏
撰 稿 人: 王 娟 赵妮娜 米金升 吴婧雅 杨驿昉
责任编辑: 熊冰岷
英文翻译: 郦 青 李 雪
英文审定: Marian Rosenberg Wafaa M. Ezzat 李振国
英文编辑: 冯 鑫
图片来源: 视觉中国 神舟传媒 何卫国
封面设计: 北京大盟文化艺术有限公司
装帧设计: 北京维诺传媒文化有限公司
印刷监制: 冯 浩

中国新名片

陆 仁 编

© 2018 外文出版社有限责任公司

出 版 人: 徐 步

出版发行: 外文出版社有限责任公司

地 址: 北京市西城区百万庄大街 24 号

网 址: <http://www.flp.com.cn>

电 话: 008610-68320E

008610-68995E

印 刷: 北京楠萍印刷厂

经 销: 新华书店 / 外

开 本: 787mm × 1092r

版 次: 2018 年 10 月第

书 号: ISBN 978-7-1

定 价: 58.00 元 (平装)

邮政编码: 100037

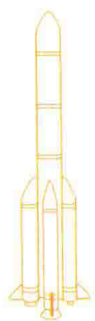
电子邮箱: flp@cipg.org.cn

4 (编辑部)

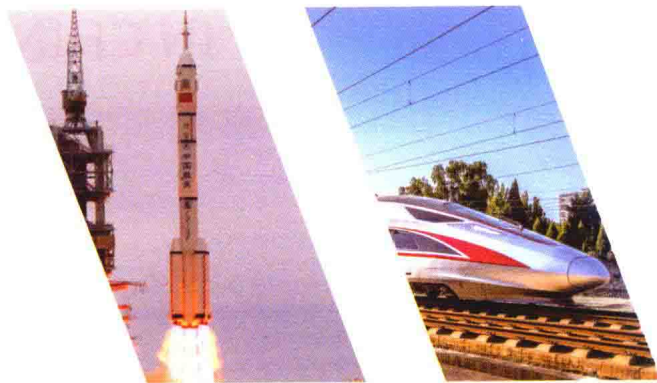
3 (投稿邮箱)

55 千

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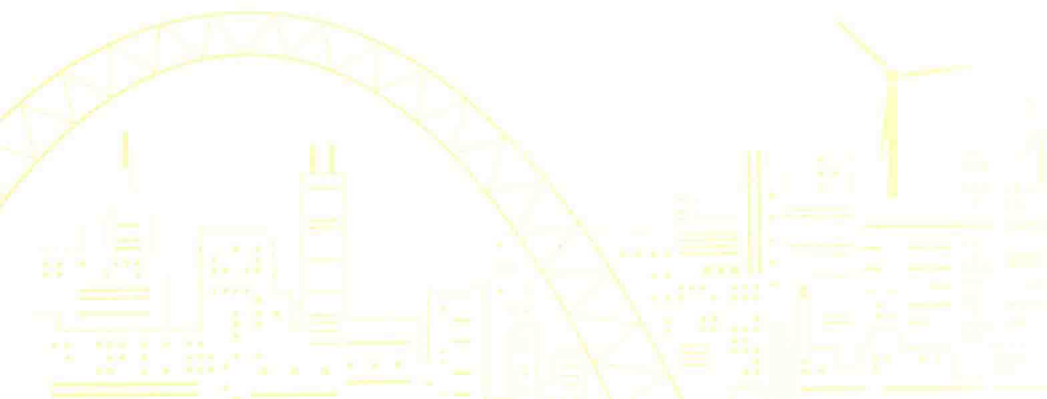


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CHINA'S AEROSPACE





“Today, we’ve witnessed a perfect ending. A brave pioneer, passing through space and turning into gorgeous fireworks, rushed to the end of its journey of exploration.” On September 22, 2017, the news that “*Tianzhou I* cargo spacecraft was actively controlled off track” was spread to every Chinese astronaut. After five months of flying in space, *Tianzhou I* burned in the atmosphere after successfully completing all its missions.

The exciting news, following the very day of the 25th anniversary of China’s Manned Space Program, is no doubt adding to its brilliance. Symbolically, the good ending of *Tianzhou I* indicates the upcoming new start of space station era.

From entering into the space for the first time to building our own space station, from building our first rocket and satellite to having a huge group of rockets, satellites, spaceships, spacecrafts and unmanned vehicles, from sending a satellite to the space to exploring the moon, Mars, and other asteroids, China has made a great progress in spaceflight industry with its growing influence.



