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12 Exciting Engineering Milestones to Look for in 2022

An electric aircraft race, a new dark-matter detector, and a permanent Chinese space station await

BY MICHAEL KOZIOL | 12 HOURS AGO | 7 MIN READ |

Psyche's Deep-Space Lasers

In August, NASA

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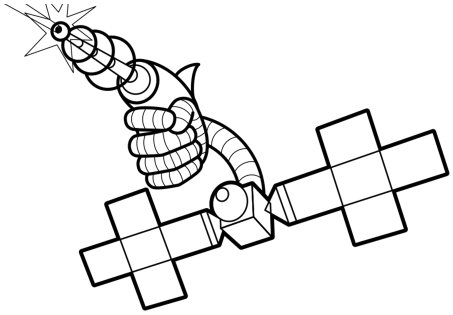

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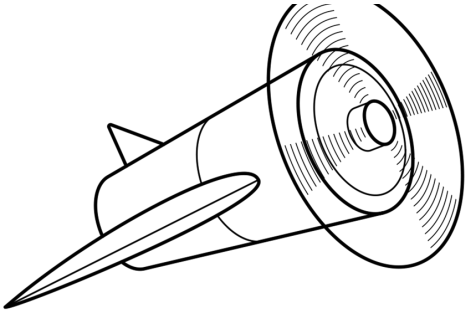
will launch the Psyche mission, sending a deep-space orbiter to a weird metal asteroid orbiting between Mars and Jupiter. While the probe's main purpose is to study Psyche's origins, it will also carry an experiment that could inform the future of deep-space communications. The Deep Space Optical Communications (DSOC) experiment will test whether lasers can transmit signals beyond lunar orbit. Optical signals, such as those used in undersea fiber-optic cables, can carry more data than radio signals can, but their use in space has been hampered by difficulties in aiming the beams accurately over long distances. DSOC will use a 4-watt infrared laser with a wavelength of 1,550 nanometers (the same used in many optical fibers) to send optical signals at multiple distances during Psyche's outward journey to the asteroid.

The Great Electric Plane Race

For the first time in



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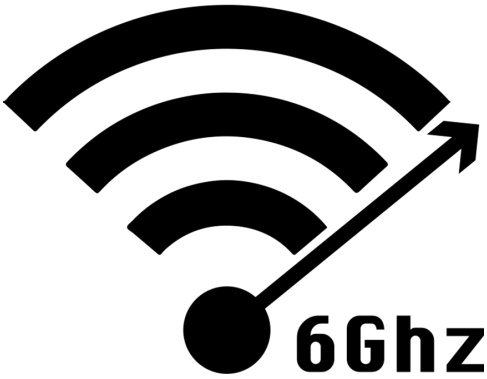
almost a century, the U.S.-based National Aeronautic Association (NAA) will host a cross-country aircraft race. Unlike the national air races of the 1920s, however, the Pulitzer Electric Aircraft Race, scheduled for 19 May, will include only electric-propulsion aircraft. Both fixed-wing craft and helicopters are eligible. The competition will be limited to 25 contestants, and each aircraft must have an onboard pilot. The course will start in Omaha and end four days later in Manteo, N.C., near the site of the Wright brothers' first flight. The NAA has stated that the goal of the cross-country, multiday race is to force competitors to confront logistical problems that still plague electric aircraft, like range, battery charging, reliability, and speed.

6-Gigahertz Wi-Fi Goes Mainstream



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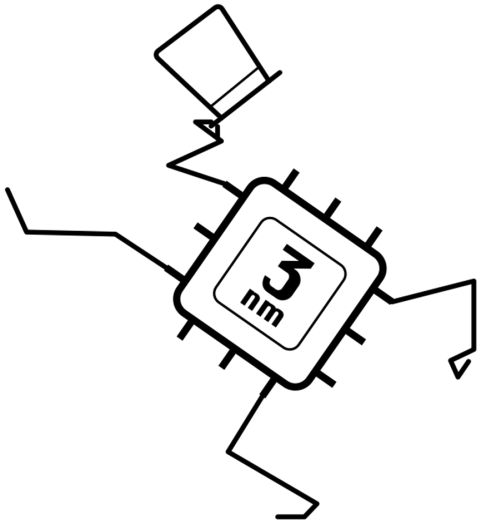
Wi-Fi is getting a boost with 1,200 megahertz of new spectrum in the 6-gigahertz band, adding a third spectrum band to the more familiar 2.4 GHz and 5 GHz. The new band is called Wi-Fi 6E because it extends Wi-Fi's capabilities into the 6-GHz band. As a rule, higher radio frequencies have higher data capacity, but a shorter range. With its higher frequencies, 6-GHz Wi-Fi is expected to find use in heavy traffic environments like offices and public hotspots. The Wi-Fi Alliance introduced a Wi-Fi 6E certification program in January 2021, and the first trickle of 6E routers appeared by the end of the year. In 2022, expect to see a bonanza of Wi-Fi 6E–enabled smartphones.

