

FORUM



FUTURE FORCE

Blending the Best of Humans and
Machines for Military Performance

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ABOUT THE COVER:

This illustration highlights cooperation between human and machines for optimal military performance.

FORUM ILLUSTRATION



Dear Readers,

Welcome to *Indo-Pacific Defense FORUM's* edition on military technology.

Staying ahead of the technology curve remains critical for the region's militaries and nations to defend their citizens, their homelands, and ultimately their sovereignty. The rapid evolution of technology is

affecting the readiness and responsiveness of Indo-Pacific militaries, law enforcement agencies, and nongovernmental organizations across the spectrum of operations, ranging from traditional warfighting to humanitarian assistance.

This edition presents leading issues related to military technology. The first series of articles discusses the challenges our near-peer competitors face in mastering and synchronizing technological advances for military uses. The opening article examines how Indo-Pacific countries are embracing space exploration, given that military systems and civilian communications increasingly rely on space technology. Next we explore how artificial intelligence (AI) applications will revolutionize the battlespace. The future of multi-domain operations, for example, may consist of symbiotic teams, where humans and AI-enabled machines bind the capabilities of each for optimal performance.

The next series of articles covers innovations across the security sphere, from helping law enforcement officers in Pacific island nations hone their crime-fighting skills to deploying cutting-edge spatial technology that can identify malaria outbreaks. Finally, we explore the opportunities and vulnerabilities of modernizing military organizations and sharing military and security advancements to increase our collective disaster mitigation and response capabilities.

I hope these articles energize regional conversations on military technology. I welcome your comments. Please contact the *FORUM* staff at ipdf@ipdefenseforum.com with your perspectives.

All the best,

P. S. DAVIDSON
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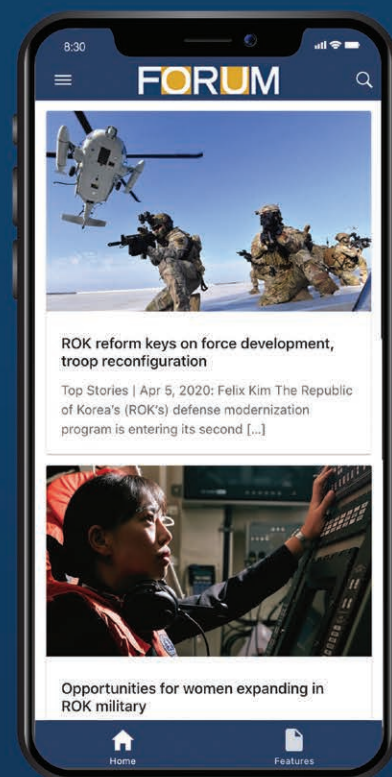


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VICE ADM. ACHMAD TAUFIQOERROCHMAN is the head of Indonesia's Maritime Security Agency, known as BAKAMLA. He was born in Sukabumi, West Java, and graduated from Naval Military Academy Class in 1985. He was commissioned as an operations officer following his graduation from the Indonesian Naval Academy. He led Indonesia's Red and White (Merah Putih) Task Force in a 2011 mission to free the Indonesian crew of the M/V Sinar Kudus after Somali pirates seized the ship. The Merah Putih Task Force had support from Indonesia's Marine Corps and Army Special Forces (Kopaska and Kopassus). After selection for flag rank in 2011, Vice Adm. Taufiqoer Rochman became vice governor of the Indonesian Naval Academy, and then governor in 2014, followed by appointment as commander in chief of the Western Fleet. During his tenure, he established the Western Fleet Quick Reaction Force that contributed to reducing armed robberies in the straits of Malacca and Singapore. *Featured on page 52.*

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MALAYSIA

PALM OIL TO PAY FOR MILITARY EQUIPMENT

Malaysia is in talks with at least six countries on the possible use of palm oil to pay for arms, as Southeast Asia's third-biggest economy seeks to replace old equipment to boost its defense capabilities.

Costs have been a hurdle to updating its defenses, but using palm oil to help pay for equipment could open new avenues to upgrade, Defence Minister Mohamad Sabu said in 2019.

Mohamad said discussions on paying with palm oil had started with China, Russia, India, Pakistan, Turkey and Iran.

"If they are prepared to accept a palm barter trade, we are very willing to go in that direction," Mohamad said. "We have a lot of palm oil."

Malaysia and Indonesia, the world's two largest palm oil producers, supply about 85% of palm oil globally. Much of it is used in food but also in items such as lipstick and soap.

Besides new ships, Malaysia was also keen to acquire long-range surveillance aircraft, unmanned aerial vehicles and fast intercept boats, the minister said.

The planned barter was part of a 10-year defense policy considered in Parliament in 2019, which Mohamad said would focus on boosting naval capabilities, including in the disputed South China Sea.

"We want this region to remain peaceful and neutral," Mohamad said. Reuters

AUSTRALIA

INVESTING IN SPECIAL FORCES

Australia will spend AUD \$500 million (U.S. \$340 million) to improve the capability of its special forces troops, the first stage of an AUD \$3 billion, 20-year plan that the government said in August 2019 will enable a better response to security threats at home and abroad.

The spending comes after some high-profile security incidents in Sydney and Melbourne in recent years and as Australia seeks to play a more prominent role in the Pacific, where the People's Republic of China (PRC) is seeking greater influence.

"This is going to be a very important part of our commitment, the biggest single commitment to upgrading the capability of our defense forces since the Second World War," Prime Minister Scott Morrison said at the Holsworthy Army base in Sydney.



Australia said in July 2019 that it would create a new military unit to train and assist its allies in the Pacific.

In early August 2019, a member of the government likened the West's attitude to the rise of the PRC to the French response to the World War II advances of Nazi Germany, drawing a rebuke from the Chinese embassy.

"It is in Australia's national interest to have an independent and sovereign Indo-Pacific where all the nations of this part of the world can engage with each other freely, according to international norms and the rule of law," Morrison said.

The government said Australia's spending on defense would reach 2% of gross domestic product (GDP) by the fiscal year ending June 2021, which U.S. President Donald Trump has said should be the spending goal for NATO alliance members.

World Bank data showed Australia's military spending at 1.89% of GDP in 2018. Reuters



MILITARY SEEKS *eighth straight spending hike*

Japan's military has asked for an eighth consecutive annual increase in defense spending to help pay for U.S.-made interceptor missiles, stealth fighters and other equipment to counter threats from North Korea and the People's Republic of China (PRC).

The Ministry of Defense budget proposal released in late August

2019 calls for spending to increase 1.2% to a record 5.32 trillion yen (U.S. \$50.48 billion) for the year starting April 1, 2020. Finance Ministry officials will scrutinize the request before it is approved by Prime Minister Shinzo Abe's Cabinet.

Already one of the world's biggest military spenders despite

a Constitution that forbids the possession of weapons to attack other countries, Japan has increased military outlays by 10% over the past seven years. That growth is being driven by alarm over military buildups by its neighbors.

For the next fiscal year beginning in April 2020, Japan's defense officials have asked for 115.6 billion yen to buy nine Lockheed Martin F-35 stealth fighters, including for the first time six short takeoff and vertical landing B variants for use on aircraft carriers. That purchase will help Japan project military power by extending the range at which the country's Self-Defense Forces can operate.

The Defense Ministry also wants 116.3 billion yen to bolster ballistic missile defenses, including money for a new generation of interceptor missiles to shoot down incoming warheads in space. It also wants funds for vertical launch systems for ships and two planned ground-based Aegis Ashore radar missile tracking stations. Reuters



NEW POST TO IMPROVE MILITARY INTEGRATION

Indian Prime Minister Narendra Modi announced in mid-August 2019 the establishment of the post of chief of defense staff for better coordination among the Army, Air Force and Navy.

Indian defense experts have long called for such a post that is analogous to the structure of many Western military forces to ensure the three defense arms operate together.

"Our forces are India's pride. To further sharpen coordination between the forces, I want to announce a major decision. ... India will have a chief of defense staff," Modi said in an Independence Day address on August 15, 2019.

India had organized its military into three services, each led by

its own chief, since independence from Britain in 1947. Such an arrangement was thought necessary to prevent too much power from being concentrated in the hands of a single commander.

However, with military operations now involving close integration, many countries have moved to a single chief of defense staff to direct the military and report directly to the political executive for faster decision-making.

Modi said the establishment of a chief of defense staff was an important step toward military reform. The new chief will also have control over funding for the military, which is working to modernize its Soviet-era equipment. Reuters

ANTI-TERROR *upgrade*

Japan takes reactors
offline in bid to
harden defenses





Japanese utilities face hundreds of millions of dollars in extra fuel costs in 2020 as they buy extra liquefied natural gas (LNG) and coal while nearly half the country's working nuclear reactors go offline for government-ordered security upgrades.

Analysts expect four of Japan's nine operating reactors to close temporarily while utilities make changes required under stricter anti-terrorism rules adopted after the 2011 Fukushima disaster. Kyushu Electric and Kansai Electric Power are among the utilities mandated to build emergency off-site control rooms to serve as backup bases that can keep nuclear reactors cooled and prevent meltdowns in the event of a terrorist attack.

Serving the southernmost of Japan's four main islands, Kyushu Electric said its Sendai No. 1 reactor will be shut down from March 16 to December 26, 2020, with No. 2 offline from May 20, 2020, to January 26, 2021. The utility estimated the suspension of the two 890-megawatt (MW) units — the first plants to be restarted under stricter regulations after the 2011 disaster led to the shutdown of Japan's nuclear power industry — would boost its monthly

costs by 8 billion yen (U.S. \$74 million) as it purchases fossil fuels such as LNG and coal as alternatives for power production.

"We plan to utilize a newly built 1,000 MW Matsuura No.2 coal-fired power plant to replace nuclear power," a Kyushu executive said at an earnings news conference in October 2019. The precise mix of substitute fuels will depend on various factors including demand and fuel prices, he said.

Japan's Nuclear Regulation Authority has strictly enforced deadlines for implementing the new security measures. It turned down a request from Kyushu Electric for a deadline extension in 2019, leaving the utility with no option but to decide on a temporary shutdown.

At Kansai Electric, serving Osaka, Kyoto and the surrounding industrial region, the deadlines for building backup bases at its Takahama No. 3 and No. 4 reactors are August and October 2020, respectively. A Kansai spokesman said the company is trying to speed up construction, but analysts forecast the utility will have to suspend operations at the reactors to meet its deadlines.

Lucy Cullen, principal analyst at Wood Mackenzie, predicts Kansai will close the two Takahama reactors in 2020 and expects a combination of coal, LNG and even oil could be used to offset the lost nuclear generation. If both coal and gas-fired generation capacity are available, the choice of substitutes for nuclear power ultimately depends on relative fuel economics, Cullen said. "When contracted LNG volumes are available, we would expect [utilities] to use LNG. However, if additional spot LNG cargoes are required, then coal is generally more economic," she said.

The impact in 2020 could be enough to help reverse a declining trend for Japan's imports of LNG and thermal coal. Cullen estimated Japan LNG imports would fall 5% in 2019 from 2018 to about 78 million metric tons, but expects LNG demand will recover slightly to 79 million metric tons in 2020, supported in part by closures of the four reactors.

While the four reactors at Sendai and Takahama are expected to be suspended, no new units will be restarting in 2020, said Takeo Kikkawa, an energy studies professor at Tokyo University of Science. "Japan's imports of LNG and coal may see an increase next year as operating nuclear reactors drop from nine to five and without restart of any new reactors," he said. Reuters



Operators monitor the nuclear reactor at Kyushu Electric Power's Sendai plant in Japan.

LEFT: Kyushu Electric Power's Sendai nuclear power station is one of four being taken offline in Japan to harden its defenses against potential terrorist attacks.

Indo-Pacific SPACE AGE



REGION PLAYING LARGER ROLE IN
EXPLORATION, DEFENSE COLLABORATION

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Indo-Pacific countries are embracing space exploration, as rapidly developing programs in India and Japan blaze new scientific trails to keep pace with the People's Republic of China's (PRC's) growing capabilities. The region's space programs have landed spacecraft on an asteroid and on the far side of the moon in a striking era of technological advancement, and new missions to Mars and Venus are being planned. With military systems and civilian communications increasingly reliant on space technology, Indo-Pacific scientists and engineers are accelerating efforts to explore a domain that was once solely the province of great powers Russia and the United States. More recently China has established itself as arguably the third largest space power.

Japan's Hayabusa2 spacecraft landed on the asteroid Ryugu and completed its final rock-collecting maneuver in July 2019. The Japan Aerospace Exploration Agency (JAXA) said the spacecraft's reentry capsule should make its way back to Earth with a payload of samples in late 2020 when it lands in the Woomera Prohibited Area of southern Australia.

Japan blasted a hole in the asteroid and then landed a probe inside the crater it created. Scientists hope the samples will provide clues to the origin of the solar system. "Everything went perfectly, even better than perfect, as if Hayabusa were reading our minds," said JAXA research director Takashi Kubota, according to a CBS News report.

India, meanwhile, attempted a lunar landing with its Chandrayaan-2 spacecraft but lost contact with it in September 2019. Despite the setback, the Indian Space Research Organisation (ISRO) said it has even more ambitious plans to follow. India is targeting August 15, 2022 — the 75th anniversary of India's independence from the United Kingdom — as the date for putting three "gaganauts" into orbit for the first time. "India calls it human spaceflight rather than manned spaceflight because it plans to send a woman," Pallava Bagla, science editor for New Delhi Television, told *Forbes* magazine.

Perhaps the ISRO's proudest moment came with the November 2013 launch of a Mars orbiter mission. The Mangalyaan spacecraft began orbiting Mars in 2014. Mangalyaan, which is Sanskrit for Mars-craft, eventually captured 980 images of Mars, one of which made the cover of *National Geographic* magazine in 2016. Bagla told *Forbes* that India plans a return trip to Mars, possibly with an attempt to land on the surface, and also is orchestrating an effort to send a probe to study the surface and atmosphere of Venus.

Both India and the PRC have plans to construct their own space stations, and the PRC in July 2019 became the first country to land a rover on the far side of the moon. The rover discovered what Chinese officials termed an unusually colored "gel-like" substance while exploring

impact craters on the lunar surface. The discovery sent scientists scrambling for an explanation, although they have offered no definitive conclusions. Some researchers suggested, according to a report by space.com, that the substance could be glass melts created by meteorites striking the moon's surface.

The number of countries in the Indo-Pacific region actively pursuing space programs continues to grow. Australia, Bangladesh, Indonesia, Malaysia, New Zealand, North Korea, the Philippines, Singapore, South Korea, Thailand and Vietnam are all actively developing space capabilities, according to a June 2019 report by the Australian Strategic Policy Institute.

"A trend toward indigenously produced small satellites is evident throughout the region," the report said. "Indonesia, Malaysia, New Zealand, the Philippines, Singapore and Vietnam have all committed to developing space technologies. Bilateral and multilateral collaboration is the driving force behind these rapid advances in space science and engineering."



India launches a military communications satellite into orbit from a site in the state of Andhra Pradesh in December 2018. AFP/GETTY IMAGES

A VULNERABLE FRONTIER

New vulnerabilities arise with each scientific advancement. "We are almost as dependent on satellites as we are on the sun itself," U.S. Rep. Jim Cooper wrote in the forward of an April 2019 report on space threats by the Center for Strategic and International Studies (CSIS). "They are our infrastructure of infrastructure, enabling our television, internet, telecommunications, energy, trade and financial networks to function."

This overwhelming reliance makes space technology an inviting target for countries seeking military advantage. The PRC in May 2013 launched a new type of anti-satellite system that U.S. experts said could reach altitudes high enough to affect military communications, missile warning systems and GPS. The PRC's testing



of anti-satellite weapons continues despite the fact that its January 2007 destruction of an aging meteorological satellite drew international condemnation for the amount of space debris produced. The destruction of the satellite created more than 3,000 trackable pieces of debris and thousands more particles that are too small to track. In March 2019, India became the fourth country to test an anti-satellite weapon when it shot down its Microsat-R satellite to demonstrate that it can shoot down an enemy country's space-based infrastructure.

The militarization of space isn't limited to anti-satellite weapons. In 2018, U.S. intelligence officials reported that the PRC was making advances in directed-energy technology that could blind or damage sensitive space sensors, such as those used for missile defense, the CSIS report said. Also, electronic warfare units within China's People's Liberation Army "routinely conduct jamming and anti-jamming operations against multiple communication and radar systems and GPS satellite systems in force-on-force exercises," the report said. The report added that the PRC has highly advanced cyber capabilities that could target satellite technologies.

North Korea, meanwhile, has built up cyber and electronic warfare capabilities that could disrupt space-based technologies. Vincent Brooks, then-commander of United States Forces Korea, said in congressional testimony in March 2018 that North Korea's well-organized cyber forces are perhaps among the world's best, the CSIS report noted. North Korea doubled its cyber warfare personnel from about 3,000 troops in 2013

to 6,000 in 2015. North Korean cyber personnel were responsible for an attack against Sony Pictures Entertainment in November 2014 in which private communications were stolen and publicized.

North Korea also has been actively using electronic forms of attack against space systems. The systems, the CSIS report said, have an effective radius of 50 to 100 kilometers. North Korea repeatedly has used its GPS jamming capabilities against South Korea, the report said.

These potential threats to military and civilian satellite-based systems haven't gone unnoticed in the region. Indo-Pacific neighbors are beginning to work together specifically to counter the PRC's space initiatives.

"China's enormous capacity means that no other Asian power can counter it alone," wrote Dr. Rajeswari Pillai Rajagopalan, a distinguished fellow and head of the Nuclear and Space Policy Initiative at the Observer Research Foundation in New Delhi.

"Just as this is encouraging new terrestrial alignments between India, Japan, Australia and others, it is also leading to cooperation in outer space by a number of countries, all [of] whom have common concerns about China's capabilities and behavior in space," Rajagopalan penned in an August 2019 article for the *Nikkei Asian Review* journal.

India and Japan, for example, "despite having highly nationalistic space programs, are cooperating more,"

India's Chandrayaan-2 spacecraft lifts off on July 2, 2019, on a mission to land a lunar rover.

INDIAN SPACE RESEARCH ORGANISATION

“With the increasing democratization of space comes a responsibility and need to keep space sustainable.”

~ ROBIN J. FRANK, former associate general counsel for international law at the U.S. National Aeronautics and Space Administration

Rajagopalan wrote. The countries in 2017 formally recognized the importance of deeper cooperation, and their space agencies said they plan to conduct a joint lunar mission in the future. The countries also held their first space security dialogue in March 2019.

Representatives of ISRO and JAXA discussed surveillance and maritime domain awareness in the East China Sea, South China Sea and the Indian Ocean. They also discussed space-related norms and space security, according to Financial Express Online.

COSMIC COOPERATION

This growing awareness of the need for space cooperation extends beyond the region. After nearly nine years of work, a United Nations committee formally approved 21 new guidelines for the long-term sustainability of space in June 2019. The 92 member states of the U.N.'s Committee on the Peaceful Uses of Outer Space (COPUOS) signed off on a range of recommended behaviors and best practices.

