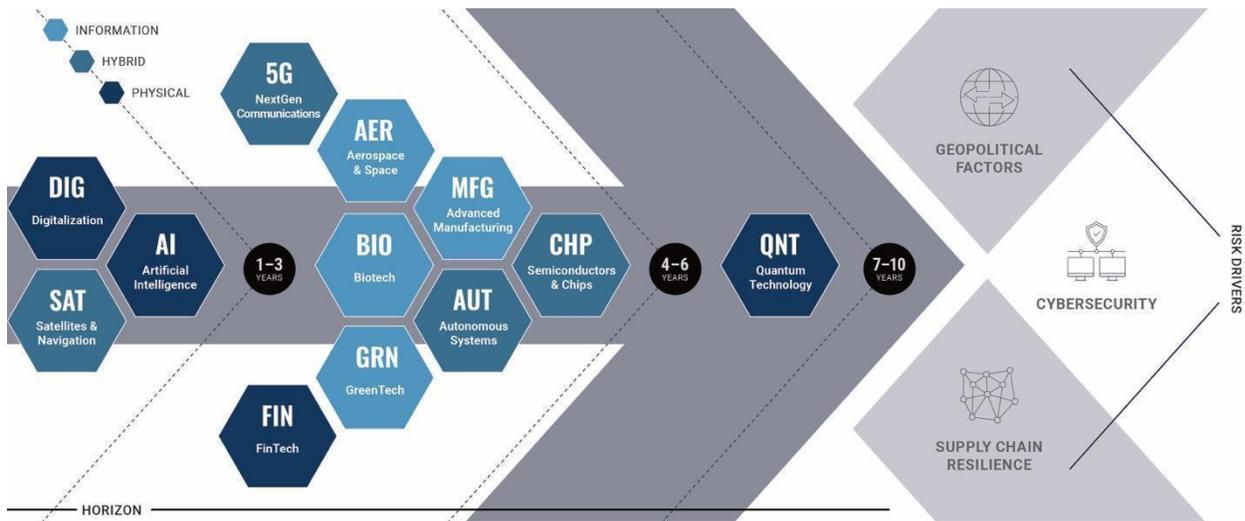




MATRIX MONITOR

Friday November 4, 2022

The only source dedicated exclusively to the emerging technologies shaping the future of business and national security.



This week's Next5 Matrix Monitor features the NSA cybersecurity director's takeaways from the Russia-Ukraine cyber conflict, companies investing in a smartwatch app that surveils employees, neuroscientists using AI to study the effect of art on peoples' brains, the USG funding research to determine whether genetic changes in viruses are real or lab-engineered, a breakthrough in the development of a molecular computer, the development of a quantum watch, federal investigations into whether a US-based company transferred technology to a Chinese startup, and a global helium shortage.

NEXT5 EDITOR'S HIGHLIGHTS

→ **Senator Josh Hawley (R-MO) announced a bill proposing sanctions on President Xi Jinping (and other officials) for Beijing's human rights abuses in Xinjiang, provoking a direct rebuke from the Chinese government.** Hawley introduced the bill last week on the heels of the CCP's 20th party congress. The Chinese Embassy in Washington, DC sent an 800 word email to Hawley's office in response to what it called an "arrogant and despicable bill." As Xi assumes his third term as leader of the CCP, Chinese diplomats have been making public displays of defending him against criticism. There is a steady flow of bills targeting China that are being proposed on the Hill, but they do not all prompt the embassy to send angry letters. There is no indication that Hawley's bill has gained much traction. And the US very rarely sanctions sitting world leaders. While China continues to defend against any accusations of human rights abuses in Xinjiang, a UN report released in August found "serious human rights violations" against the mostly Muslim Uighers in the province. #CHN #USA #Geopolitics [Axios](#)

→ **The National Security Agency's Cybersecurity Director, Rob Joyce, shared six takeaways from the Russia-Ukraine cyber conflict,** at a conference in October:

- Both espionage and destructive attacks will occur in conflict.
 - Civilian infrastructure in Ukraine has been under as much risk as the government, if not more, and cyber attacks focused on Ukraine spilled out into near neighbors and allies.
- The cybersecurity industry has unique insights into these conflicts.
 - Cybersecurity companies were able to detect and even block attacks, as well as find evidence on the victims. Companies also discovered and shared early information on wiper malware families.
- Sensitive intelligence can make a decisive difference.
 - The US Intelligence Community learned to "get much better at sanitizing intelligence and making it useful and operationally effective in defense purposes to our foreign partners and the cybersecurity industry at scale," he said.
- Resiliency skills can be developed.
 - Ukraine improved its resilience after years of coming under attack. They got better at building architecture, doing backups and restoration. They had an incident response plan.
- Leverage alliances to scale security.
 - Ukraine was able to take domestic processes run on servers in Ukraine and move them to foreign soil, like the US, to deter Russia from attacking them.
- There's always more planning required to prepare for contingencies.
 - Many companies did not realize how tied they were to Ukraine until the conflict began, including in the cybersecurity industry.

#UKR #RUS #USA #Geopolitics #SCRM #Cybersecurity [Infosecurity Magazine](#)

