

University's computing center marks its first decade

By YUAN SHENGGAO

When the renowned National University of Defense Technology, which is based in Changsha in Central China's Hunan province, was deciding whether to build a supercomputing center in Shanxi, it beat the expectation of many that Lyuliang, a city in the mountainous region in the west of the province, was chosen as the locale.

After 10 years operation, the center, which is called Lyuliang High-Tech Development Research Academy, has proved to be a success.

When representatives of the NUDT were signing the agreement for the center with the city government of Lyuliang 10 years ago, they said the city's climate featuring an annual average temperature of 9 C, and its steady electricity supply from local coal-fired power plants and solar farms, as well as the strong demand from Shanxi's manufacturing enterprises for digital transformation were key factors in the university's decision.

Over the past decade, the center, based on its powerful Tianhe-2 supercomputer, has developed into the most important supercomputing center in Shanxi, offering services to more than 1,800 enterprises, research institutions, universities and other entities in the province and beyond.

When talking about how the center works, Wang Lian, an engineer at the center's operational hub, described the surprisingly powerful performance of the Tianhe-2 with an easy equation. "The computation of the Tianhe-2 in an hour can be completed by 1.3 billion people over 104 years using calculators."

Over the past decade, the supercomputing center has offered services to enterprises in fields including coal mining, new energy, new materials, life sciences, artificial intelligence and nonferrous metals by helping them build big data and cloud computing platforms.

It has made a special contribution to the coal-mining and related industries by helping companies develop digital and smart manufacturing solutions.

One example is its collaboration with the coal-based chemicals research institute of the Chinese Academy of Sciences since 2014. Its analog simulation system based on high-performance computing helped the institute develop a globally leading catalytic agent for coal liquefaction.

The supercomputing center has also helped the city of Lyuliang develop its e-government project, greatly improving its efficiency in many administrative areas like government services, social governance and production safety management.

Hou Guangyu, president of Lyuliang High-Tech Development Research Academy, said while helping the local government improve its administration efficiency through digitalization, the supercomputing center also aims to create a talent pool for local development by training more high-tech professionals.

"A strong force of high-tech professionals is crucial for transforming Lyuliang from a coal-mining city to a 'data-mining' hub," Hou said.

Guo Yanjie contributed to this story.



Engineers check the Tianhe-2 supercomputer at the Lyuliang High-Tech Development Research Academy.

YAN ZHONGXING / FOR CHINA DAILY

Yungang Grottoes saved for the nation and people to enjoy for years to come



Experts and skilled workers applying scientific methods to protect treasure trove of Buddhist art

By YUAN SHENGGAO

Preserving a historical and cultural heritage site that was created more than 1,500 years ago would be a challenge in any country, but China has fulfilled the task in the case of the Yungang Grottoes in Shanxi province, thanks to the efforts of researchers in recent decades.

Yungang Grottoes, located in the northern Shanxi city of Datong, is one of the three most famous Buddhist grottoes sites in China. The other two are Mogao Grottoes in Dunhuang, Gansu province, and Longmen Grottoes in Luoyang, Henan province.

Yungang Grottoes was built during the Northern Wei Dynasty (386-534), when Datong, which was then called Pingcheng, served as the nation's capital. The grottoes were carved out of sandstone cliffs at Wuzhou Mountain in the northwestern suburbs of Datong.

According to historical documents, a total of 54 main caves were carved out during the period from 460-524. Today, 45 main caves remain intact, which house more than 59,000 statues, ranging from a few centimeters to 17 meters in height.

Yungang Grottoes was added to the UNESCO World Cultural Heritage list in 2001. UNESCO said in a document that the site has a universal value as it represents "the out-



Crowds of people admire a full-sized replica of Yungang's relics at a gallery in Shanghai earlier last year, which was made with 3D-printing technologies. XUAN LIN / FOR CHINA DAILY

standing achievements of Buddhist cave art in China."

While influenced by Buddhist cave art from South and Central Asia, UNESCO said Yungang Grottoes interprets Buddhist art with a Chinese characteristic and local spirit. "As a result, Yungang Grottoes has played a vitally important role among early Oriental Buddhist grottoes and had a far-reaching impact on Buddhist cave art in China and East Asia."

