對外合作組織與機構動態報導

2017/8/11

AIR FORCE FELLOWS AIM HIGH AT ARGONNE

空軍受阿岡培訓，展望更高遠

By Joan Koka • July 12, 2017

Science, technology and national security come together in a personal and powerful way through the U.S. Air Force Fellows program at the U.S. Department of Energy's (DOE) Argonne National Laboratory, which on July 10 became a second home to Lt. Col. Chris Snyder and Maj. Sean "Skeet" Richardson.

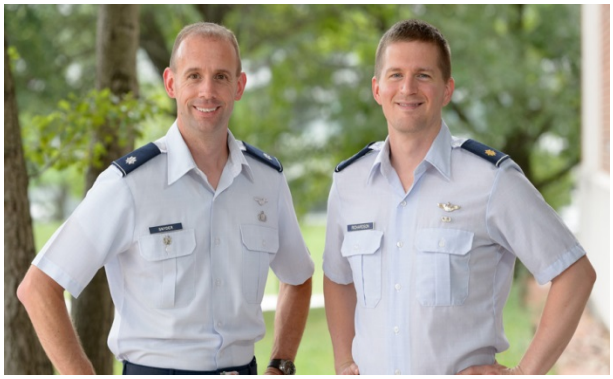
Snyder and Richardson were selected for the prestigious one-year national program after a rigorous selection process based on merit, rank in their respective career fields and education

報告摘要(KEY INFORMATION)

1. 科學、科技與國安，三者在美國空軍計畫裡協同合作，進行相當有力的人員培訓。該培訓對於參訓者和阿岡實驗室都是一大機會，能藉此拓展知識並體驗基礎與應用科學，讓國防科技的使用者瞭解他們所用器械的原理與材料，有助其成為更頂尖的決策者。
2. 在維持經濟制裁的同時，日本及歐洲國家也在尋求與俄合作的方式。相較下，美國參議院日前尚進一步通過對俄制裁法案，日、歐對其後續影響深感憂慮。
3. 卡達與阿烏地阿拉伯等國家的斷絕外交關係仍在進行中。對於各國的要求，卡達無疑已經被激怒，而美國的反應使局勢更加惡化。伊朗又一次面對沙烏利阿拉伯與美方的敵意。
4. 史丹佛的工程師團隊在二十年前就曾提出這樣的問題：「什麼樣的攝影機最能提供機器人所需的資訊？和人眼所需的又有何不同？」而現在，他們開發出具有 140 度視角的 4D 攝影機，期待能提高機器人的「視力」並對擴增實境的研發有所裨益。
5. 一新開發的蛇形機器人可以在不移動其主體的情況下延長相當距離。該設計可能有助搜救操作及醫療處置的進行。

and experience relevant to the Argonne mission. The program promotes open communication between the Air Force and Argonne and encourages collaborations to benefit the departments of Energy and Defense.

"The fellowship is an opportunity for both participants to expand their knowledge and experience with the basic and applied sciences at which Argonne excels," said Argonne's Keith Bradley, who leads the lab's National Security Programs.



The Air Force, like all branches of the military, depends heavily on science, technology, engineering and math, like the hallmark research conducted at Argonne. For example, stealth aircraft employ some of the most advanced composite materials, made possible in part because of discoveries by scientists and facilities at Argonne and other national laboratories.

This program, which began in 2003, is aimed at bringing the Air Force and broader scientific community together to foster greater collaboration and understanding.

For Lt. Col. Brian Gamble, who just completed his assignment as a senior technical fellow at Argonne, it was the experience of a lifetime.

"When I arrived in the summer of 2016, I was not sure what to expect," Gamble noted in the preface to his research paper. "I knew I would have the chance to work with outstanding scientists and engineers, and get to witness new and exciting scientific discoveries."

Although Gamble admitted to being intimidated at first, he said he was welcomed with open arms by many gracious people who were interested in working with him. His paper is an analysis of current and future state of nanomaterial science with a focus on specific areas of interest for the Air Force.

" Working at Argonne has both enriched my career and my life," Gamble said. "It really challenged me personally, it challenged me academically and beyond that, it made a lasting and lifelong impression."

Bradley emphasized that to be selected as an Air Force Fellow is a significant accomplishment.

"The Air Force Fellow program is highly competitive," Bradley said. "It attracts the top few percent of Air Force officers, many of whom go on to become among the most important decision-makers within the Air Force."