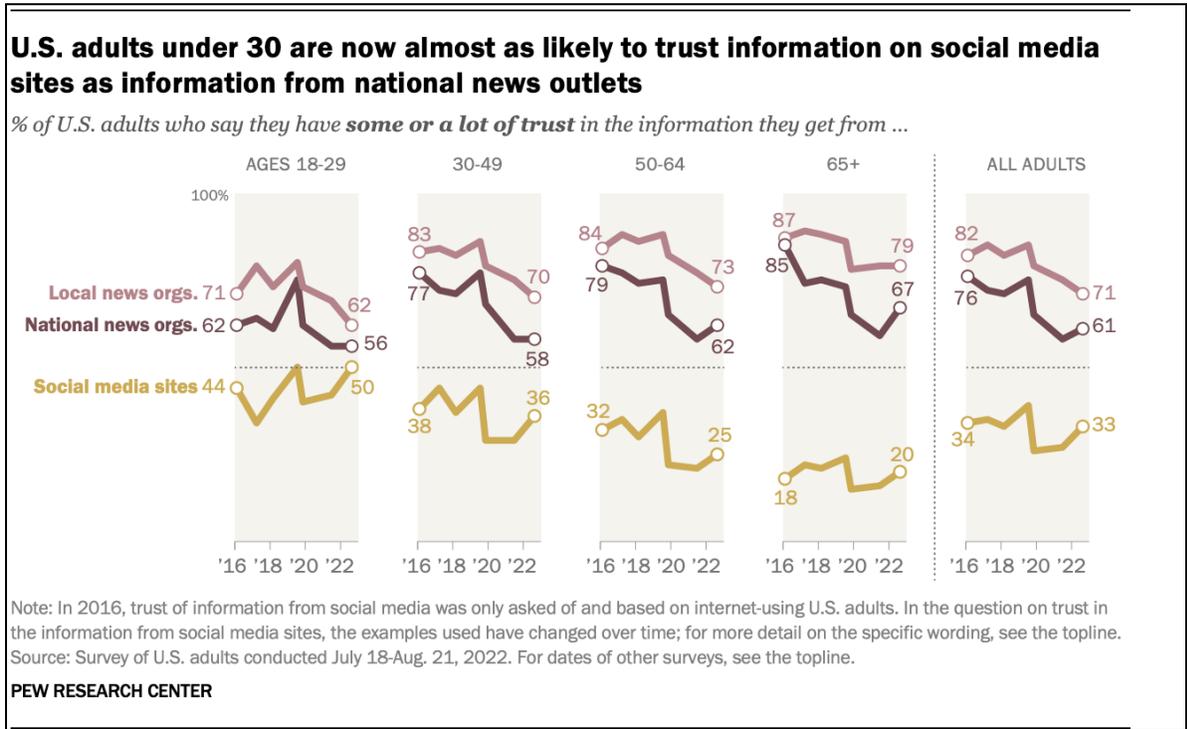
DIGITALIZATION

→ **TikTok is informing its European users that their data may be accessed by employees outside of Europe, including in China, amid concerns about Chinese access to user information on the platform.** Other countries where TikTok staff could access European user data include Brazil, Canada, and Israel, in addition to the United States and Singapore, where European user data is currently stored. Data could be used to audit aspects of the platform, such as the performance of its algorithms which recommend content to users, and to detect fraudulent automated accounts. TikTok has previously admitted that employees of the company's parent, ByteDance, in China have access to some user data. The privacy policy update, which applies to the UK, the European Economic Area, and Switzerland and goes into effect on December 2, comes amid political and regulatory pressure over the use of data generated by the app, which has more than 1B users worldwide. #DIG #Cybersecurity #Geopolitics #EUR #GBR #CHE #CHN #BRA #CAN #ISR #USA #SGP [The Guardian](#)

→ **Google is funneling money to some of the web's most prolific producers of disinformation in Europe, Latin America, and Africa, according to a ProPublica investigation.** Google makes ~\$200B in annual ad sales that provides essential funding for non-English-language websites that misinform and harm the public. Google placed ads on 41% of roughly 800 active online articles rated by members of the Poynter Institute's International Fact-Checking Network as publishing false claims about COVID-19, according to the analysis. In addition, the company served ads on 20% of climate change articles that [Science Feedback](#), an IFCN-accredited fact-checking organization, rated false. Additionally, 57% of debunked English-language articles in Africa had ads from Google, while the percentage was higher, 66%, for French-language articles. In 2019, the [Global Disinformation Index](#) estimated that disinformation websites earned \$250M per year in revenue, of which Google was responsible for 40%. ProPublica also scanned ~10k active articles that fact checkers in the three Balkan countries flagged for false claims since 2019. ~60% were earning money with Google. While conducting a study in Brazil, ProPublica found that 46% of the more than 250 sites flagged for disinformation earn money from Google. When that list was compressed to the 30 most shared sites in WhatsApp and Telegram groups, 80% of them earned money with ads placed via Google. A coalition of fact-checking organizations in Latin America provided ProPublica with a list of websites they said are frequent sources of false and misleading claims. Of the 49 active sites on the list, 39% currently earn money with Google. Euskal News was one of 32 active Spanish sites flagged by the Brussels-based EU DisinfoLab as frequent sources of false and misleading claims. 44% of those sites earned money with Google. Over 1,000 of the analyzed articles were rated as false by Turkish fact-checking operation Teyit since 2019, and found that 73% are earning money from Google ads. #DIG #EUR #SRB #USA #BRA #TUR [ProPublica](#)

→ **More Americans are getting news on TikTok, in contrast with many other social media sites, where news consumption has either declined or stayed about the same in recent years.** In just two years, the share of US adults who say they regularly get news from TikTok has roughly tripled, from 3% in 2020 to 10% in 2022. Adults under 30 are the most likely group to say they regularly get news on TikTok. About 26% of Americans in this age group say they regularly get news there, higher than in 2021 and 2020. This compares with 10% of those ages 30-49, 4% of those 50-64 and just 1% of those 65 and older. Additionally, US adults under 30

now trust information from social media sites such as Tiktok almost as much as from national news outlets. In this [survey](#), 50% of 18- to 29-year-olds in the US say they have some or a lot of trust in the information they get from social media sites, just under the 56% who say the same about information from national news organizations, but somewhat below the 62% who say so about information from local news organizations. The share of adults under 30 who express at least some trust in information from social media is at its highest level (tied with summer 2019), while the share with trust in national news is at its lowest level (tied with last year).



