Science & Technology Briefs

Russia Begins Work on Major Arctic Oil Ports and Industrial Centers

Oil and gas company Rosneft has begun construction of Russia's largest oil delivery port and a major cargo berth in the Bukhta Sever port at the mouth of the Yenisei River on the Kara Sea.

As part of the Vostok Oil project in the northern part of Krasnoyarsk Krai (territory), it will be a transshipment point for crude to be transported via the Northern Sea Route. In the first stage, the port will be able to handle up to 30 million tons per annum, with 3 ship berths totaling almost 1,300 m in length, 27 storage tanks with a capacity of 30,000 cubic meters each, and auxiliary infrastructure. By 2030, it will have 102 oil tanks with a capacity of 100 million tons, making it the largest oil terminal in Russia. A 770 km pipeline will connect the port with oil fields in the Payakha and Vankor clusters, currently under construction.

A new Arctic port project was also recently announced for the Arkhangelsk region, involving construction of a port and industrial zone to be integrated into the West-East transport corridor. The project includes building a plant to make giant reinforced concrete structures for Arctic hydraulic engineering facilities and ship repair facilities for Russia's expanding fleet of Arctic ice breakers and cargo ships. The complex will receive vessels with dead weights up to 30,000 tons.

In other Russian Arctic news, the *Akademik Lomonosov* floating nuclear power plant at Pevek is advancing toward its goal of heating all the homes in the town of 4,500. The project required conversion of the town's heating system to receive heat from the power station, reports *World Nuclear News*. Moored to a special jetty, the station has two KLT-40S pressurized water reactors producing steam for turbine generators that generate 35 MWe each. All 57 housing blocks in Pevek are now able to take heat from the plant, so their residents will have a warm winter—unlike those in Western Europe.

U.S. DART Altered Asteroid Orbit—A First

For the first time in history, mankind has succeeded in altering the orbit of a celestial body—by impacting it. In an Oct. 11 briefing, NASA presented its initial findings:

The DART mission (Double-Asteroid Redirection Test) successfully shortened the orbital period of the asteroid Dimorphos around its binary, Didymos, by 32 minutes (from 11 hours, 55 minutes), when NASA scientists were only hoping for at least 73 seconds! Mission planners had expected the mass of DART alone to play a role; they were surprised to find that recoil from ejecta from the asteroid's surface contributed significantly to the asteroid's change of orbit.

Neither asteroid of this binary asteroid system posed or poses any danger to Earth, before or after the impact of the DART spacecraft. Professional and amateur astronomers and observatories will continue monitoring the after-effects of DART's crash into Dimorphos.

Said Lori Glaze, director of NASA's Planetary Science Division at NASA Headquarters in Washington, "As new data come in each day, astronomers will be able to better assess whether, and how, a mission like DART could be used in the future to help protect Earth from a collision with an asteroid if we ever discover one headed our way."

China Advances Strategic Defense of Earth

When in 2011, Dmitry Rogozin, then Russia's special envoy to NATO, proposed to the U.S. government cooperation in defense against asteroids, under the name, Strategic Defense of Earth (SDE), harking back to President Reagan's Strategic Defense Initiative, the U.S. rejected the offer. China, however, has persevered.

In October 2021, China held its first Planetary Defense Conference in which an array of capabilities were reviewed and discussed—including radar astronomy, other monitoring, impact simulation, disaster scenarios, meteorite collection, deflection technologies, and legal and policy issues.

In January 2022, a government white paper stated that China will "study plans for building a near-Earth object defense system and increase the capacity of near-Earth object monitoring, cataloging, early warning, and response." China has useful elements already in place, including the radio telescope set up on the far side of the Moon in January 2019. A research station at the Moon's south pole is planned.

Speaking at a press conference on China Space Day this past April 24, Wu Yanhua, Deputy Director of the China National Space Administration (CNSA), reported on a planetary defense plan that will include conducting

technical studies and other research into developing systems to counter threats posed by near-Earth asteroids. CNSA, he said, will establish an early warning system, develop software to simulate operations against near-Earth objects, and test and verify basic procedures, and in 2025 or 2026, CNSA will conduct a mission to make close-up observations of a selected, potentially dangerous asteroid and then impact the target in order to alter its trajectory.

