# CHINA SCIENCE AND TECHNOLOGY NEWSLETTER

*Department of International Cooperation*
*Ministry of Science and Technology(MOST), P.R.China*

*No.16*
*August 25 2014*



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## President Xi Jinping Talks about Innovation

During his trip to Shanghai from May 23 to May 24, President Xi Jinping inspected China (Shanghai) Pilot Free Trade Zone (Shanghai FTZ), the R&D Center of Commercial Aircraft Corporation of China (COMAC), company United Imaging and SAIC Motor, gaining an in-depth understanding of the development of Shanghai FTZ, enterprises and research bases.

President Xi remarked that in today's world, scientific and technological innovation (STI) has become an important pillar for improving comprehensive national strength, facilitating the change of production mode and bettering the way of people's lives. It is indeed that those countries who have STI advantages, like grasping the key of things, or taking a decisive step on chessboard, could seize opportunities and win the strength of development. We must be clearly aware of the trend in the progress of science and technology, focus on the world advanced technologies and science frontiers, endeavor to gain great innovation in basic research and make key breakthroughs in core technologies. In line with the major trend of the industrial revolution, we must deploy relevant tasks for innovation with aim to promote and upgrade the industrial chain, and boost STI for industrial development. Efforts should be made to gather talents for innovative activities, improve environment for innovation in research institutes and universities, and enhance the mechanism for IPR management and protection, so that various talents could be playing greater role in their innovative activities.

During his inspection, President Xi listened to the report on the work of Shanghai, and was satisfied with Shanghai's development and the efforts by local government.

(Source: Science & Technology Daily, May 25, 2014)


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# MOST and Other 14 Government Bodies Push for Implementation of National Technological Innovation Project

On May 9, the Ministry of Science and Technology (MOST), the National Development and Reform Commission (NDRC), the Ministry of Finance (MOF), the Ministry of Education (MOE), the Ministry of Industry and Information Technology (MIIT), the Ministry of Human Resource and Social Security (MHRSS), the Ministry of Agriculture (MOA), and other 8 government agencies and public institutions convened the second inter-ministerial meeting of National Technological Innovation Project, during which the participants reviewed work for national technological innovation in 2013 and discussed the work plan in 2014.

According to the representative from MOST, with efforts jointly made by all parties, positive outcomes in promoting technological innovation have been achieved in the initial stage, which are mainly as follows:

1. Enterprises have been increasingly enhanced their innovative capacity and become major players in technological innovation. Due to an increased amount of corporate R&D input and support from government, 99 State key labs, 55 engineering labs and 300 engineering research centers have been established based on enterprises. In several national programs for industrial R&D and technological development, the projects with enterprises as participants respectively accounted for 52.3 percent of the total projects in the National Major S&T Projects, 38.7 percent of the total in the National 863 Program and over 40 percent in the S&T Enabling Program. In 2013, corporate R&D expenditure accounted for over 76 percent of the total social R&D expenditure, and domestic invention patent authorizations accounted for 54.9 percent of the total.

2. The measures and mechanism for collaborative innovation between enterprises, universities and research institutes have been gradually improved. A total of 146 Industry Technology Innovation Strategic Alliances have been established and linked over 5,000 backbone enterprises, universities and research institutes, and with governmental support 14 collaborative innovation centers have been built up based on cooperation between universities, enterprises and research institutes. Such measures have facilitated the pooling of research achievements and talents in enterprises as implementing the national action plan for technology transfer, promoting technical task force (TTF) and building postdoctoral work stations.

3. The industrialization led by enterprises has rendered good performance, effectively leading to industrial restructuring and technological upgrading. In 2013, the main business revenue of hi-tech industries reached 12 trillion yuan, a year-on-year increase of 17 percent. In national hi-tech zones nationwide' a scientific and technological entrepreneurship service chain was developed, which means from pioneering parks to technological business incubators, then to innovation accelerators, an enterprise can grow up. In national agricultural science parks some collaborative innovation alliances and modern agricultural S&T service systems were established. Venture capital investment has become increasingly important in supporting S&T entrepreneurship.

4. Some public technological service platforms have been established, and the mechanism of sharing scientific and technological resources has been built up for enterprises. The government has helped build 412 public service demonstration platforms for SMEs, guided various localities in establishing regional technological innovation service platforms, and strengthened information services bridging scientific and technological resources and the needs of enterprises. National Science and Technology Infrastructure Platform has come into use with open sharing of large equipment in 10

universities, offering services to enterprises more than 470,000 times.

5. Key policies for innovation have been further improved and carried out gradually bettering innovation climate for enterprises. The government has taken financial measures to effectively support R&D and innovation in enterprises. There have been over 30 financing service centers, over 60 branch banks and a number of guaranty companies for financing services. A total of 16 pilot regions have established, where various financial measures are used to support tech-based enterprises. The IPR pledge loans nationwide reached 25.4 billion yuan in 2013.