#DIG #USA [Pew Research Center](#)

→ **Elon Musk is considering implementing an \$8 Twitter subscription that includes verification, long-form video and audio posting and fewer ads.** The price will be adjusted according to purchasing power parity of the country, hinting toward a global launch of Twitter Blue. Earlier this week, reports noted that Musk and Twitter are revamping the verification process, and it might involve a fee as high as \$20 per month. However, the billionaire has seemed to settle on the \$8 per month pricing for now. Data from analytics firm [Sensor Tower](#) suggests that Twitter's app has generated only [\\$6.4M in in-app purchases to date, with Blue being the top purchase](#). Separately, [Mastodon](#), a six-year-old social media platform popular among a devoted base of left-leaning niche communities, has gained 70k users since Elon Musk completed his purchase of Twitter last week. #DIG #USA [TechCrunch](#) [The Guardian](#)

→ **Two of the largest meat companies in the United States have invested in a smartwatch app that allows managers to track and monitor the movements of their employees.** JBS and Tyson Foods have backed [Mentore](#), a startup that claims to use surveillance data and AI to improve worker productivity and reduce workplace injuries, according to a [report by Investigate Midwest](#). Mentore's application, when paired with a compatible smartwatch, collects data on the

force, rotation, speed, and directional movement of a worker's arm as they repeat the same task. The data is then analyzed by the company's algorithm to determine whether the movements are safe and alerts the individual if they are found to be using too much speed or force. This raw watch data is then converted into real-time metrics that are displayed on a dashboard for supervisors. Mentore intends to combat uncertainty and concerns about the app's transparency by allowing employees to access their current and historical "injury risk" scores, but it's unclear whether they will be able to challenge the real-time metrics on the watch itself. In addition, the app can distinguish between "intense active motion" and "mild active motion." The system has already been installed on ~10k devices in four different countries, including the US, Canada, Chile, and Japan. The move is similar to controversial tracking practices that many other companies, including Amazon, have tried to implement in order to increase worker productivity over the years. Using technology to monitor or assist workers has long been known to raise stress and injury levels. These dangers are especially prevalent in the meat industry, where labor rights activists claim employees are routinely subjected to dangerous and inhumane working conditions. In recent years, the US Department of Labor has repeatedly investigated incidents involving meat industry safety concerns. One JBS employee died in 2021 after falling into a vat of chemicals used to process animal hides at a facility in Colorado. One Tyson employee died shortly before the end of his shift earlier this year, though the cause of death is still under investigation. #DIG #AI #BIO #Cybersecurity #USA #CAN #CHL #JPN [VICE](#)

SATELLITES & NAVIGATION

→ **Elon Musk has assured that he will continue to fund Ukraine's access to Starlink, which provides Kyiv with battlefield and humanitarian communications in its conflict with Russia, according to a senior Ukrainian official.** Musk tweeted in mid-October that supporting Ukraine's communications needs was costing SpaceX \$20M per month. He also mentioned that his company is responsible for developing, launching, maintaining, and replenishing satellites and ground stations. US officials confirmed at the time that Musk had requested that the DoD would take over funding for the service Starlink provides in Ukraine. Starlink's significance extends beyond military use, allowing soldiers to call home, allowing humanitarian operations, and allowing the Ukrainian government to continue providing e-services to its citizens during the war, according to Fedorov. #SAT #5G #DIG #USA #UKR #RUS #Geopolitics [AP News](#)

→ **The US Space Force is funding research into the use of AI to predict satellite malfunctions.** The US Space Force recently awarded a contract to [RS21](#), a data science startup, to investigate the use of AI to predict satellite failures in orbit for specific use cases. The AI-powered monitoring system detects faults and predicts satellite malfunctions. It predicts a lead time before satellites fail using real-time satellite telemetry data and anomaly messages. RS21 is also developing software that will be integrated into the STP ground station at NASA's Johnson Space Center in Houston. In preparation for the STPSat-7 experiment, the data will be used to train the AI model. The technology will be tested in an upcoming Space Test Program (STP) experiment, STPSat-7, which is scheduled to launch to low Earth orbit in 2023. #SAT #AI #AER #DIG #AUT #USA [SpaceNews](#)

ARTIFICIAL INTELLIGENCE

→ **Neuroscientists are using an AI opera to study the effects of art on the human brain by observing the brain waves of audience volunteers.** "Song of the Ambassadors," which was presented to the public at Alice Tully Hall, was created by K Allado-McDowell, who leads Google's Artists and Machine Intelligence initiative, using the AI program GPT-3; composer Derrick Skye, who incorporates electronics and non-Western motifs into his work; and data artist Refik Anadol, who contributed AI-generated visualizations. Additionally, just to the side of the stage, sat a pair of neuroscientists, Ying Choon Wu and Alex Khalil, who had been monitoring the brain waves of two audience volunteers sitting nearby, with their heads encased in research-grade headsets manufactured by [Cognionics](#). Shanta Thake, the performing arts complex's artistic director was the "brainist," sitting silently to one side of the stage with a simple, inexpensive EEG monitor on her head, feeding brain waves into Anadol's AI algorithm to generate the digitized patterns. The photos that resulted showed Thake's brain doing something remarkable: creating images of flowers. Bright and colorful flowers of no known species or genus, morphing continuously in size, color, and shape. Currently, the scientists are analyzing the data of additional volunteers. They also want to see if there will be policy implications, and whether institutions could play a role if we know that sound and music are healing. They are also exploring whether this research can lead to new avenues for arts funding, policy, and the definition of a therapeutic or artistic experience. #AI #DIG #BIO #USA [NY Times](#)

→ **A new art exhibition in San Francisco, the first of its kind, highlights some of the innovative ways in which artists have begun to incorporate Dall-E 2, GPT-3, and other AI systems into their work.** The exhibition, titled "[Artificial Imagination](#)," comes amid a heated debate over the legal and artistic merits of AI-created art, as well as fears that more powerful computers will displace humans. According to the artists and curators, the exhibition is an important acknowledgement that AI art is indeed art. The release of Artificial Imagination comes at a time when society is grappling with how to comprehend the arrival of AI art on a variety of levels, from who owns the work to its impact on artists. A number of the artists who participated in the exhibition compare the current situation to the hand-wringing that accompanied the invention of the camera. Its ability to capture scenes with detail and precision did not kill art, but rather paved the way for photography, a completely new art form, according to an analyst. The exhibit is on display at bitforms gallery until December 29. #AI #DIG #USA [Axios](#)

→ **According to a recent IBM-Morning Consult [survey](#) of over 7,500 businesses, the majority of respondents stated that they lag in many efforts to ensure trust in AI.** Currently, 35% of businesses use AI in their operations, up from 31% a year ago. A further 42% are investigating AI, according to the survey. There are advantages, such as cost savings and efficiencies (54%), improved IT or network performance (53%), and better customer experiences (48%). Trust is important, but many organizations haven't taken enough steps to ensure AI is trustworthy, according to the survey. Consumers are more likely to choose a company that is transparent about how the AI models are built, managed, and used, according to 85% of respondents. Furthermore, 84% believe that "being able to explain how their AI arrives at different decisions is critical to their business." The most important reason for pursuing

