

# THE PLOUGHSHARES MONITOR

VOLUME 43 | ISSUE 1

SPRING 2022

**PLOUGHSHARES AT WORK**  
A conversation with our  
Executive Director

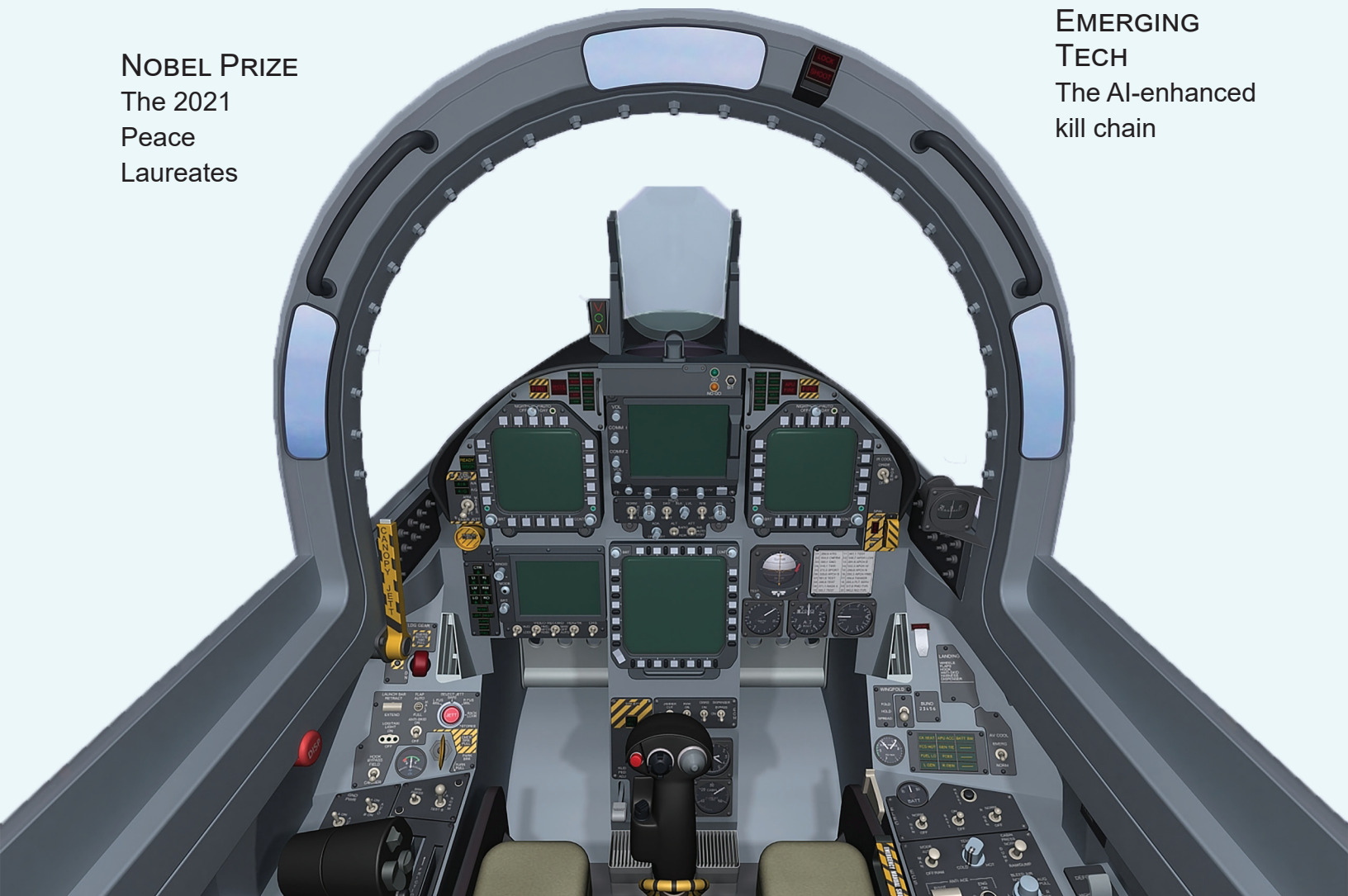
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kill chain



*"and they shall beat their swords into ploughshares,  
and spears into pruning hooks; nation shall not lift  
up sword against nation; neither shall they learn war  
any more." Isaiah 2:4*

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## From the Director's Desk

# Challenging times

Written by Cesar Jaramillo



I was recently asked to identify the main threats to global security today. If we set to one side the COVID-19 pandemic, the two most formidable existential threats are environmental degradation and the existence of nearly 14,000 nuclear weapons.

Both could destroy human civilization and irreparably damage the ecosystem. Both are also the products of human decisions and actions; addressing the threat and containing the damage is now the responsibility of all humanity.

## Global tensions

Other tensions in the global order also require creative solutions and urgent, concerted international attention. The main files that Project Ploughshares works on (nuclear disarmament, arms controls, emerging military technologies, outer space security, the protection of civilians in armed conflict) relate to some of the gravest challenges to international security.

The rise of populist political leaders, both those on the far right and far left, is worrying. These figures thrive by spreading fear and misinformation, often stoking nationalistic fervour and exploiting identity politics. And, let's be clear, liberal democracies are not immune to populist political discourse. All systems of governance can be manipulated and undermined by such leaders

and their followers.

For many people, armed conflict and resource scarcity represent daily threats to their lives and livelihoods. The uneven allocation of resources – and the lack of any drive to share them more equitably – are big problems. An unacceptably high proportion of the global population cannot satisfy basic needs as a consequence of armed conflict, and/or are in dire need of humanitarian assistance. Yet national and international budgets to address these needs continue to be only a fraction of military budgets.

When the international community does respond to pressing security challenges, a lack of policy coherence can often be observed. How can nuclear weapons be deemed unacceptable for Iran, but appropriate for nuclear-armed states? If the persecution of Uyghurs by China merits strong denunciation, so too does the oppression of Palestinians by Israel. A military incursion that violates international law and endangers civilian lives must be forcefully challenged—whether it is carried out by Russia or Saudi Arabia. Double standards only erode the credibility of collective responses.

According to the UN Refugee Agency, there are more than 82 million forcibly displaced persons around the world – more than there were at the end of the Second World War. That so many exist in wretched conditions indicates the unwilling-



It is far from impossible that any conflict between nuclear-weapon states could escalate to include the use of their most powerful weapons. This could occur even if none of the parties involved intends to take such a step. From this perspective, there is no moral high ground.

ness of the international community to meet its responsibilities under international refugee law. And there are other problems, of oppression and suppression of human rights, that have become disconcertingly normalized.

### **Nuclear disarmament remains a chief concern**

Yes, there are many things to regret in our world today. Nevertheless, I would contend that nuclear disarmament must remain a priority for the international community—and will remain one for Project Ploughshares – until there are no more nuclear weapons. For now, the risk remains that these weapons will be used, to devastating effect.

At the time of writing this column, Ukraine is under attack by Russia. Ukraine has no nuclear weapons, but Russia and three NATO states do. Together, the four possess more than 95 per cent of the world's nuclear weapons.