While proud of its increasing recognition in global academic circles, the local authorities and researchers understand that, after Yungang Grottoes having been battered by wind, rain and snow for over 1,500 years, protecting this precious cultural heritage site has become a pressing challenge.

Initial preservation work on the grottoes started in the 1930s and systematic protection has been made since the founding of the People's Republic of China in 1949.

Efforts in protection have been

enhanced since the establishment of Yungang Grottoes Academy in February 2021.

"Yungang Grottoes Academy was launched on the basis of the former Datong Institution for the Preservation of Yungang Grottoes," said Zhang Zhuo, head of the academy. "Cultural heritage protection is a major task of Yungang Grottoes Academy."

Over the past decade, the Datong Institution for the Preservation of Yungang Grottoes launched a number of programs to protect the site.

One effort was a collaboration with Getty Conservation Institute based in the United States. In Yungang, collaborative activities included environmental monitoring to assess the extent and effect of weathering due to pollution, wind, rain and extreme temperatures. They also developed a comprehensive conservation plan to prevent deterioration caused by visitors and the environment, according to Zhang.



Fenhe, the largest branch of the Yellow River in Shanxi, has seen 70 percent of its sections reach the nation's excellent and good-level water quality in recent years. WANG PEI / FOR CHINA DAILY

Province moves closer to river protection goals

By YUAN SHENGGAO

With its growing efforts to improve water quality and green its land to prevent soil erosion, Shanxi province is moving closer to its target of becoming an important experimental zone for ecological protection as well as for high-quality development in the Yellow River drainage region.

The 5,464-kilometer Yellow River is the second-longest river in China. It is regarded as the mother river of the nation because it has nurtured the Chinese civilization for millennia.

The Shanxi section of the Yellow River is 965 km in length. More than 73.1 percent of the land in Shanxi belongs to the river's drainage basin, which is home to 73.4 percent of the province's population and makes up the majority of Shanxi's GDP.

As Shanxi is located on the Loess Plateau, where soil erosion has been a severe challenge for millennia, it holds an important position in protecting the ecological environment of the Yellow River.

Shanxi began to implement its strategy to develop into an important experimental zone for ecological protection and high-quality development in the Yellow River drainage

region back in 2017. Provincial authorities have put the strategy high on their work agendas.

Officials said efforts to improve the ecological environment of the Yellow River and its tributaries are a combination of measures including greening, controlling soil erosion, economizing the use of water and curbing water pollution.

With regard to greening, Shanxi has seen the annual addition of nearly 270,000 hectares of forests in recent years on average.

A recent survey designed by the Shanxi Forestry and Grassland Administration shows that the province's forest coverage surpassed 25 percent at the end of 2020. The forest coverage will further expand by more than 1 million hectares by the end of 2025.

The administration said that the ever-growing forest and grassland areas will play a crucial role in preventing soil erosion and helping to steadily increase river runoff volume.

In Shanxi, the efforts in soil erosion control also include engineering measures such as building level terraces and facilities for gully head protection.

According to the Shanxi Department of Water Resources, the com-

bination of greening and engineering measures led to a reduction of 55,400 square kilometers of soil-erosion areas in Shanxi and the reduction of 30,000 sq km of such areas in the Yellow River drainage basin in the province by the end of 2021.

Improving water quality is also one of Shanxi's priorities in developing an experimental zone for ecological protection in the Yellow River drainage region.

Fenhe, the largest Yellow River branch in Shanxi, has seen water quality of 70 percent of its sections reach the nation's excellent and good levels in recent years.

Wetland development along the Yellow River and its branches is also key to local ecological protection. According to the Shanxi Department of Water Resources, the province has invested nearly 88 million yuan (\$13.07 million) in 49 wetland protection projects in the Yellow River's drainage area.

Shanxi began to harness and improve its rivers about a decade ago. Its innovative practice is to appoint chiefs for each river. A river chief is usually the head of the local government according to each section of the river.

There are a total of 18,000 river chiefs in Shanxi and their responsibility is to ensure that the rivers can maintain a good water quality and good ecological environment.

Han Linfang contributed to this story.

Now boasting a number of expert researchers and devoted preservation workers, the academy is in a better position to maintain the authenticity of the grottoes with more scientific and systematic measures.