Wenchang, Hainan: The *Long March V/II Y2* rocket, combined with *Tianzhou I*, being transported to the launch pad

After more than 60 years of development, the achievements of the country in the industry have grabbed the world's attention.

Dream of Exploring the Vast Space

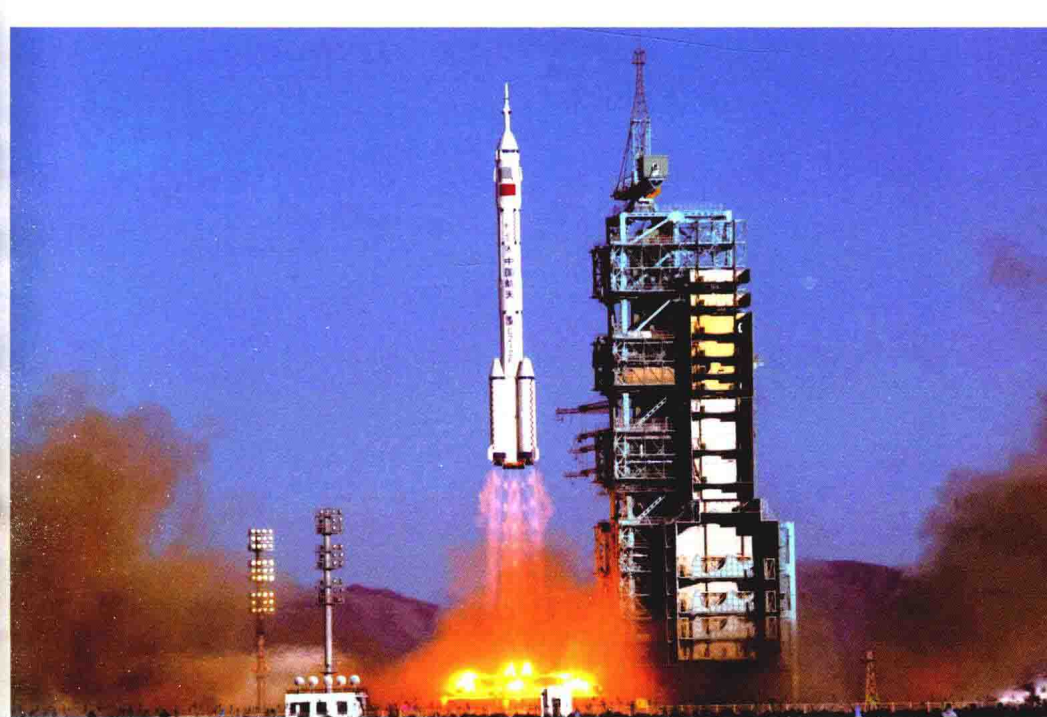
In 2003, China caught the attention of the whole world. The big country in the Orient, having successfully launched four unmanned spacecrafts, announced that it would launch the *Shenzhou V* manned spacecraft and send the first Chinese astronaut to space.

“Ready? Go!” Li Ji’nai, chief commander of China’s Manned Space Program, gave the order at 5:30 am on October 15.

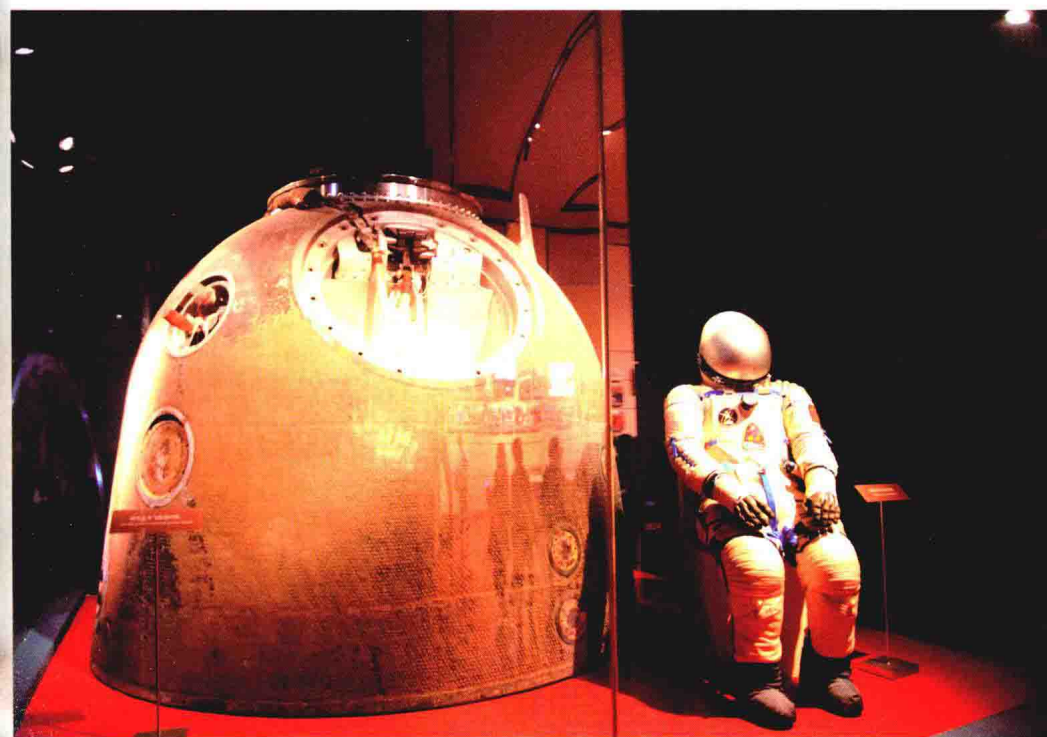
“Yes, sir.” Astronaut Yang Liwei made a standard military salute to him.

