Drones and Deterrence: How Robotics will Impact Strategic Stability

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Introduction

This paper offers a preliminary overview of some of the most important aspects regarding the introduction of advanced unmanned weapons systems, their evolution, and the implications of their development on future strategic stability between major powers. It discusses the trends that can be seen at this point in time, while bearing in mind the difficulties with future forecasting. Today the debate about unmanned systems has centred on their use as principle tool in US President Barack Obama's counterterrorism or counterinsurgency policies, through targeted killing of insurgents.[1]

However, until now, there has been little long-term strategic thinking regarding robotics. The international community has been slow to realise the impacts of this technology. Nevertheless recent studies carried out by the United Nations' Special Rapporteur and the European Parliament both highlight that unmanned systems may have a 'destabilizing effect on the international security environment as a whole'. Indeed, maintaining strategic stability in the form of current dyadic relationships, predominantly with nuclear weapons, will become increasingly complex as advanced conventional capabilities emerge in combination with modernised strategic forces. Current drone programmes herald a future in which stability will be characterised by asymmetric cross-domain deterrence.

The Impact on Robotics on Warfare

Increasingly scholars and practitioners of international relations are realising the emergence of the concept of 'convergence'. In International Security, 'convergence' is happening simultaneously over a number of fields, especially in technology and robotics - a 'convergence of exponential trends'.[2] This process is leading to increasing technological change that is proceeding at an ever-increasing rate over a wide range of technological categories; each new improvement is creating synergies that create novel possibilities, new combinations and applications.[3] Indeed, as other experts have predicted; 'future breakthroughs will stem from the fusion of knowledge from different fields.'[4]

Peter W. Singer, an established expert on robotics, describes how a 'Robotics Revolution', driven by the military is taking place, leading to the increasing introduction of robotics into military practice.[5] Singer has described the Robotics Revolution as a new revolution in military affairs akin to the advent of the atomic bomb.[6] Unmanned vehicles in their variety of guises, on land, in the air, at sea or underwater, colloquially named drones, are today used in a limited number of military plans and operations , but it is thought that in the near future they will be used in almost every aspect of military planning and operations as a platform for intelligence, surveillance, target acquisition, and reconnaissance, but also for logistics, command, control, communications and for strikes.

As the Robotics Revolution continues, lines between systems will blur. Currently nuclear weapons can and are deployed on ICBMs, SLBMs, cruise missiles, and on bombers. Yet it is important to remember that in the future there will be a very fine line between the different robotic combat systems as opposed to the classification we currently use to identify units or weapons; such as helicopters, jets, bombers, submarines and missiles. These combat systems could be remotely controlled or function as autonomous systems and combine some or all of the characteristics that each system currently possesses.

Emergence of new technologies

As stated, not only will drone technologies become increasingly more sophisticated, but other technologies will also be developed in parallel, combining with each other to provide new capabilities. For instance, energy requirements for sustained operation will be met by novel means. Today the US Global Hawk unmanned aerial vehicle (UAV) can stay in the air for 28 hours. This airtime could soon be extended, initially by conventional means such as mid-air refuelling. Yet more elaborate systems are being studied, such as solar power, direct wireless energy transfer, nuclear reactors, blimp

technology, microbial driven fuel cells, and wave or current energy for marine vehicles.[7] One project aims to maintain 'a large unmanned aircraft at stratospheric altitudes for at least five years'.[8] Some experts point out that range and endurance will soon be limited only by the need for upkeep and maintenance.[9] However, the US Air Force has estimated that by 2049 drones might automatically perform some repairs in flight.[10]

Aside from power requirements, mobility and deployment options for drones will be much improved. In the spring of 2013 the US Navy successfully demonstrated its ability to launch and land a drone from an aircraft carrier at sea.[11] It seems that this capability will be extended to next generation warships as well. The US Defense Advanced Research Projects Agency (DARPA) notes that 'establishing bases or deploying carriers requires substantial financial, diplomatic and security commitments that are incompatible with rapid response'. To mitigate the need to cultivate relationship for bases or commit mission specific aircraft carrier, the agency envisions using smaller ships such as mobile launch and recovery sites for unmanned aircraft.[12] DARPA's hopes to 'ability to conduct airborne intelligence, surveillance and reconnaissance (ISR) and strike mobile targets anywhere, around the clock' will be further supported by a corresponding initiative to develop the next generation vertical take-off and landing (VTOL) aircraft.[13] This project has the potential of making any ship a mobile base for drones and offer the US even more flexibility and reach, because 'about 98% of the world's land area lies within 900 nautical miles of ocean coastlines'.[14]

