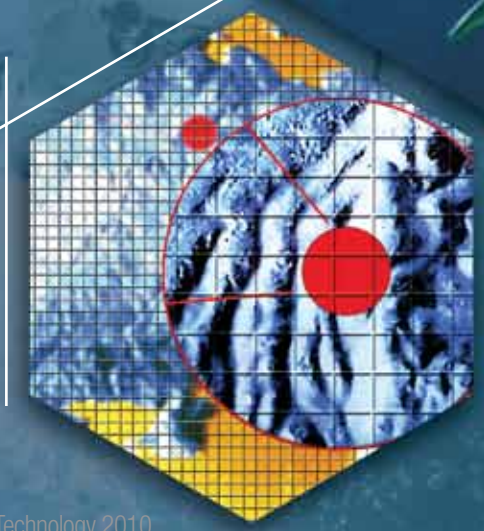
Reviews & Papers



From the Technical Editor

The world watched with horrified fascination for 87 days as oil poured into the Gulf of Mexico. Those of us involved with the ocean engineering business know the complexity of the challenges involved in stopping it, but we were not getting much sympathy from our neighbours, who wondered why it took so long. The different attempts at sealing the well brought together some unlikely combinations of high technology robots stuffing what amounted to bits of garbage into the well. It highlighted that, in the bottom line, the oil industry is founded on pretty basic plumbing principles. The challenges occur doing this plumbing at very deep water depths.

Technology has a role to play in providing a way to prevent these disasters from occurring. Remotely operated and autonomous vehicles provide ways of accessing places which are inaccessible any other way. Deepwater drilling is a classic case where these vehicles provide the only practical way of inspecting and maintaining the systems.

However, the current levels of technology are not sufficient to prevent this type of disaster from happening. There must be better ways to do it. It is easy to put the oil company and drilling company at fault, but nobody set out to deliberately create all this damage. The people involved were trying to make money for their company producing something that in the end we all use. But then something went horribly wrong and eleven lives were lost.

How do we move forward? We all know that any technology will let us down at some time. What we don't know is exactly how and when each failure will occur or what the exact consequences will be.

The real bottom line is that we as a society must be willing to accept the risk. Societies are complex with often contradictory requirements and points of view, but as individual citizens and as a collective, we must ensure that we are aware of the key steps in the full supply chain of the products we buy, and the cost of fixing things when they go wrong. We must accept as a society that we all pay the cost of the cleanup and we really should have better ideas about how to do it before it happens. This requires everyone to accept that openness and disclosure are part of the governance process. We must all accept that sensible questions from concerned outsiders are an essential check on the supply chain. It also means that the cheapest solution is not always the best and as a result we should be willing to pay for what is required, even if it means a higher price at the pumps.

Dr. David Molyneux
Technical Editor

Damn the torpedoes? Perhaps not ...

James Kraska

Kraska suggests a clear path ahead for continued development of unmanned systems.

Who should read this paper?

Some scientists and lawyers have warned that there exist legal challenges to integration of unmanned systems into routine naval operations. This paper suggests that international law will not be an obstacle to the widespread adoption of unmanned systems in the naval environment. Anyone interested in the legal framework for the naval application of unmanned systems – naval officers, oceans scientists and legal academics – will find the arguments presented here to be of interest.

Why is it important?

Much of the technology in unmanned systems is driven by naval and defense investments. The advances in unmanned systems capability are accelerating, bringing us closer to a networked "system of systems" in the air and sea domains.

This paper is a comprehensive look, perhaps the first, at the legal aspects of unmanned naval systems. The work clears up growing misperceptions about the legal aspects of unmanned naval systems. For example, the book "Wired for War" adheres to the formula that although scientific and technological breakthroughs are impressive, we face vexing legal and policy impediments to widespread adoption of unmanned systems in naval operations. This paper lays those fears to rest, and defuses some of the media sensationalism that surrounds the issue of unmanned systems.

About the author

Commander James Kraska is a U.S. Navy officer and international law attorney serving as the Howard S. Levie Chair of Operational Law at the U.S. Naval War College. Kraska has been thinking about and writing about legal aspects of unmanned system for nearly 20 years, having undertaken a year-long study of the subject at the Marine Policy Center, Woods Hole Oceanographic Institution in 1992-93.

THE LAW OF UNMANNED NAVAL SYSTEMS IN WAR AND PEACE

James Kraska
U.S. Naval War College, USA
www.usnwc.edu

ABSTRACT

Unmanned systems are becoming ubiquitous in the oceans, and naval forces throughout the world are primary operators of unmanned aerial vehicles (UAVs), unmanned surface vessels (USVs) and unmanned underwater vehicles (UUVs). International law governing activities on, over and under the sea emerged well before the development of unmanned systems. As UAVs, USVs and UUVs become more advanced – already autonomous, expendable and "intelligent" robots are emerging, forming networked systems – legal and policy issues are becoming acute. This article suggests that as "aircraft" and "vessels," unmanned naval systems fit within the existing legal architecture for peacetime maritime operations, including the 1944 Chicago Convention on Civil Aviation and the 1982 United Nations Convention on the Law of the Sea. These two treaties and their progeny provide guidance for the use of most of the global commons, and reflect a liberal legal architecture for unmanned air-sea vehicles and systems.

