

From Outer Space to Deep Ocean: Innovation Drives Comprehensive Development in China

Voice of the World

Edited by QI Liming

As 2021 draws to a close, countries around the world are still struggling to recover from the COVID-19 pandemic. However, despite the virus threat, the year has seen how technology, especially in China, is advancing all aspects of life on and away from the Earth.

Space exploration recognized

In the past year, China has made massive strides in space exploration, bringing the last frontier closer to home and into people's consciousness.

One of acknowledgments of this achievement is Chinese engineer Zhang Rongqiao, making science journal *Nature's* top ten list of people who helped shape science in 2021.

Zhang led China's first successful Mars mission. On May 15, China's Mars rover landed safely on the planet's red surface, making it the second country after the U. S., to place a rover on the planet.

Though *Nature's* list is not an award or a ranking, the selection is compiled by the journal's editors to highlight key events in science through the compelling stories of those involved.

Progress on foundational and advanced technology

Released in December 2021, a report from Harvard University's Belfer Center concluded that China has made extraordinary leaps on a wide range of technologies.



Quanzhou Bay. (PHOTO: VCG)

In each of the foundational technologies of the 21st century, such as artificial intelligence (AI), semiconductors, 5G wireless, quantum information science, biotechnology and green energy, China could soon be the global leader. In some areas, it has already taken the lead.

In the advanced technology likely to have the greatest effect on economics and security in the coming decade, for example AI, China is a pioneer in crucial areas. The Harvard report adds that China now clearly tops the U.S. in practical AI applications, including facial recognition, voice recognition and fintech.

Free from dependence on imported technology

According to Ryan Fedasiuk and Emily Weinstein, research analysts at

Georgetown University's Center for Security and Emerging Technology, China is trying to free itself from dependence on imported technology.

In a new framework being called EPIC, an anagram of equipment, personnel, information, and capital, the four key resources represent the foundational tools that China uses in its push to amass comprehensive national power.

- Equipment, China is committed to building domestic supply chains for linchpin commodities like semiconductors and gas turbines.

- People, Chinese universities have climbed in global university rankings, and, by 2025, China's education system is projected to produce twice as many STEM PhDs as the U. S. each year.

- Information, China has encour-

aged Chinese firms to "go out" and seek investment opportunities abroad.

- Capital, it is also a resource that China has excelled at amassing.

Growing dominance in maritime shipping

According to Matthew Rochat, a PhD candidate in political science at the University of California Santa Barbara, given that 90 percent of the world's goods travel across the ocean to reach their destination, the importance of the maritime shipping industry cannot be understated.

Historically, control rights of global shipping lanes has been a central goal of economic statecraft. Since the Age of Discovery, maintaining reliable access to the world's waterways has been understood as a key source of national power.

In this light, China is increasing investment in the maritime shipping industry, both domestically and abroad, Rochat said. In addition to its growing accumulation of shipping ports, China is the leading manufacturer of shipping equipment, producing 96 percent of the world's shipping containers, 80 percent of the world's ship-to-shore cranes, and receiving 48 percent of the world's ship-building orders in 2020.

At present, China is home to more shipping ports than any other country, including seven of the ten busiest ports in the world. In addition to its massive accumulation of domestic shipping infrastructure, China also owns more than 100 ports in approximately 63 countries. It represents a string of ports and ocean corridors that direct trade to and from China via the waterways.

Opinion

Range of Tech Supporting Metaverse Construction

By YU Haoyuan

The metaverse is a futuristic Internet product based on Web 3.0. As a parallel reflection of the real world in virtual reality, the metaverse is defined differently by multiple experts in different industries. However, no matter what or how it is defined, BIGANT is the key to metaverse development.

According to Yu Jianing, executive director of China Mobile Communication Association Metaverse Consensus Circle, BIGANT is an acronym for six technology clusters, namely Blockchain, Interactivity, Game, AI, Network and Internet of Things (IoT).

Blockchain provides data trust in the virtual world

The metaverse needs a cryptocurrency to build the digital economy as a reflection of the real world. Blockchain's bitcoin can support the metaverse's economic construction as the first cryptocurrency.

A report published by Binance Academy, a blockchain & cryptocurrency think tank, says that blockchain technology provides a transparent and cost-effective solution, making it ideal for the metaverse.

Replacing stuff from the real world to the virtual world with reliable and accurate data is essential to the metaverse. According to *Barron's*, a financial and investment website, a blockchain can bring trading trust among net users. It outlined that the technology could allow metaverse-like games to be decentralized and interoperable, which signifies that individual players can swap tokens and trade digital assets.

Interaction drives the digital community

People wish to get physical and mental real senses in the virtual world. As a result, interactive technologies such as virtual reality (VR) and augmented reality (AR) are being further developed. The designers have constructed the Internet with VR and AR from a 2D community to a 3D world, enabling people to do several activities online.