And it is little consolation that there are liberal democracies on one side, because, as the mantra says, there are no right hands for wrong weapons. It is far from impossible that any conflict between nuclear-weapon states could escalate to include the use of their most powerful weapons. This could occur even if none of the parties involved intends to take such a step. From this perspective, there is no moral high ground.

The thought that nuclear weapons might actually be used is, at its core, absurd. What a waste in scarce resources and human ingenuity. Such foolishness and faulty reasoning that could lead

to such perilous brinkmanship. Such a loss of opportunity – because, in fact, any use of nuclear weapons is preventable.

### **Hope despite difficulties**

But there is still hope that the international community will choose to craft more effective mechanisms that contain armed conflict and minimize harmful humanitarian consequences. Indeed, in the very challenges lie the seeds of progress.

At Project Ploughshares, we have witnessed the adoption and entry into force of the Arms Trade Treaty and the Treaty on the Prohibition of Nuclear Weapons. Canada's arms export controls have been strengthened. The international community is restarting conversations about norms of behaviour in outer space. An ongoing multilateral process aims to enhance civilian protections in armed conflict.

There is now greater awareness of the perils posed by emerging military technologies. Civil society advocacy is growing in sophistication, effectiveness, and numbers. New avenues for communication are allowing the general public to be better informed about peace and security issues.

Of course, much work remains. One would be naïve to deny the multiple, overlapping security challenges facing the world today. The path to sustainable peace is full of obstacles. But Project Ploughshares is on that road, with our many partners and supporters.

Progress has been made. With work and resolve, more can and will follow. □

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## A PROJECT PLOUGHSHARES WEBINAR

# UKRAINE, NATO AND THE FUTURE OF TRANSATLANTIC SECURITY

### FEATURING



**Dr. Pavel Podvig**  
Senior Researcher  
UNIDIR



**Peggy Mason**  
President, Rideau  
Institute; Former  
Canadian Ambassador for  
Disarmament to the UN



**Cesar Jaramillo**  
Executive Director  
Project Ploughshares



**Dr. Branka Marijan**  
Senior Researcher  
Project Ploughshares  
MODERATOR

*Held in February before the Russian invasion of Ukraine, this event is available on the Ploughshares YouTube channel.*

The 2022 Ukraine crisis is often viewed by media and even Canadian government ministers as a contest between liberal democracies (the United States and its NATO allies) and an authoritarian state (Russia). A different perspective is developed in this paradigm-expanding webinar.

The panelists provide a broader and deeper context for tensions, including the dismantlement of many arms control agreements in recent years, Russia's growing feelings of isolation, the eastward expansion of NATO, and the refurbishing of nuclear arsenals.

The main takeaway: Talks between adversaries will not produce the desired result. What is required is a common security approach that provides security guarantees for all parties. Canada should be promoting such a diplomatic solution.



# OTTAWA DECLARATION

## Canada and the Treaty on the Prohibition of Nuclear Weapons

**“Humanity remains one misunderstanding, one misstep, one miscalculation, one pushed button away from annihilation.”**

**U**.N. Secretary-General António Guterres issues this stark warning of the immediacy of the nuclear threat and the unacceptable catastrophic humanitarian consequences of firing any of the world’s 13,000 nuclear weapons. All nine states holding these weapons pursue the perpetual “modernization” of their arsenals—notably making a mockery of the disarmament commitments of the nuclear weapon powers party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and threatening to extend the nuclear weapons era indefinitely. More than ever, the world needs to hear a clear moral and legal call for the elimination and perpetual prohibition of these instruments of mass destruction.

Just such a call has come with urgency and authority in the January 2021 entry into force of the Treaty on the Prohibition of Nuclear Weapons (TPNW). In unequivocal language, the TPNW declares that “any use of nuclear weapons would be abhorrent to the principles of humanity and the dictates of public conscience.”

This historic treaty exposes and stigmatizes nuclear weapons and their use as standing outside the norms of international humanitarian law. It challenges nuclear weapon states to finally act on their NPT disarmament commitments. The TPNW reinforces the urgent need for nuclear weapon states

to undertake and conclude nuclear disarmament negotiations, with non-nuclear weapon states also at the table.

Therefore, we the undersigned urge Canada to join the Treaty and call on the Government to begin the process by publicly welcoming the Treaty’s moral authority and legal mandate in the pursuit of a world without nuclear weapons. We also urge Canada to join Norway and Germany as observers at the first Meeting of States Parties, and to work at bringing NATO into conformity with the Treaty and the NPT.

We thus call on Canada to challenge the nuclear retentionist policies of NATO, by, as a first step, acting decisively on the still relevant 2018 recommendation of the House of Commons Committee on National Defence—that, “on an urgent basis,” the Government of Canada “take a leadership role within NATO in beginning the work necessary for achieving the NATO goal of creating the conditions for a world free of nuclear weapons.”

The overwhelming majority of Canadians support the abolition of nuclear weapons and look to their government for energetic and sustained leadership in helping to push the world back from the abyss of nuclear annihilation. Nuclear disarmament diplomacy must become a national priority. Emergency action is required.

*January 2022*

*This “Ottawa Declaration” emerged out of the conference of international experts initiated and convened by The Simons Foundation Canada and Canadians for a Nuclear Weapons Convention (CNWC) in Ottawa, November 29-30, 2021, on “Canada and the Treaty on the Prohibition of Nuclear Weapons.” The declaration is endorsed by the following individuals (conference participants, indicated by an asterisk, and CNWC supporters, all of whom are recipients of the Order of Canada). Affiliations are included for identification purposes only and do not indicate institutional endorsement.*

**Ray Acheson\***

Director, Reaching Critical Will of the Women's International League for Peace and Freedom

**Carolyn Acker C.M.**

Founder, Pathways to Education Canada

**The Hon. Lloyd Axworthy, C.C.\***

Former Minister of Foreign Affairs, Canada

**Tom Axworthy, O.C.**

Secretary General, InterAction Council; Chair, Public Policy, Massey College, University of Toronto

**Christopher R. Barnes, C.M.**

Professor Emeritus, Earth and Ocean Sciences, University of Victoria

**Gerry Barr, C.M.**

Former CEO of the Directors Guild of Canada; Former President and CEO of Canadian Council for International Cooperation

**Adele Buckley\***

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Distinguished University Professor of Medicine, McMaster University; Past President, World Heart Foundation

**Canadians for a  
Nuclear Weapons Convention**



**Rassemblement canadien pour une  
convention sur les armes nucléaires**



# The AI-enhanced kill chain

Written by Branka Marijan

**M**ilitary research and development in recent years have focused on artificial intelligence (AI) tools that gather and analyze data quickly. Combined with improved sensors, they make possible faster and seemingly more accurate targeting of enemy positions.

Now this R&D is being operationalized. Last September, according to Secretary of the Air Force Frank Kendall, the United States Air Force, for the first time, used AI to help to identify a target or targets in “a live operational kill chain.”

The “kill chain” outlines the attack structure: a target is identified, forces are prepared for the attack, engagement of the target is planned and ordered, the target is destroyed, and, finally, the results of the action are evaluated. In the last two decades, the time needed to complete this process has decreased significantly.