“This is probably the most significant output of COPUOS in the last decade and a significant step forward for promoting space sustainability,” said Peter Martinez, executive director of the Secure World Foundation, in his June 2019 opening remarks at his organization's Summit for Space Sustainability.

The guidelines include calls for enhanced registration of space objects; sharing contact information and space situational awareness data with other countries and agencies; designing satellites to increase their trackability; sharing space weather data and forecasts; and addressing the risks of uncontrolled atmosphere reentries.

A great deal of cooperation is already occurring. U.S. Strategic Command (USSTRATCOM), for example, signed its 100th space situational awareness agreement in April 2019 with the Romanian Space Agency. The agreements are designed to foster openness, predictability and transparency in space activities. While many of the pacts are with commercial operators, USSTRATCOM has space agreements with 20 nations, including Australia, Japan, New Zealand, South Korea and Thailand in the Indo-Pacific.

Apart from any concerns about potential adversaries weaponizing space, the simple need to control traffic to avoid collisions has become a monumental task. As Bloomberg opinion columnist Adam Minter summed up in a September 2019 article, humans have launched at least 9,000 satellites into orbit since 1957, and roughly 5,000 remain in orbit. “And satellites make up just a

fraction of the man-made objects orbiting the Earth,” Minter wrote. The 19,000 additional pieces of space debris being tracked by the U.S. Air Force include pieces from space collisions and old rocket parts.

It's a reality partly created by the democratization of space. The onset of less-expensive, small-satellite technology has spurred many smaller nations to undertake space exploration and add to the congested environment. While not binding, the best practices outlined in the U.N. measure offer hope for a more collaborative and less congested future.



Takashi Kubota, research director for the Japan Aerospace Exploration Agency, discusses the touchdown of the Hayabusa2 probe on a distant asteroid. AFP/GETTY IMAGES

“With the increasing democratization of space comes a responsibility and need to keep space sustainable,” Robin J. Frank, a former associate general counsel for international law at the U.S. National Aeronautics and Space Administration wrote in an opinion piece for spacewatch.global. “More players in the game naturally leads to more launches to coordinate, more objects to track, more debris to avoid and more critical systems at risk.”

Achieving space sustainability, she wrote, requires a global effort. Such an environment can be realized, she said, “through efforts such as cataloguing space objects, mitigating debris creation and sharing relevant operational data. A sustainable environment means that current actors can continue to operate with minimal disruption, while new space-faring nations and companies will be assured that the domain will remain accessible in the future.” □



ISLAND EMBRACE

FORUM ILLUSTRATION

FBI training part of broader U.S. outreach in Pacific

FORUM STAFF

As new threats reach their remote Pacific island homes with the arrival of high-speed internet, police officers from the Federated States of Micronesia (FSM) converged on Honolulu, Hawaii, in October 2019 to hone their crime-fighting skills with veteran U.S. agents of the Federal Bureau of Investigation (FBI). The training was part of a broader outreach program by the U.S. to engage Pacific island nations.

The 20 officers from the island states of Chuuk, Kosrae, Pohnpei and Yap immersed themselves in evidence collection, crime scene photography, evidence packaging and labeling, crime scene sketching and latent print collection. The training also involved firearms instruction and active shooter drills and was held October 8-18, 2019, at the East-West Center on the campus of the University of Hawaii and at Marine Corps Base Hawaii.

It was one of many U.S. engagement efforts with Pacific island nations.

“The FBI has always done outreach and training for foreign governments. But for us, particularly here in this area of responsibility, we feel that they are an underserved area,” said Bryan D. DuChene, assistant special agent in charge of the FBI’s Honolulu Division. “It’s teaching them how to make good cases, how to get the best evidence and how to get the best prosecutions.”

The FBI trainers have been involved in some of the world’s most devastating cases — a mass shooting at a festival in Gilroy, California, in 2019 that left four people dead and 17 injured; an Asiana Airlines crash on a runway in San Francisco in 2013 that killed three and injured 187, and a terrorist bombing at the Boston Marathon in 2013 that killed three and injured hundreds. A senior team leader for evidence collection at the FBI’s San Francisco Division told the officers that evidence collection is not a solitary pursuit. If evidence is challenged in court, she said, officers need corroboration. “You don’t collect anything without two people,” she said. “I don’t want it to be just me against you.”

The Micronesian officers said they gained valuable insights. “I learned how to collect evidence and preserve evidence from the crime scene,” said Officer Danny Joe, who works with the state police in Kosrae. “It helps a lot.”

Lt. Darney Phillip, a 19-year officer who works for the FSM National Police in Pohnpei, said that although the islands don’t see mass shootings or some of the violent crimes experienced by the FBI, they are witnessing an upswing in human trafficking. People who work on fishing vessels sometimes abduct girls and force them into the sex trade, he said. “I hope we can learn from this and go back and apply it,” he said.

“At first, I didn’t understand what police work really is, but I really needed the job. But when I started work as a police officer, I fell in love with it — serving my country and keeping the peace.”

— **Kenny Obispo**, FSM National Police officer



Police officers from the Federated States of Micronesia participate in firearms training at Marine Corps Base Hawaii. FBI HONOLULU

Kenny Obispo, a seven-year police officer with the FSM National Police, was captivated by the sensational nature of the crimes described by the FBI. “Where we work is a very remote and very peaceful place,” Obispo said. “We don’t really get a lot of homicide cases. Major cases are robbery and things like that.” He said he hoped to use the training to further a career he has learned to love. “At first, I didn’t understand what police work really is, but I really needed the job,” Obispo said. “But when I started work as a police officer, I fell in love with it — serving my country and keeping the peace.”

FORUM

HELPS REMOTE ISLANDS reach the world, each other

FORUM STAFF

One key way leaders of the Pacific islands and the United States engage each other is through the Pacific Islands Forum (PIF). Leaders of the remote islands realized five decades ago that they needed a forum to discuss common challenges and opportunities, so in 1971 they established PIF, which formerly was called the South Pacific Forum.

From hashing out mutual trade goals to confronting Australia's recent scourge of bushfires, PIF has created a setting for island leaders to unite behind common causes. Headquartered in Suva, Fiji, the forum includes Australia, the Cook Islands, the Federated States of Micronesia, Fiji, French Polynesia, Kiribati, Nauru, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, the Solomon Islands, the Marshall Islands, Tonga, Tuvalu, Vanuatu and Western Samoa.

Two years after its founding, PIF established a bureau to focus on economic issues. The South Pacific Bureau for Economic Cooperation facilitates cooperation on trade, tourism, transportation and economic development. Good governance is also a key emphasis. In 2000, PIF leaders adopted the Biketawa Declaration, which established principles to promote open and democratic government and equal rights for citizens regardless of color, creed, gender, political belief or race.

PIF holds annual meetings with heads of government. After that meeting, a ministerial-level dialogue is held with non-regional parties that include Canada, the European Union, France, Japan, Malaysia, the Philippines, the People's Republic of China, South Korea, the United Kingdom and the United States.

The police training in Honolulu demonstrated successful cross-agency cooperation. The East-West Center, a research and educational center established by the U.S. Congress in 1960, provided the facilities. The U.S. Department of Defense and the FBI funded the training, which is one of many efforts by the U.S. to deliver more economic assistance to the islands. U.S. Secretary of State Mike Pompeo in September 2019 announced U.S. \$65 million in new aid when he met with island leaders at the United Nations General Assembly in New York. The U.S. already offered an additional U.S. \$36.5 million in support at the 50th Pacific Islands Forum in August 2019. The aid will go toward projects that include improving cyber capacity, development assistance, broadband connectivity, combating illegal fishing, and establishing better maritime security and good governance initiatives. Many of the islands are in various stages of broadband buildout.

In addition to the economic aid, Pompeo announced in August 2019 that negotiations were already underway to renew a critical national security agreement. Under the terms of the Compact of Free Association, which doesn't expire until 2024, the U.S. military receives exclusive access to airspace and territorial waters of the FSM, the Marshall Islands and Palau while the islands receive financial assistance and security guarantees.

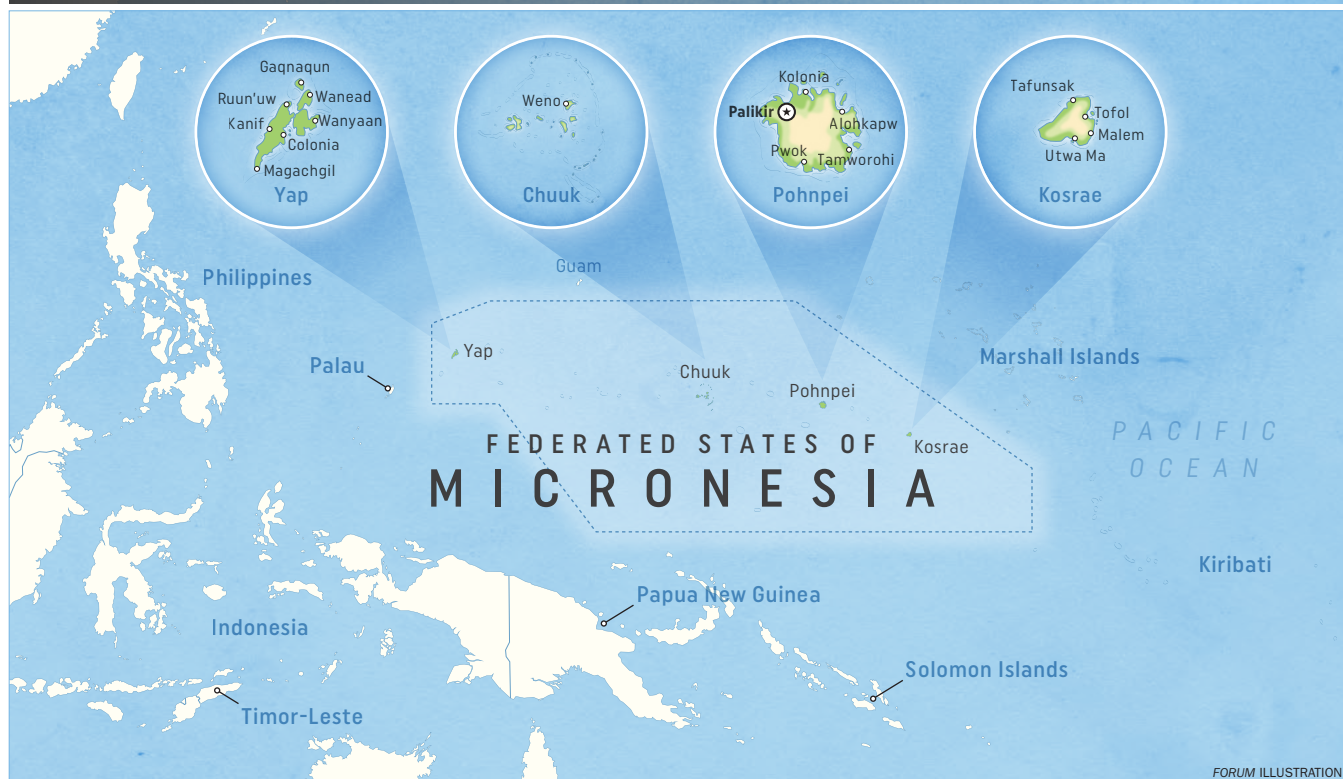
"The security relationship between the United States and Micronesia continues to be very close, and I'm hopeful it will get even closer."

— U.S. Defense Secretary **Mark Esper**



U.S. Secretary of State Mike Pompeo's plane makes its approach to Pohnpei International Airport in August 2019. Pompeo was the first U.S. secretary of state to visit the Federated States of Micronesia.

FEDERATED STATES OF MICRONESIA



Pompeo was the first U.S. secretary of state to visit Micronesia. The visit demonstrated how the island nations have gained greater strategic significance in recent years due to an increased push by the People's Republic of China to gain influence there. "Today, I am here to confirm the United States will help you protect your sovereignty, your security, your right to live in freedom and peace," Pompeo told reporters in Pohnpei in August 2019. "I'm pleased to announce the United States has begun negotiations on extending our compacts. ... They sustain democracy in the face of Chinese efforts to redraw the Pacific."


As increased connectivity brings progress as well as new threats, such as cyber crime and child pornography, the FBI has continued to reach out to build the capabilities of island police. FSM hosted an anti-human trafficking conference in July 2019 in which FBI agents discussed best practices for coalition building, how to build community awareness and how to prosecute human trafficking cases.

This multilayered engagement was capped off in October 2019 when FSM President David Panuelo met with U.S. Defense Secretary Mark Esper at the Pentagon. "The security relationship between the United States and Micronesia continues to be very close, and I'm hopeful it will get even closer," Esper said at a press briefing. "We are very proud, as you and I discussed, of the many Micronesian citizens who serve in the United States military, the highest per capita of anywhere else. So, this is remarkable."



U.S. Secretary of State Mike Pompeo and Federated States of Micronesia President David Panuelo attend a memorial to fallen Micronesians who served in the U.S. military. REUTERS

Panuelo said the strategic partnership represents common values — sovereignty, rule of law and regional security. "We're proud of that," Panuelo said. "And we're proud that our citizens serve in the U.S. Armed Forces at the highest per capita. And we're proud of the close ties — you know, the alliance that we do enjoy between our two countries." □



BACK TO BASICS

A New Zealand Army infantry trainee tests his skills and knowledge on New Zealand's West Coast. NEW ZEALAND DEFENCE FORCE



MILITARY TRAINERS STRESS SKILLS WITH AND WITHOUT TECHNOLOGY

FORUM STAFF

Inside the classroom at the U.S. Naval Academy sit roughly two dozen midshipmen attending a mandatory course on celestial navigation.

“Raise your hand if you have ever determined your location on the planet using the stars,” instructor Lt. Daniel Stayton says to the class, according to NPR.

A young cadet timidly raises her hand. Another hesitates. The rest? They sit silently, unable to answer affirmatively to having ever used stars and sextants. “I mean, obviously I heard about using stars to navigate in the old days,” midshipman and class participant Audrey Channell told NPR, “but I never thought I’d be using it.”

Senior officers responsible for training the next generation of Sailors and Soldiers recognize the need to ensure troops can still accomplish the mission when there’s a technology glitch. After all, batteries die. Hackers succeed. Systems fail.

Army trainers from Japan, New Zealand and the United States probed this topic during the Land Forces of the Pacific (LANPAC) Symposium and Exposition in Hawaii in May 2019 on a panel titled “Effect of Force Modernization on Basic Soldiering Skills.”

“When we modernize, modernization requires wholistic modernization. From training bases, to facilities to people skills. It can’t be just about the gadget,” U.S. Army Materiel Command Sgt. Maj. Rodger Mansker said at LANPAC.

Multi-domain operations (MDO) — also known as cross-domain operations — can provide capabilities. Without a Soldier’s ability to use MDO, the technology is useless, Mansker said.

“A materiel solution without the right Soldier is just another piece of equipment,” he said. “If you don’t know how to use it for its capability, then you might as well buy an old one.”

Modernization should enhance a Soldier’s mastery of fundamentals, the LANPAC panelists said. What constitutes fundamentals depends on the military branch, the unit, and often, the mission.

New Zealand Army Warrant Officer Class One Clive Douglas said the fundamentals for his military’s troops consist of trainings in discipline, leadership, communication, and shoot and kill crafts. “Those don’t change,” Douglas said at LANPAC. “How you integrate all of that into technology is what changes.”



Royal Thai Armed Forces Soldiers and a U.S. Army sergeant create fire using friction during a jungle survival training exercise as part of Cobra Gold in Thailand.

STAFF SGT. DAVID N. BECKSTROM/U.S. ARMY



CORE TENETS

Some new recruits with the Japan Ground Self-Defense Force (JGSDF) only train with rudimentary tools before ever integrating technology. JGSDF rangers, for example, use paper maps and compasses, not GPS, said Warrant Officer Susumu Takahashi.

“We educate basic map and compass land navigation capability without the use of GPS or assuming the GPS is not available,” Takahashi said at LANPAC. “Training this way also develops a better sense of direction and ingrains essential concepts like cardinal directions, maneuvering through woods or other various terrain. In subterranean facilities, in which many radios have problems maintaining connections, we verified the effectiveness of setting a lot of ad hoc relay points and using hard-line wires. Also, we sometimes rehearse hand-and-arm signals to maintain communication as alternative solutions.”

The JGSDF has what Takahashi called a “unique education system,” referring to an intensive instruction called “preparation course.”

Before entering a new educational course, JGSDF candidates must attend preparation courses at their home unit to receive repetitive and intense training on how to lead a squad or small group of Soldiers. Once trainees have developed their confidence and fundamental skills, they can enter a primary educational course.

“It has been 35 years since I enlisted in the JGSDF, and the core elements of the education have not changed,” Takahashi said. “It is significant for all NCOs [noncommissioned officers] and enlisted to master the basics and fundamentals of combat skills and knowledge to accomplish given tasks successfully. Accumulation of these repeated trainings would add up to make a big difference and become strength to be agile and intellectually prepared.”

When it comes to agility and adaptability, Indo-Pacific countries with fewer resources to afford the latest technology may find themselves at an advantage because many of them are adept at fundamental skills. Take, for example, countries where jungle warfare training is routine, like Thailand.

JUNGLE SKILLS

Thai Marines teach other militaries how to capture, kill and survive on animals they might encounter in a jungle. They also train Soldiers on which jungle plants and insects are edible should the need arise. The lively real-world scenario and constantly changing elements push Soldiers to lean further into their basic training skillset.

“You have to take every situation separately. Understand the concept of operations, each piece of it and why it’s important,” Mansker said. “Train differently depending on the relationship and the



organization you're supporting. If you know an organization's strengths and weaknesses, you can adjust and adapt."

That adjustment could include spending more time reviewing training in a particular area that a partner nation in an upcoming mission may not be as strong. Regardless of the situation, Mansker said, troops should train for the worst day of war and the best day of war.

"It's hard to train that way. It proves and helps us understand where our weaknesses are," he said. "We should be able to [be] put in rain, snow, elevation, fog and adapt. We've come to a point where maybe we're a little bit too game-ish and less training to the actual environment we're going to face."

Jungle warfare training in Thailand shocks the system of troops by thrusting them into an unpredictable and real-life training environment. The jungle terrains of Thailand add an element of noncombat ways a person can die, but Thai Marines have such skillful jungle warfare training that they pass on those skills during multinational exercises like Cobra Gold.

"The jungle itself provides a very dynamic environment in which not a lot of people are accustomed," said Cpl. Caleb Buck, a U.S. Marine rappelling instructor at the Jungle Warfare Training Center in Okinawa, Japan.