At nine o’clock, *Long March II F* carrier rocket blasted off. Nine minutes and 50 seconds later, *Shenzhou V* spacecraft successfully entered its preset orbit, and Yang Liwei became the first Chinese opening the door to the universe.

The long-pursued dream of flying to space has become a reality. The success of *Shenzhou V* mission not only became an important milestone in China’s manned spaceflight program; it also ignited the patriotic enthusiasm and pride among the Chinese nation. In the minds of Chinese people, China’s aerospace industry has gone far beyond its fields and industries, but is closely linked with national strength and self-confidence, and has become an



At 9 o'clock on the morning of October 15, 2003, a *Long March F2* was lifting off from the launching pad, carrying the *Shenzhou 1* manned spacecraft into space.



National Museum of China: *Shenzhou 1* reentry capsule and Yang Liwei's spacesuit



Launch Date: September 29, 2011.

First Rendezvous with *Shenzhou 1 III* (unmanned):
November 3, 2011.

Second Rendezvous with *Shenzhou 1 III*
(unmanned): November 14, 2011.

First Rendezvous with *Shenzhou IX*
(manned): June 18, 2012.

First Manual Rendezvous and Docking
with *Shenzhou IX*: June 24, 2012.

First Rendezvous with *Shenzhou X*:
June 13, 2013.

First Manual Rendezvous and Docking
with *Shenzhou X*: June 23, 2013.

China Manned Space
Engineering Office
formally announces
official decommission-
ing and start of orbital
decay: March 16, 2016.

Reentry and atmo-
spheric burn-up:
April 2, 2018.

important symbol of the country's power.

After the flying dream being materialized, China's aerospace, along with its national aspirations, has been marching non-stop toward the future.

In October 2005, *Shenzhou VI* manned spacecraft was launched, carrying two astronauts. In September 2008, *Shenzhou VII* was launched. From 2011 to 2013, *Tiangong I* space module and *Shenzhou VIII*, *Shenzhou IX* and *Shenzhou X* spacecrafts were launched in succession, making a successful space docking. From 2016 to 2017, *Tiangong II* laboratory, *Shenzhou XI* manned spacecraft and *Tianzhou I* cargo spaceship were launched successively, completing the rendezvous and docking, with a series of technical and space science experiments conducted in space.

Through the implementation of these missions, China has made breakthroughs and mastered such key technologies as manned space flight, space walking, space rendezvous and docking, astronaut mid-term residency, space cargo transportation, and on-orbit supplement of propellants, laying a solid foundation for space station building.