Analysts are fairly certain that the militaries of other countries are working on similar AI capabilities. What is not yet known is how soon they will operationalize such technologies. But, as humans build smarter, AI-enhanced weapons systems, we all need to consider the consequences, to civilians and the planet.

## Compressing the kill chain

According to U.S. Army Officer Mike Benitez, in a commentary piece published on the platform



“War on the Rocks” in 2017, in the early 1990s it was “crazy” to think that air power could strike emerging targets on the battlefield in less than 10 minutes. But in the intervening years, new technologies had allowed for much quicker data gathering and processing.

Benitez predicted that it wouldn’t be long before, once a target had been detected, it would be verified through other surveillance tools, such as satellite imagery, and a weapon would be fired. The desire for speed would mean that more platforms, such as drones, would be equipped with software capable of assessing target identification and selection. As the drone approached the target, its sensors would get a fix on the target and signal engagement.

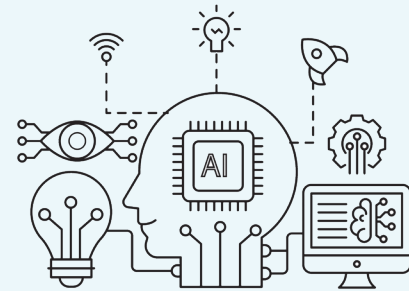
Transmitting all the information picked up by the sensors to human analysts, as is generally done now, still takes time and more human resources than might be imagined. According to journalist David Hambling in a *Forbes* article from last October, a crew of 45 is needed to “handle the returns” of a RQ-4 Global Hawk drone mission.

## Artificial and human intelligence: How to determine accountability

Secretary Kendall did not say if the AI-assisted strike in September 2021 employed a drone or a

## Building new audiences for the Ploughshares message

This past winter, Ploughshares Senior Researcher Dr. Branka Marijan participated in a workshop “AI and Semi-Autonomous Systems,” part of a series on Artificial Intelligence for Defence and Security put on by the Centre for International Governance Innovation and Defence Research and Development Canada. She was also the guest lecturer in a University of Waterloo undergraduate course, STV 208: Artificial Intelligence and Society, largely populated by students from the various departments of the Faculty of Engineering.



On these occasions, Branka explained the need to regulate AI-empowered weapons systems and other systems, like facial recognition, which can both aid and harm military and civilian populations. Regulations can contribute to a stable security environment, establishing universally recognized red lines and building confidence among all countries that common boundaries will be observed. Some clarity is certainly needed in a security and technical environment riddled with ambiguity and conflicting definitions. There is no single definition of “autonomous,” no generally accepted understanding of who is accountable for the results of the use of AI-supported technologies.

Those who are creating technologies that employ AI and machine learning – and those who will be doing so in the coming years – need to hear and heed such messages.

piloted aircraft, nor did he provide any operational information about the role of human operators and analysts. A U.S. Air Force spokesperson did assure Hambling that, even though AI helped with targeting, human intelligence professionals were the ultimate decision-makers.

But are the analysts and operators merely approving the strikes that the AI systems are recommending? How well do they understand the technological contexts and reasons that lead to these recommendations?

And are the humans being given all the information that they need to make suitable military decisions? In contemporary conflicts, operators are often a great distance from the actual targets. There might be no friendly forces in the area. In these cases, the operators must rely on surveillance from various platforms that may not always provide the ability to confirm the targets.

Even if humans make the final decision, the interventions of machines, time, and distance can result in faulty judgements that result in the loss of civilian lives. A recent example is the August 29, 2021 drone attack in Afghanistan.

All these questions and observations illustrate the problems involved in using AI in military decision-making, particularly in target selection

and engagement. This then leads to concerns about accountability. If the human decision-maker does not have sufficient control over the decision-making, it might be difficult to hold them accountable for the resulting actions. This is no small matter when trying to apply International Humanitarian Law (IHL or the law of war), which can only regulate the actions of humans, not technologies.

Enhancing human decision-making with AI starts to complicate any determination of what constitutes human control. Research on automation bias has shown that human operators tend to rely too much on technology when it is made available. Human operators can also be subject to automation complacency, expecting the system to function as advertised and not being sufficiently alert for any aberrations. Concurrently, human operators must also be prepared for an automation surprise when a system’s actions are unexpected or when a human operator doesn’t understand the cause of a certain machine response.

### The spread of technology

Although the development of military technologies is cloaked in secrecy, we can be fairly certain

that some of the AI military tools will soon begin to appear in the arsenals of a growing number of armed forces.

Some hurdles will have to be overcome. There are still challenges in applying AI technologies to larger, more sophisticated weapons systems. Further improvements are needed in robotics, sensors, and energy efficiency. Some military personnel will resist technologies that seem to disrupt the usual structures long employed by military forces. However, the ability to quickly identify and engage targets that AI tools and better sensors will make possible will likely prove irresistible in the end.

Evidence that militaries beyond the United States are keen to leverage these technologies could be found at the October 2021 Scarlet Dragon exercise conducted by U.S. armed forces and observed by representatives from the United Kingdom, Australia, and Canada. According to U.S. Colonel Joseph Boccino, the exercise focused on “using AI to shorten the kill chain.”

In its January 29, 2022 issue, *The Economist* notes that, in Scarlet Dragon, an “exercise in which a wide range of systems were used to comb a large area for a small target, things were greatly

speeded up by allowing satellites to provide estimates of where a target might be in a compact form readable by another sensor or a targeting system, rather than transmitting high-definition pictures of the sort humans look at.” The exercise appears to demonstrate a further move away from meaningful human control over targeting decisions.

In 2017, Colonel Benitez said, “We have entered an era where more cognitive weapons and levels of autonomy will only be limited by policy.” Yet, international policy discussions on autonomous weapons have moved slowly. No progress was made at the December 2021 meetings of the United Nations Convention on Certain Conventional Weapons, the main global forum for such discussions.

Political will is needed to regulate these advancing technologies before it is too late. The development of new, enforceable international policy is the only way to address valid concerns about the deployment of still immature systems that will certainly cause harm to civilians and civilian infrastructure. It is also the only way to bolster international humanitarian law and preserve the principle of human accountability. □

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## Canada's to-do list for 2022

In January, the Executive Director and researchers of Project Ploughshares published a list of recommendations on how the Canadian government can refurbish its “arms control and disarmament credentials.”

Among them:

- Implement the 2018 recommendation of the House of Commons Standing Committee on National Defence that Canada take “a leadership role within NATO in beginning the work necessary for achieving the NATO goal of creating the conditions for a world free of nuclear weapons.”
- Promote the peaceful use of outer space and denounce all rhetoric that views space as a warfighting domain at all relevant domestic and international forums.
- Revoke all arms export permits to belligerents in Yemen.
- Support international calls to ban autonomous weapons that function without meaningful human control.
- Review rules of engagement across all branches of the Canadian Armed Forces to ensure the highest standards are in place to protect civilians from the use of explosive weapons in populated areas.