In 2014, relevant government departments will strengthen coordination, promote innovation in management system and operating mechanism, build a sound policy environment, strengthen public services and improve the ecosystem for technological innovation in industry, thus fully stimulating the endogenous driving force and good performance of corporate innovation.

(Source: Science & Technology Daily, May 10)

## Cases of China's Technological Innovation

### China's High Speed Railway Equipment

The High Speed Railway Key Technology and Equipment Research, an S&T major project supported by the National S&T Enabling Program, was officially approved by relevant government departments. The landmark achievement – 350km/h high speed train – has become the major way of transportation connecting Beijing and Shanghai as well as Beijing and Guangzhou, with a total mileage of over 400 million km.

The project was the priority task set out in an action plan concerning innovation of China's high speed train organized and implemented by MOST and former MOR (Ministry of Railways). Based on Beijing-Shanghai high-speed railway, the project aims to develop independently China's own 350km/h high speed train, as well as establish and improve an equipment manufacturing system with strong innovative capacity, independent IPR, international competitiveness, and strengths for sustainable development.

The project consists of ten subjects, such as high speed rail core & key technologies, traction power supply system, operation control system and transportation system. Since the initialization in February 2008, under the support of MOST and the former MOR, a joint team dedicated to technological innovation for high speed rail was established. In the joint team, 10 Chinese backbone enterprises served as the major innovators, 68 academicians and over 500 professors took part in the initiative, and 25 prominent universities, 11 research institutes as well as 51 state key labs and engineering research centers carried out close collaboration.

In August 2010, China Southern Locomotive and Rolling Stock Industry Group's (CSR) branch Sifang Co Ltd managed to develop what was accredited as the role model of China's innovation in equipment manufacturing industry-CRH380A high speed train. Great breakthroughs were made in key technologies for this new equipment, such as system integration, light-weight compartment as well as vibration absorption and noise reduction. In December 2010, CRH380A broke world railway speed record, reaching 486.1 km/h on Beijing-Shanghai railway line.

In the process of implementation, China built a world-class high speed rail technology platform, mapped out a management mechanism involving various parties for innovation, set up a technology system integrating design, manufacturing, assessment and maintenance, produced a large number of talents in railway engineering technology, established simulation and testing platforms for railway equipment technologies, and formed an industrial chain covering 22 provinces, autonomous regions and municipalities.

By the end of 2013, the total mileage of China's railway system has topped 10,000 km, accounting for half of that of the world. China boasts of the world's largest high speed rail network, the most complicated running environment and the largest number of passengers for high speed rail. At present, China has researched into and developed 29 types of high speed trains, covering various genres of trains with speed ranging from 200 to 380 km/h.

(Science & Technology Daily, June 8, 2014)

## Third-Generation Nuclear Power Technology in China

In January 2014, the preliminary design of Chinese large-scale advanced pressurized water reactor (APWR) CAP1400 nuclear power system passed the assessment by the National Energy Administration with its general technical solution, technical indexes and major parameters approved by the state authorization, which marked the taking-off of the third-generation nuclear power technology in China.

According to a principal from the State Nuclear Power Technology Corporation (SNPTC), as the national brand of nuclear power, CAP1400 is the third-generation nuclear power technology that SNPTC researched and developed incorporating the Chinese experience in R&D and design as well as construction and operation of nuclear power, based on learning from the American AP 1000 third-generation passive nuclear power technology. It was listed as one of National Major Science and Technology Project in 2006. As for the term CAP1400, C stands for China; AP1400 refers to the increase of electric power from 1000 MW (a.k.a. 1 million KW) of the American AP1000 to 1400 MW (a.k.a. 1.4 million KW).The actual electric power of CAP1400 surpasses 1.5 million KW, which makes it the largest passive PWR nuclear power equipment. It inherits the advanced concept of passive security of AP1000 with no dependence on external power supply, which ensures that the security of the reactor under extreme conditions can be acquired, that the after heat and reactor core decay residual heat are removed safely, and that no human intervention is needed within 72 hours of the accident. Through the technological innovation in various fields, the security, economical efficiency and environmental compatibility are further improved, which have matched the world's latest nuclear safety standards and reached internationally advanced level.

Later on May 29th, Mr. Wang Binghua, President of SNPTC, declared that from the introduction of third-generation power technology AP1000 in China to the development of CAP1400 nuclear power equipment with independent intellectual property rights, a globally oriented and mutually shared AP/CAP third-generation nuclear power supply chain at home and abroad had been formed. During the process, Chinese enterprises accelerated their industrial upgrading and cultivated their

manufacturing capacity of an annual output of 6-8 sets for the AP/CAP nuclear power equipment supply.