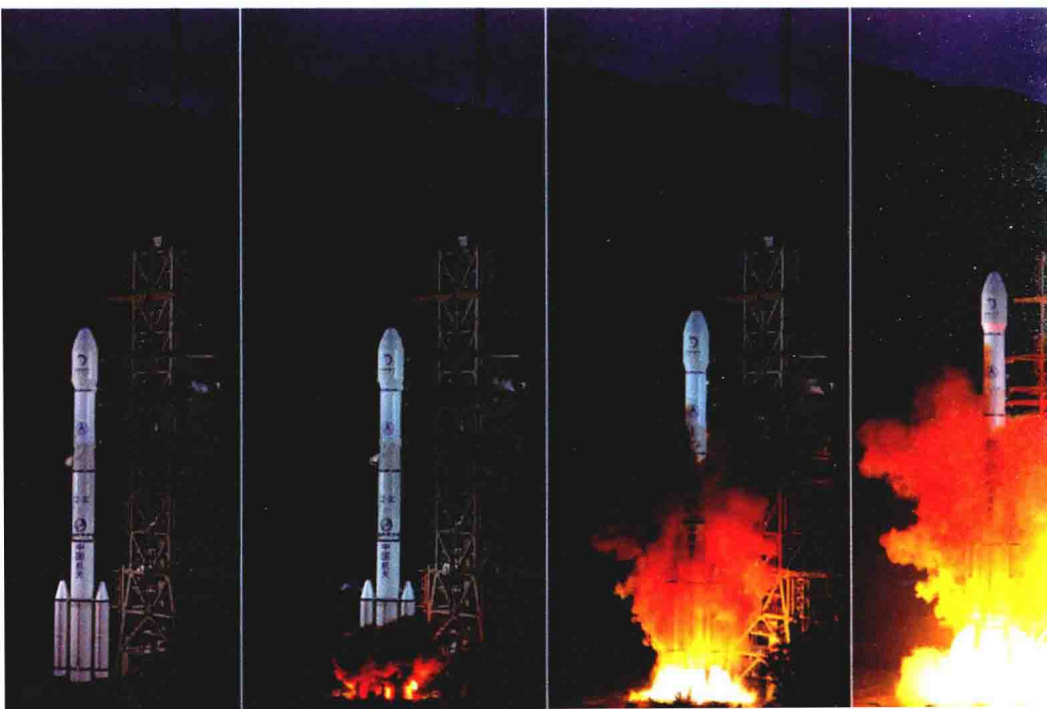
It has been 25 years for China to go from the launch of manned space program to the upcoming start of the space station. In these years, China has launched altogether 11 *Shenzhou* spacecrafts, two space laboratories (target aircraft) and one cargo spacecraft, and sent 14 astronauts into space, creating an unbeaten record of manned space missions. The manned space program has truly become a strong point in China's aerospace industry. As planned, China's first space station will be completed around 2022.

China, once was excluded from the “club” of international space stations, is expected to become the third country in the world to have a space station.

While the manned space project still remains in full swing, another major project in China has quietly been unveiled.

On November 22, 2000, a white paper on China’s space activities, first published by the State Council Information Office, clearly stated that “preliminary research on deep-space exploration based on lunar probe will be conducted.” On January 23, 2004, the lunar exploration program was approved, thus sounding the horn for the start

Carrying the *Chang’e I* lunar exploration satellite as its payload, a *Long March III-A* carrier rocket was launched from the Xichang Satellite Launch Center on October 24, 2007.



of exploration into the deep space.

China's lunar exploration program is based on unmanned detection, and is divided into three stages: "circling", "landing" and "returning". The first is to launch lunar exploration satellite to carry out around-the-moon exploration, before the second step, that is, to achieve soft landing on the lunar surface and make an inspection tour, is taken. Finally, it is to return to the earth with the lunar surface samples.

It is an extraordinary challenge to travel from 36,000 km to 380,000 km and from taking off from the earth to landing on another planet.

On October 24, 2007, the Xichang Satellite Launch Center, amidst the Daliang Mountains, displayed great vitality when dense clouds and mists over it slowly dis-



persed. At 18:05, along with the call of “Ignition”, a *Long March III-A* rocket began its journey to the moon, carrying China’s first lunar exploration satellite *Chang’e I*.

At 11:15 on November 5, *Chang’e I* made perilune braking for the first time. At 11:37, the satellite was successfully captured by the moon. We made it!

At that moment, audience throughout the country saw the event on television: The aerospace personnel in the hall stood up in great excitement, some cheering and some jumping up and down, some hugging and shaking hands with each other. Sun Jiadong, chief engineer of the lunar exploration project, walked to a corner and quietly turned his back then burst into tears.