A Royal Thai Marine cooks various animals over a fire pit as part of jungle survival training during exercise Cobra Gold 2019 in Thailand. STAFF SGT. MATTHEW J. BRAGG/U.S. MARINE CORPS

A Japan Ground Self-Defense Force sniper takes aim at a target during Orient Shield 2019 as part of a training exercise to refine basic Soldiering skills and multi-domain (cross-domain) operations. PFC. EDWIN PETZKE/U.S. ARMY

U.S. military personnel use paper maps during 2019 training at the 3rd Marine Regiment Jungle Warfare Training Center in Okinawa, Japan. STAFF SGT. PETER REFT/18TH WING PUBLIC AFFAIRS

MANAGING MASTERY

Through it all, LANPAC panelists said providing basic skills to new recruits requires a certain level of metered expectations and discernment when deciding how much time to spend on any given fundamental.

"Not everybody is trained to excellence on everything," Mansker said, adding that to become a master at something, a person has to do it 10,000 times.

"So, when we talk about repetition and training to become a master, can you really become a master at 17 things when you are only going to do one?" Mansker continued. "This is where commander's intent comes in. What is your purpose? Be a lot more directive and specific on the things you're going to put the time and repetition to that you can do well. The repetition versus time spent on training has to go to the person who will execute it." □

SYMBIOTIC ADVANTAGE



FORUM ILLUSTRATION

Human-Machine Military Teams Harness the Best of What Each Offers

FORUM STAFF
PHOTOS BY THE ASSOCIATED PRESS

Gone are the days of turning to science fiction to glimpse a future in which the artificial intelligence (AI) of machines rivals the brain power of mankind.

“Artificial intelligence is already here,” said Brig. Gen. Matthew Easley, director of the U.S. Army Futures Command and AI Task Force. “There’s huge AI applications in your hand as you hold your smartphone. It’s both in your device and in all the systems that it’s connected to.”

Defined simply, AI represents any type of computing system used to augment decision-making — including the ability to make decisions on its own.

Researchers working to harness AI for military applications say armed forces remain years away from deploying machines with 100% decision-making capabilities in the battlefield. The future of multi-domain operations (also known as cross-domain operations) will instead consist of “centaur” teams, where man and machine bind the top abilities of each for optimal performance.

“The fact that the best human chess players can no longer beat super computer chess players is old news. What’s less old news is that amateur chess players who have computers that you can buy at Best Buy are beating both grand master chess players and the best super computers in chess,” Broc Perkuchin, a retired U.S. Army colonel who held command and staff positions in engineering and logistical organizations in the Middle East, Asia and the United States, said during the Land Forces Pacific (LANPAC) Symposium and Exhibition held in May 2019 in Honolulu, Hawaii. “That’s because these teams, these human-machine teams, dubbed centaurs after the mythical creature that’s half man, half horse, bring the best of what humans have to offer — intuition, judgment and creativity — and they bring the best of what machines have

“This isn’t about artificial intelligence replacing Soldiers, and this isn’t about Soldiers using artificial intelligence as tools. It’s about a physically and mentally integrated symbiotic relationship, where each brings the best that they have to offer to the fight. Ultimately, it’s about machines and humans helping each other think.”

~ COL. BROCK PERKUCHIN, U.S. ARMY, RETIRED

to offer in terms of data processing speed and capacity.”

From the military’s perspective, these centaur teams must be integrated to seemingly function as one body and one mind, said Perkuchin, who now works for Cougaar Software Inc. as vice president of government solutions and leads the company’s efforts to enhance the U.S. Department of Defense’s operational performance through application of the company’s multiagent systems AI technology.

“This isn’t about artificial intelligence replacing Soldiers, and this isn’t about Soldiers using artificial intelligence as tools,” Perkuchin said. “It’s about a physically and mentally integrated symbiotic relationship, where each brings the best that they have to offer to the fight. Ultimately, it’s about machines and humans helping each other think.”

AI Training

Beyond research and development, proper implementation of AI into multi-domain operations requires a vetted process, infrastructure, network, policies and people, said Easley, who served as chairman of the AI and autonomous capabilities panel during LANPAC.



Nicholas Otero points out features on a so-called centaur robot at Endeavor Robotics in Chelmsford, Massachusetts. These robots won't fight, but they will be designed to help the men and women who do.

Part of the process, Easley said, requires deep learning. That involves joint training of Soldiers and AI. Take for example, rifleman training. A Soldier would use a smart scope with technology similar to a smartphone that would collect data on Soldier performance to help predict accuracy and even identify the best shooters in a unit.

Deep learning also involves discovering how the machine works and teaching it how to learn as it collects data.

Developers still have to train machine models how to identify help versus harm, fear and other emotions as well as physical objects in a scenario. Experts warn that establishing that baseline knowledge for AI should remain objective, because data manipulation on any level and by any means presents challenges and the risk of injecting false or harmful information. Humans come with their own biases. Inventors must be careful not to introduce those biases into AI components.

"Any technology — or, really, anything that we build — reflects the values, the norms, and,

of course, the biases of its creators. We know that the people who build AI systems today are predominantly male, white and Asian, and a lot of the innovations come out of the United States," said Douglas Yeung, a social psychologist at Rand Corp. whose specialty includes human behavior. "People have expressed concern that this could potentially introduce bias. It's of concern because AI, by its very definition, can have broader impact. We should be asking, 'What might be the unintended consequence of bias?'"

Managing Bias

Companies have realized that they can't train facial-recognition technology by mainly using photos of Caucasian men because that feeds a bias into the algorithms, explained Osande A. Osoba, a Rand information scientist with a background in the design and optimization of machine learning algorithms.

"But better training data alone won't solve the underlying problem of making algorithms achieve fairness," Osoba said.

“Algorithms can already tell you what you might want to read, who you might want to date and where you might find work. When they are able to advise on who gets hired, who receives a loan or the length of a prison sentence, AI will have to be made more transparent — and more accountable and respectful of society’s values and norms. Accountability begins with human oversight when AI is making sensitive decisions.”

Perkuchin agreed. “There’s no switch where we say now, we do everything with AI. Make sure the right verification techniques are in place,” he said. “There’s a difference between decision enablement and the actual decision. We’re far away from the autonomous decision whether to shoot or not to shoot or make a particular action.”

Accordingly, it’s important to design products that enhance a Soldier’s performance and not make his life more difficult, Easley said. “Provide only what’s necessary so that Soldiers can win and have decision advantage to operate at the highest level against the risks as they unfold,” Easley said.

Soldiers, not machines, should maintain final decision-making authority, he added. “You still need to apply [a] commander’s judgment. The laws of war don’t go away. Design systems that still allow for the human operator to make the decision.”

Future Applications

Three potential applications of AI at the operational level illustrate wide-ranging applications for the military: omnipresent and omniscient autonomous vehicles; big-data-driven modeling, simulation and wargaming; and focused intelligence collection and analysis, according to Zachary S. Davis, a senior fellow at the Center for Global Security Research at Lawrence Livermore National Laboratory and a research professor at the Naval Postgraduate School in Monterey, California. He expounds on them in a March 2019 report titled “Artificial Intelligence on the Battlefield: An Initial Survey of Potential Implications for Deterrence, Stability and Strategic Surprise.”

Exploiting the new generation of autonomous vehicles is a high priority for military application given the focus on navigation for a variety of unmanned land, sea and air systems, Davis contends. “Autonomous vehicles and robotics are poised to revolutionize warfare,” Davis wrote. “AI-informed navigation software supported

by ubiquitous sensors enables unmanned vehicles to find their way through hostile terrain and may eventually make it possible for complex formations of various types of drones to operate in multiple domains with complementary armaments.”

Easley shared similar sentiments during LANPAC, when he said, “Let the robot do the dirty and dangerous work. Don’t put Soldiers at risk. Use drones or other hardware.”

Where big data and simulation are concerned, models have enabled scientists to confirm the reliability of nuclear stockpiles without nuclear testing, for example.

“Simulation and modeling [are] already a key part of the design process for nearly all major weapons systems, from jets and ships to spacecraft and precision-guided munitions,” Davis wrote. “Massive modeling and simulation will be necessary to design the all-encompassing multi-domain system of systems envisioned for battle management and complex missions such as designing, planning and managing systems for space situational awareness.”

For intelligence collection and analysis, machine learning will remain an important tool to all analysts who consider information from a combination of sources, locations and disciplines to understand the global security environment, Davis wrote. “Machine learning also makes it possible to combine open-source trade and financial data with multiple forms of intelligence to glean insights about illicit technology transfers, proliferation networks, and the efforts of proliferators to evade detection. These insights enable analysts to inform policy makers and support counterproliferation policy and actions.”

Insights gleaned from AI also have practical applications in the field, according to Perkuchin. AI can help locate the golden needle, predict when a platform will break and eliminate communication problems between armies that don’t speak the same language, he said.

“Most significantly, a broader application of artificial intelligence helps multi-domain operations commanders achieve convergence, which is a rapid and continuous integration of capabilities in all domains. That is a key to a centaur army that will best deploy AI.”

After all, Perkuchin concluded, “It’s a human-machine team for the next many years that will yield the most power. Elevate a Soldier, elevate a command environment.” □



Linking **HUMANS** *and* **MACHINES**

Soldiers could control defense systems with their minds

FORUM STAFF

The arrival of user-friendly computer tablets, smartphones and smartwatches accelerated the adoption of wearable technologies that provide everything from biometric monitoring of blood pressure, heart rates and hours slept to weather updates and navigational guidance.

The world's militaries have taken this technological evolution to new levels with increasingly sophisticated human-machine interfaces, such as wearable devices that diagnose and treat combat illnesses and wounds, augmented reality programs that aid battlefield decision-making and exoskeletons to help Soldiers increase their strength and endurance. A growing field of research promises a much deeper connection between humans and machines.

Defense researchers are developing neurotechnology that could one day enable warfighters to interact with artificial intelligence-enabled machines without the need for a keystroke, voice command or even flipping a switch. Using neural interface technology, pilots theoretically could control swarms of unmanned aerial vehicles (UAVs) using only their minds.

"Neural interfaces are tools for conveying information to and from a human and a machine," Dr. Al Emondi, program manager at the Biological Technologies Office at the U.S. Defense Advanced Research Projects Agency (DARPA), said in an interview with the Nextgov.com website. "The concept is roughly similar to any other means of communicating with a computer

or smartphone to accomplish a task — think about voice commands, a touch screen, a keyboard or a mouse — but this technology bypasses the intermediate step of a physical action."

Emondi now leads a DARPA effort called the Next-Generation Nonsurgical Neurotechnology (N3) program, which aims to eliminate the need for physical action to operate defense systems.

"What neural interfaces promise is a richer, more powerful, and more natural experience in which our brains effectively become the tool, enabled by the interface system," Emondi said. "For the first time, rather than adapting ourselves to the tools we use to accomplish a task, neural interfaces have the potential to adapt to us."



Researchers at the U.S. Defense Advance Research Projects Agency say that pilots may one day be able to control swarms of unmanned aerial vehicles with their minds. DARPA ILLUSTRATION

“These wearable interfaces to connect human brains with computers ultimately could enable diverse national security applications such as control of active cyber defense systems and swarms of unmanned aerial vehicles, or teaming with computer systems to multitask during complex missions.”

~ DARPA



A researcher at the French National Center for Scientific Research tests a brain-computer interface. The interface allows the user to select symbols on a screen without using voice or hand commands.

AFF/GETTY IMAGES

Brains Linked In

DARPA's four-year N3 program involves six organizations that hope to develop noninvasive or “minutely” invasive neural interfaces. “These wearable interfaces to connect human brains with computers ultimately could enable diverse national security applications such as control of active cyber defense systems and swarms of unmanned aerial vehicles, or teaming with computer systems to multitask during complex missions,” DARPA's website states.

The government is working with Battelle Memorial Institute, Carnegie Mellon University, Johns Hopkins University Applied Physics Laboratory, Palo Alto Research Center, Rice University and Teledyne Technologies on the N3 program. Until now, neural interfaces have been surgically invasive and mostly used to restore motor functions to injured troops. The goal of the N3 project, however, is to quicken data processing and decision-making without surgery for use on able-bodied Soldiers.

The technology could give Soldiers and commanders a “superior level of sensory sensitivity and the ability to process a greater amount of data related to their environment at a

faster pace, thus enhancing situational awareness,” according to an August 2019 article by Chatham House, an independent policy institute in London. “These capabilities will support military decision-making as well as targeting processes.”

The challenge for DARPA's partners is to eliminate the need for surgery. “DARPA has made impressive progress in recent years demonstrating what is possible using electrodes implanted in or on the brain for the purpose of restoring function to ill or injured service members and veterans,” Emondi said. “However, because of the inherent risks currently involved with brain surgery, these invasive technologies are not ethically justifiable except in cases of medical necessity.”

The N3 teams are all pursuing projects that would make brain signals easier to read, such as developing injectable, inhaled or ingested nanoparticles that would bind to neurons and amplify the signals. The signals would be read by a system placed in a cap or embedded in a headrest.

In addition to controlling ground robots or drone swarms, the technology could allow militaries to monitor a complex cyber network

with a neural interface or keep up with huge flows of data by presenting information in a digestible way at machine speed, DARPA officials said.

Leading one of the teams is a scientist from the Indo-Pacific region. India native Gaurav Sharma, a senior research scientist at Battelle, is leading a team that won a U.S. \$20 million contract from DARPA to develop a system that could allow a Soldier to control multiple UAVs or a bomb disposal robot with his thoughts. Battelle's N3 program has been named BrainSTORMS (Brain System to Transmit Or Receive Magnetolectric Signals).

"This is one of the most exciting and challenging projects I have worked on," Sharma said, according to a May 2019 report in *The Tribune*, a newspaper in northern India. "With BrainSTORMS, we will again be pushing the limits of engineering and physics."

Global Quest

The idea of improving human learning, healing, performance and decision-making through neural interface technology is drawing worldwide interest. The People's Republic of China reported in May 2019 that its scientists had

achieved a breakthrough with a brain-computer interface (BCI) chip, according to state news agency Xinhua. Called Brain Talker, the technology debuted at the World Intelligence Congress in northern China.

Brain Talker allows a person to control a computer or electronic device using only brainwaves, Xinhua reported. Co-developed by Tianjin University and China Electronics Corp., Brain Talker identifies minor neuron information sent by the brainwave from the cerebral cortex and then decodes the information and speeds up the communication between the brain and the machine. The scientists hope to enhance the chip for use in the fields of medicine, education and gaming.

South Korea is conducting similar research at the Brain Signal Processing Lab of Korea University. Researchers there are using magnetic resonance imaging, commonly known as an MRI, and electroencephalography with a goal of constructing either a brain-computer interface or a brain-machine interface. The lab wants to use data analysis and machine learning to diagnose psychiatric conditions and neurological diseases,

including mild cognitive impairment, Alzheimer's disease, sleep disorders, epilepsy and depression.

Two U.S. companies are even researching how neural interface technology can improve driver safety. Trimble Inc., based in California, and Massachusetts-based Neurable Inc. have entered a partnership to explore the use of brain-computer interfaces that will track brain signals and eye movements to improve training efficiency and driver safety.

Expedited Recovery

While controlling robots with brain waves could be on the horizon for able-bodied troops, injured Soldiers can also benefit from neural technology advances. DARPA in February 2019 launched a program geared toward smart and adaptive wound recovery through the use of bioelectronics, artificial intelligence, biosensors, tissue engineering and cellular regeneration. The Bioelectronics for Tissue Regeneration (BETR) program aims to limit the prolonged pain and hardship for Soldiers who suffered blast injuries and burns.

"Wounds are living environments, and the conditions change quickly as cells and tissues communicate and attempt to repair," BETR program manager Paul Sheehan said in a statement. "An ideal treatment would sense, process and respond to these changes in the wound state and intervene to correct and speed recovery. For example, we anticipate interventions that modulate immune response, recruit necessary cell types to the wound or direct how stem cells differentiate to expedite healing."

DARPA intends to use any available signal — optical,



Quadriplegic Nathan Copeland underwent surgery to have four microelectrode arrays placed in his brain. The arrays connect to a robotic arm, which contains sophisticated sensors that detect pressure applied to its fingers.

UNIVERSITY OF PITTSBURGH MEDICAL CENTER/
PITT HEALTH SCIENCES

biochemical, bioelectronic or mechanical — to monitor physiological processes and then stimulate them to bring healing and speed recovery.

“To understand the importance of adaptive treatments that respond to the wound state, consider the case of antibiotic ointments,” Sheehan explained. “People use antibiotics to treat simple cuts, and they help if the wound is infected. However, completely wiping out the natural microbiota can impair healing. Thus, without feedback, antibiotics can become counterproductive.”

Restoring Limb Control

Civilians and Soldiers who have lost the function of their limbs or have undergone amputations are also benefiting from BCI technology. Scientists in Japan are using it to improve the limb function of stroke patients. Researchers at Tokyo University of Agriculture and Technology have found that stroke patients who observe their own hand movements in video-assisted therapy can speed up rehabilitation.

A stroke can paralyze a patient by obstructing blood flow to the brain, so promoting brain plasticity where a healthy region of the brain fulfills the function of a damaged region can help a person recover motor functions, the scientists said in a July 2019 reported in *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, a monthly peer-reviewed scientific journal. To promote plasticity, stroke patients may incorporate motor imagery, which allows them to mentally simulate an action by imagining themselves going through the motions. BCI technology detects and records the motor intention while they observe the action of their own hand or the hand of another person.

Neural interfaces also are being used to improve the function of prosthetic limbs. Researchers working on DARPA's Hand Proprioception and Touch Interfaces program are using peripheral nerve implants to

A military veteran demonstrates the Life Under Kinetic Evolution arm system, which promises near-natural arm and hand motion. The arm is part of the Revolutionizing Prosthetics Program at the U.S. Defense Advanced Research Projects Agency. DARPA



give amputees direct access to natural control signals and “enable more natural, intuitive control of complex hand movements, and the addition of sensory feedback will further improve hand functionality by enabling users to sense grip force and hand posture,” DARPA said in a news release.

Setting Ethical Parameters

Brain research has generated increasing publicity as high-profile players such as Tesla billionaire Elon Musk and Facebook have unveiled brain-machine interface projects. Musk established a company called Neuralink, which in July 2019 revealed a project to use a brain-machine interface to help paralyzed people type with their minds. Facebook, on the other hand, is working on a noninvasive, wearable device that would allow people to type by simply imagining themselves talking.