Mr. Wang Binghua introduced that since the last annual meeting in Hangzhou, the number of qualified supplier of AP/CAP had grown from 57 to 109, which included not only Chinese enterprises but also foreign ones, not only state-owned enterprises but also private ones. All parties would keep working in accordance with the technical requirements of AP/CAP, ASME standard and other advanced international standards, and continue to realize new breakthroughs in the R&D and manufacturing of the equipment. As a result, a community with common interests had been formed further. According to the estimation by the World Nuclear Association, by 2030, there will be a newly added 160 or so units and $ 1500-billion-dollar investment in the international market of nuclear power. Currently, more and more countries such as the UK and South Africa are showing increasingly bigger interest and willingness to cooperate on AP1000 or CAP1400.

(Source: S&T Daily. The original title: the Preliminary Design of CAP1400 Passed National Review; Chinese Brands of the Third-generation Nuclear Power Technology has Taken Off, Published on January 12th, 2014; Globally Oriented AP/CAP Third-Generation Nuclear Power Supply Chain Has Been Formed, published on May 30, 2014)

## Systematic Control Technology of China's Very Large Power Grid

VLPG defines the power grid with an installed capacity of more than 60 million KW as a Very Large Power Grid (VLPG). Currently, China State Grid has become the ac/dc hybrid VLPG that has the highest running voltage level, the largest electricity consumption, and the most renewable energy installed in the whole world. By the end of 2012, the installed capacity nationwide has reached 1.145 billion KW, among which the installed wind power capacity has reached 76 million KW. China State Grid is ranking among the top 3 power grids together with the U.S. Grid and European Grid.

The characteristic of VLPG is that it covers multiple regions, and is operated and controlled by multiple operators and coordinated in the whole grid network.

In May 2004, an industry-university-research cooperation team composed of over 40 organizations including the State Grid Corporation, State Grid Electric Power Research Institute and China Electric Power Research Institute was formed for solutions of VLPG. An accumulated amount of 110 million yuan has been invested as R&D funds in the project, and work has started in 4 subjects of R&D, namely safe operation of complex large power grid, large-capacity and long-distance transmission of VLPG and the combining of large-scale renewable energy, security protection of the operation and control system, and construction of a standard and unified integrated platform.

Through R&D work, a series of technologies were developed, including grid real-time monitoring, integrated intelligent alarm and security control of large power grids that are multi-layer operated and coordinated, which helped realize the real-time alarm of faults in the grids of 500 kV and above in State Grid, and solve some technical problems in the multi-layer operation and coordination and the joint fault disposal in the operation of VLPG.

The enterprises and research institutes have jointly developed a power grid operation control system that is based on the domestic equipment, hardware and software, and matches the 4th class security protection requirements, forming an above-provincial backup and coordination system with relevant groups. The system has significantly improved the capability of China VLPG in resisting major natural disasters and syndicated network attack.

The participating organizations initiated and realized 2 IEC international standards, 1 national standard, 7 standards for industry and 24 for enterprise. In addition, they gained 3 international patents, 10 authorized invention patents, 4 software copyrights and published 135 papers. The project was awarded the second prize of the 2013 National Progress Awards in S&T, and named as the national strategic innovative product. The key technologies for VLPG were awarded respectively the first prize of China Electric Power Science and Technology Award in 2011 and 2012, and the Outstanding Patent Invention Award in the 14th China Patent Award.

In 2009, the integrated operation and control system for VLPG has completed its R&D tasks and the system came into operation and soon was promoted and applied in the above-provincial level operation and control centers of the State Grid. By the end of 2013, achievements of the project had been utilized in 32 operations on above-provincial level and 57 on municipal level, covering the whole-level grid operation with the 4th class protection system, which has greatly supported the proper and safe operation of China's VLPG.

(Source: S&T Daily, March 12, 2014. Original Title: Integrated Operation, 3-5 Years Ahead of the European and American Grids)

## Lithography Machine Developed by Chinese Enterprises

In March 2002, under support of the national 863 Program and working as a comprehensive integration platform, Shanghai Micro-electronics Equipment Co Ltd (SMEE) conducted the early stage research and development work on lithography machine in a way of industry-university-research collaboration.

In 2009, the development of lithography machine was listed as one of the 16 National Major S&T Projects. The government conducted a comprehensive layout for IC development in the key areas and technologies from lithography machine and etcher to high-end equipment, high-end materials and advanced manufacturing technology, trying to build a supporting platform for IC industrialization. In the same year, the R&D of 200×200 new-type lithography machine became a key project in S&T Program Supported by Shanghai government. SMEE and Shanghai University became participants of the project.