Wu Weiren, the chief designer of China's Lunar Exploration Program, wrote on his idea for a daring new phase of that program in a Chinese peer-reviewed scientific journal *Scientia Sinica Informationis*, as reported July 23 in a *South China Morning Post* article, "China Plans To Turn the Moon into an Outpost for Defending the Earth from Asteroids." He wrote:

"Two optical telescopes would be constructed at the Moon's south and north poles, to survey the sky for threats evading [Earth-based] early warning network." These would include objects coming towards Earth from the blind side facing the Sun. At the same time, three "guardian satellites," carrying significant amounts of fuel and armed with kinetic weapons, or perhaps coherent energy beams, would be sent into the Moon's orbit of the Earth, which would be able to intercept asteroid threats as soon as they are detected either by the optical telescopes on the Moon, or by telescopes and giant radars (now under construction) on Earth. The guardian satellites could then either intercept and displace the asteroid from its path, or blow it up.

"It will have the ability to intercept incoming asteroids from all directions, and can form a defense circle … about 800,000 km in diameter," explained Wu Weiren. It is estimated that there are hundreds of thousands of small to medium-sized asteroids and comets in proximity to, or on a pathway to Earth, any of which could destroy a city or devastate a country.

U.S. Decides Not To Rebuild the Arecibo Radio Telescope

The U.S. National Science Foundation (NSF) has decided not to rebuild the Arecibo Observatory's 305-meter radio telescope in Puerto Rico, which collapsed in 2020. The NSF owns and manages the observatory.

Numerous scientists, educators and average citizens have advocated a new, more advanced radio telescope to be built on the site. Instead, the NSF has announced plans to construct only a facility for research on STEM education. Evidently it will not teach STEM. Is NSF seeking to dumb down Puerto Rico and the entire U.S.?

China's 500-meter FAST telescope, with 64% greater diameter than the Arecibo had, will have 64% more resolution (ability to distinguish two close objects from each other). And having more than ten times the collecting area of Arecibo, it will have more than ten times its sensitivity (signal-to-noise ratio). It will search for pulsars and "fast radio bursts," and conduct studies of the interstellar medium (the dilute gas and dust between the stars). FAST, like Arecibo did, participates in the SETI project, the search for extraterrestrial intelligence. More about FAST is available here.

Tonga's Volcanic Output Could Produce Global Warming Lasting Months

When the underwater Hunga Tonga–Hunga Ha'apai volcano in the South Pacific, about 30 km southeast of Tonga's Fonuafo'ou island erupted Jan. 13-15, 2022, it was likely the biggest recorded eruption on the planet in more than 30 years. Scientists calculated it spewed a staggering 45 million metric tons of *water vapor* into the atmosphere, in addition to enormous quantities of ash and volcanic gasses.

According to the National Oceanic and Atmospheric Administration:

"This massive vapor injection increased the amount of water vapor in the global stratosphere by more than 5%, which could trigger a cycle of stratospheric cooling and surface heating—and these effects may persist for months to come, according to a new study."

The study was published Sept. 22 in the journal *Science*, and reported by *ScienceAlert*.

Normally, a large volcanic eruption sends massive amounts of ash, dust and sulfur dioxide into the atmosphere, which block solar radiation, leading to global *cooling*. However, in an underwater volcanic eruption, the hot magma interacts with the surrounding ocean water, generating steam and tremendous forces, projecting the water and ash into the atmosphere. *ScienceAlert* reported:

"Atmospheric water vapor absorbs solar radiation and re-emits it as heat; with tens of millions of tons of Tonga's moisture now adrift in the stratosphere, Earth's surface will be heating up—though it's unclear by how much, according to the study. But because the vapor is lighter than other volcanic aerosols and is less affected by gravity's pull, it will take longer for this warming effect to dissipate, and surface warming could continue 'over the months to come,' the study said."

It's unknown how this much water vapor will affect stratospheric chemical reactions, which also may affect temperature.