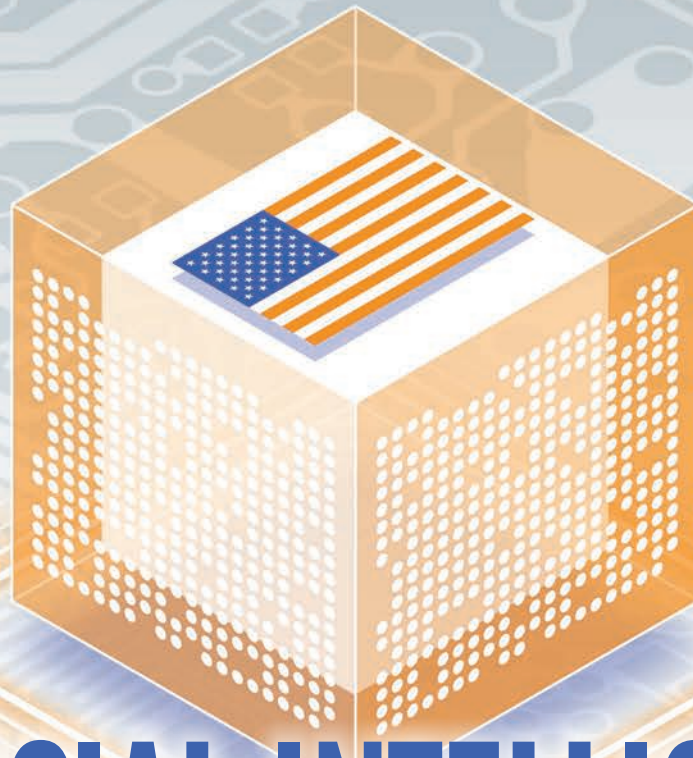
These new frontiers raise fundamental ethics questions. One concern, according to ethicists, is that linking machines with a human brain could raise a question about whether that person remains self-governing.

“In the case of a device for monitoring blood glucose that automatically controls insulin release

to treat diabetes, such decision-making on behalf of a patient is uncontroversial,” stated a July 2019 article in the scientific journal *Nature*. “But well-intentioned interventions in the brain might not always be welcome. For instance, a person who uses a closed-loop system to manage a mood disorder could find themselves unable to have a negative emotional experience, even in a situation in which it would be considered normal, such as a funeral.”

While it's common for militaries, governments and research hospitals to work with ethicists to establish ethical guidelines for applying new technology, commercial operations are often “notoriously covert and subjected to minimal oversight,” the *Nature* article said.

A key challenge will be how much effort countries exert to maximize the potential of the technology while still protecting privacy. Digitally stored brain data could be stolen by hackers or used by companies to whom users grant access, said ethicist Marcello Ienca at the Swiss Federal Institute of Technology in Zurich, according to the *Nature* report. “Brain information is probably the most intimate and private of all information,” Ienca said. □



ARTIFICIAL INTELLIGENCE

U.S. strategy seeks to promote an international environment that supports AI research and development

FORUM STAFF

The United States leads the world in artificial intelligence (AI). The People's Republic of China (PRC), despite its ambitions, has failed to capture the top spot, but the competition is intensifying.

Experts predict that AI, along with powering the world's future economic base, will revolutionize the future battlespace by enabling machines to act without human supervision, process and interpret massive amounts of data, and enhance the command and control of warfare. With the stakes being economic and military supremacy and control of technologies that can be applied for social control, the U.S. has moved to counter the PRC threat and maintain its AI dominance.

"If you look at industry output, if you look at the leading academic institutions that are leading the way and advancing the state of the art and AI, they're American industries and they're American academics," Lynne Parker, the White House coordinator on AI policy, told Politico, a U.S. political journalism website, in July 2019.

"We're clearly producing the most impactful commercial products. And certainly, that's not to say that the rest of the world isn't waking up to the great opportunities of AI — but clearly, the United States is in the lead."

A study released in August 2019 by the Center for Data Innovation (CDI), a global think tank based in Washington, D.C., confirmed U.S. leadership in AI in talent, research, development and hardware, among other parameters.

"Despite China's bold AI initiative, the United States still leads in absolute terms; China comes in second, and the European Union lags further behind," said the 106-page report, titled "Who is Winning the AI Race: China, the EU or the United States?"

The PRC's State Council released a strategic plan in 2017 to rival the U.S. in AI by 2020 and assume world leadership in AI technology by 2025, although the plan didn't specify what such leadership might look like. The CDI report found China trails the U.S. in many metrics despite the PRC's plan to invest U.S. \$150 billion in AI by 2030, as part of Chinese President Xi Jinping's Made-in-China push.

The U.S. "has the most AI start-ups, with its AI start-up ecosystem having received the most private equity and venture capital funding," the CDI report said. The U.S. "leads in the development of both traditional semiconductors and the computer chips that power AI systems; while it produces fewer AI scholarly papers

Then-U.S. Energy Secretary Rick Perry speaks about the importance of U.S. leadership and public-private partnerships in artificial intelligence at an August 2019 forum.

THE ASSOCIATED PRESS

than the EU or China, it produces the highest-quality papers on average.” The PRC still lags behind on most metrics, especially on a per capita basis.

Moreover, the U.S. has the leading AI talent in the world, although the EU has access to more AI talent, the report found. The PRC lags behind both the U.S. and EU in talent.

The PRC has collected more civilian data than the U.S. and EU, and its population is adopting AI more rapidly, according to the report. However, its policies such as civil-military integration will hinder its success in the global market because the PRC’s practices foster distrust in other societies, the report said.

Russia, under President Vladimir Putin, has also been investing in AI, especially for military purposes. However, its efforts trail the rest of the world because it has failed to establish the required culture of innovation, according to analysts. Putin openly asserted “whoever becomes the leader in this sphere will become the ruler of the world.” Ironically, many of Russia’s leading innovators have fled Russia for the U.S. and Europe, according to a June 2019 report by the website Defense One.

U.S. AI Strategy

To protect the U.S. competitive advantage in AI technology, the U.S. Department of Defense (DOD) introduced its AI strategy in February 2019, in conjunction with the White House issuing an executive order creating the American AI Initiative, which calls for the administration to “devote the full resources of the federal government” to propel AI innovation. The White House also created a National Security Commission on AI that first convened in March 2019.

The U.S., along with its allies and partner nations, must adopt AI to dominate the future battlespace and ensure not only a free and open Indo-Pacific but also an international order. The U.S. Pentagon’s budget for 2020 allocates U.S. \$927 million for AI and about U.S. \$3.7 billion for AI-driven unmanned and autonomous capabilities. Meanwhile, leading U.S. technology companies taken together have been investing tens of billions of dollars in AI in recent years. For example, large tech invested roughly U.S. \$20 billion to U.S. \$30 billion



in AI in 2016, *The Economist* magazine reported.

“The success of our AI initiatives will rely upon robust relationships with internal and external partners, interagency, industry, our allies and the academic community will all play a vital role in executing our AI strategy,” Dan Deasy, DOD’s chief information officer, said on the launch of the strategy.

“It’s hard to overstate the importance of operationalizing AI across the department, and to do so with the appropriate sense of urgency and alacrity,” added Lt. Gen. John N.T. Shanahan, director of the Joint Artificial Intelligence Center (JAIC), which began operation in June 2018 to drive AI capability across the DOD. “Everything we do in the JAIC will center on enhancing relationships with industry, academia, and with our allies and international partners.”

Shanahan previously led the Pentagon’s pathfinder intelligence project on AI and machine learning, known as Project Maven.

Daniel Castro, CDI’s director, called for expansion of the U.S. AI strategy to cover digital free trade, data collection practices and other related issues.

“If the administration wants its AI initiative to be transformative, it will need to do more than reprogram existing funds for AI research, skill development, and infrastructure development,” Castro, who was a lead author on the August 2019 report on AI competitiveness, told The Associated Press (AP). The CDI report also recommended that the DOD create a body of government and industry stakeholders to accelerate adoption of dual-use AI technologies by the military.

“By consolidating expertise, DOD can better prioritize projects, focus on solving scaling issues, and develop a culture of AI-driven innovation within DOD,” Castro told *FORUM*. “In addition, the U.S. government should consider joint funding initiatives with allies around the globe to foster research collaboration.”



Some analysts worry that the PRC's edge over the U.S. and its allies and partners in data collection, due in large part to the PRC's endeavors to amass data on its citizens for social control purposes, could wend its way to the future battlespace. However, the utility of civilian data for critical military applications is likely limited, others contend.

"What I don't want to see is a future where our potential adversaries have a fully AI-enabled force and we do not when it goes back to this question of time and decision cycles, and I don't have the time luxury of hours or days to make decisions. It may be seconds and microseconds where AI can be used to our — to our competitive advantage," JAIC's Shanahan said at a late August 2019 DOD briefing. "I doubt I will ever be entirely satisfied that we're moving fast enough when it comes to DOD's adoption of AI. My sense of urgency remains palpable."

Ethics and Oversight

Many nations are concerned about how AI technologies might be used in the future, not only in battle, but also by governments and authoritarian regimes. The U.S. has pledged to deploy AI in keeping with American values, and the Pentagon is working with industry and academia to set ethical guidelines for AI applications, according to AP.

The U.S. is "using [AI] technology to help speed up the process but not supplant the command structure that is in place," Todd Probert, an executive at Raytheon's intelligence division, told the AP in February 2019. His firm is working with the Pentagon on various AI projects,

including Project Maven, which is employing deep learning and other techniques to analyze video for actionable intelligence.

Many Western governments are working to ensure that humans remain in the command loop. However, some military experts are wary of where the technology may lead, given that emerging capabilities could exceed those of human cognition. Linked AI systems could then take the battlespace to a new level of automation.

"It seems likely humans will be increasingly both out of the loop and off the team in decision-making from tactical to strategic," Wing Commander Keith Dear, a Royal Air Force intelligence officer, told *The Economist* in September 2019.

The Organization for Economic Co-operation and Development (OECD) adopted the first international standards on AI in May 2019 to guide how the technology will evolve and be employed. Forty-two nations, including the U.S., agreed to the OECD principles. In June 2019, the G20 adopted human-centered AI principles drawn from the OECD principles. Meanwhile, the PRC, through its National New Generation of Artificial Intelligence Governance Committee, released its own principles that are similar to those of OECD. However, many experts worry that the way the PRC and some other countries interpret ethical issues in the science and technology communities often varies from international

Villagers wait in line to have their photos taken for a facial data collection project with artificial intelligence applications in Jia, Henan province, China, in March 2019. REUTERS

norms. The PRC, for example, has drawn criticism for numerous ethical breaches in its research and application of technologies, ranging from its widespread use of fraudulent data to ill-advised experimentation with genetic-editing capabilities in humans and with monkey-human hybrids.

Already, the PRC's uses of AI-enabled facial and voice recognition technologies to monitor its Uighur community, a majority Muslim population in Xinjiang province, have drawn criticism for enabling the PRC to discriminate against the minority group by tracking movement of members through the country, storing their profiles in separate databases and placing them in so-called re-education camps, *The New York Times* newspaper and other media organizations have reported.

Surveillance State

As the PRC's economic growth has been slowing and signs of social unrest have been growing, the Chinese Communist Party has sought to tighten control over not only its 11 million Uighurs but also on its general population. In 2016, for example, the PRC introduced its so-called Sharp Eyes project to increase video surveillance throughout the nation with the goal of "coverage across all regions, sharing across all networks, availability at all times, and controllability at all points by 2020." At the time, roughly 176 million video surveillance cameras monitored China's streets, buildings and public spaces, compared with 50 million in the U.S., according to global consultancy IHS Markit. Cameras were already covering "every block in Beijing," according to the *Los Angeles Times* newspaper.

The PRC is also using AI applications to power its social credit scoring system, another tool to control its



Three unmanned aerial systems soar at Edwards Air Force Base, California. The U.S. Pentagon is developing craft that rely on artificial intelligence to collaborate in high-threat environments without human contact. STAFF SGT. RACHEL SIMONES/U.S. AIR FORCE

citizens, which is targeted to be fully operational in 2020. Using a secret methodology, the system, which is already partially in place, will monitor people's behavior, analyze the collected data and punish them by restricting travel, access to luxury items and other such perks, all on the basis of their scores.

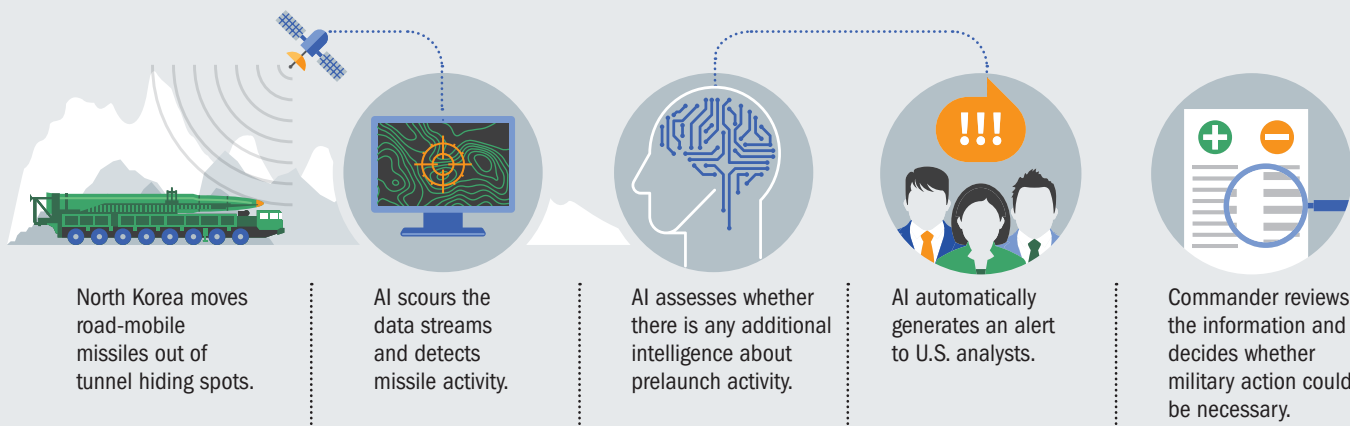
Not only is the PRC's use of AI technologies to control minority groups and its population at large troubling, but the PRC also is exporting such AI capabilities to other authoritarian regimes and countries in the international community.

The U.S. government, meanwhile, is working on a framework to regulate AI in the United States.

AMERICA'S PUSH TO USE AI

The U.S. military increasingly believes artificial intelligence (AI) can be used to help identify and target enemy missiles to speed a response to a North Korea-style missile launch and is funding research projects — some of them classified — to use AI to bolster U.S. defenses.

HOW IT COULD WORK — THE STEPS THEORIZED



REUTERS

“We always want to use AI in a way that’s consistent with civil liberties and privacy and American values. So clearly, we don’t want to become a surveillance state like China,” Parker, the White House coordinator on AI policy, told Politico. “On the other hand, the opposite extreme is to over-regulate to the point where we can’t use it at all.”

Other factors could stall the PRC’s AI ambitions, such as the nation’s lack of contribution to the theories employed to create the tools on which the field is being built and the reluctance of Chinese companies to invest in basic research, analysts contend.

The PRC, for example, still trails the U.S. in AI hardware; U.S. companies manufacture most of the

world’s AI-enabled semiconductor chips. The PRC also lacks “expertise in designing computing chips that can support advanced AI systems,” Zheng Nanning, director of the Institute of Artificial Intelligence and Robotics at Xi’an Jiaotong University, told the journal *Nature* in August 2019.

Moreover, the mere scale of the PRC’s investment thus far has not translated into real results. “The downside to having a centralized focused approach is that you get very quickly to an end goal that may be the wrong goal. The advantage of the American innovation ecosystem is that we allow many good ideas to be explored in depth and we can see which ones are going to be fruitful,” Parker told Politico.

ARTIFICIAL INTELLIGENCE RANKINGS

The U.S. leads the world in talent, research, development and hardware, but the People’s Republic of China has the edge in civilian data collection and adoption of AI, according to an August 2019 Center for Data Innovation report.

Category	United States	China	European Union
Absolute ranking	1	2	3
Ranking points	44.2	32.3	23.5
Ranking points (adjusted for workforce size)	58.2	17.5	24.3
Number of AI researchers (2017)	28,536	18,232	43,064
Number of top AI researchers (2017)	5,158	977	5,787
Highly cited AI patents	28,031	691	2,985
Patent Cooperation Treaty patent applications	1,863	1,085	1,074
Number of highly cited patents per 1 million workers	170	0.9	12
Number of AI papers (2017)	10,287	15,199	14,776
Top 100 software and computer service firms for R&D spending (2018)	62	12	13
R&D spending by software and computer service firms in top 2,500 (U.S. billions, 2018)	\$77.4	\$11.8	\$10.1
Number of acquisitions of AI firms (2000-2019)	526	9	139
Number of AI startups (2017)	1,393	383	726
Number of AI startups that received more than U.S. \$1 million in funding (2019)	1,727	224	762
Fixed broadband subscriptions (millions, 2018)	110	394	176
Number of individuals using mobile payments (millions)	55	525	45
Firms adopting AI	22%	32%	18%
Number of firms designing AI chips (2019)	55	26	12
Number of firms in the top 10 for semiconductor R&D spending (2017)	5	0	0
Number of supercomputers ranked in top 500 (2019)	92	219	116

Source: Center for Data Innovation, August 2019 report, “Who is Winning the AI Race: China, the EU or the United States?”
<https://www.datainnovation.org/2019/08/who-is-winning-the-ai-race-china-the-eu-or-the-united-states/>



AI Next

The U.S. government's Defense Advanced Research Projects Agency (DARPA) has historically succeeded by cooperating with the country's leading researchers and innovation centers to produce game-changing capabilities, ranging from the internet to GPS and self-driving cars. DARPA is continuing to apply its winning research and development formula to AI. In 2018, DARPA unveiled its AI Next program to invest U.S. \$2 billion on AI-related research over five years, which is to be strategically allocated to help usher in the next wave of AI to produce machines that understand and reason in context.

"With AI Next, we are making multiple research investments aimed at transforming computers from specialized tools to partners in problem-solving," according to DARPA director Dr. Steven Walker. "Today, machines lack contextual reasoning capabilities, and their training must cover every eventuality, which is not only costly but ultimately impossible. We want to explore how machines can acquire human-like communication and reasoning capabilities, with the ability to recognize new situations and environments and adapt to them."

"Within this U.S. \$2 billion that we're spending, it's across a very wide range of projects — no two of which are alike — and so we're placing a lot of strategic bets on technologies that may emerge in the future," said John Everett, DARPA's deputy director of the Information Innovation Office, according to Politico. "A lot of the money that's going into the research in China seems to be going into pattern recognition. So, they will be able to do incrementally better pattern recognition by spending an

enormous amount of money on it. But there's a declining return to incremental expenditures."

"In today's world of fast-paced technological advancement, we must work to expeditiously create and transition projects from idea to practice," Walker said.

Earlier generations of DARPA AI research endeavors are already bearing fruits. The agency, for example, has succeeded in developing Real-time Adversarial Intelligence and Decision-making (RAID) software that can predict the goals, movements and possible emotions of enemy forces five hours into the future. RAID applies an aspect of game theory to reduce problems into smaller games, decreasing the amount of computational power needed to achieve a solution. In recent tests, the software outperformed human planners in terms of speed and accuracy and is close to being fielded for U.S. Army use.

U.S. thought leaders remain optimistic that U.S. ingenuity and values will prevail in shaping how AI is adopted worldwide in the future.