INTRODUCTION

Unmanned systems are becoming ubiquitous in the naval force structure of dozens of nations. After a rapid expansion of their use in the wars in Iraq and Afghanistan, maritime unmanned vehicles (UVs), including unmanned surface vehicles (USVs), unmanned underwater vehicles (UUVs) and unmanned aerial vehicles (UAVs), the latter of which are now referred to as unmanned aerial systems (UAS), are poised for a breakout in the maritime operating environment. Collectively, these devices and platforms are known as "unmanned systems." Since the advent of torpedoes – what we now call "mines" – UVs, marine instruments and weapons in the marine environment have been a feature of the defense industry, naval research and naval operations. There also occurs a large amount of cross-pollination between naval applications and civilian usages of unmanned systems at sea. Perhaps the most comprehensive study relating to legal aspects of civilian unmanned systems was conducted by the Society for Underwater Vehicles a decade ago [Brown and Gaskell, 2000A; Brown and Gaskell, 2000B; Showalter, 2004]. In the past ten years, however, there have been rapid advances in marine technology as well progress in refining and modifying international law for unmanned systems. More importantly, however, naval use of unmanned systems invokes special rules such as sovereign immunity that do not apply to civilian vessels and aircraft. Consequently, this article focuses on how unmanned and autonomous naval systems fit into existing international law regimes.

Unmanned naval systems are becoming much more sophisticated, acquiring a range of "smart" traits, including adaptability and machine autonomy. Military forces are employing UVs in greater numbers, and the vehicles are growing in sophistication

and "intelligence." Whereas first generation unmanned systems were tethered and remotely controlled, the advanced progeny emerging from laboratories are more likely to be autonomous. "Smart" UVs that "learn" and exercise independent judgment are on the horizon. Autonomous systems are replacing individuals and manned systems in a variety of the most hazardous mission sets. Surveillance and reconnaissance applications of unmanned systems are giving way to combat roles. These distributed and forward-presence systems, moreover, are connecting into a network of systems – a system of systems. The trend lines have shifted from mechanics to robotics, and from surveillance to combat. Consequently, the numbers and capability of UVs are growing at an exponential rate, giving rise to the question of how unmanned systems will fit within long-standing international law regimes that never contemplated them.

ROBOTS WILL FILL BILLETS

Nazi Germany used homing torpedoes and radio-controlled glide bombs during World War II [Patton, 2003]. During the Vietnam War, the U.S. Air Force used unmanned drones for reconnaissance to shoot raw film footage of enemy territory [Acohido, 2001]. During June 1982 Israel used remotely piloted drones as decoys that simulated the electronic radar signature of full-size strike aircraft, tricking Syria into activating its 19 batteries of surface-to-air (SAM) missile target acquisition and tracking radars [Millis, 1983]. Once the location of the SAMs was exposed, the Israeli Air Force destroyed all of the sites with AGM-78 anti-radiation missiles (ARM) and AGM-45 Shrike air-launched ARMs [Mayo, 1983]. In the first Gulf War in 1991, Iraqi soldiers famously surrendered to a crude RQ-2 "Pioneer" unmanned aerial vehicle (UAV) launched from the battleship *USS Wisconsin* (BB-64). By the late-1990s, unmanned drones were critical to the American way of warfare. During NATO's aerial bombing of Serbia in 1999, for example, Serbian forces quickly shot down 42 U.S. drones, drastically reducing the effectiveness of the NATO bombing campaign [Goldenberg, 2010].

