Autonomous Weapons and the Future of War

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“[T]he notion of a completely robotic system that can make a decision about whether or not to inflict harm on an adversary is here. It’s not terribly refined. It’s not terribly good. But it’s here….”

Gen Paul Selva, Vice Chairman of the Joint Chiefs of Staff, August 2016

“If our competitors go to Terminators and we are still operating where the machines are helping the humans and it turns out the Terminators are able to make decisions faster, even if they’re bad, how would we respond?”

Robert Work, Deputy Secretary of Defense, May 2016

“There will be a raucous debate in the department about whether or not we take humans out of the decision to take lethal action. … I am an advocate of keeping that restriction.”

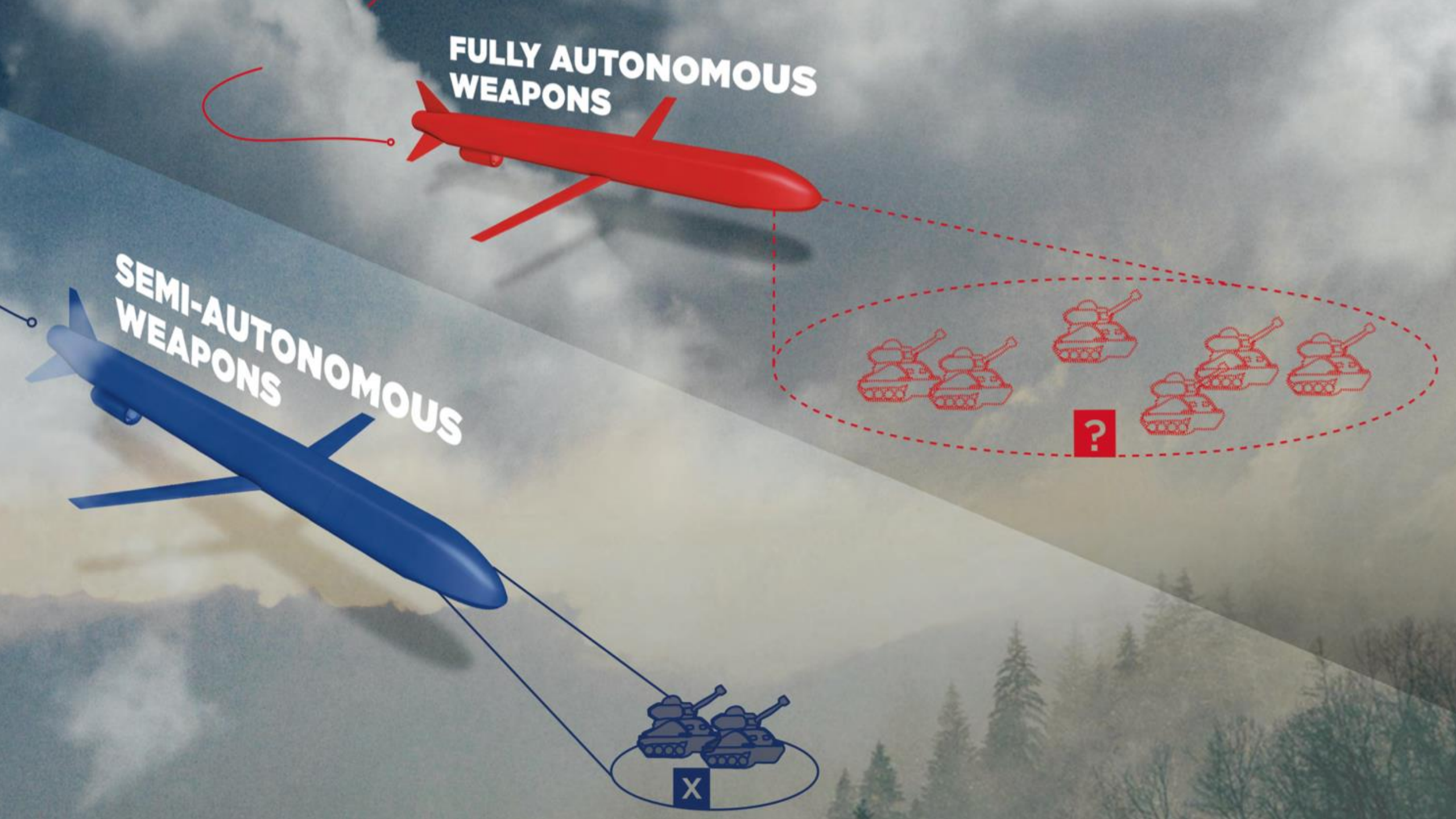
Gen Paul Selva, Vice Chairman of the Joint Chiefs of Staff, July 2017

“Others are going to do it. They are not going to be as constrained as we are, and we’re going to have a fundamental disadvantage if we don’t.”