For the complete list, as well as contextual information and analysis, go to the Ploughshares Briefing *Restoring Canada's arms control and disarmament credentials* at [www.ploughshares.ca](http://www.ploughshares.ca).

# How Canadian technology is shaping modern conflict

## CAE's international sales 2017-2021

Written by Kelsey Gallagher



**E**stablished in 1947 as Canadian Aviation Electronics, CAE Inc. has more than 10,000 employees and operates 180 sites and training locations in more than 35 countries. While CAE produces goods for the civilian market, it is also one of Canada's largest military manufacturers, chiefly producing cockpit simulators and associated equipment that are used in training air crew. As is true of many Canadian defence manufacturers, most of its goods and services are exported and sold on the foreign market.

CAE also offers land-, maritime-, space-, and cyber-related training solutions, and has provided in-person, on-location training to military personnel of more than a quarter of all the world's states. "Canada's training partner of choice," CAE has supplied the Royal Canadian Air Force since the 1950s and operates more than 30 simulators or flight training devices at 15 Canadian facilities.

### A compilation of international sales

The accompanying table is a non-exhaustive dataset of CAE's international sales from 2017 to

2021. Data was collected from available sources, including defence journals, business publications, official contract announcements, and government releases. Information was collected only on foreign sales and so does not reflect CAE's provision of goods and services to the Canadian Department of National Defence.

Most transactions are prime contracts or sub-contracts awarded to CAE or its subsidiaries. The rest are delivery notices, contract renewals or amendments, or export permit applications. They are identified and defined in the table.

Many of these transactions deserve further attention. Here we will provide some additional information related to contracts awarded to customers in the United States and the Middle East.

### Big business in the United States

Florida-based subsidiary CAE USA handles most CAE contracts with the U.S. military. Between 2017 and 2021, CAE USA was awarded at least 20 contracts, most with the U.S. Department of Defense. With many deals going unreported, the actual number of individual trans-

YEAR	CAE MILITARY GOODS AND SERVICES	RECIPIENT	SUBSIDIARY
2021	Upgrading 3 Hawk M127 Full-Mission Simulators (FMS)	Royal Australian Air Force	CAE Australia Pty Ltd
	Class "A" and "B" naval Bridge Simulators*	Egyptian Navy	Xebec (joint venture)
	Design, development, and manufacture of C-130J aircraft simulators*	French Air Force/German Air Force	
	Maintenance and operation of M-346 trainer aircraft and Ground-Based Training System (GBTS)*	Italian Air Force	
	P-8A Operational Flight Trainer (OFT) and equipment*	Royal New Zealand Air Force	
	Bridge Part-Task Trainer (BPTT) for Multi-Mission Surface Combatants (MMSC)*	Royal Saudi Navy	Xebec (joint venture)
	10 Medallion MR e-Series visual display systems*	UK Royal Air Force	
	Simulator and live-flying training*	Irish Air Corps	CAE USA
	Platform development for 3D geospatial monitoring*	National Geospatial Intelligence Agency	CAE USA
	Maintenance and training for Bell's Future Vertical Lift (FVL) family of systems*	US Army	CAE USA
	Integration efforts for the Special Operations Forces Global Situational Awareness initiative	US Special Operations Command	CAE USA
	Maritime Integrated Training System (MITS)*	US Army	CAE USA
	Simulation and live flight training services	US Customs and Border Protection	CAE USA
	Aircrew training on F-15E/F-16/F-22A aircraft*‡	US Air Force	CAE USA-Mission Solutions Inc.
	Simulation aircrew training services on T-44C Pegasus‡	US Navy	CAE USA
	3 Littoral Combat Ship (LCS) Bridge Part-Task Trainers (BPTTs)*†	US Navy	CAE USA
2020	Developing initial prototype of HH-60W aircrew trainer	US Air Force	CAE USA
	PC-21 Full-Mission Simulator (FMS)*‡	French Air Force	
	Avionics updates on the E-3A flight deck simulator/E-3A flight training device*‡	NATO Airborne Early Warning & Control Program Management Agency (NAPMA)	
	2 Eurofighter Full-Mission Simulators (FMS) and upgrades to existing simulators*	Eurofighter Pilot Synthetic Training System (PSTS) consortium	CAE GmbH
	CAE 700MR Series NH90 Flight Training Device (FTD)	New Zealand Defence Force/Royal New Zealand Air Force	
	4 Medallion MR e-Series Eurofighter aircraft simulators*	Qatar Emiri Air Force	
	Simulator and training services on the CH-47 Chinook/UH-60 Black Hawk/AH-64 Apache helicopters	US Army	CAE USA
	Support for prototype development of wargaming centre*	US Marine Corp	CAE USA-Mission Solutions Inc.
	6 CAE Magnetic Anomaly Detection-Extended Role (MAD-XR) system for MH-60R Seahawk*	US Navy	
	Support on the Global Situational Awareness initiative	US Special Operations Command (USSOCOM)	CAE USA-Mission Solutions Inc.
	Installation and integration of cloud-based Learning Management System	US Air Force	CAE USA
2019	MQ-9 Predator Remotely Piloted Aircraft (RPA) Mission Trainer*†	General Atomics Aeronautical Systems (GA-ASI)	
	Technology and software for F-16 Weapons and Tactical Trainer (WTT)/Forward Air Controller Sensor (FACS)§	Turkish Air Force	
	Technology and software for AW139 Full-Flight Simulator (FFS)§	Qatar Emiri Air Force	

Delivery notice (†): A notice that goods or services under contract have been delivered.

Export permit request (§): Record of transaction is sourced from CAE application for authorization to export military goods or services.

Renewal/amendment to previously awarded contract (§)

Subcontract (\*)