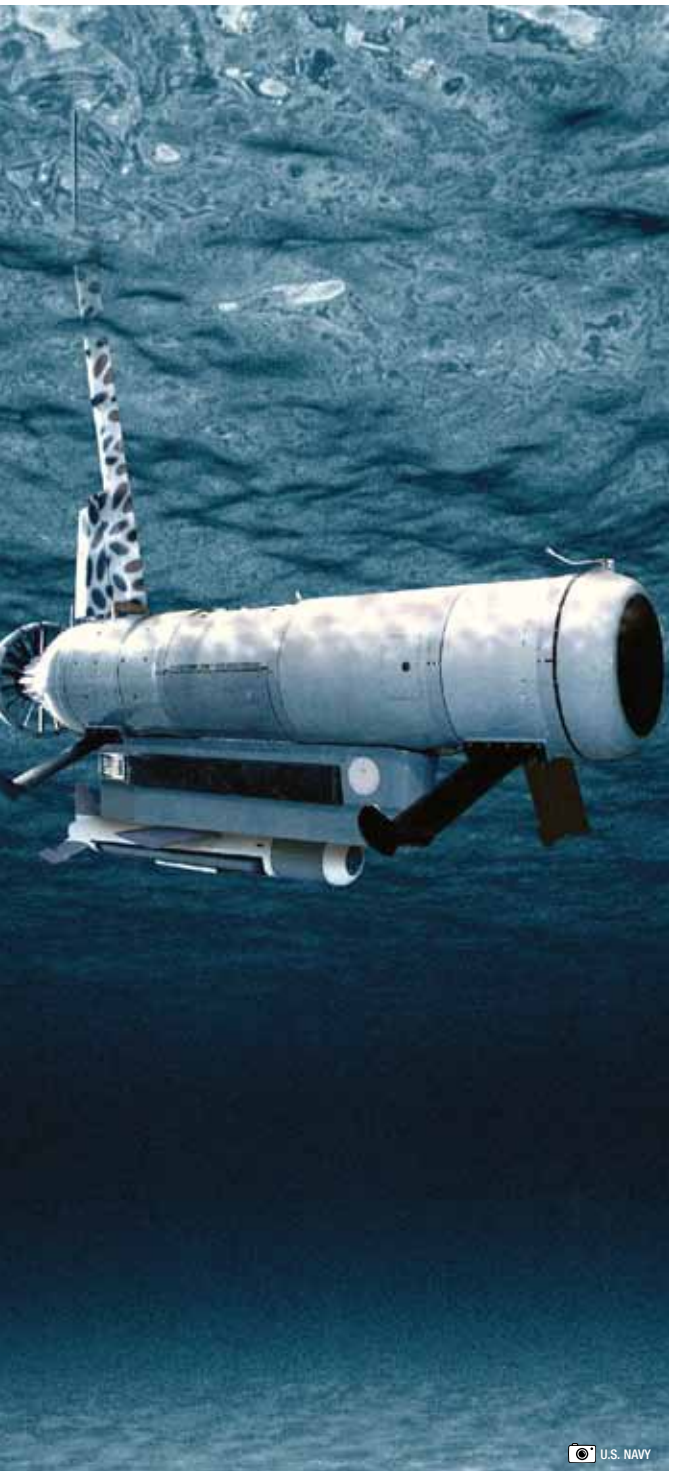
The U.S. Navy, in conjunction with the Spatial Integrated Systems Incorporated, holds a demonstration of a fully autonomous unmanned surface vehicle (USV) at Fort Monroe. A harbour patrol scenario depicts how the USV uses its autonomous maritime navigation systems to patrol and scan designated areas for intruders using onboard sensors and obstacle avoidance software in order to carry out its mission and report back its findings to a command center.

U.S. NAVY

Since the attacks of 9/11, robots operating in the air and on the ground and at sea are now deployed by the thousands in Iraq and Afghanistan, spying from the sky for hours on end, searching for deadly booby-traps and firing lethal missiles without putting U.S. soldiers at risk [U.S. Air Force, 2009]. When the United States and its coalition partners entered Iraq in 2003, they had no robots with them, but by the end of 2004 there were 150. In 2005 it was 2,400, and it doubled the next year. By the end of 2008, there were more than 10,000 first generation robots on the battlefield in theatre. Today U.S. armed drone strikes against Al Qaeda leadership targets in Iraq, Afghanistan, Pakistan, Yemen and the Sudan have been among the most effective counter-terrorist operations, resulting in the elimination of 400-500 fighters.

The U.S. Navy has deployed its first operational UUV in Iraq, the Remote Mine-hunting System (RMS), which is used to identify mines in the Khwar Abd Allah channel at the approaches to the port of Umm Qasr. The U.S. Marine Corps plans to deploy UAVs in remote regions like Afghanistan that can haul cargo around the battle space, servicing the materiel needs of the force in territory without well-developed ground transportation networks [Sherman, 2009]. For its part, Israel has introduced a fleet of huge pilotless planes that can remain in flight for 24 hours, and can strike as far as Iran. The size of a Boeing 737 passenger jet, the Heron TP drones are used primarily for surveillance and carrying diverse payloads [Goldenberg, 2010].No other technology over the past decade has had such a transformational effect on military operations. The U.S. defense budget reflects the growing demand for unmanned systems, with the funds allocated to development and procurement of robots rising from $1.7 billion in 2006 to more than $4.2 billion in 2010 [Defense iQ, 2010].

The diversion of attention by the United States and NATO nations toward the land wars in Iraq and Afghanistan has masked breakthrough advances being made in the use of unmanned systems at sea. As autonomous naval systems acquire additional missions, we can expect their use to generate substantial controversy. First, whereas unmanned systems on a ground battlefield necessarily involve the laws of warfare, the use of unmanned systems at sea is more likely to occur during routine naval activities, such as manoeuvres and exercises, or peacetime maritime security operations, such as counter-drug or shipping interdiction. Thus, a serious discussion of the legal aspects of operating unmanned naval systems in the oceans has more to do with the peacetime international law of the sea than with the law of naval warfare. The use of unmanned systems at sea gives rise mostly to questions of access and presence – where may UVs operate in the oceans and what activities may they undertake? These questions largely have been deferred, but with a bold new stable of UVs entering service and even more impressive systems in test and evaluation, the legal issues concerning unmanned systems at sea should be placed on the table. As the number of unmanned systems rapidly increases, the U.S. Chief of Naval Operations suggested that operational commanders soon will have to gain a firm grasp of the policy and legal dimensions of their use. This article sets forth some of the issues at stake with unmanned and autonomous naval systems, and offers a few signposts for thinking about them [Scutro, 2009].



