Notes from the Edge

Insights into an Evolving Future

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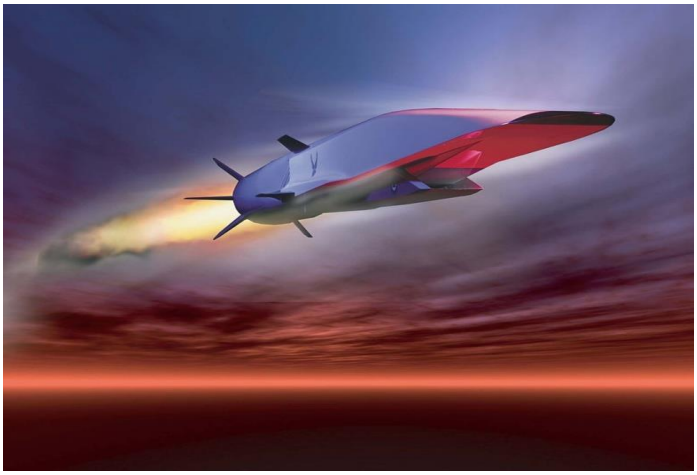

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FORESIGHT

Warfare: 2040 The future of military technology. The science of war is beginning to look more like science fiction. Technologies that were once confined to the fever dreams of Hollywood's sci-fi directors are becoming commonplace throughout projections of tomorrows military: lasers, railguns, hypersonic missiles, and secretive spaceplanes. **Warfare Infographic**

The rise of the robots: What the future holds for the world's armies. Land, air, and sea robots have moved from science fiction to a standard part of the modern arsenal – and now there's even serious debate to program killer bots and drones to think on their own, and communicate with each other. Other forces, from rival superpowers Russia and China to smaller countries and insurgent groups like ISIS, are developing their own combat robots, raising the possibility of a Cold War-style race to build offensive and defensive bot technology. Militaries are beginning to grapple with when and how to integrate increasingly autonomous robots into their operations. Some of the questions they face are the same ones of safety and efficacy the civilian world deals with. But world leaders are also actively mulling when, if ever, they'll be allowed to fire guns or other weapons without express orders from a human. **Future Military Robots**

Future milestones in AI predicted by experts. A team from the University of Oxford and Yale University has published a new survey that reveals experts' opinions on the likely timing of future milestones in artificial intelligence (AI). According to this survey, experts believe that AI will outperform humans in many activities in the near future, such as translating languages (by 2024), writing a high-school essay (by 2026), driving a truck (by 2027), working in retail (by 2031), writing a bestselling book (by 2049), and working as a surgeon (by 2053). Researchers believe there is a 50% chance of AI outperforming humans in all tasks within 45 years, and of automating all human jobs within 120 years. While there is much hype and fear about the danger of robots, depicted in movies such as Terminator, the researchers take a more optimistic view about the longer-term future of AI. The majority believe it will

benefit humanity, with only a 5% chance of being "extremely bad" (i.e. causing human extinction). **Optimistic AI**

Artificial intelligence has potential to increase corporate profitability in 16 industries by an average of 38 percent by 2035. Businesses that successfully apply artificial intelligence (AI) could increase profitability by an average of 38 percent by 2035, according to a new report from Accenture. The introduction of AI could lead to an economic boost of US$14 trillion in additional gross value added (GVA) across 16 industries in 12 economies. "By exploring the macroeconomic impact of AI as it matures over the next few decades, it's clear that organizations in every industry have tremendous opportunities to apply AI to unleash remarkable benefits," said Mark Purdy, managing director, Accenture Research. "By optimizing processes with intelligent automation, augmenting human labor and physical capital, and propelling new innovations, AI can drive dramatic and long lasting profitability and economic growth." **$14 Trillion More**