YEAR	CAE MILITARY GOODS AND SERVICES	RECIPIENT	SUBSIDIARY
2019	Technology and software for T129 Full-Mission Simulator (FMS)/ Part-Mission Simulator(PMS)/Avionics and Weapons Tactical Trainer (AWTT)/Stealth View Display (SVD)§	Turkish Land Forces	
	Technology and software for A400M Cockpit Maintenance Operational System (CMOS)§	Turkish Air Force	
	Suite of NH90 Sea Lion simulators/trainers*	German Navy	CAE Elektronik GmbH
	Upgrade to Naval Warfare Training System (NWTs)*	Swedish Navy	
	Simulator hardware for P-8A Operational Flight Trainer (OFT)*	UK Royal Air Force	CAE USA
	Development of mission trainers for Protector RG Mk1 remotely piloted aircraft system (RPAS)*	UK Royal Air Force	
	Simulator training on UC-12 aircraft	US Navy	CAE USA
	6 M1A2 Abrams engine maintenance trainers†	US Army	
2018	Hardware, technology, and software for T129 Full-Mission Simulator (FMS)§	Turkish Land Forces	
	2 S-70B training devices	Brazilian Navy	CAE USA
	Hardware for P-8I Operational Flight Trainer (OFT)*	Indian Navy	
	MQ-9 Predator Remotely Piloted Aircraft (RPA) Mission Trainer*	Italian Air Force	
	CAE 700MR Series NH90 Flight Training Device (FTD)†	Royal New Zealand Air Force	
	6 Simulator systems for NH90 NATO Frigate Helicopters (NFH) and associated training and support services*	Qatar Emiri Air Force	
	Contract extension for training on Chinook Mk4/Mk6a/Merlin Mk3/Puma Mk2 helicopters‡	UK Royal Air Force/Royal Navy	Serco
	Lead development on a Joint Multinational Simulation Centre	Unspecified Gulf Cooperation Council country	
	Training and simulator device modifications, upgrades, and associated support for C-130H military transport aircraft	US Air Force	CAE USA
	Development and delivery of 2 M1A2 Abrams tank maintenance trainers	US Army	CAE USA
2017	Maintenance and support service on 3 Mk127 Full-Mission Simulators (FMS)	Royal Australian Air Force	
	3 Mk127 Full-Mission Simulators (FMS)*	Royal Australian Air Force	
	Simulator upgrades and training support on MH-60 Seahawk	Royal Australian Navy	
	Support of training exercises on F/A-18/E-7A Wedgetail/C-130J simulators†	Royal Australian Air Force	
	2 PC-21 Full-Mission Simulators (FMS) and part-task trainers*	French Air Force	
	CAE Medallion-6000MR and upgrades to King MK31 helicopter simulator†	Germany Navy	
	CAE 7000MR Series C295 Full-Flight Simulator (FFS)*	Polish Air Force	
	CAE 3000MR Series SW-4 Full-Flight Simulator (FFS)	Polish Air Force	
	2 C295 Full-Flight Simulators (FFS)*	Airbus Defence & Space	
	Simulator training and establishment of training centre for Remotely Piloted Aircraft (RPA)	UAE Air Force/Air Defence	CAE Maritime Middle East LLC
	6 simulators configured for Chinook Mk4/Mk6a/Merlin Mk3/ Puma Mk2 helicopters*‡	UK Royal Air Force/Royal Navy	
	Training functions for veterinary care simulations	US Army	
	Design and development of 6 C-130J weapon systems trainers*	US Air Force/Air National Guard	CAE USA
	Development of an HC/MC-30J enhanced fuselage trainer (eFuT)*	US Air Force Special Operations Command	CAE USA
	Development of 4 KC-130J fuselage trainers (FuT)*	US Marine Corps	CAE USA
	Simulator upgrades and training support on MH-60 Seahawk	US Navy	
	C-130 aeromedical evacuation simulator†	US Air Force	CAE USA

actions is likely much higher and of substantial value.

CAE currently trains American pilots on platforms that include the F-15, F-16, and F-22



In 2016, CAE won a contract worth a potential 450-million CAD to establish a naval training centre for the United Arab Emirates. In 2017, it won another contract to establish a training centre for the UAE Air Force and Air Defence.

fighter aircraft, the MQ-9 Predator Uncrewed Aerial Vehicle (UAV), and a number of helicopters, transportation aircraft, and maritime vessels. CAE recently acquired L3Harris Technologies' Military Training business, which will be operated by CAE USA, and will position the company to become one of the largest providers of training to the U.S. military.

### CAE in the Middle East

In 2016, CAE won a contract worth a potential 450-million CAD to establish a naval training centre for the United Arab Emirates. In 2017, it won another contract to establish a training centre for the UAE Air Force and Air Defence. CAE describes itself as the prime contractor responsible for delivering all UAV-type mission training for the UAE Air Force. A subsidiary based in Abu Dhabi, CAE Middle East is a main hub for serving other customers in the region.

CAE currently trains UAE forces on the RQ-1E UAV, which is the unarmed version of the notorious American-made Predator UAV. The aircraft is used for surveillance, reconnaissance, and target acquisition. As a principal member of the Saudi-led coalition supporting the Yemeni government in the current civil war, the UAE has recently deployed the RQ-1E in Yemen.

Since 2015, the coalition has launched more

than 20,000 air attacks in Yemen. According to the Yemen Data Project, January 2022 was the deadliest month for coalition air strikes in more than five years, with at least 138 civilians killed and scores more injured. As a result, leading civil society groups have called for a halt to UAV exports to coalition members.

In 2015, the coalition established a naval blockade of Yemen, which has indirectly led to the deaths and suffering of thousands of Yemenis. In 2021, a joint venture of CAE USA and Pinnacle Solutions was awarded a contract with the U.S. Department of Defense to supply trainers to both the Egyptian and Saudi navies through the Foreign Military Sales (FMS) program. Because such activities could facilitate more blockades in Yemen and elsewhere, this award raises obvious red flags.

In 2018-2019, CAE sought Canadian government approval to export to the Turkish Air and Land Forces training technology and services for T129 helicopter gunships, cockpit maintenance systems for the A400M transport aircraft, and weapons and flight trainers for the F-16 fighter aircraft. In recent years, Turkey has deployed its fleet of F-16s and other aerial assets in airstrikes against Kurdish groups and other opponents in Syria, Iraq, and southeastern Turkey. Human rights monitors such as the Kurdish Red Crescent contend that some of these airstrikes have targeted civilian sites, including markets and civilian convoys. Such actions could constitute breaches of international humanitarian law.

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### Final thoughts

The demand for virtual training options for today's militaries is expected to grow – and CAE is ahead of the curve. As its international footprint expands, it will become increasingly important to monitor CAE's activities, if we are to understand how Canadian technology is shaping modern conflict. □

*Kelsey Gallagher is a Researcher at Project Ploughshares. He can be reached at [kgallagher@ploughshares.ca](mailto:kgallagher@ploughshares.ca).*

# Astronauts and astronomers need better space governance



Written by Jessica West

On November 15, 2021, seven astronauts on the International Space Station (ISS) were ordered to take shelter because of the possibility of catastrophic collisions as the station passed through a cloud of debris. The astronauts remained in lifeboats while the ISS passed through the cloud multiple times.

The reported cause of the danger was a “debris-generating event” that U.S. Space Command later attributed to a kinetic anti-satellite (ASAT) test conducted by Russia against one of its own defunct satellites. The test was subsequently confirmed by Russian Defence Minister Sergey Shoigu.