The Remote Minehunting System (RMS) is an organic, off-board mine reconnaissance system that offers the Navy's Littoral Combat Ship an effective defense against mines by using an unmanned remote vehicle. RMS is capable of searching an area five times faster and at less than 1/10th the cost of legacy systems. The system also can operate over the horizon with 24-hour endurance.

LAW OF ARMED CONFLICT

This next generation of UVs is inheriting a suite of advanced characteristics that is converting what once were mundane legal and policy issues into questions of diplomatic importance. The use of armed, remotely piloted MQ-1B "Predator" and MQ-9 "Reaper" drones to conduct targeted attacks on terrorist leadership targets, for example, has raised several intractable legal questions. So far, most of the legal issues associated with unmanned systems have revolved around the application of the law of armed conflict, including whether contractor operators of remotely-controlled drones are civilians engaging in "direct participation in hostilities," and thereby stripping themselves of civilian protections under the Geneva Conventions. The expression "active part in the hostilities" appears in Common Article 3 of the Geneva Conventions I-IV, and it evolved into "direct participation in hostilities." The term "direct participation" occurs throughout the 1977 Additional Protocol I and II to the Geneva Conventions [Geneva Conventions, 1978]. In recent years, the term "direct part" and "active part" have been held to be so similar that they may be treated as synonymous [ICTR-96-4-T, 1998].

The International Committee of the Red Cross (ICRC) has criticized America and Israel for using Predator drones armed with Hellfire missiles in so-called "targeted killings" against terrorist leadership. The ICRC, however, appears to be acting more out of a desire to "level the playing field" in combat rather than any serious application of the law of armed conflict, since the drones spare more innocent civilians than conventional air attack. The ICRC's approach illustrates how law and

Artist concept of the SSGN conversion program. Four Ohio-class strategic missile submarines *USS Ohio* (SSBN 726), *USS Michigan* (SSBN 727), *USS Florida* (SSBN 728), and *USS Georgia* (SSBN 729) have been selected for transformation into a new platform, designated SSGN or Tactical Trident. The SSGNs will have the capability to support and launch up to 154 Tomahawk missiles, a significant increase in capacity as compared to other platforms. The 22 missile tubes will also provide the capability to carry other payloads, such as unmanned underwater vehicles, unmanned aerial vehicles and Special Operations Forces equipment. This new platform will also have the capability to carry and support more than 66 Navy SEALs (Sea, Air and Land) and insert them clandestinely into potential conflict areas.

military technology can become entrapped by politics. The surrounding discussions concerning the proper role of unmanned systems in contemporary hybrid wars – those at the juncture of conventional battles and irregular conflict – cannot escape the greater politics of the Middle East and South Asia.

OPERATING IN THE OCEANS

As unmanned systems enter into the inventory of the sea services, it is likely that similar legal and policy issues will arise. Rules governing the airspace over the oceans are reflected in international aviation law, as well as the international law of the sea. Due to the tyranny of time, distance and space in the world's oceans, vessels must be capable of being at sea for extended periods of time. Manned ships are slow and heavy, but provide all of the logistical infrastructure to support a crew on long voyages. The U.S. Coast Guard, Marine Corps and Navy refer to all autonomously or remotely navigated vehicles, whether launched from ships, submarines or aircraft, as "unmanned vehicles" (UVs) or "unmanned systems" [Commander's Handbook, 2007A].In anticipation of these changes, U.S. Navy judge advocates – commissioned officers serving as legal advisers for operational commanders – already are working to add greater context and definition to the use of UVs in the maritime air-sea battle space. Unmanned systems, by contrast, can be lighter and more agile, and they are on the cusp of becoming even more important to naval operations than they are to land-based activities [Kraska, 1995B]. For example, after the surge in Somali piracy off the Horn of Africa in 2008, the United States began to monitor maritime piracy threats with UAVs operating from the Seychelles [Radio Gaalkacyo, 2009]. In April 2010 the U.S. Navy reported that a Fire Scout UAV operating off the *USS McInerney* (FFG 8) scored the first-ever drug bust by an unmanned system. Launched from the frigate, which was on patrol in the Eastern Pacific, the UAV was engaged in a routine test flight. The Fire Scout's radar