TECHNOLOGY

The most revolutionary thing about self-driving cars isn't what you think. Laser-based LIDAR (light detection and ranging) technology sensors send out a pulse of light and measure the reflective return to determine the distance between objects, generating a precise 3D map of the car's surroundings. These sensors, and other necessary systems, such as GPS, lead to estimates that each autonomous vehicle will generate and consume roughly four terabytes of data for every eight hours of driving. Four terabytes is the amount of data it takes to store over 1.2 million photos. According to a report from IHS Automotive, the number of self-driving vehicles on roads worldwide is expected to grow to 21 million by 2035. Coordinating the computing and communications between self-driving cars and other edge elements will increase the need for hybrid and private clouds, and coordination between and across them, requiring a great deal of automation. *"Editor's Note: Imagine the economic and security possibilities if commercial and government organization have access to huge volumes of data on 5G network clouds in real-time."* **Data Overload**

What 5G means for the future of tech. Mobile technology has progressed over the past two decades from a people-to-people engagement platform (3G) to a people-to-information connectivity platform on a global scale (4G). 5G mobile networks will be the next phase in mobile telecommunications standards beyond the current 4G LTE system, according to a January 2017 study from IHS Markit Economic and Technology. In the new 5G network, cellular coverage will be extended to a broader range of structures, including office buildings, industrial areas and large venues with high concentrations of people. This capability will also likely spur innovations in the "internet of things," or machine-to-machine communication, which is expected to bring about $12.3 trillion in global economic output and bring 22 million new jobs within the next 20 years, IHS reports. From 2020 to 2035 alone, 5G's total contribution to global economic output is expected to be equivalent to an economy the size of India's. **5G IoT**

CYBER SECURITY

First post-quantum cryptography on a contactless security chip. Quantum computer attacks on today's cryptography are expected to become reality within the next 15 to 20 years. Once available, quantum computers could solve certain calculations much faster than today's computers, threatening even best currently known security algorithms such as RSA and ECC. Researchers at Infineon Technologies recently implemented quantum-resistant cryptosystem on a commercially available contactless smart card chip without requiring additional memory space. **Encryption Beyond Quantum**

Invention of forge-proof ID to revolutionise security. Scientists have discovered a way to authenticate or identify any object by generating an unbreakable ID based on atoms. The technology, which is being patented at Lancaster University and commercialized through the spin-out company Quantum Base, uses next-generation nanomaterials to enable the unique identification of any product

with guaranteed security. The research published today in Nature's *Scientific Reports* uses atomic-scale imperfections that are impossible to clone as they comprise the unmanipulable building blocks of matter. The ground-breaking atomic-scale devices do not require passwords, and are impervious to cloning, making them the most secure system ever made. Coupled with the fact that they can be incorporated into any material makes them an ideal candidate to replace existing authentication technologies. **Forge-Proof**

IoT goes nuclear: Creating a ZigBee chain reaction. Within the next few years, billions of Internet of Things (IoT) devices will densely populate our cities. In the linked paper, the authors describe a new type of threat in which adjacent IoT devices will infect each other with a worm that will rapidly spread over large areas, provided that the density of compatible IoT devices exceeds a certain critical mass. The attack can start by plugging in a single infected bulb anywhere in the city, and then catastrophically spread everywhere within minutes.
"ZigBee" is a type of simple, very low cost radio link used in many devices to connect a controller with the device being controlled, in this experiment the increasingly common Hue smart lamp made by Philips. The very techie paper explains an experiment meant to illustrate how insecure the Internet of Things is and the implications of such, especially at large/wide scale, should hackers decide to exploit it. **IoT Chain Reaction**

How software is eating the military and what that means for the future of war. As software-based weapons and information systems start to touch all phases of conflict, military leaders are grappling with a new set of challenges. Countries around the world are wielding cyber weaponry these days like never before. Russia is widely credited with previous cyberattacks on Ukraine. The ransomware used recently was based on software tools developed by the U.S. National Security Agency, and leaked by a hacking group in April. Governments like Russia and North Korea are almost certainly behind other recent cyberattacks. And cybersecurity experts generally credit the U.S. and Israel with developing one of the first cyberweapons, a virus called Stuxnet that targeted Iran's nuclear program. While war is still conducted with fighter jets, assault rifles, and roadside bombs, the world's governments and armed forces are increasingly bringing new kinds of weapons and information systems to bear. And these software-based systems may soon eclipse most others in the effect they have on the battlefield. At the very least, a shift is under way that will see software come to have a deeper and deeper impact on almost every aspect of conflict. **Software in War**