3-Nanometer Chips Arrive



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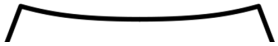
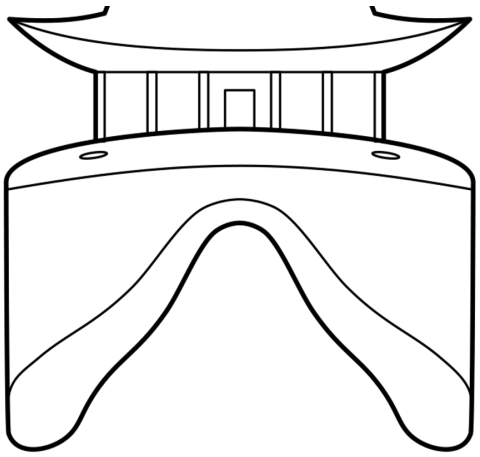
Taiwan Semiconductor Manufacturing Co. (TSMC) plans to begin producing 3-nanometer semiconductor chips in the second half of 2022. Right now, 5-nm chips are the standard. TSMC will make its 3-nm chips using a tried-and-true semiconductor structure called the FinFET (short for "fin field-effect transistor"). Meanwhile, Samsung and Intel are moving to a different technique for 3 nm called nanosheet. (TSMC is eventually planning to abandon FinFETs.) At one point, TSMC's sole 3-nm chip customer for 2022 was Apple, for the latter's iPhone 14, but supply-chain issues have made it less certain that TSMC will be able to produce enough chips—which promise more design flexibility—to fulfill even that order.

Seoul Joins the Metaverse



After Facebook



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(now Meta) announced it was hell-bent on making the metaverse real, a host of other tech companies followed suit. Definitions differ, but the basic idea of the metaverse involves merging virtual reality and augmented reality with actual reality. Also jumping on the metaverse bandwagon is the government of the South Korean capital, Seoul, which plans to develop a “metaverse platform” by the end of 2022. To build this first public metaverse, Seoul will invest 3.9 billion won (US $3.3 million). The platform will offer public services and cultural events, beginning with the Metaverse 120 Center, a virtual-reality portal for citizens to address concerns that previously required a trip to city hall. Other planned projects include virtual exhibition halls for school courses and a digital representation of Deoksu Palace. The city expects the project to be complete by 2026.

IBM’s Condors Take Flight

In 2022, IBM will

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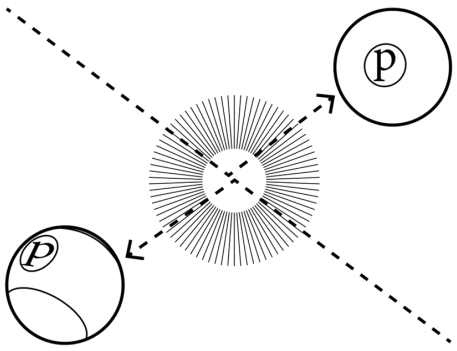
In 2022, IBM will debut a new quantum processor—its biggest yet—as a stepping-stone to a 1,000-qubit processor by the end of 2023. This year's iteration will contain 433 qubits, three times as much as the company's 127-qubit Eagle processor, which was launched last year. Following the bird theme, the 433- and 1,000-qubit processors will be named Condor. There have been quantum computers with many more qubits; D-Wave Systems, for example, announced a 5,000-qubit computer in 2020. However, D-Wave's computers are specialized machines for optimization problems. IBM's Condors aim to be the largest general-purpose quantum processors.