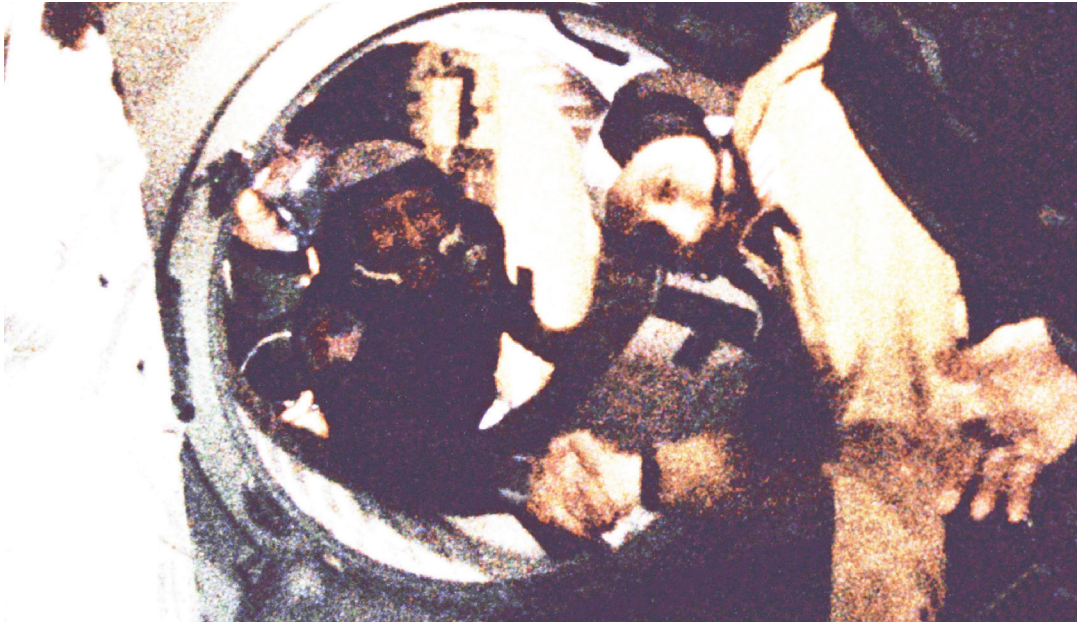
Reactions from the United States were swift and condemnatory. U.S. Space Commander General James Dickinson called the weapons test a “deliberate disregard for the security, safety, stability, and long-term sustainability of the space domain for all nations.” Pointing to the particular risk to astronauts, NASA in a formal statement called the test “reckless and dangerous,” while NASA administrator Bill Nelson tweeted that “Russia would endanger not only intl partner astronauts on the ISS but also their

own cosmonauts.” Other states concurred. U.K. Space Command, for example, called the test “irresponsible.”



## Astronauts and space governance

Astronauts remain enduring symbols of aspiration and achievement—not only for their home countries but the entire globe. In *Heroes in a*



The famous handshake in space in 1975 between American astronaut Thomas Stafford and Soviet cosmonaut Alexey Leonov symbolized the beginning of the Cold War thaw.

*Vacuum: The Apollo Astronaut as Cultural Icon*, historian Roger D. Launius details the careful curation of U.S. astronauts as celebrities, beginning with the Mercury Seven test pilots. Soviet cosmonaut Yuri Gagarin, the first human to fly in outer space, became a global celebrity. China crafted a publicity campaign around Yang Lewei, China's first taikonaut in space. And Canadian astronaut Chris Hadfield is one of the best known astronauts in the world.

The role of an astronaut also has a legal dimension. The Outer Space Treaty (Article V) refers to them as “envoys” of humankind, who are accorded special privileges and protections, including the right to assistance, rescue, and return from all states. They also act as envoys of international diplomacy. The famous handshake in space in 1975 between American astronaut Thomas Stafford and Soviet cosmonaut Alexey Leonov symbolized the beginning of the Cold War thaw. The permanently crewed International Space Station remains an important symbol of unprecedented international cooperation in outer space.

### **Victims of failed governance**

However, the growing vulnerability of astro-

nauts in outer space also illustrates our collective failure to govern space so that it remains safe and accessible for all. While the impact of any action on the ISS is generally viewed as key to determining if that action can be deemed “responsible,” such an understanding has not halted tests that produce dangerous debris. NASA publicly condemned India's 2019 ASAT test because it produced new debris that threatened the ISS, while India claimed that the test was safe. When NASA scientists claimed that the risk of debris puncturing the ISS has increased twofold because of the recent Russian test, Russia countered with its own analysis that showed that its test posed no threat to space activities.

Concern for the protection of astronauts is not limited to debris from weapons test. Most recently, China invoked the protection of astronauts under Article V of the OST in a note verbale to the UN Committee on the Peaceful Uses of Outer Space (COPUOS) after two “close encounters” by satellites from the SpaceX Starlink constellation with the Tiangong space station caused the station to conduct “preventive collision avoidance control.” China argued that these encounters “constituted dangers to the life

or health of astronauts onboard the China space station” and asked the UN to remind states parties of their obligations under the OST. The United States responded with its own note verbale in which it indicated that it would have warned China of any possible close encounter. Underlying this incident is a deep schism in common understandings about what counts as safe, and inadequate means of communication and coordination.

Spaceflight is inherently dangerous and always has been. But activities related to debris, weapons, and congestion produce unnecessary risk. Mitigating such risk will require sustained diplomatic action and cooperation. To get there, we might need to shift our focus from astronauts to astronomers.

### Thinking like astronomers

Vulnerable astronauts in space put a human face on our collective governance failures. We need to see them and recognize the seriousness of the problem. But it is the rising chorus of astronomers who are telling us how to fix this situation and we need to listen to them just as closely, because astronomers remind us that space is for everyone.

The rapid proliferation of vast constellations of satellite systems in low Earth orbit is damaging the ability of astronomers – and the rest of us – to see the night sky or the galaxies beyond. This loss illustrates yet again how poor collective governance affects all of us as individuals.

The ability to observe and know about space is essential to science, traditional knowledge and practices, and backyard stargazers. When we lose this ability, to whatever extent, our capacity to explore and use space is diminished and threatened. We stand to lose any facility to conduct deep-space navigation, protect our planet from asteroids, and learn more about our Earth, our solar system, and the universe.

Astronomers are speaking up and working together to mitigate this loss. On February 2, the International Astronomical Union announced a new Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference. This centre will coordinate and unify international efforts to mitigate the negative impact



### JESSICA WEST SPEAKS ON NEW UN OPEN-ENDED WORKING GROUP

In February, Jessica participated in a panel put on by the Outer Space Institute about a new United Nations OEWG on outer space security.

She focused on what Canada could contribute to this new endeavour, indicating that “Canada is well positioned to make a constructive contribution to the OEWG.” Canada’s diplomatic role at the UN Committee on the Peaceful Uses of Outer Space (COPUOS) is well known. Canadian space experts also provide “a wealth of specialized technical knowledge.”

Jessica described the unique perspective that Canada brings, with its long history of advocating arms control in space, “even if that voice has been quieter in recent years.” Canada also has close military and defence ties with major powers such as the United States. And while Canada isn’t a major space power, it is “a significant actor in space, with robust civil, commercial, and military space programs.”

Jessica encouraged Canada to contribute to outer space security by supporting a ban on testing anti-satellite weapons, building capacity through education and outreach, empowering civil society, and taking practical lessons from multilateral arms control agreements that have and are working.

## SPACE CAFÉ CANADA: DECEMBER 3, 2021

### "COLLISION COURSE: ANTI-SATELLITE WEAPON TESTING AND THE CRISIS OF SPACE DEBRIS"

HOST: Dr. Jessica West

GUESTS: CO-DIRECTORS OF THE OUTER SPACE INSTITUTE (OSI) AT THE UNIVERSITY OF BRITISH COLUMBIA DR. AARON BOLEY, CANADA RESEARCH CHAIR IN PLANETARY ASTRONOMY, AND DR. MICHAEL BYERS, CANADA RESEARCH CHAIR IN GLOBAL POLITICS

The Canadian space cafés go from strength to strength, ably led by Ploughshares Senior Researcher Jessica West. The last event for 2021 covered mega-constellations of satellites, anti-satellite (ASAT) tests, and space debris. Viewers learned just how critical outer space is to global security, as well as how OSI contributes to a global understanding of security problems in outer space and to possible solutions.