"Assuming that the U.S. does in fact learn how to draw on all of its talent and embrace a national identity that reflects the world, American traditions of individualism, openness, rebellion, and humanism (notwithstanding a national infatuation with STEM [science, technology, engineering and math]) will offer the best chance of harnessing AI in the service of humanity rather than of private profits or public power. Or at least a better chance than China," Dr. Anne Marie Slaughter, president and chief executive officer of New America, a think tank dedicated to renewing America in the Digital Age, summed in an article published on the website slate.com in March 2019. □



AI Initiatives

FORUM *talks with Daniel Castro, director of the Center for Data Innovation, about U.S. competitiveness*

FORUM: *What does the United States need to do to maintain its lead in artificial intelligence [AI]?*

Castro: The U.S. needs a comprehensive national strategy on AI, which should include increased research and development [R&D] funding, targeted initiatives to increase skills in the workforce and educational pipeline, efforts to recruit and retain foreign AI workers, and a strategic effort to craft regulatory policies to enable more use of AI. On the regulatory side, this will especially require revamping policies allowing for the collection, use and sharing of data, both in the private sector and public sector.

FORUM: *What are your impressions of the U.S. artificial intelligence strategy?*

Castro: This administration's efforts are starting to gain steam. The executive order has kicked off a series of actions that will lead toward meaningful improvements in how the federal government lays the foundations for future work on AI. In addition, the recent [September 2019] White House AI summit was an important catalyzing event to spur enthusiasm and momentum across federal agencies to pursue their own AI efforts independently. As the administration makes it clear that there is top-level support for this work, more people in government will start making this a priority. Also creating AI.gov will help.

FORUM: *How do you think the U.S. strategy could be expanded?*

Castro: There is always more work to be done. One area is funding. It's difficult, if not impossible, to get a clear sense of how much some other governments are pouring into AI R&D, yet it is substantial. Congress needs to prioritize additional funding to supplement what the private sector provides and the "business as usual" funding it already offers to computer science and related disciplines. There is also a need to better track this funding across different agencies, particularly in relation to the various AI R&D priorities that the

administration has identified. A lot of R&D on AI will not come from the National Science Foundation, but from the Department of Energy, Health and Human Services, the Department of Transportation and other federal agencies. In addition, the U.S. government should consider joint funding initiatives with allies around the globe to foster research collaboration.

FORUM: *How important is the Joint Artificial Intelligence Center (JAIC) to U.S. competitiveness in AI?*

Castro: The JAIC will be especially important in the near-term as a lack of talent in the Defense Department [DOD] constrains what defense agencies can do with AI. By consolidating expertise, DOD can better prioritize projects, focus on solving scaling issues, and develop a culture of AI-driven innovation within DOD.

FORUM: *What is the bottom line of your recent report from the Center for Data Innovation?*

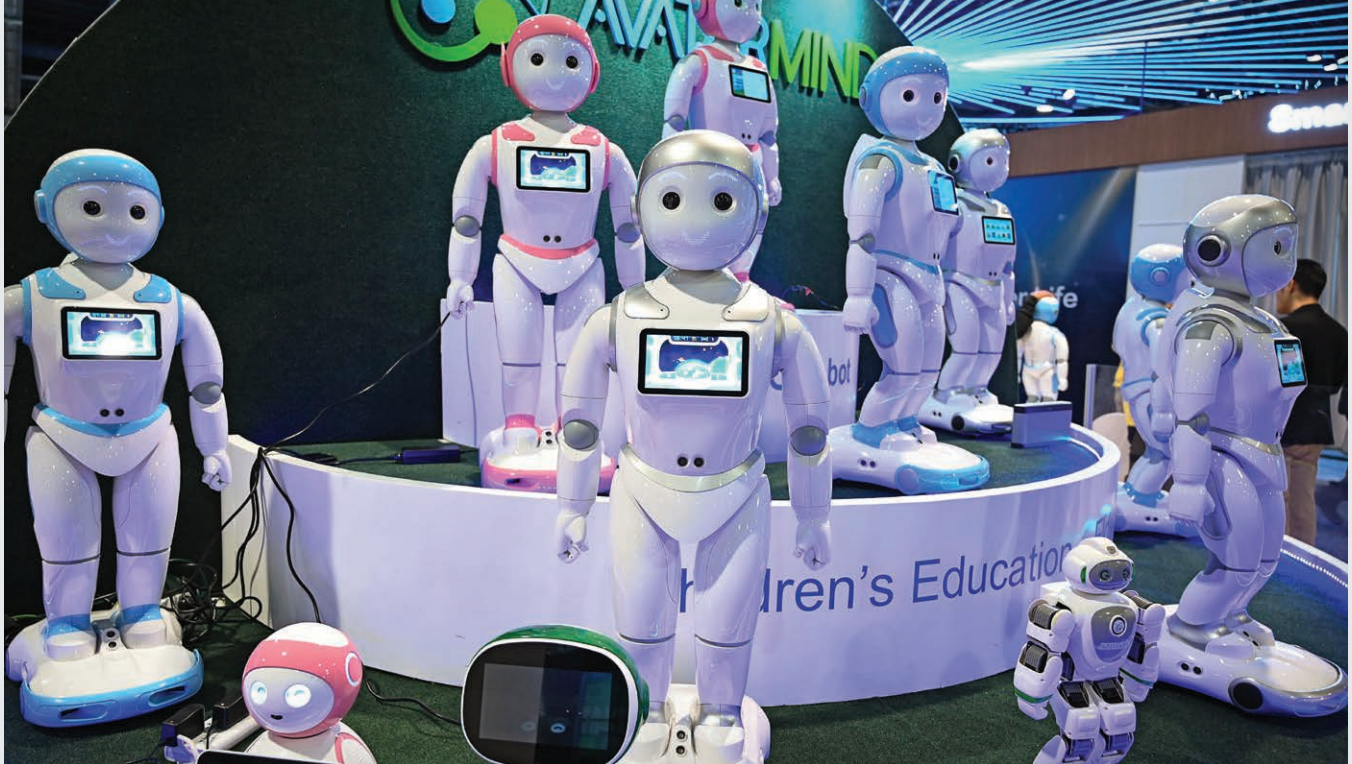
Castro: The U.S. has an early lead in artificial intelligence, but China is gaining fast, and if the U.S. does not commit the resources necessary to compete, it will squander its early lead. The implications of falling behind in AI could have seriously negative implications for the U.S. economy, national security, and overall global competitiveness. Many other countries are making AI a priority, and the U.S. needs to do so as well.

FORUM: *Are most people aware that the U.S. still leads China in absolute terms? Were your findings surprising in any way?*

Castro: China is further behind in some areas than I would have initially thought. Although it's important to note that this is a snapshot, and while we are using the most recent data, some of it is still about a year out of date. And even over the past few years, we have seen China making significant strides forward, so the gap between the countries is narrowing quickly. Moreover, both the U.S. and China have a lot of focus on using AI in the military, and much of that work cannot be publicly compared.

But one of the most significant factors is that China leads in adoption of AI, especially around piloting the technology. And public polls show that Chinese citizens generally are optimistic about AI. So, China has the wind at its back as it pursues ever more ambitious AI initiatives. In contrast, the U.S. public is more pessimistic about the potential of AI, which likely limits the willingness of lawmakers to pursue the technology.

FORUM: *How does Russia factor in this competition, especially in the realm of military technology?*



**Electronics Show
in Las Vegas,
Nevada, in
January 2019**

AFP/GETTY IMAGES

Castro: Russia is a big player, too, although not at the same scale as China, the EU or the U.S. From a geopolitical standpoint, the bigger concern is what are the implications for the U.S. if Russia and China

establish closer ties on AI. This is one reason why the U.S. needs to form close partnerships on AI with allies like Australia, Canada, France, Germany, Japan, South Korea and the U.K. [United Kingdom].

FORUM: *What role will Europe play in AI?*

Castro: Europe is a major force for AI research, and it is committing a lot of resources to this issue. From an economic standpoint, Europe right now is not as much of a threat to U.S. leadership in the field. But if European leaders revamp their AI strategies to focus more on commercialization and adoption, they could be a much stronger player.

FORUM: *What is the significance of China leading in adoption of AI and data?*

Castro: Adoption of AI is key for disrupting industries. The threat for most countries from China isn't just that it leads in AI development, but that by being a lead adopter of AI, it will be more competitive in traded sectors like financial services or health services. China beats a lot of other countries on data partially because of its size, but also because of its policies. But there are still big opportunities for China to increase data sharing, particularly government data to the private sector. So again, this is an area where countries like the U.S. should not only look to improving domestically, but also recognizing that to compete with China they will need to

form international partnerships with allies to ensure U.S. companies have access to global data sets.

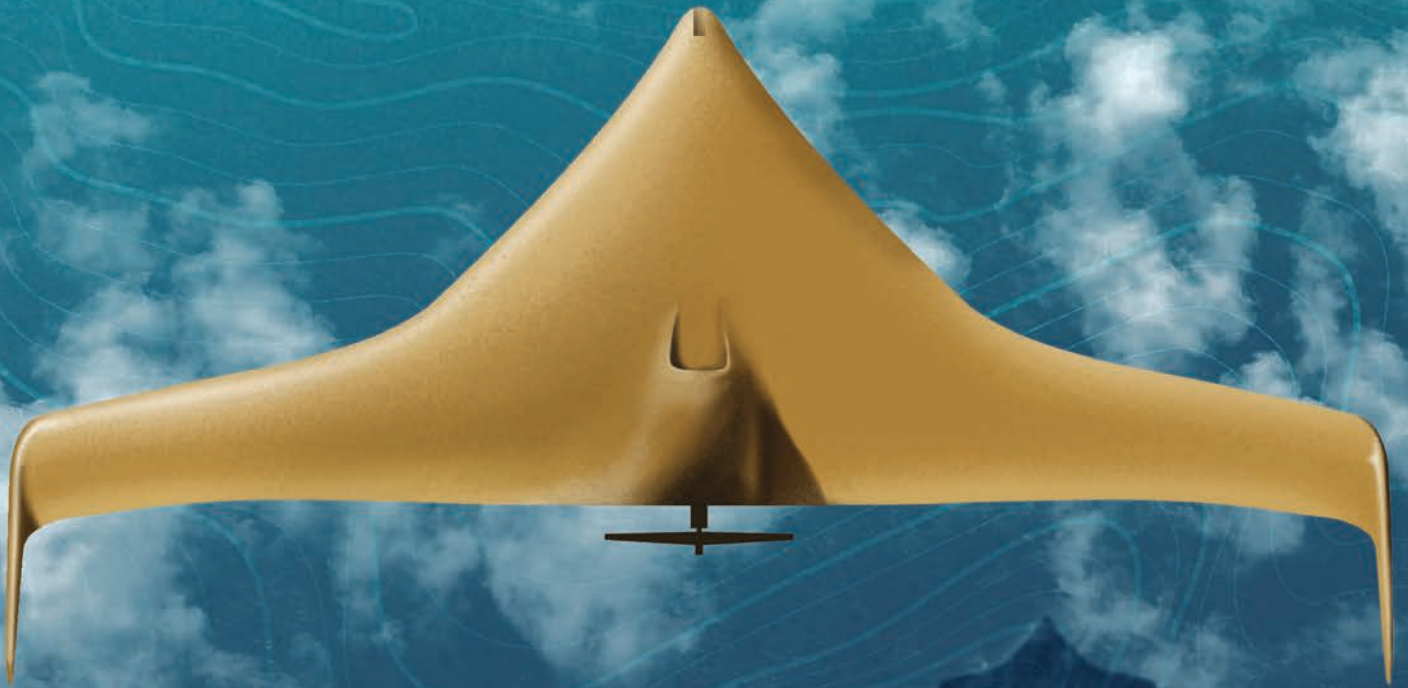
FORUM: *Do you think there is a need for an international ethics panel on AI?*

Castro: Many of the ethical questions about AI are going to be highly context specific. That is to say that questions about AI ethics are going to be related to how AI is used in self-driving vehicles or credit-risk scoring or other specific scenarios. So, countries should not try to develop a single forum for debating AI ethics, but rather recognize that sectors where AI is having a transformative effect will need to consider the ethical implications of using the technology. But even in these sectors, it is unlikely that the focus should be on ethics of AI, and instead on ethics of the larger system or process that is being used. Too often people get tunnel vision talking about AI ethics and ignore, or get distracted from, the broader ethical questions associated with a particular issue.

FORUM: *What do you think of U.N. or other international efforts to establish a ban on so-called killer robots? Do you think humans should be maintained in the decision-making loop?*

Castro: AI will be increasingly integrated into military and defense systems. Attempts to impose bans on the technology are likely misguided at this stage. Almost everyone agrees that no country should be unleashing unaccountable killer robots on the world. The harder question is deciding how much accountability is appropriate, under what conditions, and what the implications of those choices will be. Fortunately, there is still time to study this question and work toward developing global consensus and norms. □

FUTURE BATTLESPACE TECHNOLOGY



U.S. ARMY PACIFIC ADVANCES MULTI-DOMAIN
OPERATIONS, AUTOMATION AND DATA FUSION

STEVE KACHILLA/USARPAC FUTURES DIVISION

From an undeveloped island on the perimeter of the South China Sea, a Bat 12 unmanned aircraft system (UAS) rises from an open field. The catapult-launched, tactical low-observable/stealth aircraft makes its way over the water searching for a maritime target. The Bat 12 UAS operator, a U.S. Army sergeant, received her cue from a high-altitude balloon with passive electromagnetic sensing and another balloon that connects data feeds from U.S. Navy assets, both launched at sea hundreds of kilometers away. The targeteer, an Army sergeant 1st class sitting in the Multi-Domain Task Force (MDTF) Headquarters on a different island, integrated data from the air assets with sensors on maritime drones by using custom artificial intelligence (AI) and machine learning (ML) capabilities.

The Bat 12 operator and the MDTF targeteer both work in austere conditions. Both drink water from small-unit water purification systems, negating the need to transport potable water. Both draw power from micro-grid technologies that smartly distribute and store electricity using a combination of battery and power generation technology that enables mobility, decreases heat signatures and vastly reduces the need for logisticians to transport fuel. Autonomous land vehicles and lead-follow technologies reduce the sustainment operation's manning requirement.

Army watercraft that distribute supplies to the dispersed nodes of the MDTF are also equipped with electromagnetic and communications suites, contributing to MDTF resiliency. Any one of the craft can also be configured to launch UAS or serve as a firing platform for the High Mobility Artillery Rocket System (HIMARS). Onboard, a compact critical care facility is stocked and ready to receive a trauma team and their casualty to care for and transport across littoral waterways.

Data from Army-controlled sensors, along with information from other U.S. service platforms and space assets, pours into the MDTF and Intelligence, Information, Cyber, Electronic Warfare and Space (I2CEWS) G2 data integration center. Army intelligence analysts and data scientists sit side by side constructing and maintaining AI/ML programs that structure and collate terabytes of data in minutes, instead of having to send data across the ocean and wait for operational intelligence. The MDTF can now independently compare that data with other intelligence feeds from the coalition to maintain a multi-domain common operating picture (COP) and an organic MDTF targeting process, which in turn automatically updates all of the COPs that feed it.

The Bat 12 finds its target, provides visual confirmation and confirms that no civilian ships are in the vicinity. The MDTF COP updates the Joint Task Force COP, initiating a time-sensitive targeting process that looks for available shooters. The best weapon for the target is the MDTF's HIMARS multi-rocket launch system, located on yet another island. With a communication link provided by a separate UAS, the MDTF transmits targeting data and gives the command to fire, and a salvo of U.S. Army long-range anti-ship weapons launch into the sky. To avoid counterbattery fire, the HIMARS unit moves to an alternate firing position while I2CEWS assets conduct nonkinetic fires to mask and protect its movement.

THE BAT 12 FINDS ITS TARGET, PROVIDES VISUAL CONFIRMATION AND CONFIRMS THAT NO CIVILIAN SHIPS ARE IN THE VICINITY.

ORGANIZED FOR TECHNOLOGY

The pace of today's technological change has challenged U.S. military research, development and acquisition processes, and potential adversaries have leveraged technology to create significant capabilities that U.S. forces must overcome. The U.S. Army's answer to that problem is a multifaceted approach spurred by the realization that it "can no longer afford to defer modernizing our formations and capabilities without risking overmatch and the ability to accomplish our mission on future battlefields," according to the 2018 Army Modernization Strategy. Two of the most important changes the U.S. Army has made are organizational and conceptual. Organizationally, the U.S. Army has consolidated research, development and acquisition functions into the Army Futures Command, which acts as the Army's technology manager. Conceptually, it has adopted multi-domain operations (MDO) designed to "penetrate and disintegrate enemy anti-access and area denial systems" and "expands combined arms for a new strategic context, accounting for new technologies — most notably cyber, robotic and autonomous systems, and artificial intelligence — and adversaries who can contest all domains," according

to a December 2018 United States Army Training and Doctrine Command pamphlet.

The U.S. Army tasked the U.S. Army Pacific (USARPAC) headquarters with conducting the pilot program for the first MDO formation, the MDTF. Fortunately, USARPAC was already organized to address future concepts and future capabilities through its own Futures Division. The USARPAC Futures Division has special working relationships with national research and development organizations, industry, think tanks, Army and Defense Department analytical centers, allies and the joint force that it leverages to create experimentation opportunities in USARPAC and U.S. Indo-Pacific Command (USINDOPACOM) exercises, war games and studies. USARPAC endeavors to find ways to improve an MDTF's ability to conduct organic targeting for long-range precision fires while operating in an environment that limits communications and land maneuver.

Experimenting with automation, the Futures Division is devising ways to test the coordination of runway independent UAS to interact with ocean wave gliders, combining air and maritime automated sensing capabilities, comparing and contrasting data to positively identify maritime contacts. The resultant maritime domain awareness will provide an MDTF with the capability to share a common operating picture with the host nation and the joint force. During competition, it translates into the MDTF's ability to contribute to domestic law enforcement activities and, during heightened competition and conflict,

the ability to discern friend from foe for the MDTF, joint, and multilateral forces. As more unmanned and autonomous platforms become capable of remote launch, control and recovery, the Futures Division will find ways to put them in the hands of multi-domain operators at the lowest levels, thereby increasing capability, capacity, redundancy and lethality.

Sometimes, the best counter to a new technology is an old one. The USARPAC Space Division and Futures Division also coordinates with sister services and other combatant commands in the development of high-altitude technologies, such as balloons, dirigibles/airships, and solar fixed-wing platforms. These technologies provide substantial passive and active intelligence, surveillance and reconnaissance collection capabilities due to their dwell time and payload capabilities and create significant challenges to adversarial targeting. Balloons can be launched from nearby land features or ships or by the MDTF itself, carrying passive visual and electromagnetic sensing capabilities that further contribute to early warning, a multi-domain common operating picture and targeting process. Airships and fixed-wing platforms can launch and recover from distant locations to do the same. These assets can also deploy to provide tactical and operational communications capability, either enhancing the MDTF's ability to coordinate with other joint and allied forces, or to replace capabilities lost to adversarial anti-access, area denial operations. The U.S. Army and USARPAC are pursuing high-altitude technologies to further enable the MDTF forward.