New Dark-Matter Detector



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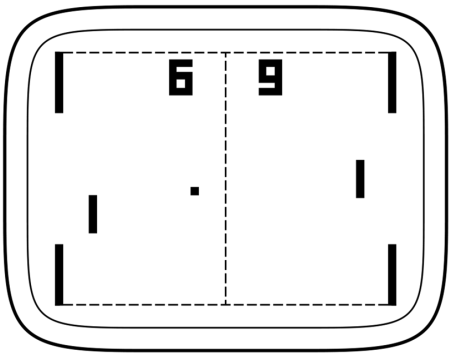
The Forward Search Experiment (FASER) at CERN is slated to switch on in July 2022. The exact date depends on when the Large Hadron Collider is set to renew proton-proton collisions after three years of upgrades and maintenance. FASER will begin a hunt for dark matter and other particles that interact extremely weakly with “normal” matter. CERN, the fundamental physics research center near Geneva, has four main detectors attached to its Large Hadron Collider, but they aren’t well-suited to detecting dark matter. FASER won’t attempt to detect the particles directly; instead, it will search for the more strongly interacting Standard Model particles created when dark matter interacts with something else. The new detector was constructed while the collider was shut down from 2018 to 2021. Located 480 meters “downstream” of the ATLAS detector. FASER will also hunt for neutrinos

produced in huge quantities by particle collisions in the LHC loop. The other CERN detectors have so far failed to detect such neutrinos.

Pong Turns 50



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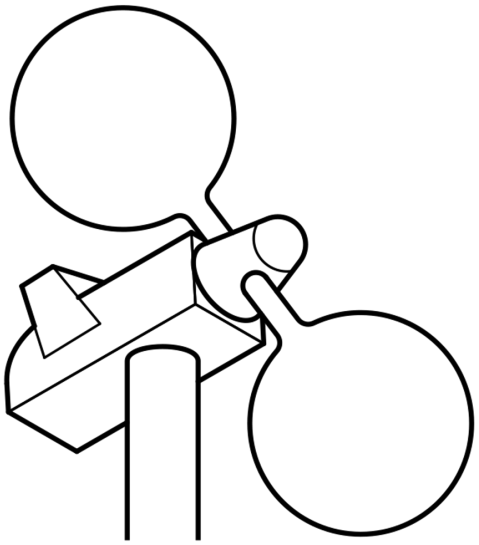
Atari changed the course of video games when it released its first game, Pong, in 1972. While not the first video game—or even the first to be presented in an upright, arcade-style cabinet—Pong was the first to be commercially successful. The game was developed by engineer Allan Alcorn and originally assigned to him as a test after he was hired, before he began working on actual projects. However, executives at Atari saw potential in Pong's simple game play and decided to develop it into a real product. Unlike the countless video games that came after it, the original Pong did not use any code or microprocessors. Instead, it was built from a television and transistor-transistor logic.

The Green Hydrogen Boom



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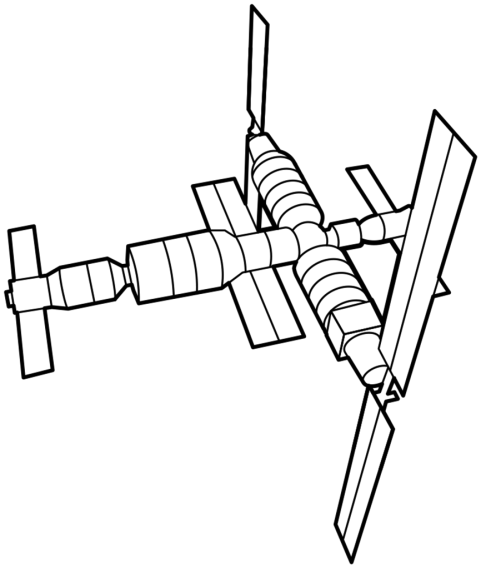
Utility company Energias de Portugal (EDP), based in Lisbon, is on track to begin operating a 3-megawatt green hydrogen plant in Brazil by the end of the year. Green hydrogen is hydrogen produced in sustainable ways, using solar or wind-powered electrolyzers to split water molecules into hydrogen and oxygen. According to the International Energy Agency, only 0.1 percent of hydrogen is produced this way. The plant will replace an existing coal-fired plant and generate hydrogen—which can be used in fuel cells—using solar photovoltaics. EDP's roughly US $7.9 million pilot program is just the tip of the green hydrogen iceberg. Enegix Energy has announced plans for a $5.4 billion green hydrogen plant in the same Brazilian state, Ceará, where the EDP plant is being built. The green hydrogen market is predicted to generate

a revenue of nearly $10 billion by 2028, according to a November 2021 report by Research Dive.