AI trust, according to 56% of managers, is to maintain brand integrity and customer trust. Another 50% believe that meeting external regulatory and compliance obligations is critical, and 48% believe that the ability to govern data and AI across the entire lifecycle is critical. Another 48% want to be able to monitor data and AI throughout the lifecycle. The majority of respondents say they lag in many efforts to ensure trust, from finding the right skills to being proactive in avoiding bias. The majority of organizations have not taken key steps to ensure that their AI is trustworthy and responsible, such as reducing bias (74%), tracking performance variations and model drift (68%), and ensuring that AI-powered decisions can be explained (61%). **The following are the top challenges to increasing trust in AI:**

- Lack of skills and training to develop and manage trustworthy (63%)
- AI governance/management tools that don't work across all environments (60%)
- Lack of an AI strategy (59%)
- AI outcomes that aren't explainable (57%)
- Lack of company guidelines for developing trustworthy, ethical AI (57%)
- AI vendors who don't include explainability features (57%)
- Lack of regulatory guidance from governments or industry (56%)
- Building models on data that has inherent bias (56%)

#AI #DIG #Cybersecurity #Geopolitics [Forbes](#)

NEXT GENERATION COMMUNICATIONS

→ **The Digital Markets Act entered into force on November 1 and will be applicable on May 2, 2023. Its goal is to require companies such as Apple to offer alternatives to allow third-party app stores on its platforms and alternative payment systems.** According to the European Parliament, a gatekeeper has to provide browsers, messaging services, or social media and have at least 45M monthly end users in the EU. They must also have 10k annual business users, a market cap of at least \$82B, or a yearly turnover of \$8.2B. Companies that violate the rules of the DSA could face a fine of up to 6% of their annual global turnover. The Commission will be able to impose penalties and fines of up to 10% of a company's worldwide turnover, and up to 20% in case of repeated infringements. #5G #USA #EU [AppleInsider](#) [MacRumors](#) [PopSci](#) [European Commission](#)

FINANCIAL TECHNOLOGY

→ **Hong Kong laid out a master plan to become a top Asian crypto hub offering legalized retail trading and digital-asset exchange-traded funds.** The city invited global crypto exchanges to explore opportunities, adding that work toward a new virtual-asset licensing regime is intensifying. The Securities and Futures Commission for the first time detailed criteria for authorizing crypto ETFs, which initially would only be able to invest in Bitcoin and Ether futures traded on CME Group exchanges. [Bloomberg News](#) reported earlier that a planned mandatory licensing program for crypto platforms due to be enforced in March next year is likely to allow retail trading. The current voluntary crypto framework restricts exchanges to clients with

portfolios of at least \$1M. In the statement, Hong Kong also said it's willing to review "property rights for tokenized assets and the legality of smart contracts." The new approach to digital tokens was rolled out at the start of the Hong Kong FinTech Week conference. According to Chainalysis, "Digital-token transaction volume in Hong Kong expanded less than 10% in the 12 months through June from a year earlier, the least in East Asia outside of a slump in China." #FIN #DIG #Geopolitics #HKG #CHN [Bloomberg](#)

AEROSPACE & SPACE

→ **On Tuesday, November 1, SpaceX's Falcon Heavy, the world's most powerful active rocket, took off for the first time in more than three years launching satellites for the US Space Force.** The rocket system, consisting of three Falcon 9 boosters strapped side by side, lifted off from a SpaceX launch pad, carrying two Space Force satellites and a slew of smaller satellites into orbit. Tuesday's mission marked the first use of the rocket by the Space Force. #AER #SAT #USA [Reuters](#)

→ **China took another step toward completing its own space station with the launch of a rocket carrying the third and final module for the project.** The Long March 5B rocket lifted off from the Wenchang Satellite Launch Center on Hainan island at 3:37 p.m. local time on Monday, October 31 carrying the Mengtian laboratory module. The Tianhe core module and the Wentian experiment module will complete the Tiangong space station. China will be the only country with its own space station once Tiangong is completed, adding to other achievements such as landing on Mars last year and on the far side of the moon in 2019. Under Xi Jinping, China has increased efforts to compete with the US as the dominant power in space, collaborating with Russia on a proposed lunar research station and opposing the Washington-backed Artemis Accords, which are intended to help govern future space activity such as moon mining. The nearly 18-meter-long Mengtian module also has a payload airlock, which allows the station's small robotic arm to take payloads and place them on an experiment platform outside the module. #AER #CHN #RUS #USA [Bloomberg](#) [Space.com](#)

→ **Japanese space tech startup [ispace](#) plans to build a human settlement on the moon by 2040, but first it wants to become the lunar equivalent of FedEx, earning money by transporting scientific and commercial goods to the moon.** It is planning to launch a lunar lander with government and commercial payloads, including two rovers, as early as November 22. The mission will put to the test not only the company's technological credentials since its inception in 2010, but also the faith of its backers, one of whom is a former SoftBank Group executive. A lot is riding on its success, including a potential IPO as early as this fiscal year and a bigger slice of an industry pie that Morgan Stanley estimates will triple to \$1T in 20 years starting from 2020. The success of ispace will also be critical to Japan's own space program, as the moon becomes the focus of geopolitical intrigue once more. NASA hopes to return to the moon with Artemis this decade, and China and Russia have announced plans for a joint lunar base. Last year, Japan's Lunar Industry Vision Council urged greater collaboration between the public and private sectors in order to remain competitive in the developing space economy. #AER #SCRM #Geopolitics #JPN #USA #CHN #RUS [Bloomberg](#)