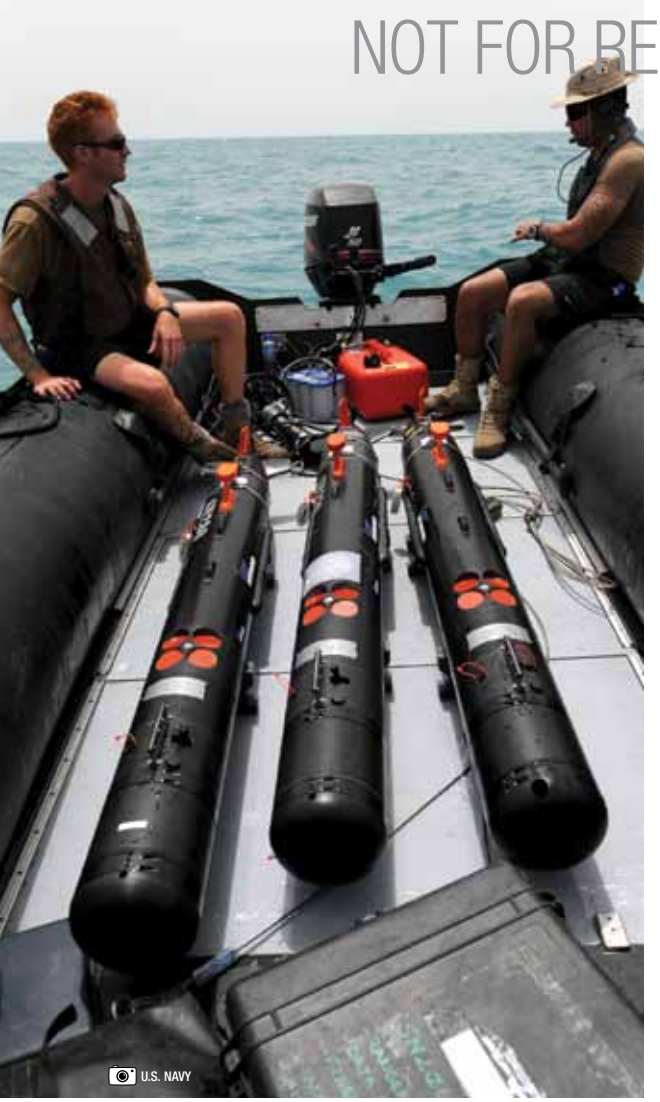
acquired a suspected narcotics go-fast boat making its way northward. The UAV tracked the go-fast for hours, and a law enforcement boarding team from the frigate interdicted the small vessel after it rendezvoused with a mother ship. Sixty kilograms of cocaine were seized.

In the future, people may be out of the loop altogether. Elbit Systems, for example, already has developed the "Sting Ray" unmanned surveillance platform and the larger "Silver Marlin." The Silver Marlin is an autonomous USV designed for over-the-horizon maritime patrol missions. The heavy USV is equipped with surveillance, communications and weapons capabilities and has a range of 500 kilometres. The system is used for a variety of intelligence, surveillance and reconnaissance (ISR) missions, including force protection and maritime counter-terrorism, anti-surface warfare (SUW) and anti-mine warfare, search and rescue (SAR), port and waterway security and electronic warfare (EW). Unlike earlier systems, the Silver Marlin is fully autonomous, able to independently depart and return to port and conduct missions unaided.

Unmanned robot boats or "bot boats" hold promise as a force multiplier in a variety of near-shore and high seas missions. Able to operate either remotely or autonomously, but untended for longer periods than manned ships, bot boats will serve as tireless sentries, monitoring sea lane approaches for pirates, terrorists and saboteurs. In the future bot boats could provide greater surveillance and interdiction capabilities for coastal patrol. Bot boats are being employed as pickets and harbour security, to serve as pickets to protect busy ports, as well as conduct oil rig surveillance and monitor high-profile waterfront developments, such as residential complexes, desalination plants and power stations. In the case of the terrorist rampage through Mumbai in 2008, for example, the cell of Lashkar-e-Taiba fanatics entered the city on board a hijacked fishing trawler, and a greater force presence could provide harbour deterrence.

Another technology developer, 5G Marine Systems LLC, has built a 20-foot bot boat called "Interceptor" that can be deployed onto the surface of the ocean using a helicopter and parachute. The Interceptor is designed for long-distance deployment by air to address emergent high seas threats, such as an increase in piracy. The vehicles are operated

The U.S. Navy's Fire Scout vertical takeoff and landing tactical unmanned aerial vehicle during developmental flight tests at the Webster Field Annex on board Naval Air Station Patuxent River. The Fire Scout, developed by Northrop Grumman, will undergo operational evaluation in late 2010 aboard the *USS Halyburton* (FFG-40).



Petty Officers Juan Perez and Matthew Giannini, both assigned to Explosive Ordnance Disposal Mobile Unit (EODMU) 1, embarked aboard the mine countermeasures ship *USS Dextrous* (MCM 13), conduct unmanned underwater vehicle recovery operations. EODMU-1 and *Dextrous* are conducting drills in the Arabian Gulf.

remotely from anywhere, or they may be fully autonomous. Current models are unarmed, but the Interceptor has a variety of organic dissuasion capabilities, including the ability to project loud sound-blasts using a device similar to the long-range acoustic device (LRAD), and confuse suspected criminals with intense lights, laser dazzlers, and water cannon [Walsh, 2009]. The small craft also can be outfitted with lethal, remotely-operated small arms and grenade launchers, in addition to counter-sniper systems [Walsh, 2009]. The smaller, tactical capabilities are being integrated into the conventional fleet. The U.S. Navy's Littoral Combat Ship (LCS) is the first ship designed to carry USV modules. General Dynamics already has delivered two 11-metre bot boats to the LCS, and the unmanned craft operate a suite of sensors and sonar that deliver 360-degree situational awareness. The larger USVs also carry a 5,000-pound payload and are capable of being underway for 24 hours straight [Walsh, 2009]. Fifty-five LCS hulls are planned.