Frank Kendall, Under Secretary for Acquisition, Technology, and Logistics, August 2016

The Terminator Dilemma

- The basic technology to build weapons that could hunt for and attack targets on their own is here.
- There are many good reasons to keep humans “in the loop” for lethal force decision-making.
  - Legal, moral, ethical, safety, risk, operational control …
- Will our enemies be similarly concerned? Could autonomous weapons give a decision advantage? If so, how do we respond?


FULLY AUTONOMOUS WEAPONS
SEMI-AUTONOMOUS WEAPONS
?
X

Do Autonomous Weapons Exist?

- Human-supervised autonomous weapons
  - At least 30 countries have defensive human-supervised autonomous weapons, such as the Aegis or Patriot.
  - Limited use: to defend human bases or vehicles, anti-vehicle, human supervised, humans co-located with system

- Fully autonomous weapons
  - Israeli Harpy drone (anti-radiation loitering munition). Sold to India, Turkey, South Korea, and China. China reported to have reverse-engineered their own variant.
  - Experimental U.S. systems (cancelled): LOCAAS, Tacit Rainbow
  - Out-of-service: 80s era U.S. Navy Tomahawk Anti-Ship Missile (TASM)

Why Build Autonomous Weapons?

- Lots of advantages for incorporating autonomy into weapons, but there are advantages to keeping humans in the loop too.
  - For the forseeable future, no machine intelligence will have the breadth, robustness, and flexibility of human cognition.

- So why take the human out of the loop?
  - Speed
  - Loss of communications (uninhabited vehicle in communications-denied environment)

Considerations

- Law – Is it legal?
- Ethics – Is it ethical?
- Risk – Is it safe?
- Operational value – What is the price of missing out on this technology?

Legal Issues

- If a weapon can be used in a manner that meets law of war criteria, then it can be used lawfully.
  - Distinction, proportionality, precautions in attack, hors de combat …
- Accountability gap? No requirement for individual accountability.
- Machines are not legal agents, humans are. The laws of war impose obligations on humans. Humans must make a determination about the lawfulness of an attack.

Human Moral Responsibility

"one of the places that we spend a great deal of time is determining whether or not the tools we are developing **absolve humans of the decision** to inflict violence on the enemy. And that is **a fairly bright line that we're not willing to cross**. … it is entirely possible that … we could get dangerously close to that line. And we owe it to ourselves and to the people we serve to keep it a very bright line."

-- Gen Paul Selva, Vice Chairman of the Joint Chiefs of Staff, August 2016

Risk and Operational Control

- Human and machine cognition is different. Humans and machines have different kinds of accidents.
  - Machine intelligence is brittle. Human intelligence is more flexible and robust. Machines are often more capable at narrow tasks, but can dramatically fail if pushed outside the bounds of their intended use.
- What happens when the system fails? What are the consequences? Does the system fail-safe or fail-deadly?
  - Potential for runaway gun & large-scale accidents
  - Failures can be replicated across multiple systems
  - Unintended escalation of a conflict/crises