Incoming Air Force Fellow and Indiana native Richardson is an F-16

experimental test evaluator pilot and assistant director of operations at the 416th Flight Test Squadron, Edwards Air Force Base, California. He is responsible for flying developmental test missions, leading engineering teams to plan and report on developmental flight test programs and serving on flight test technical and safety review boards.

Richardson sees the highly coveted Argonne assignment as a way to expand his experience into related fields that provide personal and professional rewards and benefits to the Air Force.

"I'd like to learn more about early technology readiness levels, especially through hands-on work with Argonne's core competencies of nuclear, battery and computer research and development," Richardson said.

Ohio native Snyder is the executive officer for the Test and Evaluation Directorate of Headquarters Air Force in Washington, D.C. He is responsible for the executive administration staff, which guides policy, resources and oversight of developmental and operational testing. Snyder is a distinguished graduate of the Air Force Test Pilot School and has 250 flight hours as an experimental test flight engineer in 31 aircraft types.

Being selected as an Air Force Fellow was a total surprise for Snyder.

" I had completed my senior developmental education by correspondence," Snyder said. "Getting to go to school in residence doesn't happen for all of us." He had listed the National Laboratory Fellowship program on his "dream sheet," and the dream came true. With a strong background in engineering, he is especially excited about the chance to see and experience basic research.

"I look forward to getting back to 'grass roots' as an engineer and experiencing cutting-edge laboratory work in a world-class environment like Argonne," Snyder said. "For an Air Force officer, this type of opportunity doesn't come around for many of us, and I hope to truly broaden my horizons – not only with the jump back to basic research but also in a field that I may not be the most familiar."

He and Richardson hope to get their hands dirty, expand their experience into areas of new technology and make long-lasting contributions.

From Argonne's perspective, Bradley emphasized that the Air Force Fellows program provides far-reaching benefits as it helps maintain and strengthen a longstanding relationship between the laboratory and Air Force. The partnership also further reinforces the vital role played by Argonne's National Security Programs, which serves as a gateway for government sponsors and contractors to link into tailored diverse teams of elite researchers to solve research and development challenges in national security.

Funding for the Air Force Fellowship program is provided by the USAF, which sends more than 100 officers to fellowships each year.

RUSSIA: US MOVES AHEAD WITH BILL TO TOUGHEN SANCTIONS ON RUSSIA

俄國觀察：美國通過法案以加重對俄制裁

Sanae Kurita, Senior Researcher

On June 1-3, the Saint Petersburg International Economic Forum was held, attended by more than 14,000 participants from 143 countries including the US, Germany, China, Italy, and Japan. More than 475 investment agreements and MOUs worth over 30 billion dollars were signed during the event. From Japan, Hiroshige Seko, Minister for Economy, Trade and Industry and also for Economic Cooperation with Russia, participated for the first time, and had a meeting with Maxim Oreshkin, Minister for Economic Development and the president's special representative for trade and economic cooperation with Japan. The parties confirmed that the eight-item cooperation plan is progressing smoothly, and exchanged views on how to work on each area of cooperation ahead of the Japan-Russia Summit in September in Vladivostok. Concurrently, a meeting was held between Japanese trading houses, JBIC and Gazprom for possible cooperation.

From the EU, many businesspeople participated in the Forum. Shell agreed with Gazprom on the joint promotion of the Baltic LNG Project, and BP agreed with Rosneft on collaborating on a natural gas project. Further, the Austrian prime minister and President Putin have apparently discussed the extension of TurkStream in central and southern Europe. As gas is not included in the EU's sanctions on Russia, European firms are moving forward, albeit cautiously, with studies on their Russia-related projects despite the sanctions. Incidentally, the European Council announced a one-year extension of the Crimea sanctions on June 19, but the scope of the sanctions remains unchanged.

On the other hand, no major agreements were reached between Russia and the US. The US sanctions on Russia are tougher than those of the EU, and accordingly, Exxon's projects with Russia in the Arctic region, deep sea exploration, and tight oil are all currently on hold. On June 15, the US Senate almost unanimously passed a bill that imposes new sanctions on Russia and requires Congressional approval when easing or lifting existing ones. The bill reflects the strict stance of the US toward the alleged Russian interference in the US presidential election,

annexation of Crimea, and support for Syria's Assad administration. The bill targets Russia's mining, metals, shipping, and railway industries, and if passed, will enshrine into law the sanctions that were issued as executive orders under the previous administration. However, the bill still needs to pass the House of Representatives and be signed by President Trump. Further, on June 20, the US Treasury added two authorities and 36 individuals and organizations from Russia to the sanctions list. Their assets in US banks will be frozen, and US firms will be prohibited to trade with these individuals and firms.