BIOTECHNOLOGY

→ **Scientists used mRNA technology to create a potent flu vaccine that could last for years, in the latest attempt to develop a universal influenza vaccine that targets more influenza viral proteins.** The researchers created an mRNA jab encoding the four influenza proteins neuraminidase, nucleoprotein, matrix protein 2, and the stalk portion of hemagglutinin for their influenza vaccine (which is conserved compared to its head domain). The vaccine was then given to a group of about 20 mice who had not been exposed to influenza. They were either given a quadrivalent (all four mRNA segments for each protein) or a monovalent vaccine (the conventional flu vaccine or vaccines containing an individual mRNA for any one of the proteins). Some only got one shot, while others got one shot plus a booster four weeks later. The mice were then infected with a variety of different influenza strains, including those that infect humans as well as other animals such as dogs. The researchers noticed two significant phenomena. To begin, while both the quadrivalent and monovalent vaccines stimulated antibody production, only the quadrivalent shot protected the mice from the viral challenge, with the exception of the monovalent vaccine containing nucleoprotein, which appeared to protect vaxxed mice from death. While antibodies get most of the attention when it comes to vaccines, immune cells called T cells, which roam the body and kill infected cells, are also important in the fight against viruses. The researchers discovered that the nucleoprotein-specific jab stimulated a type of cytotoxic T cell that has been linked to protection against severe influenza infection in humans and animal models. The fact that immune responses to the four different influenza viral proteins differ suggests that a mixed vaccine is more effective than a regular vaccine, according to the researchers. #BIO [Inverse](#)

→ **The US government is investing in research to determine whether genetic changes in a virus are an evolutionary anomaly or a lab-engineered threat.** The Intelligence Advanced Research Projects Activity (IARPA) within the ODNI, announced the initiative in 2017. In a livestream update in October, an IARPA program manager announced two of the platforms being developed under the program. One of the platforms, developed by the Massachusetts-based nonprofit [Draper](#), is a rapid, handheld testing device that detects engineered genetic material using a thumbnail-sized chip. The other is [Ginkgo Bioworks'](#) software, which uses machine learning to identify engineering in genomic data generated from sample organisms. Both technologies are intended to detect common genetic engineering signatures. Ginkgo's software also uses algorithms to compare the genome being analyzed to those in a massive database to determine whether it is engineered or natural. Draper's device is intended for rapid deployment in the field on single samples, whereas Ginkgo's is intended for large-scale analysis of many samples. Government scientists evaluated the technology on 100 samples of both engineered and natural organisms taken from a variety of places in a test IARPA ran this spring and announced on October 17. Among these were 73 samples of bioengineered organisms, many of which were mixed with non-engineered organisms. 70% were correctly identified as bioengineered by the Draper and Ginkgo teams. Draper had no false positives, whereas Ginkgo had one: results indicating that bioengineering was detected when it was not. In addition, the platforms had a more difficult time detecting evidence of engineering in samples from organisms with large genomes. More accurate technology will necessitate a

larger, more diverse dataset—more reference genomes of the organisms all around us. The platforms have already been made available to various US government agencies by IARPA.



Drapier is developing a chip capable of identifying genetically engineered organisms in soil, water, and other samples. COURTESY OF DRAPER LABORATORY OF BOSTON

#BIO #CHP #AI #DIG #USA [WIRED](#)

→ [Verge Genomics](#), a biotech startup backed by Merck, Eli Lilly, and BlackRock, has announced the start of one of the first human clinical trials of a drug discovered using artificial intelligence to analyze a massive database of brain tissue. The company has administered the first dose of VRG50635 to a patient suffering from ALS, a neurodegenerative disease with no known cure, according to founder Alice Zhang. AI platforms can sift through massive amounts of data to quickly identify drug targets — proteins in the body linked to specific diseases — and molecules that can be turned into medicines. The technology can reduce the time it takes for a drug to go from initial discovery to approval, as well as the costs of development and the high failure rate in clinical trials, according to experts. According to Morgan Stanley, which forecasted in a June report that the technology would increase the viability of early-stage drug development and could deliver an additional 50 therapies within 10 years, Big Pharma and investors are chasing a \$50B opportunity in AI over the next 10 years. Zhang stated that Verge took four years to get its ALS drug through the discovery process and into clinical trials. This is faster and less expensive than traditional drug discovery techniques, which often rely on trial and error, she added. Verge has created a database of human tissues from patients with neurodegenerative diseases such as ALS, Parkinson's, and Alzheimer's. Through genetic sequencing, it has created a "human disease map" that can be mined using its AI platform to identify therapeutic targets for disease. Verge said it discovered a new causative mechanism in ALS — the loss of endolysosomal function, which affects human cells — by analyzing more than 11.4M data points, revealing a promising new therapeutic target. Verge's

approach eliminates the need for large-scale experiments or screening thousands of drugs and potential disease targets, according to Zhang. #BIO #AI #USA [Financial Times](#)

GREEN TECHNOLOGY

→ [Xpeng](#) has launched the latest version of the world's first fully electric vertical take-off and landing (eVTOL) flying in China. The model is similar to the company's previous horizontal dual-rotor model, but it has been optimized to include a new distributed multi-rotor configuration. The overall system design complexity has also been reduced to improve flight safety and reliability. So far, this new vehicle has completed its first flight as well as multiple single-motor failure tests with success. When driven, the eVTOL functions similarly to any other car. In flight, the prototype is controlled by the steering wheel and the right-hand gear lever. It has a full range of motion because the controls allow it to move forward and backward, turn, ascend, hover, and descend. It can take off and land vertically, and fly over traffic, obstacles, and rivers in short distances.



#GRN #AER #CHN [Interesting Engineering](#)

ADVANCED MANUFACTURING

→ In a scientific [breakthrough](#), University of Manchester researchers have gotten one step closer to building a molecular computer by demonstrating that a molecule-sized machine can read as it moves. In a molecular machine, instructions are encoded on one molecule and then interpreted or read by another. Chemists have long conceptualized these tiny machines that could fabricate drugs, plastics, and other polymers that are hard to build with

