China Takes Key Step towards Permanent Space Station

By XIN Ling (Staff Reporter)

China has successfully sent a cargo craft to dock with and refuel its Tiangong-2 space lab, taking a crucial step towards establishing a permanent space station by 2022.

Lifting off from China's new Wenchang Satellite Launch Center on April 20, 2017, the Tianzhou ("Heavenly Boat")-1 cargo resupply spacecraft first rendezvoused with Tiangong ("Heavenly Palace")-2 in an automated maneuver, and then performed a complete propellant transfer two days later.

On June 19, after two months of coupled flight, Tianzhou-1 detached from Tiangong-2 and completed a more complicated, second docking from the opposite direction.

The cargo and the lab are flying separately at the moment, waiting for a third opportunity to test the so-called automatic fast-docking technology, which will complete the docking within 6 hours rather than the usual two days. During this period of time, Tianzhou-1 will also be conducting its own space science experiments onboard.

Roughly 10m-long and 3m-wide, Tianzhou-1 can carry up to 6.5 tonnes of goods, including two tonnes of fuel. It will function as the main vehicle to deliver supplies needed for sustaining human presence on board the future Chinese space station.

China launched Tiangong-2 in September 2016. A month later, two Chinese astronauts spent one month aboard the lab in what was the country's longest-ever manned space mission.

With the success of Tianzhou-1, China has finished all its tests needed for the upcoming space station. In 2018, the core module for the future station will be sent into orbit, followed by two lab modules and a dozen minor launches, until the entire station is pieced together in 2022 if everything goes according to plan.

Upon completion, the Chinese Space Station (CSS) will weigh about 90 tonnes and be able to accommodate three astronauts to live and work on a long-term basis, with a design life span of ten years or more. After the likely retirement of the International Space Station in 2024, CSS may become the only space station in operation for a while. The Chinese government has been positive in collaborating with many countries on the CSS, including Russia and Europe.

The Tianzhou-1 cargo spacecraft. *Credit: China Aerospace Science and Technology Corporation (CASC).*

Tokamak in Hefei Sets New Record with Steady State, High Performance Plasma

EAST, or the Experimental Advanced Superconducting Tokamak, the world's first fully superconducting Tokamak hosted by the Institute of Plasma Physics, Chinese Academy of Sciences in Hefei successfully operated a stable 101.2-second steady state, high confinement plasma on July 3, 2017, which is a new world record in the long-pulse H-mode operation for Tokamak devices.

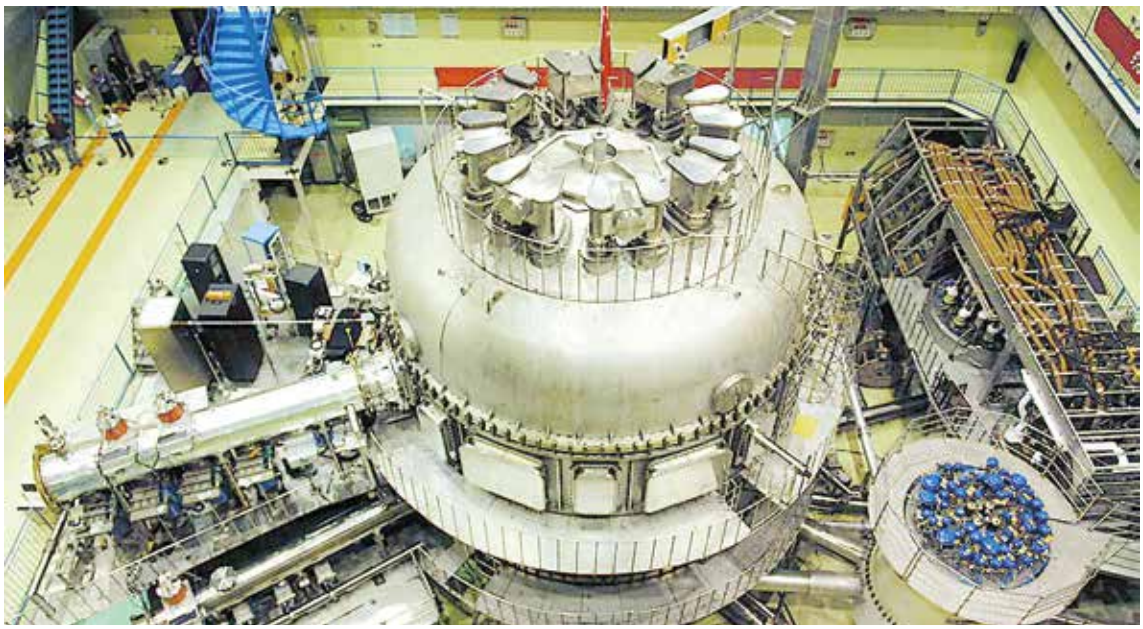
The high confinement mode features the edge localized modes with small perturbation amplitude under the condition of low-momentum injection with pure RF wave heating, actively cooled ITER-like monoblock tungsten divertor.