Avid viewers of Space Café Canada would already know that the number of satellites in space is increasing rapidly. According to Dr. Boley, there were 3,000 satellites in low Earth orbit (LEO) in 2019; by the end of 2021, there were 6,000. If plans are realized, there could be as many as 100,000 satellites orbiting Earth in a few years.

Do we know how to manage this new, increasingly crowded, space environment? No, we do not. Two things are certain, however. ONE: What goes up comes down. Anything we send into space will eventually return to Earth, much of it as tiny particles made up largely of aluminum. Almost certainly the chemistry of Earth's upper atmosphere will change, but we don't really know how. TWO: There will be accidents (or deliberate actions) in space that result in debris. The more objects in space, the likelier a debris-causing incident. And all this debris can then cause other, possibly catastrophic, damage.

One immediate change that OSI is promoting is a ban on all kinetic ASAT tests in space. Current guidelines against long-lived debris are not adequate because they are based on the fiction that events can be designed to generate only short-lived debris. Viewers learned that, without fail and even with precautions in place, all ASAT tests produce dangerous debris, much of which will survive for years.

Everyone has a role to play in protecting outer space. The OSI website hosts the International Open Letter on Kinetic Anti-Satellite (ASAT) Testing, which calls on the United Nations General Assembly to legislate a ban on kinetic ASAT tests. The letter should be signed and shared with colleagues, young people, governments.

Find the complete interview on YouTube.

of satellite constellations on the night sky and to develop and promote norms of best practice. These concerns will also appear on the agenda of COPUOS.

The conflict is not between satellites and stars. We need both. Astronomers are taking up the mantle of the less powerful to fight for some-

thing that could otherwise be lost, but doesn't have to be. As with spaceflight safety and environmental sustainability, solutions require open dialogue and coordinated and collective action. The international astronomy community is showing us how to do this. We should follow their lead. □

*Jessica West is a Senior Researcher at Project Ploughshares. She can be reached at [jwest@ploughshares.ca](mailto:jwest@ploughshares.ca).*

## PLOUGHSHARES AT WORK

# An educated, cautious optimism



Wendy Stocker interviews Executive Director Cesar Jaramillo

**Wendy Stocker:** Please give our readers a brief chronology of your career at Ploughshares. When did you start, what roles have you filled over the years?

**Cesar Jaramillo:** I started at Project Ploughshares on September 1, 2009. My first role was as Program Associate – a position we now call Researcher – working on the Ploughshares outer space security program.

I hit the ground running. Back then, Ploughshares served as the secretariat for an international collaborative research project with academic and nongovernmental partners called the Space Security Index (SSI), which monitored developments related to the security of outer space and produced an annual publication. The 2009 publication had just been released and a series of outreach events in Canada and abroad was planned for the SSI launch soon after my arrival. In early October, I spoke for the first time at the United Nations on behalf of Project Ploughshares, presenting key SSI findings at an event during sessions of the UN General Assembly First Committee, which deals with matters related to peace

and international security. I ended up leading the publication of the next six annual editions of the SSI, with a great team of collaborators.

Early on, I also began to take responsibility for nuclear disarmament, working with and then taking over from Ploughshares co-founder Ernie Regehr. I have learned a lot from Ernie and am fortunate to still have the benefit of his sage advice.

With the retirement of Ken Epps after a distinguished career managing the Ploughshares program on the arms trade, I started working on conventional weapons controls, including multilateral efforts to better regulate the global arms trade and Canadian military exports. It was an exciting time for this program as the Arms Trade Treaty (ATT) had just been adopted by the international community. There was ample opportunity for work, both monitoring compliance by states parties and urging Canada – then an outlier – to join the treaty, which it eventually did in 2019.

In early 2015, following the announced departure of John Siebert as Executive Director, I made the decision to apply for the position. A Se-

lection Committee established an open call for applications and I was the only internal candidate. After going through the recruitment process, I was appointed Executive Director, with a start date of July 2, 2015.

As Executive Director, I combine administrative and managerial tasks with program work, which continues to interest me greatly. I have done some work on new areas, such as emerging military technologies and the protection of civilians in armed conflict.

**WS:** You have really covered the waterfront, being directly involved in just about every Ploughshares program area. I know that you have worked directly on any number of policy initiatives. Which are you most proud of?

**CJ:** I would highlight two, the first international, the second domestic.

I am very glad to have been involved with the multilateral process that eventually led to the adoption of the Treaty on the Prohibition of Nuclear Weapons (TPNW). I had the opportunity to attend the series of conferences on the humanitarian impact of nuclear weapons that preceded negotiations on the TPNW, which took place in 2013 and 2014 in Norway, Mexico, and Austria. I was also part of various other initiatives, in Canada and abroad, to promote and build support for the TPNW, attending both sessions of treaty negotiations at UN headquarters in New York. I was fortunate to be there on July 7, 2017, the day when this historic treaty was adopted.

Project Ploughshares is a proud member of the International Campaign to Abolish Nuclear Weapons (ICAN), a civil-society champion of the TPNW and the recipient of the 2017 Nobel Peace Prize for these efforts. I am in awe of the many

committed activists from Canada and around the world who worked collaboratively to bring this treaty to fruition. A central element of the TPNW effort was the attention drawn to the catastrophic humanitarian consequences of nuclear weapons, which reframed the traditional approach to the nuclear disarmament debate, making human security the main driver for abolition.

And our work has not ended with the creation of the treaty. To meet the TPNW's stated objective of the complete elimination of nuclear weapons, I, with so many others, continue to engage in efforts aimed at treaty universalization and effective implementation.

At home, I was very pleased to be involved in an effort to strengthen Canadian arms control legislation, a requirement for Canada to join the Arms Trade Treaty. Project Ploughshares had been calling on Canada to join the ATT since December 2014, but the Conservative government at the time was reluctant to do so. When a new Liberal government came into power, it started the

necessary work to join the ATT.

A critical part of this effort related to Bill C-47, which considered amendments to Canada's arms control legislation that would enable the accession to the ATT by aligning domestic obligations with those of the treaty. As part of this process, and alongside civil society colleagues, I had the opportunity to engage government officials and Parliamentarians in an effort to strengthen domestic legislation around arms exports.

Prior to the enactment of Bill C-47, the Minister of Foreign Affairs had the obligation to consider the risk of human rights violations when authorizing an arms export. However, after such consideration, the minister still had wide discretion to authorize the export in question. As a result of



### Letter to PM opposes arms sales to Saudi Arabia

Project Ploughshares was one of many nongovernmental organizations and trade unions that signed a letter to Prime Minister Trudeau in mid-December 2021, "reiterate[ing] our continued opposition to your government's issuance of arms exports permits for weapons destined to Saudi Arabia." This letter was the fifth in a series sent to the prime minister that beginning in March 2019, all demanding the end of arms sales to Saudi Arabia, which, after the United States, is Canada's largest arms customer and is also a widely recognized violator of human rights, at home and abroad. While the letter acknowledged the impact that ending such arms sales would have on workers in Canada's arms industry, it urged the Canadian government to work with unions to find ways to preserve jobs, including the development of an economic conversion strategy.