Given the characteristics attributed to future combat and surveillance drones, such platforms have been seen as a panacea for many strategic issues, including missiles defence. For example, some experts have proposed the development of drones that could hover over launch sites for prolonged periods of time, carrying relatively light-weight fast-accelerating interceptors to shoot down ICBMs while they are still under powered flight; a so-called 'Boost Phase Intercept'.[15]

Another version of drone technology under development will cause instability as it will put 'invulnerable' Continuous at-Sea Deterrence (CAS-D) at risk. Advances in anti-submarine warfare such as DARPA's Anti-Submarine Warfare (ASW) Continuous Trail Unmanned Vessel (ACTUV), new forms of undersea detection and weaponry, as well as drones able to launch from submarines or swarms of smaller vehicles, could form a framework that continuously scans the sea, tracking nuclear submarines.[16]

Finally, cyber and electronic weapons will be added to drone's arsenals. Air-launched cyber-attacks will become an integral part of tactical in-theatre operations, using drones to hijack other systems by inserting malware into integrated air and missile defences - even other aircraft.[17] As one radar expert has explained; the systems in development allow 'users to invade communications networks, see what enemy sensors see and even take over as systems administrator so sensors can be manipulated into positions so that approaching aircraft can't be seen. The process involves locating enemy emitters with great precision and then directing data streams into them that can include false targets and misleading messages algorithms that allow a number of activities including control.'[18]

Impact on Strategic Stability

It may not always be the case that national nuclear policies will remain the same.[19] Therefore one cannot exclude the possibility that nations will return to previously abandoned nuclear policies, or adopt entirely new ones.[20] In the future a more versatile, mobile, and less vulnerable leg of the nuclear triad might be spread out over numerous ships carrying drones. This will undoubtedly complicate current arms control and disarmament measures. US Air Force strategists already proposed a change to nuclear policy that would have the next generation bomber be a nuclear-dedicated unmanned combat aerial vehicle. Proponents of this option suggest this system could replace the aging US ICBM fleet.[21] Former US Vice Chairman of the Joint Chiefs of Staff Gen. James Cartwright noted when talking about

the next generation US bomber that 'nobody has shown me anything that requires a person in the airplane. Nobody, that applies, too, if the future bomber carries out the nuclear mission, I don't remember the last time I manned an ICBM or SLBM or a cruise missile, so I'm not sure I understand that logic.'[23]

Put succinctly, the convergence of applications and capabilities will enable drones, by the middle of the 21st century, to simultaneously combine and conduct a multitude of missions currently carried out by an array of different systems and units. Furthermore, it is likely that such drones will be highly adaptable – changing weapon configurations or functions at little notice to carry out new missions.[24] These versatile platforms could be launched within minutes from many locations to carry out surveillance, nuclear missions or missile defence tasks. One expert has argued that in the future 'focus will shift from away from mission-specific robots to multi-use robotic platforms that can be highly customized based on mission need'.[25] Furthermore, increased endurance will enable such a platform to track mobile launchers, a task that may currently test other national technical means.[26] This would take place under the cover of improved stealth and electronic warfare systems designed to compromise integrated air and missile defence systems.

Given the technological and logistical challenges, not to mention the complications of conducting offensive operations in contested air and maritime domains, this example may be ambitious. However, DARPA is anticipating developments similar to those above, arguing that 'modern warfare may be too complex for a single new capability to deliver sustained superiority across a variety of scenarios. But combining multiple technology advances by layering and integrating them can lead to a revolution in capabilities […] all woven together in ways that create decisive surprise in tomorrow's wars.'[27] There is also precedent for the intent to develop such a capability. During the Cold War in 1983 a covert US project code-named 'Quartz' was initiated to develop a long-endurance, stealthy combat drones that could penetrate and loiter in Soviet airspace and track down mobile missile launchers.[28] It seems that the coming of age of certain technologies, their convergence, coupled with the different requirements for future systems outlined in policy papers, is leading to the emergence of a unmanned systems capable of carrying out a multitude of tasks that could endanger strategic stability in a way hitherto impossible and unforeseen by many.