With effective control of the divertor target heat load and tungsten impurity influx and the center chord average electron density being maintained at >50% Greenwald density limit, EAST achieved a fully non-inductive current driven steady state, high performance plasma with a confinement enhancement factor H_{98y2} greater than 1.1 for over 100 seconds.

All the plasma parameters, including recycling, particle and heat fluxes, reached truly steady state after 20 s, the wall saturate time for the W divertor and maintained stable to the end of discharge.

EAST chief operator GONG Xianzu shared the good news with collaborators all over the world at midnight via social media. As the one who had witnessed every advancement made on the machine as well as each setback since 2006, he said the breakthrough indicates that EAST will "continue to play a key role in both physics and engineering frontiers of steady state operation, and has significant scientific implications for the International Thermonuclear Fusion Reactor (ITER) and the future China Fusion Engineering Test Reactor (CFETR)."

GONG called the new record a "success of joint efforts". The EAST team has been working together with domestic and international scientists over the past decade to solve a series of key technical and physical issues closely related to steady state operation, and have carried out in-depth scientific research on integrated operation scenarios with effective coupling of multi-scale physical processes. (Based on EAST news release)



The Experimental Advanced Superconducting Tokamak (EAST) at the Institute of Plasma Physics, Chinese Academy of Sciences in Hefei is the world's first fully superconducting Tokamak device.

Mathematician Passes Away at 98

WU Wenjun, a distinguished mathematician specializing in topology and recipient of the State Preeminent Science and Technology Award, died on May 7 at the age of 98.

Born in Shanghai in 1919, WU graduated from National Chiao Tung University in 1940. Driven by his keen interest in exploring modern mathematics, he went to France for further study. Later, he obtained his PhD degree from the University of Strasbourg and continued his research at the French Center for Scientific Research (CNRS).

In August 1951, WU returned to China and joined the Department of Mathematics at Peking University. By establishing the WU Formula and WU class, he made great contributions to the field of algebraic topology, and was awarded the First Prize of National Natural Science Award for his work in 1956. He was elected as a Member of CAS one year later. In the 1970s, WU switched to studies on computerized methods to prove geometrical theorems, and won the Herbrand Award in 1997 due to his contributions to automatic reasoning.

WU received the State Preeminent Science and Technology Award in 2000. He and agriculturist YUAN Longping were the first two people to receive this prestigious achievement award. He was also the winner of the TWAS Prize in 1990 and the Shaw Prize in 2006.

Mathematician WU Wenjun, who was known for his studies on algebraic topology among others, died in Beijing on May 7, 2017 at the age of 98.

WU's work has been highly acknowledged not only domestically but also worldwide. In 2010, the International Astronomical Union decided to permanently name the asteroid No. 7683 after WU Wenjun. (By WANG Danna)

CAS Scientist Bags Top Meteorology Prize

ZENG Qingcun, a senior meteorologist and pioneer in numerical weather prediction from the CAS Institute of Atmospheric Physics, has been awarded the 61th International Meteorological Organization Prize.

The prize, which was presented by the World Meteorological Organization (WMO), recognized ZENG for his work in satellite meteorological remote-sensing theory, numerical weather prediction theory, meteorological disaster prevention and earth system modeling. Zeng was also recognized for his contributions to WMO and the World Climate Research Program, the Intergovernmental Panel on Climate Change and the Commission for Atmospheric Sciences.

"Professor Zeng is most deserving of our highest award. He is an outstanding scientist, who for more than 50 years has been studying meteorology, atmospheric sciences, geophysical fluid dynamics, and change of global climate and environment," WMO President David Grimes was quoted as saying.

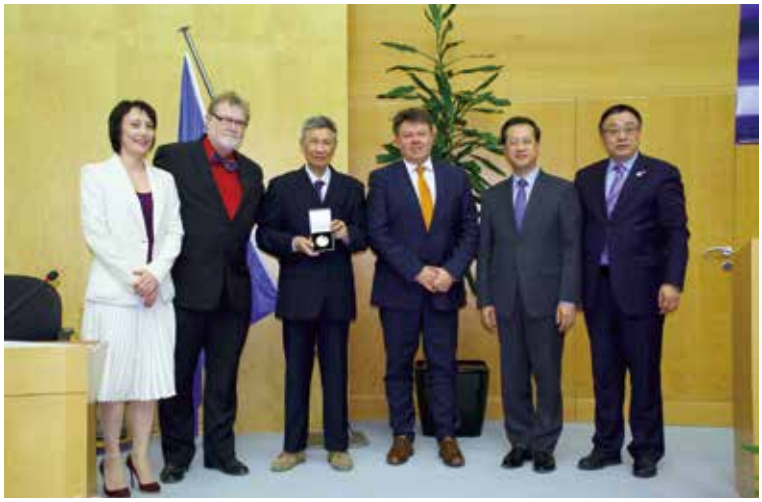
Mr. Grimes also praised ZENG's work in many related areas, such as the theoretical investigation of numerical weather prediction, climate system and earth system models; general atmospheric circulations and monsoon systems, and their dynamics; the models and methods in dynamic short-term climate prediction; the study of disastrous weather systems, especially the dust

storms in East Asia and so on.