A Soldier launches the RQ-11 unmanned aerial system during a test flight at the Fort Campbell Training Area in Kentucky.

SGT. AARON DAUGHERTY/U.S. ARMY





JASON CUTSHAW/U.S. ARMY

The U.S. Army test fires a Patriot missile at Redstone Arsenal in Alabama. The ground-based mobile defense interceptor is included in the Army Air and Missile Defense 2028 vision, which combines cutting-edge and veteran technologies to deter, prevent and defeat air and missile attacks.

Bat Unmanned Aircraft System

DATA FUSION

The benefits that an MDTF accrues from being able to control sensor platforms in several domains and receive data from service or national sensors is the ability to have a truly organic over-the-horizon targeting capability, but it comes with a big data-processing bill if that data is used to make timely decisions. Nearly all data fusion for operational fires, kinetic and nonkinetic, occurs at levels much higher than a brigade, requiring the transmission of data out for analysis and the transmission of information back to a shooter. Just as logistics technologies are being integrated into the MDTF to reduce transportation requirements for fuel and water, AI/ML are being integrated to reduce the data transportation requirement and improve organic decision-making capability.

The Tactical Data Team is an initiative by the Army Futures Command and the Army Applications Lab in cooperation with USARPAC to address the need for forward edge computing in multi-domain formations like the MDTF. Small teams of data scientists deploy to the point of data entry to structure and analyze data by building custom AI/ML software solutions



NORTHROP GRUMMAN

on the spot. This forward edge computing capability greatly increases the timeliness of MDTF fires, both nonkinetic and kinetic. Additionally, since authorities for conducting those fires must reside where adequate analysis occurs, this new AI/ML capability will help facilitate movement of authorities down to the MDTF, enabling them to act more effectively on mission orders when communications are denied.

Technologies required for an MDO formation to fight and win in the Pacific are numerous and multifaceted, covering the span of warfighting functions. Studies, exercises, experiments and wargames have revealed several applications of technology that have been extremely effective. The Futures Division continues to design and support these efforts as it persists in its mission to assess the needs of a Pacific Army and improve the concept and application of MDO in the Pacific Theater as USARPAC's technology manager. □



Buying POWER

**NATIONS MUST CONSIDER THE INTEGRITY OF THE PURCHASE PROCESS
WHEN BUYING FOREIGN MILITARY EQUIPMENT AND TECHNOLOGY**

FORUM STAFF

For many militaries in the Indo-Pacific, force modernization involves some degree of purchasing foreign military equipment, and the United States has seen requests to buy its hardware and technology soar.

When it comes to the total number of arms transfers worldwide, the United States, Russia, France, Germany and China ranked in the top 5 — in that order — between 2014 and 2018, according to the Stockholm International Peace Research Institute (SIPRI). Together, they accounted for 75% of the total volume of arms exports during that period. Of that, more than a third, or roughly 36%, of exports originated in the U.S.

“The United States is committed to strengthening allies and partners worldwide to meet their own legitimate self-defense needs and to improve their capabilities to operate beside U.S. forces to address shared security challenges,” according to a May 2019 statement by the U.S. Department of State’s Bureau of Political-Military Affairs, which oversees most

government-to-government arms transfers and commercial export licensing of U.S.-origin defense equipment and technologies.

Arms sales and defense trades are key tools in foreign policy and have potential long-term implications for regional security. That’s why the U.S. Department of Defense (DOD) considers political, military, economic, arms control and human rights conditions when making decisions to provide military equipment and technology to any country, the DOD said.

The United States signed U.S. \$55.6 billion worth of weapons contracts to allies in fiscal year 2018, amounting to a 33% increase over 2017 as President Donald Trump gave the green light to sell more, more quickly, overseas. By the end of the first three quarters of fiscal year 2019, U.S. foreign arms sales contracts had reached U.S. \$44.1 billion.

The SIPRI report noted that the gap between the world’s top two arms suppliers also grew. U.S. exports of arms were 75% higher than Russia’s between 2014 and 2018, while they were only 12% higher during the previous four-year period, according to SIPRI.



U.S. ARMY SECURITY ASSISTANCE COMMAND

Royal Thai Army Commander in Chief Gen. Apirat Kongsompong, left, and U.S. Navy Adm. Philip S. Davidson, commander of U.S. Indo-Pacific Command, greet the C-17 Globemaster aircraft delivering Stryker vehicles in August 2019 at Don Mueang Military Airport in Bangkok.

“The USA has further solidified its position as the world’s leading arms supplier,” said Dr. Aude Fleurant, director of the SIPRI Arms and Military Expenditure Programme, noting that U.S. deliveries often consisted of advanced weapons such as combat aircraft, short-range cruise and ballistic missiles and guided bombs.

While China rounded out the top 5, its percentage rate of arms exports have decreased drastically in recent years, according to SIPRI data. Between 2004 and 2008, Chinese arms exports rose by 195%. For the 2014 to 2018 period, Chinese exports rose by only 2.7%.

Foreign military sales (FMS) is a complex system, said Maj. Gen. Jeffrey W. Drushal, commanding general of the U.S. Army Security Assistance Command (USASAC), who spoke on the topic during the Land Forces of the Pacific (LANPAC) Symposium and Exhibition in Honolulu, Hawaii, in May 2019. The U.S. works with its partners step by step to generate the right bid for the right type of service, and USASAC executes about 95% of the U.S. Army’s FMS.

It all amounts to maintaining the integrity of the process, which makes the U.S. such a sought-after partner.

“When you purchase from the United States, you don’t get a helicopter that’s going to sit in a

hangar as soon as it breaks down. You are going to get a total package,” Drushal said during LANPAC. “That includes spare parts. That includes publications. That includes maintenance training. That includes training on how to employ the end item that you purchase. All of these things are bundled together and included in a total package for the country to consider.”

USASAC helps demystify the FMS process with a letter of request checklist to help potential buyers flesh out details of the equipment they need and its purpose. Requests must:

- Identify the source of funding.
- Identify which in-country military service (army, navy or air force) is submitting the request.
- Identify the type of equipment or service being requested.

Additional details about the equipment’s intended use or the desired duration and location of service must also be submitted.

Drushal acknowledged that the No. 1 item of feedback USASAC receives is that its FMS process is too slow.

“The contracting timeline takes an extraordinarily long time,” he said. “One of the advantages of using U.S. FMS is the integrity of our contracting process.” Partner nations often



U.S. ARMY SECURITY ASSISTANCE COMMAND

“WHEN YOU PURCHASE FROM THE UNITED STATES, YOU DON’T GET A HELICOPTER THAT’S GOING TO SIT IN A HANGAR AS SOON AS IT BREAKS DOWN. YOU ARE GOING TO GET A TOTAL PACKAGE.”

— Maj. Gen. Jeffrey W. Drushal

ask if there are ways to speed up the buying process, he said. “It takes a little bit longer, but it ends up in the right result, and the result is uncontested and impervious to corruption.”

Increasing tensions in the Indo-Pacific — including those in the South China Sea and the People’s Republic of China’s increasing push for influence in the Pacific and elsewhere — will likely drive a sustained increase in FMS by the U.S. to its Indo-Pacific partners.

“Aircraft and air defense purchases from East Asia and Pacific region are driven by increasing tensions in the South China Sea as well as a need to recapitalize aging military equipment,” according to *Military Embedded Systems* magazine. “In Near East and South Asia, there is a general demand for more advanced air and ground forces, an insatiable appetite for U.S.-made equipment.”

Market research company Frost & Sullivan

forecast that the DOD’s FMS market would grow at a compound annual rate of about 3.4 percent between 2015 and 2021 with the most requested and delivered items being ground-based air defense weaponry, fighter aircraft, training services and tactical vehicles.

To accommodate the demand, USASAC has a country program manager assigned to each allied nation. Once the checklist is complete, specific actional requirements can be met to transfer technology. USASAC representatives work through the language, procedures and training needs, which Drushal called the bricks of operability.

Drushal knows the geopolitical climate will spur more requests, and his team stands ready to continue helping partner nations build new capabilities. “The demand for U.S. defense products is not going to go down,” Drushal said at LANPAC. “It’s only going to go up.” □

Royal Thai Army Commander in Chief Gen. Apirat Kongsompong inspects one of the Stryker combat vehicles after it arrived.

NETWORK KNOWLEDGE



MILITARY AND SECURITY SECTORS INTEGRATE SAFEGUARDS AS
SOCIAL MEDIA PLATFORMS BECOME PART OF DAILY OPERATIONS

Almost half the global population uses social media daily, according to WeAreSocial.com's 2019 digital report, a global social media agency that tracks usage worldwide.

While personal connections remain the top reason for social media use, other areas such as e-commerce and research have grown significantly in the past five years, as illustrated by a 2018 study by GlobalWebIndex, a market research firm.

"There's an ongoing and gradual transition taking place, whereby personal sharing is becoming more of a side dish than the main fare," said Olivia Valentine, an insights analyst at GlobalWebIndex. "It's now purpose-led activities that traditionally lay outside the social arena that are drawing consumers in."

With the Israel and Hamas war spillover onto Twitter in 2012, military and security sectors began embracing social media as an operational tool. The online platform has become another battlefield, as described in the book *LikeWar: The Weaponization of Social Media*, by P.W. Singer and Emerson T. Brooking.

"Through the weaponization of social media, the internet is changing war and politics, just as war and politics are changing the internet," according to the *LikeWar* website. "Terrorists livestream their attacks, 'Twitter wars' produce real-world casualties, and viral misinformation alters not just the result of battles, but the very fate of nations. The result is that war, tech and politics have blurred into a new kind of battlespace that plays out on our smartphones."

Social media has long been the domain of public affairs offices. However, the need to share or gather information has expanded into other operational areas to include information operations, intelligence, as well as disaster and crisis management. With the operationalization — and even weaponization — of information, the ability to clear data for public release has gone beyond the public affairs realm.

While legitimate concerns and risks associated with using social media as a staple communications platform exist, the advantages it provides to

organizations outweigh those concerns. Social media is not a phenomenon that will go away in the near future, thus, if implemented correctly, it can be a force multiplier.

THE BIGGEST RISKS COME FROM LACK OF PLANNING

With the operationalizing of information, especially in areas of disaster management or counterterrorism, the authorization process to clear information for timely public release can overwhelm an understaffed public affairs office. Most public affair offices are not staffed to track, maintain and analyze information on multiple social media channels to support these additional functional areas.



Men use smartphones at a tea shop in Yangon, Burma.

AFP/GETTY IMAGES

At a November 2018 conference on social media in the military and defense sectors, a U.S. Army digital communications specialist stated, "You wouldn't send a Soldier into a battle without a rifle," as he explained the importance of providing training for Soldiers who work on social media accounts.

Clear planning and training are essential to meet the growing demands of a presence on social media. When planning to implement social media and other apps for military or security programs, it's essential to determine:

- What is your goal?
- What are the audiences' expectations as far as information quality and delivery methods?
- How are you going to overcome limitations in resources to meet these goals and expectations?
- How will you engage with your audiences?
- How will you overcome language barriers?
- Who will you have run the program? What training are you going to provide?
- What policies and processes do you need to put in place? How are you going to develop an efficient process to approve the release of information in a timely manner?
- How are you going to maintain account security to reduce the risk of hackers?
- How are you going to measure and track the effectiveness of the program?

FLEXIBILITY IS KEY

Facebook continues to dominate the global social landscape and remains strong in places such as Burma, Indonesia and the Philippines. However, many young

people, especially in the U.S., have stepped away from Facebook in favor of Instagram and Snapchat. Many also skip Google and use YouTube as their main search engine, an indication that producing quality video is as important as written text in the virtual world.

Such platforms are restricted inside China, where Tencent is the primary social media platform that continues to weave into people's everyday life. With it, comes government approval for its use and government tracking. Because of such restrictions on how certain populations consume information, it's important to not only understand the intended audience but also where they live both physically and virtually.

MAKING YOUR MESSAGE HEARD

Many social media platforms have figured out how to monetize information flow. As a result, a simple post on a Facebook page may have little or no impact. These posts no longer automatically appear in people's newsfeeds — even if they are page subscribers. For posts to get the intended reach, the disseminator of the information must build engagement. This means having someone dedicated to responding to every comment and asking questions to start conversations.

The alternative is paying for post promotion. The notion of paying for information promotion on social media varies by country. In the U.S., payments for social media boosts are only authorized for the



Philippine Army Soldiers attend a lecture about recognizing fake news on social media platforms. AFP/GETTY IMAGES

PRIVACY ISSUES AND BOTH GOVERNMENT AND CORPORATE CONTROLS ARE STILL BEING DEBATED. THERE ARE THOSE WILLING TO GIVE UP THEIR PRIVACY FOR CONVENIENCE. STILL, STRONG CONCERNS REMAIN ABOUT GOVERNMENTS TAKING OVER SOCIAL MEDIA AND USING IT TO TRACK CITIZENS.

recruiting services. As a result, many military public affairs offices have seen engagement rates on social platforms fall, forcing them to focus on organic engagement.

SOCIAL MEDIA AND DISASTER MANAGEMENT

Many governments are creating apps to help better coordinate information during disaster response. Some apps are operated at the federal government level. In large geographic areas, many operate at city levels.

For example, in 2014 the government of the Philippines partnered with Rappler, a Philippines-based online news website, to develop an app to share information called Batingaw. Since then, a number of other apps have appeared to support specific areas such as metro Manila.

Sharing bad information is a risk on social media; however, what is riskier is often the lack of sharing — resulting in not meeting the audience's expectations.

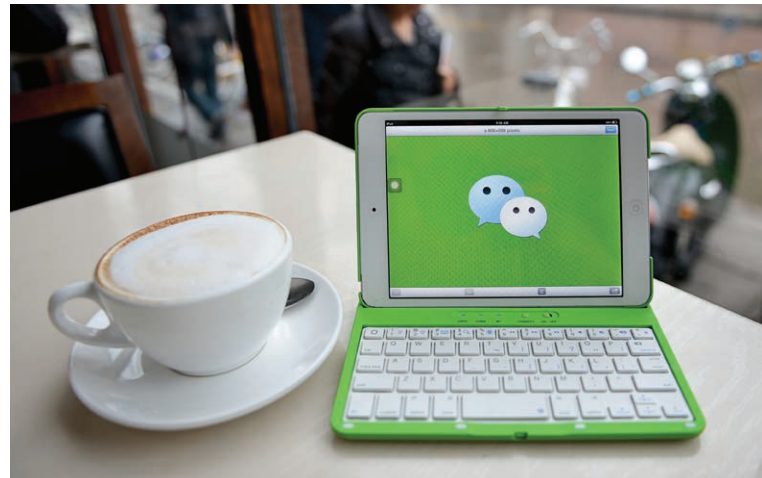
Audience expectations often defy government approval process timings. During the Hawaii missile scare in 2018, the Hawaii Emergency Management Agency (HEMA) shared information about an imminent attack through television and mobile phone alerts. It took 15 minutes for the situation to be identified as an error and receive approval to release all-clear messages. HEMA posted a correction on Twitter 17 minutes after initial message and 45 minutes later on the same channels where the erroneous messages were broadcast. It took 38 minutes before authorities issued an official statement, according to most news reports.

While a half hour may seem a quick response in a normal working environment, it can be excruciatingly long in crisis situations. While people were angry about the mistake, the perception that the government took an excessive amount of time to share corrected information and even useful information on how to protect themselves made them even angrier.

Nongovernmental organizations (NGOs) are also getting into the information-sharing business, especially in situations where people do not trust government-released information. While having an NGO assist with the process can be beneficial, especially where there are manpower constraints, it also means abdicating responsibility for information sharing to a third party.

WHAT'S COMING...

Social media usage continues to evolve, according to WeAreSocial.com's "Social in 2028" report. Messaging platforms such as WhatsApp and Snapchat continue to expand their reach. Virtual reality and augmented reality continue to change the user experience. Some argue that Facebook will overpower all other platforms to become a super platform, while others expect that the entire networking experience will change as social media becomes fully integrated into basic work and home applications.



China's instant messaging platform WeChat is monitored by the government. AFP/GETTY IMAGES

Privacy issues and both government and corporate controls are still being debated. There are those willing to give up their privacy for convenience. Still, strong concerns remain about governments taking over social media and using it to track citizens.

There tends to be three different philosophies when it comes to controlling social media. The U.S. philosophy leans toward supporting corporate interests. The European Union policy is to protect individual privacy over corporation profits. The People's Republic of China philosophy is to support full government control of social media.

The world won't see a particular social media policy become the global norm for some time. Whether a uniform policy or myriad approaches evolve, one thing remains clear that the military and security sector should note: The use of social media is unlikely to go away. □

DOUBLE INDEMNITY



The duplicity of the Chinese Communist Party's Facebook policy

FORUM STAFF

FORUM ILLUSTRATION

The Chinese Communist Party (CCP) is emerging as the master of social media irony. At home, the CCP bans its citizens from Facebook to block outside influences. Abroad, the CCP champions Facebook to spread its propaganda to developing countries. Both practices, domestic and foreign, seem to be helping the authoritarian regime control the narrative about the party outside China.

While Chinese citizens may legally only use Facebook competitors such as WeChat or Weibo, which the CCP tightly monitors, the CCP runs the top four media outlets worldwide with the greatest followings on Facebook, according to an April 2019 analysis by *The Economist* magazine. CGTN, *China Daily*, *People's Daily* and Xinhua, which are all news outlets operated by the Chinese government, are the top news sites globally on Facebook, as ranked by the number of followers.

Only one media outlet that is not Chinese-run makes the top five — the BBC, with the fifth largest Facebook following. China also runs *Global Times*, which comes in sixth, the magazine reported.

To block Facebook in China, the CCP employs an extensive web-filtering system, known as the “Great Firewall of China.” The system also blocks Twitter, YouTube, human rights sites and various other sites. The PRC also employs more than 2 million cyber police to censor “sensitive” material, according to various news reports.

Roughly 3 million people in China, however, still gain access to Facebook through circumvention tools, experts estimate, which is fewer than 0.2% of the population. The Chinese government-controlled WeChat, which started out as Tencent's instant messaging app and has evolved into an ecosystem of

its own, is the leading social media platform in China. It had amassed more than a billion active monthly users worldwide through March 2018, according to TechNode, a China-based organization providing news on China's technology. More than 900 million users are inside China, experts estimate.

Meanwhile, the Chinese government reaches nearly 300 million people worldwide via Facebook. The state-run CGTN, the CCP's top site, has attracted 77 million followers, according to *The Economist*. In many developing countries throughout Africa, Latin America and Southeast Asia, up to 30 percent of their Facebook users follow at least one Chinese-run news site, according to the magazine. At least 8% of all African Facebook users, for example, follow CCP-run news pages.