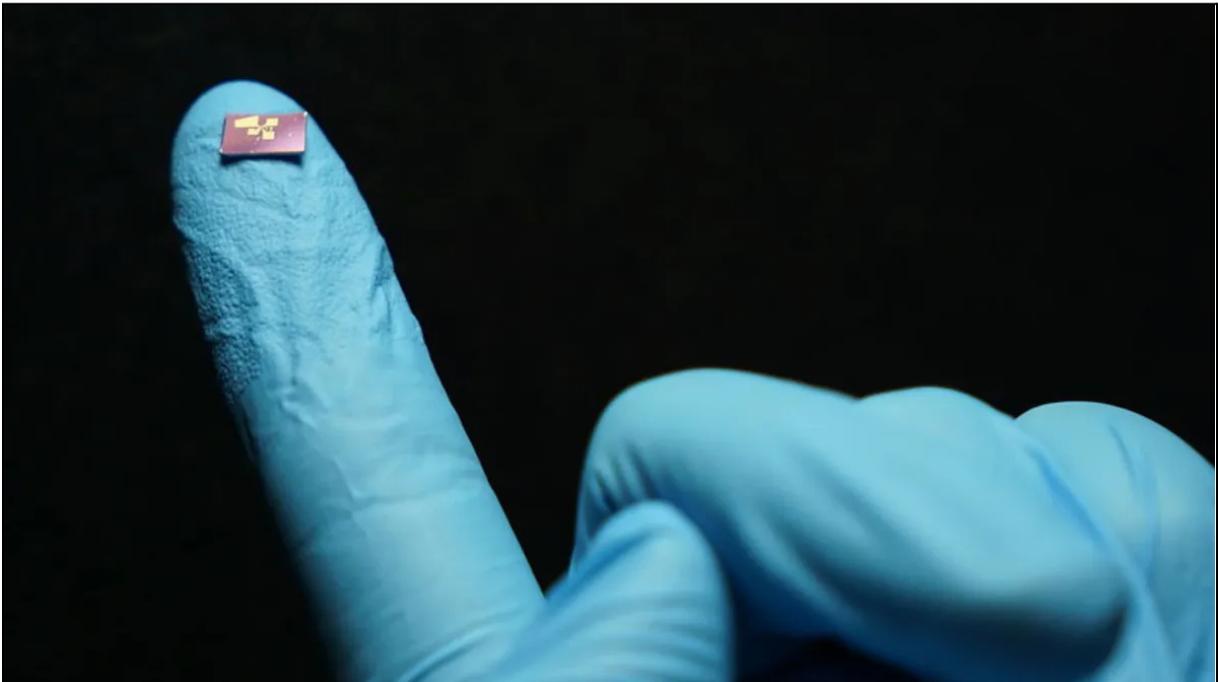
bigger tools. Now, scientists are one step closer to the realization of that concept. The scientists encoded information blocks on one molecule (the tape) and designed another to slide down its length (the head). Each time the head scanned a specific block of information, it would contort into a predictable shape as it moved along the tape. This enabled the team to decipher the information on the tape based on changes in the shape of the head — to read its code. They designed the molecular tape for this study to be more optimized than binary bits, which can be either a 0 or a 1. Instead, each information block on the tape is encoded in three-way, or ternary, code, with the values -1, 0 or +1. Because of the physics of the reading head, they could choose a more information-dense bit. When the head is stuck on a -1, it contorts predictably. When it clings to a +1 section, it contorts in the opposite direction. No contortion for 0. If light is shined at the molecular machine while it is reading, each of the three contortions will twist the light in a different way. By reading this light, the scientists were able to track how the head changed shape. The shape of the ratchet as it moved down the tape was determined using a technique known as circular dichroism spectroscopy. They demonstrated that the head reacts to what it reads. In other words, they discovered that fundamental physics and chemistry processes can be used to relay information at the molecular level. The next step forward will be getting his molecular machines to write. #MFG #DIG #GBR [WIRED](#)

AUTONOMOUS SYSTEMS

→ On October 31, [XPeng](#) received approval to begin testing its G9 electric AV on public roads in Guangzhou. The company will begin testing a small fleet with a human safety operator in the driver's seat. According to Xpeng, the G9 is the first mass-produced vehicle in China to pass such tests. To reduce production costs and make its vehicles more commercially viable, the company is pursuing a strategy of using off-the-shelf EVs for dual purposes — autonomous applications and individual sales. This is especially true in the aftermath of Argo AI's demise, with Ford and Volkswagen withdrawing their investments in the company in order to prioritize shorter-term bets like in-house built advanced driver assistance systems (ADAS). XPeng's G9 will be tested for robotaxi applications without any hardware modifications; higher-end G9 models will be built with Nvidia's Drive Orin chips and rely on 31 sensors, including a front-view camera and dual lidar sensors. That means the vehicle being tested for robotaxi operations will be the same vehicle sold to private passengers. The software will be the only difference. Individuals in Guangzhou, Shenzhen, and Shanghai will be able to download XNGP software, which is XPeng's "full scenario" ADAS that promises to automate highway driving, city driving, and parking tasks, by early next year. The G9s that XPeng will use for autonomous vehicle testing will be upgraded to perform Level 4 autonomy. The company plans to test its vehicle for robotaxi applications over the next two to three years as it develops its next generation vehicle, with the goal of launching it as one of the options by 2025, according to the company. #AUT #GRN #CHN [TechCrunch](#)

SEMICONDUCTORS & CHIPS

→ **Scientists and materials researchers have developed a new and improved tool for measuring light called "lab on a chip."** The researchers demonstrated a method for creating spectrometers that are far more miniature than what is currently used. The new device is small enough to fit on the "end of a human hair," outperforming traditional spectrometers that require bulky optical and mechanical components, according to the researchers. **To disperse and filter light, the spectrometer does not require the assembly of separate optical and mechanical components or array designs.** Furthermore, it can achieve a high resolution comparable to benchtop systems while being much smaller in size. The device is completely electrically controllable in terms of the colors of light it can absorb, making it scalable and suitable for widespread use.