CLIMATE CHANGE

The importance of Arctic and Antarctic geopolitics will increase due to climate change and the approaching 2048 Antarctic Treaty review. Antarctic geopolitics will only increase in importance due to climate change and the upcoming year 2048 when the Antarctic Treaty will be open for review. Hence it is important that Latin America, broadly speaking, takes steps to maintain a continuous presence in Antarctica in order to have a voice when the frozen continent's future is decided. Latin American governments have a strong presence in Antarctica, with two countries, Argentina and Chile, formally claiming Antarctic territories while several others carry out annual scientific expeditions (apart from having research bases there). Regional navies are of paramount importance in these operations as they are the spearhead of their respective nations' expeditions and security initiatives in Antarctic waters. **Antarctic Navies**

Rising seas could result in 2 billion refugees by 2100. By 2060, about 1.4 billion people could be climate change refugees and in the year 2100, 2 billion people – about one-fifth of the world's population – could become refugees due to rising ocean levels. Those who once lived on coastlines will face displacement and resettlement bottlenecks as they seek habitable places inland, according to Cornell research journal *Land Use Policy*, July 2017.
"The colliding forces of human fertility, submerging coastal zones, residential retreat, and impediments to

inland resettlement is a huge problem. We offer preliminary estimates of the lands unlikely to support new waves of climate refugees due to the residues of war, exhausted natural resources, declining net primary productivity, desertification, urban sprawl, land concentration, 'paving the planet' with roads and greenhouse gas storage zones offsetting permafrost melt," lead author Charles Geisler said.
Climate Change Refugee

RENEWABLE ENERGY

Renewables to grab $7 trillion of global power investment, says BNEF. In its New Energy Outlook 2017, Bloomberg New Energy Finance estimates that $10.2 trillion will be spent on power generation technology in the next 22 years, with clean energy grabbing $7.4 trillion. "This year's report suggests that the greening of the world's electricity system is unstoppable, thanks to rapidly falling costs for solar and wind power, and a growing role for batteries, including those in electric vehicles, in balancing supply and demand," said Seb Henbest, lead author of the report. **$7 Trillion Industry**

DENSITY: Key to fake and true news about energy and environment. The author offers a discussion of underlying truths and misrepresentations concerning energy and the environment over the past and next 100 years and how to discern truth from misdirection. Fake news is that renewable forms of energy are green. Hydro, biomass, solar, and wind are renewable but not green at scales that power billions of people. True news is that mobility, the great gift of petroleum, is more precious than prices usually tell. Reducing mobility cruelly limits access to education, mates, and jobs. Humans want low-cost speed, with minimal fallout. Petroleum has excelled for a century in this role. The hard news is that it will likely be surpassed soon and you must urgently think further than petroleum. **Beyond Petroleum**

FUTURE MAKING

Prototyping a better tomorrow. An ambitious new project launched in June aims to use the vision and expertise of the science fiction community to move past dystopian visions. The newly announced Science Fiction Advisory Council, composed of a stellar selection of 64 bestselling sci-fi writers and visionary filmmakers, has tasked itself with imagining realistic, possible, positive futures that we might actually want to live in – and figuring out we can get from here to there. "*Editor's Note: Numerous examples of sci-fi writers influencing future innovations spring to mind...*" **Setting the Future**

FUTURES ASSESSMENT DIVISION

The *Science Fiction Futures* anthology, the *MCSEF*, and previous editions of *Notes from the Edge* can be found at the link:
Futures Assessment Division

"Let us not go over the old ground, let us rather prepare for what is to come." – Marcus Tullius Cicero

This newsletter is intended to highlight issues and ideas which may prove significant in the evolving future. In keeping with our focus on both alternative futures and analysis, items in this bulletin will generally be of an alternative nature, or drawn from atypical sources.