LAW OF THE SEA

How will these and even more advanced unmanned systems fit into the legal and political architecture of the oceans? The international law of the sea evolved through customary norms and treaties, but it developed without any consideration for unmanned systems. Still, the various sources of oceans law and policy may be applied to legal issues concerning unmanned systems. The philosophical approach of the law of the sea, which is based on the concept of freedom of the seas, provides a point of departure. State practice, which is comprised of long-standing norms and mores as practiced by mariners through the ages, is also an important source of law. Historical usage of terms of art in the law of the sea may be used to adduce the meaning of words such as “ship” and “vessel,” as applied to unmanned systems at sea. Positive law also has made a great contribution to oceans governance. The essential framework for understanding oceans law today is the 1982 United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS reflects and prescribes widely-accepted rules for activity on, over, and under the world’s seas. The tenet of freedom of the seas is the cornerstone of the

liberal navigational framework contained in the Convention. The concept of freedom of the seas was derived from principles of customary international law dating to Ancient Greece and Rome. In the early modern era, the terms was cogently set forth by the iconic Dutch jurist Hugo Grotius. Grotius included an entire chapter on freedom of the seas as a chapter in his landmark 1625 volume, *On the Law of War and Peace* [Grotius, 1608]. Complementary and sometimes interlocking and overlapping regimes in UNCLOS delineate navigational rights and freedoms that may be exercised by ships, submarines and aircraft throughout the global commons of the oceans. For the most part, the rules governing manned surface ships, submarines and aircraft apply *mutatis mutandis* to unmanned systems operating in the same domain. (*Mutatis mutandis* is a Latin phrase that means "changing those things that need to be changed.")

UNCLOS and several dozen associated treaties and hundreds of related agreements and codes regulate the operation of "ships" or "vessels" and "aircraft" in the maritime domain. Questions concerning the legal aspects of unmanned systems necessarily pass through the corridors of definition that largely predate the existence of craft that require no crew. To make matters more complex, there is no precise, comprehensive and controlling definition of what constitutes a "vessel" or "ship" in the law of the sea, or international law more generally. For practical purposes, the two terms may be used interchangeably [O'Connell, 1984]. In *Polpen Shipping Co. v. Commercial Union Assurance Co., Ltd.* (1943), for example, Justice Atkinson concluded that a flying boat was not a "ship or vessel" because the terms were reserved for a structure "intended to do its real work upon the seas or other waters and which is capable of free and ordered movement." The key is that a vessel must be designed specifically for travel on the water, rather than be capable of doing so for the moment. Thus a raft of timber or a boom of logs would not be included in the definition of a ship [Raft of Timber, 1844]. Admiralty courts in the United Kingdom, Canada, the United States, Australia and New Zealand apply similar tests, and reach a dizzying array of opinions. A jet ski is not a "ship" because it is not designed to travel to sea on voyages [R.v. Goodwin, 2006]. But in *The Mac*, the judge explained that a ship need not be sea-going, but only be "anything floating in or upon the water and built in a particular form and used for a particular purpose" [The Mac, 1882]. There is no consensus of a definition among these various common law rulings. Furthermore, the decisions apply to civil cases occurring only within domestic jurisdiction, so they have limited utility for analysis in international law. It is more useful for our purposes to look at established treaty law, which suggest that USVs indeed may be characterized as "ships," UUVs as "submarines" and UAVs as "aircraft." Consequently, unmanned craft enjoy broad

Airman Alex Boston, left, and Petty Officer Ryan Thuecks, right, both assigned to the Naval Oceanography Mine Warfare Center, and Ana Ziegler, from the Office of Naval Research, deploy an unmanned underwater vehicle during Exercise Frontier Sentinel in the northern Atlantic Ocean. The annual joint maritime homeland security exercise involved the Canadian Navy, the U.S. Navy and Coast Guard, and federal, state, and local agencies in the detection, assessment and response to maritime security threats.

rights and freedoms that are wholly similar to, if not identical with, those that apply to ships, submarines and aircraft. Most importantly, unmanned systems enjoy unfettered access throughout most of the world's oceans and airspace in accordance with UNCLOS. At the same time, unmanned systems also acquire special privileges of immunity from jurisdiction of other states as a result of their sovereign immune status.

There is ample support in multilateral conventions for the proposition that UVs are "vessels" or "ships." The London Dumping Convention, for example, defines a "vessel" as a "waterborne or airborne craft of any type whatsoever. This expression includes air cushioned craft and floating craft, whether self-propelled or not" [Convention on the Prevention, 1972A]. The 1996 Protocol to the London Dumping Convention applies to "waterborne crafts and their parts and other fittings" [Convention on the Prevention, 1972B; Convention for the Protection, 1992]. In the UN Convention on Conditions for the Registration of Ships, an instrument which has not entered into force, a "ship" is defined as "any self-propelled sea-going vessel used in international seaborne trade for the transport of goods, passengers, or both with the exception of vessels less than 500 gross registered tons" [U.N. Convention on Conditions, 1986]. This definition would seem to exclude smaller UVs, although we may anticipate that unmanned craft larger than 500 tons could be deployed as heavy lift in future expeditionary and amphibious scenarios.