In 2018, CCP-run news pages drew 370 million likes, shares or comments on Facebook. That's more than nine times the 40 million annual engagements that Russian trolls yielded during the U.S. election.

In 2018, CCP-run news pages drew 370 million likes, shares or comments on Facebook. That's more than nine times the 40 million annual engagements that Russian trolls yielded during the U.S. election, as the Oxford Internet Institute reported.

Apparently, the Chinese Facebook numbers have been growing almost too fast. The improbable growth rate led Facebook to suspect foul play and start investigating. In March 2019, Facebook sued four Chinese companies for selling fake Facebook and Instagram accounts, likes and followers, according to court filings.

The companies offer assorted services, including bundles of phony accounts for Facebook and Instagram and other platforms such as Twitter, Snapchat, YouTube, LinkedIn and Google Voice, the complaint said. They also advertise services "designed to increase likes, comments, friends, and other activity," TechCrunch, a U.S. online publication covering technology, reported. They also use false marketing materials, The Verge, a technology news website, reported.

Facebook and Instagram disabled 2.1 billion fake accounts between January and September 2018, the complaint said, but that may be just the beginning. "By filing the lawsuit, we hope to reinforce that this kind of fraudulent activity is not tolerated — and that we'll act forcefully to protect the integrity of our platform," Facebook said in its statement.

In August 2019, Facebook and Twitter said that "accounts that originated in China acted in a coordinated fashion to amplify messages and images that portrayed Hong Kong's protesters as violent and extreme," *The New York Times* newspaper reported.

For example, a Facebook post from a PRC-linked account equated the protesters with ISIS fighters.

Twitter deleted 936 accounts and Facebook deleted seven pages, three Facebook groups and five accounts involved in the PRC's disinformation campaign against Hong Kong protesters.

"These accounts were deliberately and specifically attempting to sow political discord in Hong Kong, including undermining the legitimacy and political positions of the protest movement on the ground," Twitter said in a statement. "Based on our intensive investigations, we have reliable evidence to support that this is a coordinated state-backed operation."

The CCP's play for influence over foreign populations online doesn't stop with propaganda and disinformation on social media sites. A recent report by Valentin Weber, a research fellow for the Open Technology Fund, found that Chinese censorship and surveillance technologies were exported to over 100 countries, proliferating and normalizing the CCP's vision for a tightly government-controlled internet.

Yet the CCP has also targeted other platforms. Reddit, a U.S. social news aggregation, web content rating and discussion website, for example, is having similar problems with Chinese trolls, according to a March 2019 report by BuzzFeed News, a U.S. news website. Reddit has 330 million users across more than 215 countries.

Chinese government-sponsored users are spreading propaganda and suppressing anti-CCP messages on Reddit. Moderators and users are seeing an "increase in posts from newly created accounts that downvote anything critical of China, swarm threads to push pro-Communist Party views, or attack anyone criticizing the country. Threads about sensitive topics such as Tiananmen Square, Huawei, or Falun Gong, the religious group classified by the Chinese government as a cult, are quickly seized up by pro-China accounts," according to the BuzzFeed News website.

The increase in pro-China accounts is "the most active and aggressive" effort to date. "The pro-CCP effort vastly overshadows any operation by the Russians," a Reddit moderator told BuzzFeed.

The CCP's activities are more extensive than downvoting negative threads about China, the moderator said. "Comments and articles pushing a pro-CCP narrative or praising Xi Jinping's ventures, such as the Belt and Road Initiative, are upvoted by either a coordinated effort or bots.

"Ironically, our freedom of press and an open internet is being exploited by an adversary to subvert democracy." □



MARITIME SECURITY

The chief of Indonesia's new agency
shares his ideas for countering piracy,
illegal fishing and other threats to stability

FORUM STAFF

Vice Adm. Achmad Taufiqerachman, vice chief of the naval staff, has served as chief of the Indonesian Maritime Security Agency, known as Badan Keamanan Laut Republik Indonesia (BAKAMLA), since October 2018.



After graduating from the Indonesian Naval Military Academy in 1985, he was commissioned as an operations officer and served on surface ships and specialized in anti-submarine warfare. He commanded several ships, the escort ship squadron and the fleet's training command. His performance on his assignments afloat and ashore accelerated his career advancement. As a flag officer, he served as commander of the sea battle task group and fleet commander in chief. He led Indonesia's Merah Putih (Red and White) Task Force in a 2011 mission to free the Indonesian crew of the M/V Sinar Kudus after Somali pirates seized the cargo ship.

Duta Samudra Task Force collaborated with other established task forces in the region, especially Combined Task Force 151, and had support from Indonesia's Navy and Army Special Forces. After selection for flag rank in 2011, he became vice governor of the Indonesian Naval Academy, then governor in 2014, and commander in chief of the Western Fleet in 2015. During his tenure, he established the Western Fleet Quick Response that contributed to neutralizing armed robberies and piracy in the Malacca and Singapore straits until no incidents occurred within six months.

Under Taufiqerachman, BAKAMLA strives to be a professional maritime security agency that is trusted by

national and international maritime communities. The agency seeks to achieve a sovereign, self-reliant Indonesia with a strong character. Launched in 2014, the agency is not part of the Indonesian National Armed Forces, although its top leaders are selected by the president from the Indonesian Navy.

BAKAMLA's mission is to maintain security and safety in the Indonesian territorial and jurisdictional waters and represent Indonesia as an archipelagic state; to strengthen Indonesia's identity as a maritime state by making BAKAMLA the guardian of the world's maritime fulcrum; and to make Indonesia a strong maritime state to protect its national interests.

BAKAMLA's main roles are to conduct maritime security and safety patrols in Indonesia's waters and jurisdiction to ensure maritime security and safety issues, including illegal fishing and drug smuggling, can be prevented and will be combated. BAKAMLA has more than 1,000 personnel; 36 seagoing-class vessels, ranging from small boats to 110 meters long; and three regional bases: the western zone base in Batam, the central zone base in Manado and the eastern zone base in Ambon, which include 15 monitoring stations throughout Indonesia.

BAKAMLA, which reports directly to Indonesia's president, falls under the jurisdiction of the Coordinating Ministry for Political, Legal and Security Affairs, is also separate from the Indonesia Sea and Coast Guard, which is under the Ministry of Transportation. BAKAMLA is a stakeholder in Indonesia's Illegal Fishing Eradication Task Force, which was established by presidential order.

FORUM: Your experience in many key career positions led you to become the chief of Indonesia's Maritime Security Agency. Please tell *Forum* more about the mission of BAKAMLA and how you have transformed the agency.

Vice Adm. Taufiqerrochman: When I received the call from the [Indonesian] president to assume command of BAKAMLA, I was in Rhode Island for the symposium in 2018 [the 23rd International Seapower Symposium at the U.S. Naval War College]. When I returned, I met with the staff of the president and told them that maybe they chose the wrong person to lead BAKAMLA because for 34 years in the Navy, I was always in combatant units. It is difficult to change the mindset from combat to law enforcement — from come and destroy to come and protect. It is difficult to change my mind, way of thinking. But the president said, you must lead BAKAMLA and make the organization become better, so I followed his orders to come to BAKAMLA.

So, we learned first ... how is BAKAMLA? Because we never thought about BAKAMLA before. And we found out the president's order to form BAKAMLA and to become a coast guard function in Indonesia. And also, to develop a training facility and training program for all of BAKAMLA. We needed to define what is the coast guard? I realized that the U.S. Coast Guard (USCG) is the most experienced after existing for more than 200 years.

As I opened the first pages of the manual of the USCG, I found it very interesting because it said that the USCG is one of seven uniformed institutions in the U.S. The next question is what is a uniformed institution? I realized that it is the sole obligation for the laws and authorities for law enforcement. For BAKAMLA, I changed the uniforms from the long sleeve batik and safari uniform to establish BAKAMLA's identity as a Coast Guard institution. The first step was to change the mind of the people through a new uniform. So now we have a summer uniform for dress and a combat uniform.

We realized after we learned about the law establishing the agency that we needed to define its mission. The mission of BAKAMLA is the conduct of patrolling for the security and the safety of the sea in maritime interdiction and for the synergy of all stakeholders and make the most of available information to conduct maritime security. We are to conduct the patrolling, planning and organizing. Our mission and capability are connected to conduct the mission, so I told my staff we must prioritize. We must first develop a CONOP, a concept of operation. For the basis fleet we need 77 ships, 29 helicopters, six maritime patrol aircraft, some bases and the most important command center. We realized the budget is fairly limited, so we must prioritize, so we are building the command center first. The simple concept, since we have a lot of stakeholders, is to have regulations and law. We realized we cannot only use unity of command to conduct operations, but we can provide

unity of effort, so the BAKAMLA can provide the most reliable information.

Next, we discussed where the first coast guard stations will be located. We will put two with the command center, as it needed to be in a strategic location. For example, Indonesia has four chokepoints of nine chokepoints in the world. We also have four ancillary lines as we can guarantee the security, and then after that other strategic points allowing us a total 21 coast guard stations.

We have a long shoreline. We cannot put each place with a coast guard station. It would be very expensive, so we must have mobile coast guard stations, so they can move dynamically to a sector when we have shifts in priority. We can move assets into some areas and ignore another area. The capabilities are first, surveillance in order to detect and stop illegal activity. And of course, law enforcement and assisting them in maritime interdiction operations. These are my priorities in the future.

FORUM: What are the primary organizations and agencies that you interface with?

Vice Adm. Taufiqerrochman: The first is the Navy. They already have assets and already have well-trained people to conduct the operations. We are in close cooperation with the Navy. But additionally, law enforcement, we are closely cooperating with police, after that we partnership with BNN [National Anti-Narcotics Agency of the Republic of Indonesia, or Badan Narkotika Nasional] customs, Transportation Ministry, fisheries and others. But primarily Navy and police. The challenge and opportunity for BAKAMLA is to create synergy among the different agencies conducting law enforcement operations at sea, currently under the provision of several regulations and law. To improve on the situation, BAKAMLA has already proposed to the Indonesian Parliament to ratify the Maritime Security Law Bill, which will strengthen BAKAMLA's role in coordinating the different agencies.

FORUM: Would you please tell us more about BAKAMLA's cooperation efforts?

Vice Adm. Taufiqerrochman: BAKAMLA is supporting cooperation in Southeast Asia by improving on existing joint activities and capacity-building efforts through trainings, workshops and seminars on maritime issues, information and intelligence exchange to improve maritime security and safety. Future cooperation with the U.S. and ASEAN [Association of Southeast Asian Nations] countries will be increased. This will include cooperation in capacity-building, training, education, information and intelligence sharing. Other cooperation that needs to be improved is cooperation at regional and multinational levels, in the form of coast guard symposia with special topics that are currently the focus of global



attention, such as the South China Sea. We recognize that global threats to maritime security are shared by all. We cannot solve the problems individually and need international cooperation to find solutions.

FORUM: What international organizations are you coordinating with to build capabilities and capacity?

Vice Adm. Taufiqerrochman: We recognize that the U.S. Coast Guard is the most experienced, but it has different traits and challenges, and the U.S. is very different than Indonesia — from an archipelago view. We learned from other coast guards like Greece. It has similarities to Indonesia with 9,000 islands, the most islands in Europe, I think. We learned from the Philippines, South Korea and Japan as well. We benefit from the complexities of the coast guard functions, the archipelago. We can learn from each other.

Our first challenge is Indonesia's strategic position and geographic constellation. We have four chokepoints and then we have SLOCs [sea lines of communication]. Under the UNCLOS [United Nations Convention on the Law of the Sea] ratification, we must prepare to guard for safe passage in

the ocean, which adds to the complexities. Second is the flexibility of the strategic environment in the world. This challenge necessitates that Indonesia must be prepared to engage and influence some big players in the region. Our next challenge is we have a lot of boundaries with many countries, and some of them are still disputed. This will bring a possibility for friction between countries. That is why I have talked with my fellow coast guard commanders in the region to avoid miscalculation at sea, so maybe we can start good relations between countries. For example, recently in July 2019, we detected six fishing fleets from Vietnam, which were escorted by two coast guard ships as they entered the disputed area. I ordered to intercept them to prevent entering our territory. And then since it was the disputed area they were fishing in, we advised them to explore fishing in areas not in the disputed area. We called in the Vietnam Coast Guard and met them at sea. They agreed, and they withdrew their vessels from the area to the north. I think there are good ways to prevent heightening tensions. We realized because they were traditional fishing ships, they may not have maps, or GPS, or know the correct position where they entered into our waters.

An Indonesian Maritime Security Agency boarding team member climbs aboard the U.S. Coast Guard cutter Stratton during a joint training exercise in the Singapore Strait.

PETTY OFFICER 1ST CLASS LEVI READ/
U.S. COAST GUARD





The Indonesian Maritime Security Agency vessel KN Tan Jung Data, left, sails alongside the U.S. Coast Guard cutter Stratton in the Singapore Strait.

PETTY OFFICER 1ST CLASS LEVI READ/U.S. COAST GUARD

FORUM: Beyond meeting at sea, are you also attending international or regional conferences to talk about how to avoid these confrontations?

Vice Adm. Taufiqorrochman: We also have an organization called the HACGAM [Heads of Asian Coast Guard Agencies Meeting] to discuss these issues, where we discuss how to cooperate. Also, now our staffs conduct combined exercises. Recently, for the first time our BAKAMLA sent a ship to India to attend a combined exercise for planning and also in Jakarta, the Korean Coast Guard and in August the U.S. Coast Guard sent a ship [CG cutter Stratton] to participate in exercise CARAT [Cooperation Afloat Readiness and Training] Indonesia. We also conduct coordinated patrols with the Australian border forces. We sent one ship, and they had one ship also. In October 2019, we will conduct more staff coordination, not only patrol coordinating, and conduct visits.

FORUM: With which countries do you currently conduct border patrol operations?

Vice Adm. Taufiqorrochman: We conduct formal border patrols with only Australia, but we also do informal patrols with the Vietnam Coast Guard, so we can meet in the sea so that we can avoid hostilities. We invite them alongside my ship, so commanding officers can meet and discuss and resolve the problem. I think this is the best way to conduct operations.

FORUM: What do you see as the top security concern for Indonesia that BAKAMLA addresses?

Vice Adm. Taufiqorrochman: The top priority is to secure the Sea Lanes of Communication (SLOC) then to guarantee the archipelagic sea line obligation of the UNCLOS. Also, we see a priority to make a good order at the sea in my jurisdiction. Lastly, we can keep maintaining our national sovereignty especially at sea. As far as IUU [illegal, unregulated and unreported fishing], we support Task Force 115, led by the Fisheries Ministry per authority of the president. We support them to synergize our efforts. Also, I share with them my experience from when I was in the Navy as a combat and fleet commander. For example, when they began the task force, they had no concept to conduct operations ... and I have a capacity for that.

FORUM: Would you talk about the South China Sea, codes of conduct and the importance of all nations complying with an international rules-based order?

Vice Adm. Taufiqorrochman: In the South China Sea, we have a border with Vietnam, Malaysia, the Philippines, Brunei. We have to stop with the actions



BAKAMLA boats patrol Indonesian waters.

INDONESIAN MARITIME SECURITY AGENCY

outside of UNCLOS — the nine-dash line. It is important to our economic zone. We still stand in legal UNCLOS. Sometimes we have tension in there. Back to my experience as a commander. We send intercepts to the South China Sea because we have detected a lot of significant activities in there. I get some of them, and some are Chinese coast guard. They said, “This is the China fishing ground.” So, I said, “I do not recognize traditional fishing ground. In UNCLOS only have traditional fishing rights, not fishing grounds. As far as fishing grounds rights, we have official agreements between countries.” With Indonesia and Malaysia ... since ancient times, a lot of the fisheries of Malaysia, they are fishing in Indonesian waters after UNCLOS with agreement — so not a problem, they are still there. We do not recognize traditional fishing grounds. We still stand in UNCLOS, so we still conduct law enforcement in the region to conduct interdiction.

FORUM: Why is cooperation important with other Southeast Asian countries and the U.S.?

Vice Adm. Taufiqerrochman: Reflecting back on my experience as the battle group commander in Somalia ... when a merchant ship was hijacked by Somali pirates, I was a battle group commander. The president decided to send a task group and after discussions, he chose me to lead this task group. Because of my experience in 2004. (I remember the U.S. Pacific commander was Adm. Thomas Fargo, of the Fargo doctrine, under which the U.S. sent assets to the region to shape the SLOC). As the commander, I requested permission from the chief of the Navy to send me to the Malacca Strait to advise on the operation. Because, in 2004, hijacking was a big problem in the Malacca Strait and in the past, prior to 2004, they did not have great success in releasing the ships’ hostages, for aircraft, yes, but ships, never. As the commanding officer, I found that out and I immediately actioned, because we heard about it at 5 in evening and they pinpointed the position. Five hours later we finished planning and at

11 p.m. we called special forces to conduct the release operation. But at that time, they had not yet used special operations. It was my choice to withdraw our people or to enforce. I took a risk at the time to enforce using my teams. I had two teams of seven for a total of 14 people. We had five hijackers and 36 hostages. We learned about the situation, and we followed the situation and analyzed the situation and had the good moment at 1 a.m. to start assaulting. We conducted really close-quarter combat. We never prepared for that, so for equipment, we used AK-47s. You can imagine that, an AK-47 with 7.62-caliber at 1.5 meters, so you can imagine when the round hit, the guy’s head blew. We took out all five hijackers and the operation was 100% successful for four reasons. First, we safely released all 36 hostages without injury. Second, all hijackers were neutralized. Third, we had no loss of ship equipment. Finally, we regained the ship safely without any troop casualties in the exchange of fire. I was called by the chief of the Navy to come to Jakarta immediately. I went to Jakarta and all the general officers are there, and the chief asked me to brief the outcome of the operation. First consideration is Adm. Fargo doctrine — if you have success, build on it. If you fail, redesign. I explained and the chief of the Navy said, “You are crazy.” I said, “Yes, sir, if not crazy, I would not win.”

I think, because of that experience, in 2011, the president chose me to lead the task force group to Somalia. In time, I had written about how to respond to Somali pirates for rescue operations. (I received a call from the president at his house. I heard from the office of the president that the Armed Forces had sent 11 resumes of one stars to lead the task group. They asked for other recommendations, and they said they have a crazy captain as a fleet training command commander. I was called to his house. They had a short brief (only half hour), and I received a simple order: Leave tomorrow for Somalia. I realized at the time that we had no contingency plan for Somalia, nor did we have any solid information on the situation. I called some colleagues, like the U.S. Seal squadron commander I knew at U.S. 7th Fleet to gain additional information. We tried to plan based on information we could gather before we set sail at sunset that following night for Somalia — with almost no information. En route, we tried to plan and realized when we got to the Somali basin area that there were a lot of existing forces there besides Task Force 151 to include Task Force 550 and 552, to include other independent deployers from Russia and China. The single question when I arrived was: What are the frigate’s intentions and what was our mandate for this? I said I have a national tasking from my country. The Task Force 151 commander, then led by Rear Adm. Harris Chan of the Singapore Navy, came to my ship, and we received a lot of information to allow us to change our planning. After gaining permission and support from all authorities in the area, the mission could be successfully done by Duta Samudra Task Force.