David Touve, an expert in new technologies and digital experiences at the University of Virginia's Batten Institute, said that technology may no longer be the major barrier to experiences within immersive, virtual environments. He outlined that many smartphone manufacturers have already put some AR functions into new productions, and with a headset, users can get a decent VR experience.

Zuckerberg's Meta has recently put its Horizon Worlds online in the U.S. and Canada. By wearing an Oculus Quest 2 helmet, people's avatars can meet friends or strangers in the application. It is also reported that many users' hands and fingers can move in the digital world when they show gestures in the real world, and mouths can open and close when they speak.

Gaming: leading the metaverse development

According to Yu, games are the manifestation of the metaverse, with flexible connectivity and abundant content. They provide an innovation platform, interactive contents and a social sense to realize the flow aggregation. Specifically, metaverse technology contains gaming engine-related 3D modeling and real-time rendering, which support the building of the metaverse.

Many gaming companies have already taken the lead. In June 2020, China Central Television reported that the students of Communication University of China recreated a pixelated campus almost the same as their college in reality in the video game *Minecraft*, to hold their graduation ceremony. U.S. tech blog *The Verge* also reported that U.S. rapper Travis Scott held a concert in Epic Games' *Fortnite*, with more than 12 million fans in attendance.

AI - humans co-build the virtual world

The metaverse was described as a world where humans, as avatars, can interact with machines. AI is seen as a technology that can help create the environment, and it is ubiquitous in all levels, applications and scenarios of the metaverse.

According to *The Path to Metaverse*, AI can be estimated as the integration of computer vision, machine learning, natural language processing, and intelligent speech. While computer vision technology creates more "reality" in the metaverse, the other three technologies can give AI characters intelligence to interact with humans and reduce communication barriers among human avatars.

As an immersive tech news website, XRToday claimed that AI technology has already been used for five aspects of the metaverse-like platform, including Accurate Avatar Creation, Digital Huams, Multilingual Accessibility, VR World Expansion as Scale, and Intuitive Interfacing.

Advanced Network provides the basic foundation

The network technology for the metaverse should include some basic technologies, such as 5G/6G Internet, cloud computing and edge computing, according to *The Path to Metaverse*. "The cloud-based integrated intelligent network is the lowest-level infrastructure of the metaverse, providing high-speed, low-latency, high-computing power, and high AI access at scale. As such, it provides a real-time and smoothly immersive experience for metaverse users," the book writes.

To get realistic modeling, textured media and immersive sound require heavy digital files to be uploaded and handled online. It is difficult for user's computers to function as processing terminals supporting billions of players online at the same time. With network improvements, 5G/6G provides a better data transmission tunnel to reduce network latency, and technologies such as cloud computing and edge computing can provide more functional, lighter terminal equipment to solve the problem of letting huge numbers of users access the metaverse effectively with no network congestion.

Metaverse drives IoT to IoE

Though IoT is probably the predecessor of the metaverse, only with the "Internet of Everything", the virtual world can coexist with the real world. "The high likely scenario for the metaverse to work efficiently is using a group of IoT devices employed by the metaverse platform to collect data," Enis Abo Alhasan, a blog writer, wrote in *The Times of Israel*.

Alhasan outlined that the metaverse should not only be a digital world, but also a "physical" one, which means the metaverse will need data synchronization at any given time. Thus, such data-collection behavior needs to connect to many hardware, controllers and physical objects. IoT technology can help with this. "Implementing IoT to these objects, along with special sensors, will allow users to connect to the metaverse and 'move' both physically and virtually. This exclusive ability of the IoT is the basis of operating the metaverse," said Alhasan.



BIGANT, the key to metaverse development. (PHOTO:VCG)

Most Significant Sci-tech Events in China and the World

By YU Haoyuan

In recent weeks, media across the world have selected their Top 10 scientific achievements of 2021. Chinese media did the same, and below are listed four breakthroughs by Chinese technology, and three global successes selected by foreign media. A common listed accomplishment by local and foreign media was the Mars landing.

Chinese media commonly selected four sci-tech news of the year:

"Zu Chongzhi" is taking the lead

"Zu Chongzhi", a quantum computer designed and made by a research team from the University of Science and Technology of China, is the country's first programmable superconducting quantum computer prototype. Its 2.0 version based on photonics quantum computing technology, has 62 functional qubits, and this number has increased to 66 on its 2.1 version by using superconducting quantum computing technology, which is the highest in the world.

At present, "Zu Chongzhi" marks China the only country to achieve quantum computational advantage in two mainstream technical routes.