Zhang Juncai is one such dedicated preservation worker. He has been engaged in the repair of relics in Yungang for more than 10 years.

"Repairing relics requires long-term concentration, as work on some sections of relics can take several years to finish," Zhang Juncai said.

The skilled craftsman is now an instructor of a dozen apprentices. "With the steady growth of our repairers' team and the application of the latest technologies, we are confident that we can make a greater contribution to relics preservation," Zhang Juncai said.

Yan Hongbin, head of the academy's studio for relics preservation and repair, is one of the expert researchers in cultural heritage protection.

He and his team have proposed a number of solutions for preservation with the use of new technologies. One solution is to apply nanomaterial coatings on the walls of the caves to prevent them from being eroded by wind and water.

"The use of such new materials means a fundamental solution to the problem of water erosion that had threatened the relics for centuries," Yan said. He added that the cave-wall-strengthening project, which has been implemented for more than six decades, will be completed in one or two years.

"After the completion of these two milestone projects (for water erosion prevention and cave wall enhancement), we will focus our energy on repairing small damages to the relics."

In addition to relics preservation, academy chief Zhang Zhuo said the latest technology will be used to improve visitors' experience.

The academy operates a number of museums and galleries, allowing visitors to explore the grottoes' history and hidden details with the assistance of digital, virtual and augmented reality technologies, as well as replicas made with 3D-printing technologies.

Wang Rui, a tourist who visited the Yungang Grottoes Museum recently, said the digital displays at the museum offer a better experience than the caves themselves.

"We can have a close look at every detail of the caves — the statues and the decorations. It is impossible for you to see these in the real caves," Wang said. "And we are told the history and stories behind every detail. This is something you cannot expect from any tour guide."

According to Zhang Zhuo, the Yungang Grottoes Academy has held online exhibitions for audiences from across the country and the world, allowing them to visit this world heritage site from their homes.

Li Shu contributed to this story.

Businesses back on track after outbreak

By YUAN SHENGGAO

After hearing that the last patient in Taiyuan's latest COVID-19 outbreak was released from hospital on Wednesday, Zhao Jianfei, a deliveryman at Taiyuan branch of SF Express, said he felt relieved.

From early April, Taiyuan, the capital city of Shanxi province, reported a total of 315 domestically transmitted COVID-19 cases. As a number of cases were reported in local courier companies, the logistics industry was one of the hardest-hit sectors.

"As the delivery industry plays an important role in the livelihoods of residents, all outlets of our company have resumed normal operations since the beginning of this month," Zhao said. "I believe we will have a steady increase in our business as all the socioeconomic sectors return to normal."

Zhao's optimism comes from what he sees on the streets of Taiyuan: the increasing flow of pedestrians and traffic; the reopening of stores; and the return of tourists.

Since mid-May, Taixiangli, a famous food street in the city, has seen an increasing number of diners, especially in the evenings.

Li Xiaobin, an employee at Tanyaxue hotpot restaurant in Taixiangli, said the restaurant's seat occupancy rate has reached about 70 percent. "We normally work till 11 pm," he said.

Liu Yan, a Taiyuan resident, was

among the visitors to the street. She said there are a lot of people like herself who cannot resist the temptation of the delicious food on offer there. "We are glad to see that there are still so many varieties for us to choose from."

Business recovery on the street is also a result of local administrators' efforts in applying necessary pandemic control and prevention measures.

These measures include requiring customers to show their health codes and nucleic acid test results; checking everybody's temperature; and the thorough disinfection of restaurants and stores.

With the help of the provincial government and governments at local levels, the service industry in Shanxi, which was the hardest-hit during this round of the pandemic, is showing a strong recovery.

Incentives to service industry players include issuing preferential coupons to consumers; reducing taxes, offering subsidies for loans and granting direct government subsidies to enterprises.

According to Wang Le, chairman of the Association of the Retailing Industry in Shanxi, a total of 2.58 million consumers in the province received government-issued coupons from May 1-8, which helped the service industry generate a combined revenue of 300 million yuan (\$44.57 million).

Wu Jia contributed to this story.



The Bell Tower Street, a tourist attraction in Taiyuan, has drawn in more visitors since early May. LIU TONG / FOR CHINA DAILY