As the US prepares to toughen its sanctions on Russia without first consulting the EU, on June 16, German Economic Affairs and Energy Federal Minister Brigitte Zypries accused the US of "giving up a joint approach with Europe on sanctions against Russia," and warned of possible countermeasures if Washington ends up fining German companies. The impact of this move on the Gazprom-led Nord Stream 2 gas pipeline must also be closely monitored, as the project is being funded with loans from Germany's Wintershall, France's Total and other European companies. As the US bill on Russian sanctions remains uncertain, there is growing fear that its impact may spread beyond the US. With Japanese firms participating in projects with Russian companies mainly in the Russian Far East and Eastern Siberia, any developments in the bill must be closely monitored.

ME: LOOMING UNCERTAINTY IN THE GULF STATES

中東觀察：波斯灣逐漸增加的不確定性

Koichiro Tanaka, Managing Director & President of JIME Center

On June 20, King Salman of Saudi Arabia made a key decision to depose Crown Prince and Interior Minister Muhammad bin Nayef, who is deeply trusted by the US, and appoint his own son, Deputy Crown Prince Muhammad bin Salman, as crown prince and first deputy prime minister. This move empowers the new crown prince, who will also retain key posts such as defense minister and chairman of the Council for Economic and Development Affairs. While the change in the line of succession was considered inevitable, the uncertainties in the Salman regime are attracting renewed attention in the wake of Saudi Arabia's boycotting Qatar, and causing concern to the international community.

On June 5, Saudi Arabia, UAE, Bahrain, and Egypt unilaterally cut diplomatic ties

with and declared an economic blockade on Qatar, claiming that the country was supporting terrorism and appeasing Iran, and closed their land, sea, and air borders to the gas-rich country. Qatar denied the allegation that it is not complying with the Riyadh Agreement, which ended the confrontation within the Gulf Cooperation Council (GCC) in 2014, but reacted calmly and did not retaliate. From a humanitarian standpoint, Turkey and Iran have begun to help Qatar by exporting food. Further, the Grand National Assembly of Turkey approved increasing its troops in Qatar.

Later, Kuwait as mediator conveyed 13 demands to Qatar, including curtailing ties with Iran, closing Al Jazeera and its affiliate broadcasters, shutting down the Turkish military base, severing ties with the Muslim Brotherhood, and accepting regular checks on compliance with these points. Qatar is angered by such high-handed stance and is expected to refuse them as a sovereign country. The situation is worsening as President Trump's reckless tweet intensified the hard-line stance of Saudi Arabia, despite State Secretary Tillerson's utmost efforts to mend the situation, as Qatar is home to the largest US airbase in the Middle East.

Following the coordinated terrorist attacks by ISIS/ISIL in the Iranian capital of Tehran, Iran's conservative hard-liners condemned Saudi Arabia, and even the US, remembering the words of then Deputy Crown Prince Muhammad a month ago which referred to "the battle in Iran." In retaliation for the terrorist attacks, on June 18, the Islamic Revolutionary Guard Corps launched six medium-range ballistic missiles at the ISIS/ISIL base in eastern Syria. The anti-US hard-liners in Iran now have renewed vigor after the State Department released declassified documents on the CIA-backed coup in 1953 that reinstated the Shah (King) Mohammad Reza Pahlavi, and State Secretary Tillerson referred to a regime change in Iran as an option of the Trump administration. The operations to recapture Mosul and Raqqah are well under way, but the shooting-down of a military jet of Assad regime by a US military jet has made it more difficult for the US and Russia to enhance military to cooperation against ISIS/ISIL.

A NEW KIND OF CAMERA COULD IMPROVE ROBOT VISION AND VIRTUAL REALITY

新式攝影機可能改善機器人的「視力」並增益虛擬實境

By Taylor Kubota, July 24, 2017

A new camera that builds on technology first described by Stanford researchers more than 20 years ago could generate the kind of information-rich images that robots need to navigate the world. This camera, which generates a four dimensional image, can also capture nearly 140 degrees of information.