Finally, the navigation rules to the International Collision Regulations (COLREGs), define a "vessel" as "every description of watercraft, including non-displacement craft, wing-in-ground (WIG) craft, and seaplanes, used or capable of being used as a means of transportation on water" [COLREGS, 1972]. ("WIG" craft are defined by the U.S. Coast Guard as: "…a vessel capable of operating completely above the surface of the water on a dynamic air cushion created by aerodynamic lift due to the ground effect between the vessel and the water's surface. WIG craft are capable of operating at speeds in excess of 100 knots.) It is not clear whether the element of the definition concerning "means of transportation on the water" is restricted to include transportation of goods and people, or may be read more broadly. The U.S. Navy, however, is moving ahead to ensure that its USVs conform as much as possible to COLREGS requirements. COLREGS specify that a ship will possess a three-mile mast head light and a two-mile stern light and two-mile running lights. If a vessel is less than 20 metres in length, the running lights may be combined into a single lantern. If the vessel is less than 12 metres, then the masthead light need only be one metre above the sidelights. The three green lights situated in a triangle signify minesweeping, and are used to warn other shipping. Rule 27(g) exempts minesweepers measuring less than 12 metres in length from showing lights associated with minesweeping. The shorter vessels also are not required to post Not Under Command (NUC) lights. Red-over-red NUC lights are mandatory for safe navigation, however, if a manned or unmanned vessel is dead in the water (DIW). In areas of restricted visibility, such as due to fog, vessels must be capable of emitting "effective" sound at least once every two minutes. When underway, vessels should be capable of making one prolonged blast, and

two prolonged blasts when DIW. The Navy has integrated these and additional COLREGS requirements into its unmanned systems. If, for reasons of engineering, an unmanned vessel cannot accommodate a particular COLREGS requirement, the Naval Sea Systems Command submits a waiver to the Secretary of the Navy. While the Navy is operating a vessel remotely, the operator is required to act in a manner as prudent as if the vessel had persons embarked. The speed of advance must be appropriate for the traffic density, sea state and visibility, and sight, sound and radar are used to avoid collision with other vessels.

Although I suggest that UVs fit squarely within the definition of "every description of watercraft," there is no guidance on where the line is drawn between an unmanned "vessel," such as a USV or UUV, torpedoes, programmed and floating buoys and other autonomous and even expendable marine instruments and devices. The variation between manned systems and unmanned systems, such as size of the means of propulsion, type of platform, capability, endurance, human versus autonomous control and mission set, only further tests the malleability of UNCLOS to accommodate a new genre of ever-smarter machines operating at sea. The Law of the Sea Committee of the American Branch International Law Association (ABILA) brought together a group of scholars to define terms not included in UNCLOS. This author is a member of the committee, which developed a rather serviceable definition of a "vessel" as simply "a human-made device, including submersible vessels, capable of traversing the sea" [Walker, 2004]. The essence of the definition of what constitutes a "vessel" is whether it moves through the water.

NAVIGATIONAL REGIMES

The determination of whether UUVs and USVs are "vessels" and UAVs are "aircraft" is the key to understanding their legal status, and hence their associated rights and duties. As vessels, unmanned systems are entitled to all of the rights – and responsible for executing all of the duties – inherent in that status. Doing so requires situational awareness and an understanding of the zones and regimes reflected in UNCLOS. Nations that have an ocean shoreline and are geographically situated on the sea are "coastal states," and such countries may assert sovereignty, or certain designated sovereign rights or jurisdiction, in that ocean space adjacent to their coastline. Coastal states also may elect to develop areas of their shoreline to accept international shipping commerce, thereby acquiring the status of a "port state," which is governed by the port state's right of sovereignty over its internal waters and land area. At the same time, any nation, including land-locked states, may register ships or vessels under its flag, and thereby operate as a "flag state." Because UNCLOS balances the rights and duties of flag, port, and coastal states, the entire architecture of oceans law represents a "package deal," in which states are required to accept all of its provisions. This careful balance between the rights and duties of flag, coastal and port states represents the grand bargain of UNCLOS and forms the bedrock of global oceans law and policy.

INNOCENT PASSAGE

One of the major accomplishments of UNCLOS was designation of a uniform width of the territorial sea. The territorial sea is a

Petty Officer Christopher L. Marino uses a remote control to steer a modified Rigid Hull Inflatable Boat called the Spartan Scout. The Spartan Scout was created by the Naval Undersea Warfare Center in Newport, R.I., and will make future unmanned missions for a number of applications.

belt of ocean that may extend a maximum of twelve nautical miles from the baseline of the coastal nation, and the area is subject to the sovereignty of the coastal state. Ships and vessels of all nations, however, enjoy the right of innocent passage in the territorial sea, although aircraft are not entitled to assert a similar right to overfly the territorial sea. The right of innocent passage means continuous and expeditious traversing of the territorial sea, and may even include stopping and anchoring, but only insofar as incidental to ordinary navigation, or as rendered necessary by force majeure or by distress. All civilian vessels and warships enjoy the right of innocent passage, which cannot be conditioned on consent or notification by the coastal state. Generally, passage is innocent so long as it is not prejudicial to the peace, good order, or security of the coastal nation. Article 19 of UNCLOS contains an exhaustive list of activities that are considered prejudicial, and therefore are inconsistent with the right of innocent passage. These include any threat or use of force against the sovereignty, territorial integrity, or political independence of the coastal state. Submarines are entitled to innocent passage, but must transit on the surface and show their flag.