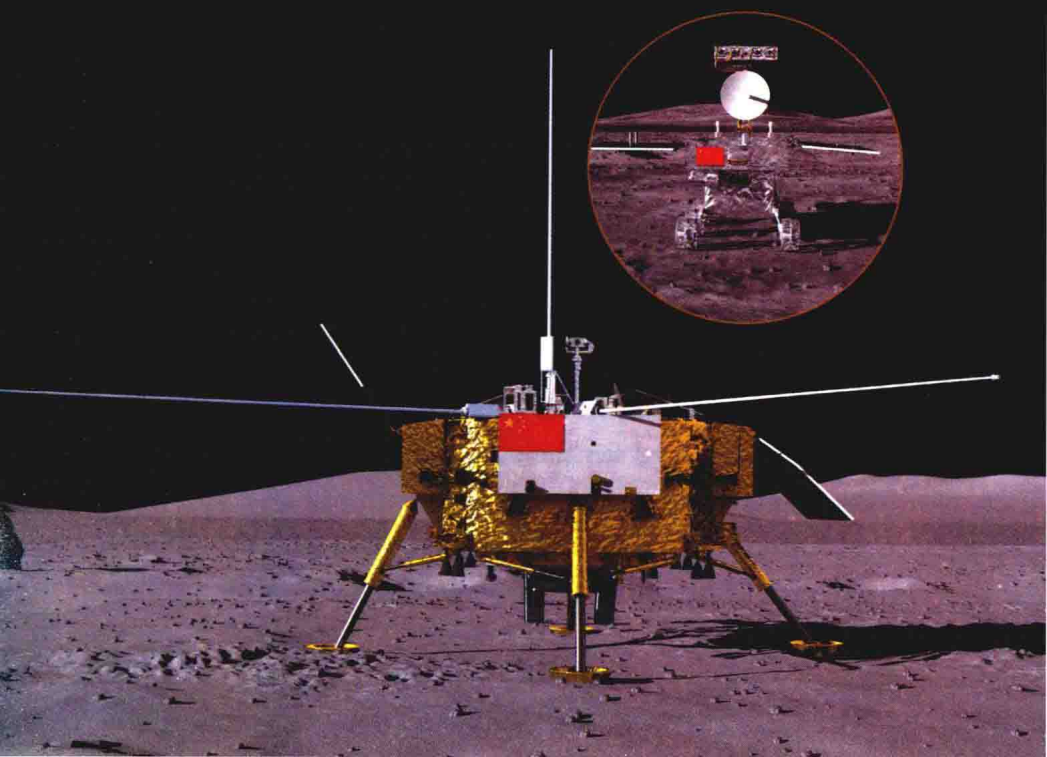
Little things like this could show how challenging was the path of China’s moon exploration.

Chang’e I eventually managed to impact the lunar surface in a rich sea area after 127 days of extended service. Since then, there have been three lunar probes from the *Chang’e* family named the three “sister flowers” who have successively went to the moon: *Chang’e II* has verified the key technologies for the lunar soft landing with a flight of more than 70 million km, refreshing the longest distance the Chinese spacecraft has ever reached. *Chang’e III* successfully landed on the moon, making China the third country in the world to achieve lunar soft landing and set the world record for the longest working hours on the moon. The three-phase reentry flight testers of the lunar exploration project verified the relevant technologies of reentry and return at an approximate second cosmic ve-

locity, obtaining the first “return ticket” from the moon to the earth.

As planned, *Chang’e 1* probe will embark on the moon later and return with lunar surface samples. *Chang’e 11* is also expected to be launched at the end of 2018, and achieve soft landing on the dark side of the moon with human probe for the very first time.

The steps of the Chinese people in space exploration are far from stopping. According to the deep space exploration and development plan, China will launch its first Martian probe around 2020; probes into the Mars, asteroids and Jupiter will start before 2030 to explore deeper into the space.



Chinese Satellites Shinning in the Space

To buy a satellite or build one of our own? In the 1980s, the aerospace industry of China was made to make such a choice.

At that time, the domestic communication satellites, due to the weak foundation in the development and production of electronic components, were not well developed in China. Although the country managed to successfully send its first artificial satellite *DFH I* into space and subsequently launched *DFH II* with four C-band transponders for communications, there was still a big gap compared with the advanced satellites with twenty or thirty transponders developed abroad.

Hence, it was debated from 1981 in the country on whether to buy a satellite or build one.

The intense discussion was finally brought to an end with the decision of developing a new generation of communications and broadcasting satellites by relying on own strength. In 1997, after a difficult course of research and development, *DFH III* satellite, independently developed by China, was successfully launched with a capacity equivalent to 12 *DFH II* satellites, making the Chinese aerospace experts finally able to hold their heads high. It was estimated by departments concerned that tens of millions dollars were saved for the state per year by public satellite communications alone.

Over three decades have elapsed and the debate whether China should buy or build a satellite on its own