"We want to consider what would be the right camera for a robot that drives or delivers packages by air. We're great at making cameras for humans but do robots need to see the way humans do? Probably not," said Donald Dansereau, a postdoctoral fellow in electrical engineering.

With robotics in mind, Dansereau and Gordon Wetzstein, assistant professor of electrical engineering, along with colleagues from the University of California, San Diego have created the first-ever single-lens, wide field of view, light field camera, which they are presenting at the computer vision conference CVPR 2017 on July 23.

As technology stands now, robots have to move around, gathering different perspectives, if they want to understand certain aspects of their environment, such as movement and material composition of different objects. This camera could allow them to gather much the same information in a single image. The researchers also see this being used in autonomous vehicles and augmented and virtual reality technologies.

"It's at the core of our field of computational photography," said Wetzstein. "It's a convergence of algorithms and optics that's facilitating unprecedented imaging systems."

From a peephole to a window

The difference between looking through a normal camera and the new design is like the difference between looking through a peephole and a window, the scientists said.

"A 2D photo is like a peephole because you can't move your head around to gain more information about depth, translucency or light scattering," Dansereau said. "Looking through a window, you can move and, as a result, identify features like shape, transparency and shininess."

That additional information comes from a type of photography called light field photography, first described in 1996 by Stanford professors Marc Levoy and Pat Hanrahan. Light field photography captures the same image as a

conventional 2D camera plus information about the direction and distance of the light hitting the lens, creating what's known as a 4D image. A well-known feature of light field photography is that it allows users to refocus images after they are taken because the images include information about the light position and direction. Robots might use this to see through rain and other things that could obscure their vision.

The extremely wide field of view, which encompasses nearly a third of the circle around the camera, comes from a specially designed spherical lens. However, this lens also produced a significant hurdle: how to translate a spherical image onto a flat sensor. Previous approaches to solving this problem had been heavy and error prone, but combining the optics and fabrication expertise of UCSD and the signal processing and algorithmic expertise of Wetzstein's lab resulted in a digital solution to this problem that not only leads to the creation of these extra-wide images but enhances them.

Robotics up close

This camera system's wide field of view, detailed depth information and potential compact size are all desirable features for imaging systems incorporated in wearables, robotics, autonomous vehicles and augmented and virtual reality.

"It could enable various types of artificially intelligent technology to understand how far away objects are, whether they're moving and what they've made of," said Wetzstein. "This system could be helpful in any situation where you have limited space and you want the computer to understand the entire world around it."

Although it can also work like a conventional camera at far distances, this camera is designed to improve close-up images. Examples where it would be particularly useful include robots that have to navigate through small areas, landing drones and self-driving cars. As part of an augmented or virtual reality system, its depth information could result in more seamless renderings of real scenes and support better integration between those scenes and virtual components.

The camera is currently a proof-of-concept and the team is planning to create a compact prototype next. That version would hopefully be small enough and light enough to test on a robot. A camera that humans could wear could be soon to follow.

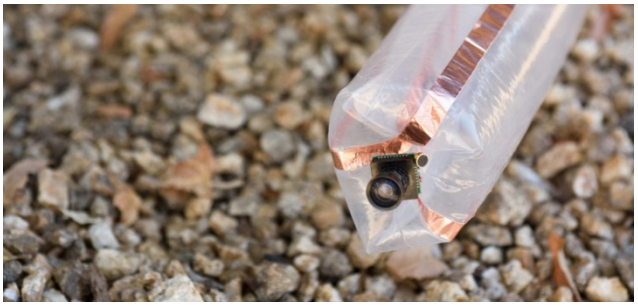
"Many research groups are looking at what we can do with light fields but no one has great cameras. We have off-the-shelf cameras that are designed for consumer photography," said Dansereau. "This is the first example I know of a light field camera built specifically for robotics and augmented reality. I'm stoked to put it into peoples' hands and to see what they can do with it."

SOME ORGANISMS COVER DISTANCE BY GROWING. NOW A ROBOT CAN, TOO.

有些生物可以藉由生長延長自己，現在機器人也可以

By Taylor Kubota, July 19, 2017

Imagine rescuers searching for people in the rubble of a collapsed building. Instead of digging through the debris by hand or having dogs sniff for signs of life, they bring out a small, air-tight cylinder. They place the device at the entrance of the debris and flip a switch. From one end of the cylinder, a tendril extends into the mass of stones and dirt, like a fast-climbing vine. A camera at the tip of the tendril gives rescuers a view of the otherwise unreachable places beneath the rubble.