The complete letter can be found at [www.ploughshares.ca](http://www.ploughshares.ca).

the Bill C-47 process, which included strong civil society advocacy on this precise point, the minister now has the obligation to deny export permits if a substantial risk of human rights violations is identified.

**WS:** Ridding the world of nuclear weapons and controlling the exports of Canadian weapons have been staple pursuits at Ploughshares since the beginning. You are walking the Ploughshares path!

Can you trace your own personal path to becoming an advocate for peace? What in your earlier education and career and life prepared you for such a calling?

**CJ:** I have been interested in current and interna-

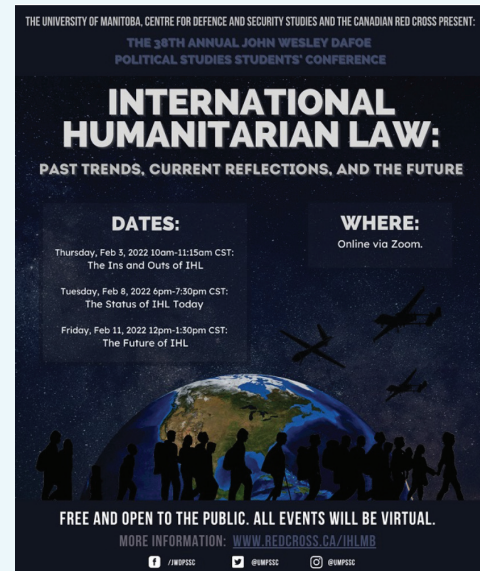
tional affairs for as long as I can remember. Parallel to this interest, no doubt influenced by the backdrop of a protracted armed conflict while growing up in Colombia, there has always been a certain sensitivity to matters related to war and peace. And I was fortunate to be raised in a household with strong values concerning justice, honesty, and basic human dignity.

I learned English at a young age at an international school in Colombia. While there, I was at various times part of the debate club, president of the student council, and a member of the school's Model United Nations program. After graduating high school, I was conscripted into the Colombian army. I served for one year before going to university, where I obtained a degree in journalism and communications.

## The future of international humanitarian law

In February, Ploughshares Executive Director Cesar Jaramillo participated in a panel discussion on “International Humanitarian Law: Past trends, current reflections, and the future.” This session was part of the J.W. Dafoe Political Studies Students’ Conference at the University of Manitoba. The conference was sponsored by the Canadian Red Cross and the University’s Centre for Defence and Security Studies.

International humanitarian law (IHL), or the law of armed conflict, is intended to protect civilian populations from the means and methods of war. Cesar related IHL to two particular Ploughshares files: lethal autonomous weapons and the protection of civilian victims from the use of EWIPA– explosive weapons in populated areas. In talking about autonomous weapons or “killer robots,” he raised concerns about the difficulty in determining accountability, if significant human agency is missing, especially in choosing and attacking human targets. And he spoke about how 90 per cent of EWIPA casualties are civilians. New regulations, even bans, are needed to protect non-combatants.



My coming to Canada as a refugee was one of the defining events of my life. The journey from a refugee shelter in Toronto – my first place of residence in the country – to Project Ploughshares has been intense and fast-paced. After settling in Waterloo, I decided to go back to university. During my studies at the University of Waterloo (political science) and the Balsillie School of International Affairs (global governance) I honed my interest in peace and security studies, which in turn helped pave the way for the work I am doing now.

But my time at Project Ploughshares has undoubtedly had the most profound effect on my attitude toward matters of war and peace today. The work itself has been continuously reinforcing and encouraging. The more I learn about the causes and implications of some of the world’s thorniest security problems, the more I feel compelled to try to craft solutions. The more I get to know my friends and colleagues from civil society, starting with the exceptionally capable and committed Ploughshares team, the more convinced I am about the transformative potential of orga-

nized groups of individuals determined to effect positive change.

**WS:** A strong expression of hope. How do you remain optimistic, when many arms control efforts seem stalled right now?

**CJ:** In my case, I would say that what I feel is educated, if cautious, optimism. This is different from wishful thinking and is based on an assessment of areas where progress has been made or is possible.

From working at and leading Ploughshares, I have learned that change for the better is possible. Sometimes progress happens in small, almost imperceptible increments. Other times in greater leaps. It can also stall or recede. But possible it is.

While I recognize that there are worrying trajectories on many of the issues we address at Project Ploughshares, I strongly reject any notion of inevitability about the materialization of worst-case scenarios. The future is still being written and, at Project Ploughshares, we want to be among those holding the pen. □

*Wendy Stocker edits The Ploughshares Monitor.*

2021 Nobel Peace Prize

# Champions for peace



Written by Wendy Stocker

Last October, the Norwegian Nobel Committee announced that journalists Maria Ressa of the Philippines and Dmitry Muratov of Russia had won the 2021 Nobel Peace Prize “for their efforts to safeguard freedom of expression, which is a precondition for democracy and lasting peace.” To both, Project Ploughshares extends sincere and hearty congratulations!

On December 10 in Oslo, each prize winner presented a lecture. Ressa spoke about how journalists are threatened and silenced when they try to present the truth. She spoke out against social media and related technology enhanced by artificial intelligence, “with its god-like power that has allowed a virus of lies to infect each of us.” And she warned about how, without “information ecosystems that live and die by facts,” there can be no lasting peace. Fortunately, her speech also illustrated ways in which that new ecosystem can be used for good. Despite her diatribe against technology, she asserted that “journalists must embrace technology,” expressing confidence that tech in the hands of journalists “won’t be viral.”

Muratov also made truth his mantra. He stated that the “mission” of journalists was to “distinguish between facts and fiction.” He also valued the new generation of journalists who can use technology – “big data and databases.”

The peace tent is a large one, able to shelter many different perspectives and principles. The Nobel committee claimed that the 2021 peace laureates were fighting for freedom of expression. But it might be more accurate to say that these two peace warriors were champions of truth and facts, striking out against misinformation and lies.

What “truth” means has been the subject of much heated debate for millennia. The belief that facts, accurately and clearly reported, are critical to building trust and peace among groups of people is, perhaps, at least somewhat less controversial.

Certainly accurate data is critical to the work that is done at Project Ploughshares. For example, we strive to present a clear, true picture of Canada’s involvement in the international arms trade and how Canada is contributing to foreign armed conflicts. It is from this platform of truth that we speak to government. We study how new technologies contribute to repression and conflict and convey this information clearly to a wide audience. We go back to the primary texts of treaties and agreements to determine what is actually lawful and appropriate behaviour for member states.

And so, it is with a sense of true community that we again applaud the 2021 peace laureates. Because we are all committed, in the words of Maria Ressa, “to bring you the truth and hold power to account.” □

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