The development of such platforms by the US or its allies will undoubtedly only serve to raise concern among other powers such a Russia and China. These countries have already strongly voiced their concerns regarding the expansion of the missile defence systems of the US and its allies in Europe and Asia, as well as against the US 're-balancing' to Asia. Exploiting technological leads could exacerbate a perception of vulnerability in other nuclear powers, which is already held in the face of increasing conventional asymmetry, and fears that their nuclear arsenals and second strike capabilities could be neutralised.[29]

Command, Control and Vulnerability

The past few paragraphs have described how over the next few decades there will be a convergence of technologies leading to an increased reliance on robotics, electronics and cyber in warfare. Yet increased dependence will be accompanied by increased uncertainty about the measure of control a commander will have on its assets. Drones (possibly carrying nuclear weapons), integrated air and missiles defence systems, nuclear missile launch facilities and their corresponding C3 systems all could be compromised at some point.[30] As one military analyst infers, 'Hints that air-launched cyber attacks could shut down industrial (and nuclear) operations could explain why the Air Force has been flying stealthy RQ-170 drones near Iran. The NGJ [Next Generation Jammer] could expand on that apparent capability.'[31]

Another astute commentator has noted that this new era of cyberwar introduces many as-yet unanswered questions of strategic uncertainty:

> *Given Stuxnet's [a malicious code designed to infiltrate Iranian uranium enrichment centrifuges] ability to cover its tracks, the variables it introduces into all computer-controlled systems are inherently 'unknown unknowns.' That means the very decision to launch must now include a much broader calculus of just what will happen once the launch is executed. There was always a "margin of error" calculus inherent to strategic nuclear launch, but Stuxnet has increased it to such an order of magnitude that it becomes a category difference. Before, we might have launched and missed Moscow. Today, we might launch and hit NY or Washington, or nothing at all. The Mutual Assured Destruction formula of nuclear deterrence is inoperative if the assured part is removed from the equation.*[32]

Whether this is a precise description of current situation or not, the need to integrate cyber threats into strategic issues is poignant. Anything using computerized systems will be vulnerable to intrusions. The trust held in systems, and a user's ability to remain in command and control may therefore be significantly degraded.

The advent of fully autonomous weapon systems will exacerbate this issue of command and control uncertainty. These systems are being pursued for a variety of reasons. One factor is that machines can act far quicker than humans. Similar systems already defend ships from aircraft and missiles and defend troops against incoming mortars, by swiftly recognising incoming munitions and automatically neutralising them. The US Air Force estimates that 'by 2030 machine capabilities will have increased to the point that humans will have become the weakest component in a wide array of systems and processes.'[33] A US Colonel has been quoted as saying that 'the trend towards the future will be robots reacting to robot attack, especially when operating at technologic speed [...]. As the loop gets shorter and shorter, there won't be any time in it for humans.' [34] Singer argues that 'the concept of keeping the humans in the loop is already being eroded by both policy makers and the technology itself.'[35] The proliferation of these technologies will reach a point when only weapons systems able to operate at an exceedingly fast pace will be able to defend against similarly fast systems. Machines will start making decisions at speeds incomprehensible to humans. Decision-making processes may evolve from the current situation (in which robots can select targets and deliver force only with human command), to a situation in which a human oversees the selection and striking of targets with the capability to override, and finally to fully autonomous systems that keep humans out of the loop, selecting targets and delivering force without any human input or interaction.[36] When humans let go of the reins of this technology, especially when drones carry out strategic and nuclear roles, the implications for crisis stability could be grave as the speed at which a crisis may be played out might exceed the possibility of humans to influence it or intervene. Once a crisis develops to a stage when drones are deployed, their autonomous decisions may create a runaway escalatory situation, seriously affecting risk calculation.