Accepting the prestigious prize at WMO's Executive Council, ZENG said that the WMO Integration Global Observing System (WIGOS) plays a very important role in continued improvements in the prediction and mitigation of meteorological disasters.

ZENG has been working at the CAS Institute of Atmospheric Physics since 1966. He served as the institute's director from 1984 to 1993, and was the director of the State Key Laboratory of Atmospheric Sciences and Geophysical Fluid Dynamics from 1985 to 1993. He founded the International Center for Climate and Environment Sciences in 1995. In 2014, he became an Honorary Member of the American Meteorological Society.

The International Meteorological Organization Prize is the most important award in the field of meteorology in the world. It is awarded annually to scientists who have made outstanding contributions to meteorology, hydrology and geophysical sciences.



ZENG Qingcun (third from left) received this year's International Meteorological Organization Prize in Geneva, Switzerland on May 16, 2017.

Quantum Physicist Receives Fresnel Prize

Chinese physicist LU Chaoyang has won the 2017 "Fresnel prize for fundamental aspects" for his "outstanding achievements in quantum light sources, quantum teleportation and optical quantum computing." The awarding ceremony was held in Munich, Germany on June 27 by the European Physical Society.

Professor LU Chaoyang.

As a Professor of Physics at the University of Science and Technology of China (USTC), LU's research focuses on the study of scalable quantum photonics, quantum computation, and quantum foundations. LU earned his Bachelor's degree from USTC in 2004 and his PhD from the Cavendish Laboratory, University of Cambridge in 2011, specializing in multi-photon entanglement and optically active quantum dots research.

He has been working as part of a team led by PAN Jianwei, which is known for their break-breaking work in quantum entanglement and quantum teleportation. In 2015, the team won the Physics World Breakthrough of the Year Award and the State Nature Science First Class Award, which is one of the highest honors in China in science and technology. In 2016, the team successfully sent the world's first quantum communications satellite into space.

The Fresnel prizes are named after the late French physicist Augustin-Jean Fresnel, who is known for his theoretical and experimental studies of the behavior of light. They are regarded as a very high honor for scientists under the age of 35 in the field of physics.

CAS Releases First RS Green Book for Sustainable Development of China

On June 12 at a news release held in Beijing, the Chinese Academy of Sciences (CAS) announced the release of its *Report on Remote Sensing (RS) Monitoring of China Sustainable Development 2016* (later referred to as "Report"), providing support for the implementation of the 13th National Plan of the country with scientific data. This also marks the first volume of the Academy's serial RS green books.

Completed by scientists from the Institute of Remote Sensing and Digital Earth (RADI), the *Report* has a foreword by CAS President Prof. BAI Chunli, and an expert panel led by CAS Member Prof. XU Guanhua, former Chinese Minister of Science and Technology and a prominent savant in remote sensing.

Inspired by seven out of the 25 indicators listed in the *Outline of the 13th National Five-Year Plan for Economic and Social Development*, the *Report* adopts an index system to evaluate the level of sustainable development of different areas in its lens of RS monitoring. Specifically, the *Report* gives general introduction and analysis of the *status quo* on different aspects of sustainable development of China, elaborating on a number of issues that have gained great attention from all walks of life, including land use, vegetation, air quality over typical urban clusters, grain production, water resources and water environment protection.

In particular, the *Report* offers in-depth analysis on some special topics, including the synergetic development of Beijing, Tianjin cities and Hebei Province, and the "Heihe-Tengchong line". Dubbed "Hu's line", the latter is a model proposed in 1935 by HU Huanyong, a Chinese economic geographer, to depict the discrepancy between population density to the east and west of the line from Heihe in northeast to Tengchong in southwest of China.

The serial of RS green books draws on the massive data and analysis results from the three-decade-long continuous monitoring by the RS community of China. Providing scientific data and analytical results from an objective view of the third party, it aims to support the compilation of developmental planning, and the monitoring over the deployment and effects of related policy decisions.

With the development of China's High-Resolution Earth Observation System Project and the continuous improvement of space-based observation infrastructure, China is building an Earth observation system featuring high-temporal, high-spatial and high-spectral resolutions, combined with powerful ground observation.

The serial will be updated annually, according to RADI.