This is just one possible application of a new type of robot created by mechanical engineers at Stanford University, detailed in a recent *Science Robotics* paper. Inspired by natural organisms that cover distance by growing – such as vines, fungi and nerve cells – the researchers have made a proof of concept of their soft, growing robot and have run it through some challenging tests.

"Essentially, we're trying to understand the fundamentals of this new approach to getting mobility or movement out of a mechanism," explained Allison Okamura, professor of mechanical engineering and senior author of the paper. "It's very, very different from the way that animals or people get around the world."

To investigate what their robot can do, the group created prototypes that move through various obstacles, travel toward a designated goal, and grow into a free-standing structure. This robot could serve a wide range of purposes, particularly in the realms of search and rescue and medical devices, the researchers said.

A growing robot

The basic idea behind this robot is straightforward. It's a tube of soft material folded inside itself, like an inside-out sock, that grows in one direction when the material at the front of the tube everts, as the tube becomes right-side-out. In the prototypes, the material was a thin, cheap plastic and the robot body everted when the scientists pumped pressurized air into the stationary end. In other versions, fluid could replace the pressurized air.

What makes this robot design extremely useful is that the design results in movement of the tip without movement of the body.

"The body lengthens as the material extends from the end but the rest of the body doesn't move," explained Elliot Hawkes, a visiting assistant professor from the University of California, Santa Barbara, and lead author of the paper. "The body can be stuck to the

environment or jammed between rocks, but that doesn't stop the robot because the tip can continue to progress as new material is added to the end."

The group tested the benefits of this method for getting the robot from one place to another in several ways. It grew through an obstacle course, where it traveled over flypaper, sticky glue and nails and up an ice wall to deliver a sensor, which could potentially sense carbon dioxide produced by trapped survivors. It successfully completed this course even though it was punctured by the nails because the area that was punctured didn't continue to move and, as a result, self-sealed by staying on top of the nail.

In other demonstrations, the robot lifted a 100-kilogram crate, grew under a door gap that was 10 percent of its diameter and spiraled on itself to form a free-standing structure that then sent out a radio signal. The robot also maneuvered through the space above a dropped ceiling, which showed how it was able to navigate unknown obstacles as a robot like this might have to do in walls, under roads or inside pipes. Further, it pulled a cable through its body while growing above the dropped ceiling, offering a new method for routing wires in tight spaces.

Difficult environments

"The applications we're focusing on are those where the robot moves through a difficult environment, where the features are unpredictable and there are unknown spaces," said Laura Blumenschein, a graduate student in the Okamura lab and co-author of the paper. "If you can put a robot in these environments and it's unaffected by the obstacles while it's moving, you don't need to worry about it getting damaged or stuck as it explores."

Some iterations of these robots included a control system that differentially inflated the body, which made the robot turn right or left. The researchers developed a software system that based direction decisions on images coming in from a camera at the tip of the robot.

A primary advantage of soft robots is that they can be safer than hard, rigid robots not only because they are soft but also because they are often lightweight. This is especially useful in situations where a robot could be moving in close quarters with a person. Another benefit, in the case of this robot, is that it is flexible and can follow complicated paths. This, however, also poses some challenges.

Joey Greer, a graduate student in the Okamura lab and co-author of the paper, said that controlling a robot requires a precise model of its motion, which is difficult to establish for a soft robot. Rigid robots, by comparison, are much easier to model and control, but are unusable in many situations where flexibility or safety is necessary. "Also, using a camera to guide the robot to a target is a difficult problem because the camera imagery needs to be processed at the rate it is produced. A lot of work went into designing algorithms that both ran fast and produced results that were accurate enough for controlling the soft robot," Greer said.

Going big — and small

As it exists now, the scientists built the prototype by hand and it is powered through pneumatic air pressure. In the future, the

researchers would like to create a version that would be manufactured automatically. Future versions may also grow using liquid, which could help deliver water to people trapped in tight spaces or to put out fires in closed rooms. They are also exploring new, tougher materials, like rip-stop nylon and Kevlar.

The researchers also hope to scale the robot much larger and much smaller to see how it performs. They've already created a 1.8 mm version and believe small growing robots could advance medical procedures. In place of a tube that is pushed through the body, this type of soft robot would grow without dragging along delicate structures.