#CHP #USA [Interesting Engineering](#)

QUANTUM TECHNOLOGY

→ **Scientists invented a novel technique to measure time by searching for "fingerprints" in the quantum realm that differs from the most common methods of keeping time because it is not anchored to a "time zero" that marks the beginning of a recorded period, according to a new study.** The team developed this quantum watch by firing lasers at helium atoms until they reached an excited "Rydberg" state with unique properties. Scientists use Rydberg atoms to investigate a wide range of physics problems, but the new study focuses on the unpredictable signatures, known as "wave packets," produced by excited electrons orbiting the atoms. These packets emerge from superposition, a quantum phenomenon in which an object can exist in two states of reality at the same time. **It is impossible to be in two places at once or to exist in two different realities in the macro-scale world that humans experience, but such feats are possible under the strange quantum rules that exist on the very small scales of**

atoms and subatomic particles. When multiple Rydberg atoms' wave packets interact, complex "fingerprints" emerge that are similar to the choppy waters of colliding ripples in a pond. These patterns (quasiunique beat signatures (QUBS)), are so unique that they can be used as timestamps to track the evolution of wave packets relative to one another. In other words, the patterns formed by interacting atoms are distinct enough to carry an innate record of their lifespans. The team notes that the watch is highly accurate, with a margin of error of only eight femtoseconds (one femtosecond is a millionth of a billionth of a second). As a result, the new technique may be extremely useful for "pump-probe experiments," which record ultrafast chemical reactions. #QNT #SWE #EST #IND [VICE](#)

GEOPOLITICS

→ **On November 1, the Special Competitive Studies Project issued recommendations aimed at encouraging US politicians to counter China's rising technological ambitions by tightening regulatory oversight, encouraging more private investment, and providing tax breaks for workers who receive training.** China surprised the US in key "battleground" technologies such as wireless 5G, microelectronics, and AI, as the Asian country's industrial policy allowed it to dominate markets for drones, high-capacity batteries, critical minerals, solar panels, turbines, and shipbuilding, according to the report. The report urges the US government to increase microelectronic production with the help of a large fund to unlock private capital, to establish an open-source security center to aid investments in digital infrastructure, to establish a national security commission on digital finance, and to give regulators more power to screen investment flows to China that could endanger US national security. The proposal also calls for the establishment of an independent development bank to provide "patient capital" to help "de-risk" private investment in deep tech, as well as an increase in the H-1B visa cap to help fill the estimated 90,000-worker talent gap in the microelectronics industry. Gilman Louie, CEO and co-founder of [America's Frontier Fund](#), stated in a recent interview that Beijing's technological advances under its Made in China 2025 strategy, with its timelines and clear standards, demonstrated that "America didn't have a business plan." He also states that "It's critical you bring together forces of government, academia, research and the market." #Geopolitics #5G #CHP #AI #AUT #GRN #MFG #DIG #FIN #Cybersecurity #SCRM #USA #CHN [Bloomberg](#)

→ **The US is urging allies, including Japan, to follow its lead in restricting advanced semiconductor and related technology exports to China, which will likely exacerbate the impact of tensions on chipmakers worldwide.** Tokyo has begun internal discussions on the issue at Washington's request. Officials are debating which restrictions can be imposed in Japan and will monitor how other US allies, such as the EU and South Korea, react. The US accounts for 12% of the global semiconductor market, with Taiwan and South Korea each accounting for about 20% and Japan accounting for 15%. Some American players have called for other countries to implement export controls similar to those used by the US, arguing that it is unfair for only US companies to lose Chinese business. The US expects that bringing allies on board with the restrictions will make it even more difficult for Beijing to purchase or manufacture advanced semiconductors for its rapidly expanding military. Aside from chip and chipmaking technology exports, Washington's restrictions prevent US citizens from working at or doing

business with Chinese semiconductor companies. American engineers who worked at Chinese chip fabrication facilities are beginning to return to the US. ASML has also told its American employees to stop servicing customers in China. China's market for chip production equipment will be worth \$22B this year, accounting for 22% of the global total, trailing Taiwan and South Korea. #Geopolitics #CHP #SCRM #USA #JPN #EU #CHN #TWN #KOR [Nikkei Asia](#)

→ [TuSimple](#), a US-based autonomous driving trucking company, **announced on October 31, that it had fired its CEO and co-founder, Xiaodi Hou, amid federal investigations into whether it improperly financed and transferred technology to a Chinese startup.**

Concurrent investigations by the FBI, SEC, and Committee on Foreign Investment in the US, are looking into TuSimple's relationship with Hydron Inc, a startup led by one of TuSimple's co-founders that is developing autonomous hydrogen-powered trucks, according to sources. The FBI and SEC were investigating whether TuSimple and its executives, particularly CEO Xiaodi Hou, violated fiduciary duties and securities laws by failing to properly disclose the relationship. They're also looking into whether TuSimple shared IP developed in the US with Hydron, and whether that action defrauded TuSimple investors by sending valuable technology to an overseas adversary. Mo Chen, TuSimple's co-founder, founded Hydron in 2021. According to public filings, Chen formed Hydron in China, Hong Kong, and Delaware with the intention of building hydrogen-powered trucks in North America based on a design by a subsidiary of a Chinese state-controlled automaker. Hydron's operations are primarily concentrated in China, where Chen spends the majority of his time. Chinese investors backed the startup. #Geopolitics #AUT #USA #CHN #HKG [WSJ](#)

CYBERSECURITY

→ **Twitter disrupted three China-based operations that were covertly attempting to influence American politics in the months leading up to the midterm elections by amplifying politically polarizing topics, according to data released by Twitter.** The operations spanned nearly 2k user accounts, some of which claimed to be located in the US, and weighed in on a wide range of contentious issues, including claims of election rigging in the 2020 presidential election and criticism of transgender people. Two of the three networks favored the right in the US, while the third favored the left. Some pro-China narratives aimed at an American audience have been repeated. Twitter also took down three networks that were based in Iran but frequently claimed to be based in the US or Israel. In its disclosure to researchers, Twitter stated that it was not attributing the activity to any specific governments. #Cybersecurity #DIG #Geopolitics #USA #CHN #IRN #ISR [The Washington Post](#)

→ **The speed and sophistication of ransomware attacks is outpacing the United States' ability to keep up with efforts to disrupt and recover from them, according to the Biden administration.** In the face of continued attacks against governments and the private sector, the US hosted the International Counter Ransomware Summit this week bringing together officials from 37 countries and 13 global companies to address the growing threat. The US is working to eliminate the illicit payment methods that make ransomware financially viable, specifically cryptocurrency. Nonetheless, ransomware actors appear to be broadening their

targets and continuing to release private troves of data if their demands are not met. This includes an attack this fall on the nation's second-largest school district, Los Angeles Unified, in which confidential information about students was leaked when the ransom was not paid. Separately, a new report published this week stated that US banks and financial institutions processed roughly \$1.2B in likely ransomware payments in 2021, a substantial rise from \$416 million in damages recorded in 2020. According to the Treasury Department's Financial Crimes Enforcement Network (FinCEN), which analyzed the data, suspected Russian cyber hackers are responsible for more than 50% of the ransomware attacks. There were 1,489 ransomware incidents with four of the overall top five ransomware attacks reported during this period being tied to Russia, according to the report. #Cybersecurity #Geopolitics #FIN #USA #RUS [Reuters](#) [Bloomberg](#) [CNBC](#)