Experience with Autonomous Systems in Adversarial Settings

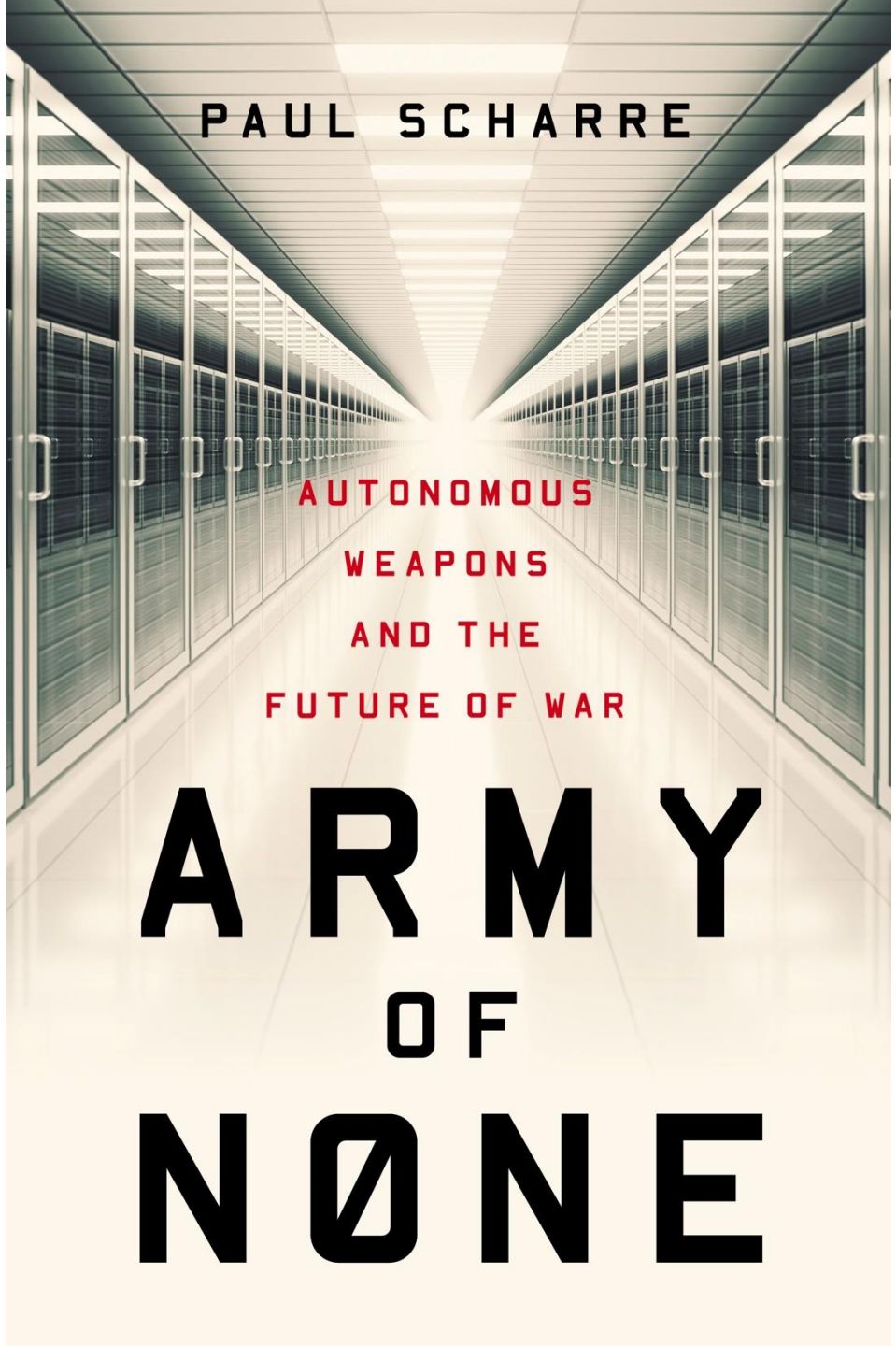
- 2003 Patriot fratricides and normal accidents
- Aegis weapon system and the role of human control
- Missiles and torpedoes
- Stock trading and flash crashes

“it is very compelling, when one looks at the capabilities that artificial intelligence can bring to the speed and accuracy of command and control and the capabilities that advanced robotics might bring to a complex battlespace, particularly machine to machine interaction in space and cyberspace where speed is of the essence.”

Gen Paul Selva, Vice Chairman of the Joint Chiefs of Staff, August 2016

“I don't think it's reasonable for us to put robots in charge of whether or not we take a human life. That doesn’t mean that we don’t have to address the development of those kinds of technologies and potentially find their vulnerabilities and exploit those vulnerabilities for our own defense. But publicly I think we should all be advocates for keeping the ethical rules of war in place, lest we unleash on humanity a set of robots that we don't know how to control. And that’s way off in the future, but it’s something we need to deal with right now.”

Gen Paul Selva, Vice Chairman of the Joint Chiefs of Staff, August 2016



Thank you. Questions?

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