Central to this issue is the way operational parameters are programmed into these systems. The greatest concern for human rights organisations is whether fully autonomous drones will be able to follow 'the rules of distinction, proportionality, and military necessity' and other rules 'beyond those found in treaties, such as the Martens Clause which requires that means of warfare be evaluated according to the "principles of humanity" and the "dictates of public conscience"'.[37] At some point an intelligent machine might carry out a mission unconstrained by regard to human suffering or principles of proportionality.[38]

Finally, besides malicious deliberate attacks on electronic systems, a further problem is posed by malfunctions simply due to faulty algorithms and coding, which poses a problem for accountability. Who would be accountable for such malfunctions that may have devastating consequences? The programmer, the pilot or operator of the drone, or the person who authorised its use (be it a military commander of civilian leader)? All of these issues may have far-reaching

and unforeseen consequences that will come to the fore when drones are tasked with strategic mission during which the retention of strict command and control is key.

Policy and Doctrinal Implications

This presentation has focused mostly on the developments within the US as it is the technological leader on almost all fronts of military robotics. However, the UK and Israel also deploy UCAVs and are conducting R&D into lethal autonomous robotics.[39] Other countries are quickly catching up with about seventy-six possessing unmanned technology in 2012.[40] Unlike previous revolutions in military affairs such as nuclear weapons, aircraft carriers, and space-based assets – all of which required enormous investments and sophisticated industrial complexes to produce - robotics will differ as their components can be mass-produced, shared, and acquired off-the-shelf.[41] Soon many other nations will possess sophisticated unmanned, automatic and autonomous drones to some extent. As argued by Bill Jones; 'Ideas can't be put back in a box; unlike uranium or plutonium, they don't need to be mined and refined, and they can be freely copied. Once they are out, they are out.'[42]

As one commentator has noted; 'without a new doctrine for the use of drones that is understandable to friends and foes, the United States risks achieving near-term tactical benefits in killing terrorists while incurring potentially significant longer-term costs to its alliances, global public opinion, the war on terrorism and international stability.'[43] In addition, a number of military experts agree that drones may lower the threshold for violence and therefore make it easier for political leaders to use force.[44] Singer explains that 'as war becomes safer and easier, as soldiers are removed from the horrors of war and see the enemy not as humans but as blips on a screen, there is a very real danger of losing the deterrent that such horrors provide.'[45] Similarly other countries at the forefront of robotics and cyber warfare will also need a doctrine for the use of drones, especially nuclear powers. A similar warning has already been issued by the UN Special Rapporteur; 'The implications [of future advances in robotics] for military culture are unknown, and lethal autonomous robotics may thus undermine the systems of State and international security'.[46]

Policymakers and scientists will need to start discussing the implications mentioned above and define clear doctrines and policies that are understandable to all. Given the rate and speed of improvements to robotics technology, the future they may herald will be upon us sooner than many anticipate.

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About the UK Project on Nuclear Issues (UK PONI)

UK PONI was established in 2010 as a cross-generational forum dedicated to fostering dialogue and building expertise amongst emerging nuclear scholars.

The issues surrounding nuclear weapons and nuclear energy are complex and multifaceted, requiring a broad understanding of everything from technical intricacies to developments in International security. Changes to the shape, size and function of the world's nuclear arsenals, have the potential to profoundly affect global dynamics. Developments in civilian nuclear energy will similarly influence the form and direction of international non-proliferation efforts. These trends will ensure that nuclear issues continue to be at the top of the defence and security policy agenda. Yet despite the continuing importance of nuclear issues, there is little evidence that sufficient expertise is being grown to sustain those with expertise in the field.

Aiming to redress this, UK PONI was established as a cross-generational forum allowing young nuclear scholars to engage with established experts on a wide variety of contemporary issues. As part of the US PONI network founded by the Center for Strategic and International Studies (CSIS) nine years ago, UK PONI aims to promote the study of nuclear issues with a European focus. Accordingly, UK PONI holds an annual conference, as well as small events throughout the year. It also sponsors young delegates to attend conferences elsewhere, and aims to facilitate a global network of emerging nuclear specialists.

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