→ **Apple has paid out a record total of \$20M through its new [bug bounty program](#).** The average reward in the product category is \$40k, and more than 20 separate payouts for high-impact vulnerabilities exceeded \$100k. In comparison, Microsoft has been paying out more than \$13M every year for the past three years, totaling more than \$40M between July 2019 and July 2022. Google said in July 2021 that it had paid out more than \$29M in the past 10 years and this year it reported awarding a record \$8.7M in 2021 alone. Facebook has not shared any data recently, but in 2020 it reported paying out a total of \$11.7M since 2011. Zoom awarded approximately \$1.8M through its bug bounty program in 2021. Beta software issues have a maximum bounty of \$1.5M, while a Lockdown Mode protection bypass can earn a researcher up to \$2M. Apple also announced that it's accepting applications for the 2023 Apple Security Research Device program where researchers are provided a special iPhone that allows them to conduct research without the need to bypass its security features. #Cybersecurity #USA [SecurityWeek](#)

Analyst Comment: Next5 previously reported that the DoD's "Hack US" bug bounty program offered a total of \$110k for vulnerability disclosures. The payouts varied between \$1k for reports of critical severity, \$500 for reports of severe severity, and \$3k for further special categories. Next5 notes that the DoD's rewards for these bug bounties are significantly less than Apple's bug bounty program, highlighting the disparity in funding for vulnerability research between the public and private sectors.

→ **[Chegg, an education technology firm based in Santa Clara, California exposed the data of 40M users.](#)** Chegg had issued root login credentials to multiple employees and outside contractors. Those credentials enabled many people to look at user account data, which the company kept on AWS' online storage system. As a result, the FTC stated that a former Chegg contractor was able to use company-issued credentials to steal the names, email addresses and passwords of these users in 2018. Some of the data was later found for sale online. Chegg represents the first case under the FTC's new campaign focused specifically on policing the ed-tech industry and protecting student privacy. In the Chegg case, the platform did not invoke the children's privacy law. The FTC accused the company of unfair and deceptive business practices. As part of the consent agreement proposed by the FTC, Chegg must provide security training to employees and encrypt user data. Chegg must also give consumers access to the personal information it has collected about them — including any precise location data or

persistent identifiers like IP addresses — and enable users to delete their records. This incident has led to the FTC pursuing a number of nonpublic investigations into other ed-tech providers. #Cybersecurity #USA [NY Times](#)

SUPPLY CHAINS

→ **Despite Washington's efforts to remove Chinese telecoms equipment from national supply chains, local and state governments in the United States have continued to purchase it, according to a CSET report.** Almost two thousand state and local entities purchased equipment and services from [Huawei](#), [ZTE](#), [Hikvision](#), [Dahua](#), and [Hytera](#) between 2015 and 2021. According to the report, there were 5,700 transactions involving a variety of covered equipment, including smartphones, surveillance cameras, temperature scanners, handheld radios, and networking equipment, with total purchases of over \$45M. Although the number of transactions has decreased since the ban was imposed in 2018, the report found that "there were still more than 600 procurements in 2021 and there is no indication the transactions have stopped." The study also discovered that public school districts, colleges, and universities made 75% of the purchases. Prisons, public hospitals, and transportation systems all purchased equipment. An unnamed midsize public university in Michigan, which invested more than \$15M in Huawei networking equipment and services during the period covered by the report, was one of the largest buyers. According to the study, Chinese equipment is "generally cheaper" than equivalent products from non-Chinese companies, "making it an appealing option for cash-strapped government agencies." According to a July FCC estimate, replacing all Chinese equipment in US systems will cost nearly \$5B. Additionally, the majority of contracts are not awarded directly to Chinese manufacturers, but rather to third-party distributors of their technology. Only Florida, Georgia, Louisiana, Texas, and Vermont have enacted regulations governing the acquisition of high-tech equipment for national security reasons. #SCRM #5G #DIG #Geopolitics #USA #CHN [SCMP](#)

→ **The Chinese government intends to increase the country's virtual reality (VR) industry output to \$48B by 2026, which would be six times the level last year.** The Ministry of Industry and Information Technology (MIIT) and four other agencies published a guideline on November 1 that set a national sales target for VR devices of 25M units by 2026. According to data from a research institute affiliated with the state-run newspaper People's Daily, this is significantly higher than last year's shipments of 3.7M units. According to the document, VR, one of the seven "key industries of the digital economy" designated by Beijing last year, will help China become a "powerhouse in manufacturing, cyberspace, culture, and the digital economy." China will have 100 "backbone enterprises" with a strong ability to innovate and create impact by 2026, as well as 20 use cases with unique characteristics, according to the guidelines. #SCRM #DIG #CHN [SCMP](#)

→ **Due to a global helium shortage, doctors are concerned about one of the natural gas's most important, and perhaps unexpected, applications: MRIs.** Without 2,000 liters of ultra-cold liquid helium to keep its magnets cool enough to function, an MRI cannot function. However, helium, a nonrenewable material located deep under the Earth's crust, is dwindling,

leaving hospitals unsure of how to prepare for a future with a significantly reduced supply. Prior to this year, the US counted on Russia to alleviate the limited supplies. A massive new factory in eastern Russia was to supply ~33% of the world's helium, but a fire in January disrupted the project's pace. Although the facility might begin operations at any time, the conflict in Ukraine has mostly halted trade between the two nations. 80% of the major US helium suppliers are now restricting the element. By decreasing helium allocations to less vital customers, these suppliers are giving priority to the healthcare sector. #SCRM #BIO #Geopolitics #USA #RUS [NBC News](#)