In 2012, the encapsulation lithography developed by SMEE was introduced into Taiwan, the base of advanced encapsulation, which attracted a lot of attention from the counterparts in the industry, and pushed them to lower the market price and improve the functions of their equipments. Currently, SMEE occupies 80 percent of the domestic market of advanced encapsulation lithography, and forces their competitors to lower the price of their products by one third.

In August 2013, based on sufficient tests, the first new type of display lithography developed by SMEE was officially put into work for the two and half-generation

IC production lines in an enterprise in Kunshan, Jiangsu province.

There has been a history of over 30 years for the development of lithography abroad. And in China, SMEE has become one among three Japanese companies and a few Europian high-tech companies that have mastered the design, manufacturing and test of the high-end lithography after its ten-year efforts. Now R&D on 90 nm lithography is still undergoing in SMEE.

(Source: S&T Daily, January 4th, 2014. Original tile: To Carve the Fingerprints of Chinese Industries Using the Optical Sword)

## First 4500-meter Remotely Operated Underwater Vehicle in China

Sea Horse, unmanned 4500-meter remotely operated underwater vehicle (Sea Horse ROV), is by now the deep sea and strong work type ROV system that is independently developed device and has the biggest dive working depth. In April 2014, Sea Horse had its 3rd voyage sea test after assembly adjusting and testing, pool experiment, and a two-month sea test. In the 3rd test, Sea Horse ROV conducted 17 times of dives, among which 3 times reached the bottom of the 4,500-meter deep sea basin, and it realized a biggest dive depth of 4502 meters. The Sea Horse completed all the items of the sea test and the technical indicators test, and passed 114 items of inspections approved by the experts on site.

Under the national 863 Program, the key project "4500-meter Deep Sea Work System" was launched in 2008. In 2009, the Ministry of Science and Technology and the State Oceanic Administration jointly issued the *National Deep-Sea High Technology Development Plan(2009-2020)*, and the project was listed on the key projects for the development of deep sea underwater vehicle technology and equipment.

4500 meter is the depth of the central sea basin of the South China Sea. Such a depth covers 98 percent of the waters of South China Sea, and the international rich cobalt crust resources enrichment region at the bottom of the sea as well as most of the hydrothermal sulfide enrichment region. R&D on the deep sea carrying and operating equipment at this level of depth can satisfy most of the related needs for deep sea detection and operation.

In the implementation of the R&D project, the administration in charge established an owner management mechanism which takes users as the core. The 4500-meter deep sea work system was clearly set to serve the deep sea resource exploration and application. The Ministry of Land and Resources was authorized to manage the project, which was lead by its affiliated Guangzhou Marine Geological Survey (GMGS). Shanghai Jiaotong University, Zhejiang University, Harbin Engineering University, the Marine Chemical Research Institute and Tongji University worked together on their R&D to develop new types of deep sea equipment through industry-university-research cooperation.

The success of the R&D and sea tests of Sea Horse has forged a strong R&D team not only for ROV technology and equipment, but also for ROV technological operation in China.

(Source: S&T Daily, May 6th, 2014. Original Title: The Rejuvenation of Dream Deep in the Sea—the Birth of the 1st 4500-meter Unmanned ROV Sea Horse)

## Sea Water Desalting Device Developed in China

On December 26th, 2013, Guohua Cangdong Power Generation Co Ltd (Guohua Cangdong Power), a Chinese power enterprise in Cangzhou, Hebei province, developed a low-temperature multiple-effect desalination device with a daily output of 25,000 tons. After 168 hours of pilot run, it was put into production.

The enterprise is located along the coast of the Bohai Sea where there is seriously deficient in fresh water resources. Since its foundation in 2001, the company has set its goal of providing their own water for production and living through sea water desalination. In March 2006, in order to support local construction of new power plant facilities, the company imported 2 sets of low-temperature multiple-effect desalination device with a daily output of 10,000 tons and put them into production. After two months, the company proposed for the first time a plan to develop independently a same type desalination device. With two years' efforts, the company domestically produced the planned device with proprietary intellectual property rights and daily output of 12,500 tons treated water. The device was put into production at the 2nd phase of desalination project in March, 2009, and its major technical and economic indexes were tested to have met or even been better than the designed value.

Nowadays, the imported sea water desalting equipment and the domestically developed equipment were placed in a row at the site. The number of evaporation device has increase from 4 units at the time of the introduction of foreign devices to 10 units today; the figure of water-making ratio increased from 8.3 to over 13. Through independent R&D activities and industrial innovation, Guohua Cangdong Power has developed its research and manufacturing capacity for large-scale sea desalination devices, having made steady progress in the path of "made in China".

(Source: S&T Daily, December 27, 2013. Original Title: Dancing along the Waves of the Bohai Sea; Creating the Water of Our Own—China-made Sea Water Desalination Device with the Largest Water Making Capacity (25,000 tons per day) per Machine Successfully Put into Production)