A Permanent Space Station for China



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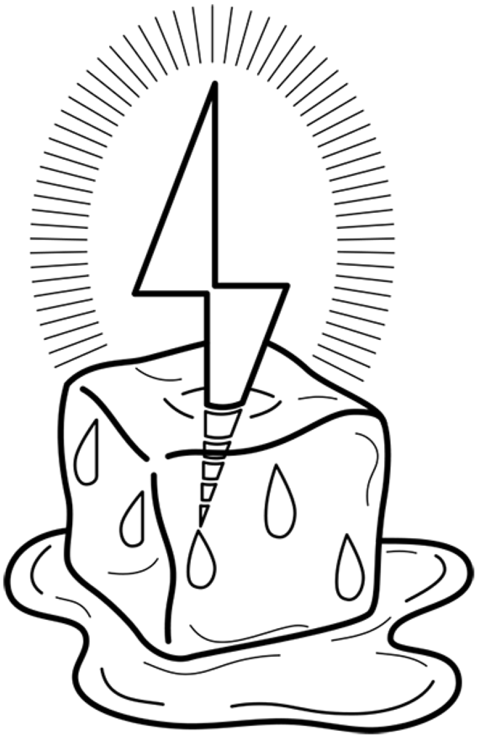
China is scheduled to complete its Tiangong ("Heavenly Palace") space station in 2022. The station, China's first long-term space habitat, was preceded by the Tiangong-1 and Tiangong-2 stations, which orbited from 2011 to 2018 and 2016 to 2019, respectively. The new station's core module, the Tianhe, was launched in April 2021. A further 10 missions by the end of 2022 will deliver other components and modules, with construction to be completed in orbit. The final station will have two laboratory modules in addition to the core module. Tiangong will orbit at roughly the same altitude as the International Space Station but will be only about one-fifth the mass of the

ISS.

A Cool Form of Energy Storage



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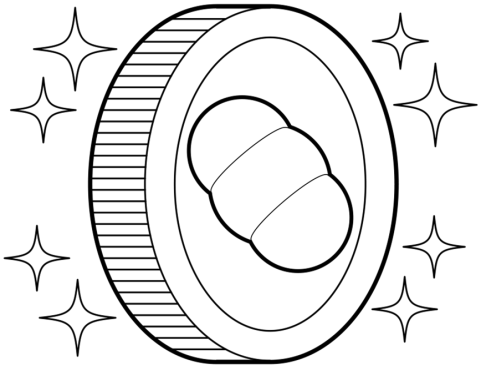
Cryogenic energy-storage company Highview Power will begin operations at its Carrington plant near Manchester, England, this year. Cryogenic energy storage is a long-term method of storing electricity by cooling air until it liquefies (about –196 °C). Crucially, the air is cooled when electricity is cheaper—at night, for example—and then stored until electricity demand peaks. The liquid air is then allowed to boil back into a gas, which drives a turbine to generate electricity. The 50-megawatt/250-megawatt-hour Carrington plant will be Highview Power's first commercial plant using its cryogenic storage technology, dubbed CRYOBattery. Highview Power has said it plans to build a similar plant in Vermont,

although it has not specified a timeline yet.

Carbon-Neutral Cryptocurrency?



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Seattle-based startup Nori is set to offer a cryptocurrency for carbon removal. Nori will mint 500 million tokens of its Ethereum-based currency (called NORI). Individuals and companies can purchase and trade NORI, and eventually exchange any NORI they own for an equal number of carbon credits. Each carbon credit represents a tonne of carbon dioxide that has *already* been removed from the atmosphere and stored in the ground. When exchanged in this way, a NORI is retired, making it impossible for owners to try to "double count" carbon credits and therefore seem like they're offsetting more carbon than they actually have. The startup has acknowledged that Ethereum and other blockchain-based technologies consume an enormous amount of energy, so the carbon it sequesters could conceivably originate in cryptocurrency mining. However, 2022 will

also see Ethereum scheduled to switch to a much more energy-efficient method of verifying its blockchain, called proof-of-stake, which Nori will take advantage of when it launches.

ABOUT THE AUTHOR

Michael Koziol is an associate editor at IEEE Spectrum where he covers everything telecommunications. He graduated from Seattle University with bachelor's degrees in English and physics, and earned his master's degree in science journalism from New York University.

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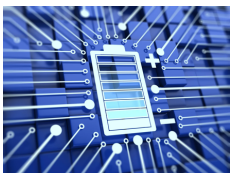

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