FAST opens for global research

FAST, the world's largest radio telescope, based on observables between 70 MHz and 3 GHz, is over 2.5 times more sensitive than that of the 305-meter

dish at the Arecibo Observatory. Early this year, the telescope was opened to global research from March 31. Scientists from across the world can use FAST for observation and research.

Artificial Sun sets a new record

China's experimental advanced superconducting tokamak, also known as Artificial Sun, has successfully achieved repeatable running at a plasma temperature of 120 million degrees Celsius for 101 seconds, and 160 million degrees Celsius for 20 seconds in May, setting a new world record for the operation of the tokamak experimental device. It was designed to replicate the nuclear fusion process carried out by the sun to provide inexhaustible and pollution-free energy on Earth.

From CO₂ to starch

Starch is mainly made from plants. Chinese scientists designed an artificial method of producing starch by combining chemical catalysts and enzymes to convert CO₂ into starches. Compared with the traditional method of producing starch from plants, the production efficiency of the new method is 8.5 times higher.

Many global sci-tech media also agreed on several scientific news issues around the globe to be listed in the world's Top 10:

"AlphaFold" predicts protein's 3D shapes

The study of protein structure helps

understand the role of proteins in the body. AlphaFold, made by Google's DeepMind (located in the UK), is an AI system able to predict a protein's 3D structure from its amino acid sequence. This year, its upgrade version AlphaFold 2 was claimed to be able to uncover 98.5 percent of human protein structures, and it was also made freely available in July.

Global efforts on fighting against COVID-19

Scientists from all over the world have made commendable efforts in trying to contain COVID-19. The anti-virus vaccines were the fastest to be rolled out in history. Some vaccines were approved for emergency uses and their inoculations began in early 2021. With the discoveries of Delta and Omicron variants, the R&D work of COVID-19 antiviral medicines and booster injections have been included in global science collaboration.

The Mars mission

In recent years, different countries have announced their Mars plans, with a handful having success. In February 2021, NASA's Perseverance, the world's biggest and the most advanced rover, landed on Mars. In the same month, the UAE's Mars probe Hope broke into the Mars orbit, and took a group photo of Mars auroras. Three months later, China landed its Tianwen-1 on Mars, which makes China the second country to be able to land rovers on Mars. Undoubtedly, Mars will be

drawn closer to us in the future.

CRISPR technology to cure human disease

CRISPR technology is considered a technology that can cure human chronic diseases. In June, Gene company Intellia Therapeutics released first-ever clinical data supporting safety and efficacy of CRISPR genome editing in humans. The company's NTLA-2001 is an in vivo gene-editing therapeutic agent that is designed to treat ATTR amyloidosis by reducing the concentration of transthyretin (TTR) in serum. After experimenting with it on six patients, their TTR levels decreased with no serious adverse events and no liver findings by day 28.

In addition, some CRISPR experiments also showed great effects on mice this year. A research published by Cedars-Sinai, shows the CRISPR/Cas9 technology can improve hereditary blindness in mice.



In 2021, in vivo CRISPR genome editing was proved to cure human chronic diseases for the first time. (PHOTO: VCG)

To realize the motion control of the soft arm in interacting with environments, team members proposed two control methods. The first was a feedback control method based on a simplified Jacobian model, utilizing the motion laws of the soft arm that are not affected by environments during interaction.

The second is a control method based on Q-learning, in which they present a novel method to increase training data by setting virtual goals.

HPN soft arm has great research value and wide application prospects in intelligent manufacturing, medical rehabilitation, home servicing and other fields due to its inherent flexibility and characteristics of continuous deformation.

First Interactive Soft Robot Commits Daily Tasks

Hi! Tech

Edited by QI Liming

The world's first interactive soft robot has been developed by the University of Science and Technology of China (USTC). Compared with industrial robots working on assembly lines, the interactive soft robot is designed to perform daily tasks, such as opening doors, pulling open drawers, cleaning glasses, and

opening bottles.

Researchers broke through the limitations of rigid robotic arms and used soft robotic arms to solve the problem of robot manipulation in uncertain scenarios. With soft arms, robots can easily complete various tasks done by humans in daily life. The most important thing is they don't need to build a model of environment accurately in advance, neither do they need force sensors to provide accurate perception of environmental contact forces.

In addition, at present most soft robots (such as flexible claws, underwater

soft robots, soft surgical robots) use soft flexible materials as the main body, such as silica gel. This kind of robot is limited by the material used, and cannot easily carry heavy loads.

To address this issue, USTC research team proposed the theory of Honeycomb Pneumatic Network (HPN) in 2013. Based on HPN, they designed a soft arm, like an elephant trunk, with flexibility and that could carry heavy loads. In nature, the elephant trunk is one of the most supple, flexible and powerful soft organs.