An important lesson in this is that all of us have the same threats and problems related to maritime security. These problems are impossible to be resolved by an individual country. That is why we need to tighten the cooperation among the countries in the region, and this cooperation will run smoother when we know the other countries' counterparts personally.

FORUM: Did you obtain any other insights from commanding the Duta Samudera Task Force?

Vice Adm. Taufiqerrochman: After receiving the authority from the president of the Republic of Indonesia, my first act was to prepare myself and the task force for long range operation that has never been done by the Indonesian Navy up to that moment. An important challenge was that the Indonesian Navy at that time did not have the doctrine for conducting

a hostage rescue operation far outside Indonesian jurisdiction required to free the crew of MV Sinar Kudus who was taken hostage by Somali pirates. In view of that, I used the time during the voyage to the operating area to prepare myself by carefully studying and training the units under my command. I also continuously coordinated with other agencies to ensure a successful hostage rescue operation. Once we were in the operating area, I called on my experience throughout my Navy career as well as the training that has been conducted by all the personnel within Duta Samudera Task Force. The coordination that was done with the Multi National Task Force in the area was invaluable in helping the operation. With the guidance and protection of God almighty, the assault on the pirates and the rescue of MV Sinar Kudus crews was conducted without any casualties, aside from the pirates that were neutralized. □

Capt. Nyoto Saptana, left, commanding officer of the Indonesian Maritime Security Agency vessel KN Tan Jung Data, visits with U.S. Capt. Bob Little, commanding officer of the Coast Guard cutter Stratton, while the vessels are moored in Batam, Indonesia.

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U.S. COAST GUARD



Scientists hit the ice to **STUDY POLAR CYCLES**

Scientists from 19 countries, including China, France, Germany, Russia, the United Kingdom and United States embarked on a U.S. \$158 million expedition in September 2019 to work together in one of the world's most inhospitable regions. Packed full of scientific equipment, the German icebreaker RV Polarstern, pictured, left the port of Tromsø in northern Norway, accompanied by a Russian vessel, to search for a suitably large floe in the Arctic on which to set up a base.

As the days get shorter and the sea freezes, the Polarstern will slowly drift toward the North Pole while rotating teams of dozens of scientists spend two months each conducting research on the ice.

Stefanie Arndt, a sea ice physicist, said darkness will be the biggest challenge. "Everyone worries about the cold, but the psychological aspect of not seeing anything and knowing there are polar bears out there is something that shouldn't be

underestimated," she said.

To prepare themselves for such encounters, scientists working on the Multidisciplinary Drifting Observatory for the Study of Arctic Climate (MOSAIC) participated in firearms training.

Arndt, who will join the mission in mid-February 2020, said the advantage of MOSAiC is that researchers will observe Arctic processes across an entire seasonal cycle. "What's particularly interesting is the transition from winter to spring," she said, a time when the ice is typically too thick for ships to reach the Central Arctic.

Recording changes in the density, size and type of snow will help scientists better understand energy flow. Energy from light affects algae growth and ocean temperatures, which influence how much sea ice melts from below. Understanding such complex processes is essential for the computer models scientists use to predict weather and climate.

The Associated Press

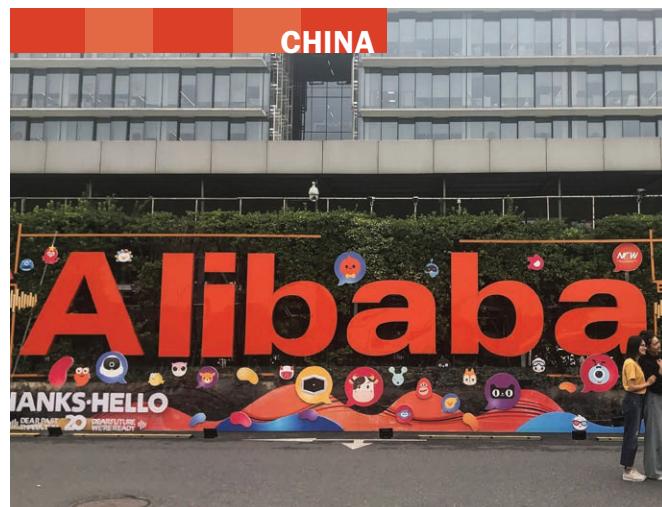
PRC government **INFILTRATES** top companies

The People's Republic of China's (PRC's) top technology hub, Hangzhou, plans to assign government officials to work with 100 private companies, including e-commerce giant Alibaba, in a move likely to raise concerns over the growing role of the state.

The step underscores how PRC government and Chinese Communist Party authorities are growing more deeply integrated into the private sector.

The city of Hangzhou, home to Alibaba Group Holding Ltd., will designate government officials to work with 100 local companies in the eastern province of Zhejiang, the local government said on its website.

The directives, presented as a means to boost the manufacturing industry, did not name the 100 companies subject to the policy, but state media reports said Alibaba and automaker Zhejiang Geely Automobile Holdings Ltd. would be affected. Alibaba said the plan would not interfere with its operations.



AFP/GETTY IMAGES

“We understand this initiative ... aims to foster a better business environment in support of Hangzhou-based enterprises. The government representative will function as a bridge to the private sector and will not interfere with the company's operations,” Alibaba said in a statement.

Chinese law has long required private companies, including foreign entities, to establish formal party organizations.

Such groups were once seen as largely symbolic. However, in recent years, foreign executives have said they have come under increasing pressure to allow party representatives more sway over business operations.

Reuters

JAPAN



Police unit created to

DEFEND **ISLANDS**

Japan is establishing a special police unit armed with automatic weapons to bolster defense of a

group of East China Sea islands and other far-flung isles, the public broadcaster NHK reported. Japan and the People's Republic of China (PRC) have long disputed which country owns the East China Sea islands.

The police unit will be based on the southern island of Okinawa, 420 kilometers east of the disputed outcrops, which are controlled by Japan and known as the Senkakus in Japan and Diaoyus in the PRC.

“Assuming scenarios that include illegal landing by an armed group, highly trained members equipped with submachine guns will be

deployed,” NHK said.

Japan's military and Coast Guard have boosted their postures around the disputed islands, pictured, but this will be the first time the police have set up a unit in the region to help defend them, NHK said.

The National Police Agency, in an annual budget request, sought 159 additional officers in Okinawa and Fukuoka, another southern prefecture, to boost its capability to respond to situations on remote islands.

Japan's relations with the PRC have long been strained by the island dispute.

Reuters

Envisioning THE FUTURE BATTLESPACE

Drone Killers

The U.S. Marine Corps successfully used a new directed-energy weapon called the Light Marine Air Defense Integrated System (LMADIS) to take down an Iranian unmanned aerial vehicle in July 2019 that came within 1,000 meters of a U.S. Navy assault ship and failed to heed warnings. LMADIS is designed to blast radio signals to disrupt communications between a drone and its home base, but in this application, it fried the drone's circuits, according to media accounts.

"It's not all that different from the drone zappers you can buy commercially," Bryan Clarke, former special assistant to the chief of naval operations, told *Wired* magazine. "It's just higher power, and it operates on a wider frequency range. You can have so much power in a small frequency range or a little amount of power over a large frequency range."

LMADIS includes two specially made Polaris all-terrain vehicles dubbed MRZR. The first functions as a command unit; the second is equipped with sensors and signal jammers. An operator can interpret the sensor data collected by the MRZR and then decide to blast radio frequencies to take down communications between the drone and its base.

The U.S. military is testing other electronic warfare systems that can jam drones and cruise missiles. The U.S. Air Force, for example, in June 2019 tested its tactical high-power microwave operational responder, or THOR, which will eventually be capable of bringing down a swarm of drones with a single blast.

The Marines' battle-proven LMADIS already offers advantages over previous capabilities. The radio weapon is less expensive than artillery and doesn't require precise targeting or optical sighting as laser weapons do, Clarke said.

AI Warfighters

Artificial intelligence (AI) has outwitted chess grandmasters, military planners and even human pilots in simulated dogfights.

"Already, an AI system can outperform an experienced military pilot in simulated air-to-air combat," Kenneth Payne of King's College London told *The Economist* magazine in August 2019.



The U.S. Defense Advanced Research Projects Agency (DARPA) wants to take AI, however, to the next level in the cockpit by training warfighters to trust computers the way they trust other human beings. Through its air combat evolution (ACE) program, DARPA wants to push U.S. pilots to trust AI for increasingly complicated fighter pilot operations. Through films such as *Top Gun*, "the media have kind of put dogfight up on this apex of human creativity and vision, but rather, in reality, a dogfight is a pretty simple problem to solve," U.S. Air Force Lt. Col. Dan Javorsek, DARPA's ACE program manager, said at a July 2019 conference, according to the FedScoop website. That's why DARPA sees



Two U.S. Air Force F-22 Raptor stealth jet fighters, with fifth-generation features, fly near Andersen Air Force Base near Agafo Gumas, Guam.

REUTERS/U.S. AIR FORCE/
MASTER SGT. KEVIN J. GRUENWALD

Light Marine Air Defense Integrated System

LANCE CPL. DALTON SWANBECK/
U.S. MARINE CORPS

collaborative human-machine dogfighting as a great starting point to build trust.

“Being able to trust autonomy is critical as we move toward a future of warfare involving manned platforms fighting alongside unmanned systems,” Javorsek said in a DARPA release. “We envision a future in which AI handles the split-second maneuvering during within-visual-range dogfights, keeping pilots safer and more effective as they orchestrate large numbers of unmanned systems into a web of overwhelming combat effects.”

In this way, ACE will help the U.S. military train pilots to be battle managers and move away from mainly manned systems to a mix of manned and less-expensive

unmanned systems that can be rapidly developed, fielded and upgraded to address evolving threats.

Dogfighting, although nonlinear in behavior, offers measurable objectives and outcomes within the limits of flight dynamics that make it ideal for advanced tactical automation. Like human pilot combat training, the AI performance expansion will be closely monitored by fighter instructor pilots in the autonomous aircraft, which will help co-evolve tactics with the technology.

“Only after human pilots are confident that AI algorithms are trustworthy in handling bounded, transparent and predictable behaviors will the serial engagement scenarios increase in difficulty and realism,” Javorsek said. *FORUM Staff*

WHO to Create Genetic Research Registry

The World Health Organization (WHO) announced in late August 2019 that it will create a global registry to track research into human genetic manipulation. A WHO committee also called for a halt to all work on germline genome editing, which was used in the People's Republic of China in 2018 to genetically modify twin baby girls.

"New genome editing technologies hold great promise and hope for those who suffer from diseases

we once thought untreatable," Tedros Adhanom Ghebreyesus, WHO's director general, pictured, told the body's genome editing oversight committee in Geneva.

"But some uses of these technologies also pose unique and unprecedented challenges — ethical, social, regulatory and technical," he added.

Chinese scientist He Jiankui announced in November 2018 that he had altered the DNA of twin girls in southern China by using molecular scissors,

ostensibly to prevent them from contracting HIV.

He was then fired from his university, put under police investigation and ordered to halt his work.

His announcement provoked a global backlash from scientists saying the untested procedure was unethical and potentially dangerous and in December 2018, the WHO set up an expert committee to look into the matter. About 30 nations have legislation directly or indirectly barring all clinical use of germline editing.

WHO's Ghebreyesus emphasized that countries should not allow any further work on human germline genome editing "until the technical and ethical implications have been properly considered," WHO said in a statement.

Accepting the recommendation of its 18-member expert committee, WHO announced plans for an initial phase of the registry to include both germline and somatic clinical trials.

Somatic mutations occur in a single body cell and cannot be inherited while germline mutations can be passed onto offspring. Agence France-Presse



**Director-General
Tedros Adhanom
Ghebreyesus**
THE ASSOCIATED PRESS

INDIA BANS E-CIGARETTES

India banned the sale of electronic cigarettes in mid-September 2019 and warned of an "epidemic" among young people. The ban at the time was potentially the biggest move globally against vaping over growing health concerns.

The ban cuts off a huge future market for e-cigarette makers at a time when the number of people smoking worldwide is declining.

"These novel products come with attractive appearances and multiple flavors, and their use has increased exponentially and acquired epidemic proportions in developed countries, especially among youth and children," India's Health Ministry said.

The ban also covers the production, import and advertising of e-cigarettes but not the use of them. It comes at a time when vaping is facing increased scrutiny in other countries.

The United States in September 2019 announced plans to remove flavored e-cigarettes from stores, warning that sweet flavors had drawn millions of youths into nicotine addiction.

The Indian prohibition will be imposed through an executive order and will include jail terms of up to three years for offenders.

India has 106 million adult smokers, second only to China in the world, making it a lucrative market for companies making vaping products, such as U.S.-based Juul and Philip Morris, which manufactures a heat-not-burn tobacco device.

The ban was announced by Finance Minister Nirmala Sitharaman at a news conference, where she showed various types of products to the media, including a Juul vaping device, which resembles a USB flash drive.

The global market for e-cigarettes is still small compared to cigarettes, but it is growing rapidly. In 2018, global cigarette sales totaled more than U.S. \$713 billion, compared to U.S. \$15.7 billion for vapor products, according to Euromonitor. By 2023, the vapor category is projected to more than double to U.S. \$40 billion, while cigarettes are expected to decline slightly. Reuters



MOSQUITO DEFENSES

Dengue fever surged worldwide in 2019 despite increased cooperation on prevention and reduction efforts. In Southeast Asia, where the disease is endemic, the numbers of cases more than doubled from the previous year, according to World Health Organization (WHO) data. Major outbreaks also hit Bangladesh, Hong Kong, India, Nepal, Sri Lanka, Timor-Leste and various Pacific island nations, including Palau, Tuvalu and Vanuatu, according to the U.S. Indo-Pacific Command's (USINDOPACOM's) Surgeon's Office.

Soldiers deployed in the Indo-Pacific region need to be vigilant in protecting themselves from such mosquito-borne illnesses in 2020. Whether military personnel are engaged in combat, training or humanitarian relief operations, their health and missions can be compromised by such viruses, according to the USINDOPACOM's Surgeon's Office.

"Malaria, dengue, Zika virus, yellow fever, West Nile fever, leishmaniasis, plague, scrub typhus, Lyme disease and a number of other tick- and insect-borne diseases continue to pose a significant health threat" to forces worldwide, according to the U.S. Army Public Health Center (APHC), Entomological Sciences Division. Cases of multidrug-resistant malaria, for example, also soared in Southeast Asia in 2019, bringing a new threat to Indo-Pacific personnel.

The resurgence of dengue in the region is likely due to many factors, including rapid urbanization, more air travel, poor sanitation, increased use and disposal of nonbiodegradable plastics that create new breeding sites for mosquitoes and changes in weather patterns that have also increased mosquito populations, the USINDOPACOM's Surgeon's Office said.

USINDOPACOM encourages its Soldiers to rely on the U.S. Department of Defense's (DOD's) Insect Repellent System to safely reduce disease risks and annoyances linked to insects. The DOD system entails factory or field treatment of uniforms with permethrin insect repellent; properly wearing the uniform with sleeves rolled down, pants tucked into boots and undershirts tucked into pants; treating exposed skin with DEET, picaridin or IR3535 insect repellent; and sleeping in a permethrin-treated bed net, according to APHC. The U.S. Centers for Disease Control and Prevention recommends DEET as a safe and well-studied product, despite unsubstantiated claims circulating on the internet of its harmful effects. Please see <https://www.cdc.gov/malaria/toolkit/deet.pdf> for more information.

A few insect-borne diseases have approved vaccines and preventive medications. Military personnel deployed or stationed in malaria-transmission areas, for example, may be prescribed anti-malarial medication, APHC said. Consult a health care provider about appropriate medications or vaccines. *FORUM Staff*

INSECT REPELLENT SYSTEM



Permethrin-Treated Uniform



DEET or Picaridin Applied to Skin



Properly Worn Uniform



Permethrin-Treated Bed Net

Source: U.S. Department of Defense

NASA PIONEERS

Malaria-Predicting Technology for Burma

NASA is developing a new technique to forecast malaria outbreaks in Burma from space, as the emergence of new drug-resistant strains in Southeast Asia threatens efforts to wipe out the deadly disease globally.

The goal of worldwide malaria eradication within a generation, by 2050, is “bold but attainable,” according to a report released in September 2019 in *The Lancet* medical journal.

Malaria cases and deaths plummeted by more than 90% in Burma between 2010 and 2017, World Health Organization (WHO) figures show, a success largely credited to better rural health services and wider use of treated bed nets.

The country, however, still has a higher prevalence of malaria than its neighbors in the Mekong region.

Several drug-resistant strains are taking hold across Southeast Asia, and it is feared these could migrate to Africa where more than 90% of cases occur globally.

To counter this threat, NASA is deploying cutting-edge spatial technology to tackle malaria outbreaks before they happen, scientist Dr. Tatiana Loboda said. She is applying her expertise in geospatial and risk modeling, coupled with her

background in predicting wildfire outbreaks in the U.S., to identify potential hot spots so medicines and health workers can be mobilized in advance.

“A lot of people use a little spatial modeling ... but not to the same depth and capabilities as we’re doing here,” said Loboda, a University of Maryland professor.

The satellites provide meteorological data, including land surface temperatures, atmospheric water content and information about land cover, including forest, shrubland, settlements or water. These are then combined with socio-economic data gathered by teams of researchers carrying out in-depth surveys with sample populations in the field.

The project is only in its third year, but Loboda’s team has already seen a high correlation between the rate of deforestation and the disease.

One unproven theory is that these areas, often dotted with logging sites, mines and plantations, are host to a disproportionate number of migrant or seasonal workers, bringing with them new strains of the parasite.

The University of Maryland team is working closely with local government and military scientists, collecting data from civilians and troops, respectively. Agence France-Presse



IN SYNC



Members of the Indian Army's motorcycle display team, known as the Dare Devils, participate in a dress rehearsal for Independence Day celebrations in Amritsar on August 13, 2019, two days before India's 73rd anniversary of its independence from British rule. The Dare Devils, a volunteer combat support arm of the Army's Corps of Signals, hold 24 world records, including the Guinness World Record for the largest human motorcycle pyramid of 304 riders and 13 bikes, according to *The Economic Times* newspaper website.

Photo By: **ADEK BERRY** | AFP/Getty Images

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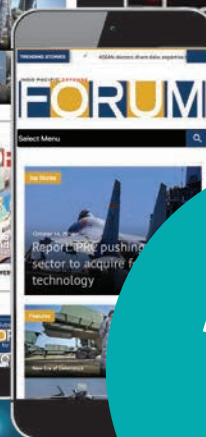
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