A coastal nation may enact certain reasonable and necessary restrictions upon the right of innocent passage for purposes of resource conservation, environmental protection, and navigational safety. Such restrictions, however, may not have the practical effect of denying or impairing the right of innocent passage, and may not discriminate in form or in fact against the ships of any nation. Oman, for example, purports to require prior permission for innocent passage for warships, and nuclear-powered vessels and vessels carrying dangerous substances, but these provisions are unlawful.

USVs that are operated for civil as well as naval purposes enjoy an independent right of innocent passage through the territorial sea.

That is, the right of innocent passage for UVs is not necessarily derived from or dependent upon the rights or legal status enjoyed by the ship or aircraft from which they were launched. UUVs, like manned submarines, must travel on the surface of the water to enjoy the right of innocent passage. Coastal states are entitled to order warships and naval UVs out of the territorial sea if the vessels violate the terms of innocent passage [UNCLOS, Article 30]. In case of autonomous UVs, such as floats and gliders, however, this recourse by the coastal state is dependent upon making effective communication with the flag state that is operating the devices.

TRANSIT PASSAGE

Areas of the territorial sea that connect one part of the high seas or exclusive economic zone (EEZ) to another part of the high seas or EEZ have the status of an international strait. Straits used for international navigation are subject to the legal regime of transit passage. Ships, submarines and aircraft of all nations, including warships, naval auxiliaries, military aircraft and UUVs, USVs and UAVs, enjoy the right of unimpeded transit passage through such straits and their approaches [UNCLOS, Article 38]. Transit passage is more robust than innocent passage, and is defined as the exercise of the freedoms of navigation and overflight solely for the purpose of continuous and expeditious transit in the normal mode of operation [UNCLOS, Article 38; Article 39]. Vessels and aircraft have a duty to proceed "without delay" through international straits, and also must refrain from the threat or use of force against the sovereignty, territorial integrity or political independence of the coastal states that are situated along or astride the strait. Furthermore, craft of any type may not loiter in the strait or conduct any other activities that are not "incidental to continuous and expeditious transit" [UNCLOS, Article 39].

Transit through straits may be made in the "normal mode." For UAVs, the normal mode is flight; the "normal mode" for UUVs is submerged. Unmanned systems may be operated, launched and recovered from "mother ships" and manned aircraft during transit passage, but only so long as the activities are aiding normal transit through the strait. "Normal transit," however, includes force protection measures. Still, USVs and UUVs may not, for example, conduct marine scientific research or hydrographic surveys while in transit passage without the consent of the coastal state [UNCLOS, Article 40]. In peacetime, coastal states may not hamper or suspend transit passage for any purpose [UNCLOS, Article 38; Article 44].

Archipelagic sea lanes passage (ASLP) is a close cousin of transit passage, and the two regimes have rules that largely mirror each other. Barring a few rather minor and technical differences, ASLP is quite similar to the right of transit passage through international straits. Unmanned systems enjoy the right to conduct ASLP in all routes normally used for transit through the waters or airspace of archipelagic nations [UNCLOS, Article 53]. Like transit passage, the purpose of ASLP is restricted to air, surface or subsurface transit in the normal mode of operations for the sole purpose of continuous, expeditious transit on routes normally used for international navigation and overflight [UNCLOS, Article 53]. Also as is the case with transit passage, the coastal state may not hamper or suspend the right of ASLP [UNCLOS, Article 54].

SOVEREIGN IMMUNITY

In order to dissect the legal status, rights, duties and obligations of unmanned systems, it is useful to introduce new additional terminology from international law. USVs and UUVs engaged exclusively in government, noncommercial service enjoy the legal status of sovereign immune craft. Furthermore, the legal status of a UV is not necessarily dependent on the status of the ship, submarine or aircraft from which it is launched. This means that the sovereign immune status of military UUVs and USVs affords them complete immunity from the jurisdiction of any state except the flag state [UNCLOS, Article 32; Article 95; Article 96; Article 236]. Consequently, although unmanned systems may voluntarily comply with internationally-approved routing measures and traffic separation schemes, such as measures adopted by the International Maritime Organization, they are not legally required to do so while exercising transit passage [UNCLOS, Article 42]. Similarly, military activities are exempt from interference by other nations, and sovereign immunity protects military assets from the assertion of jurisdiction by foreign ships or states. The expression "military activities" includes, *inter alia*, normal naval ship or vessel and aircraft operations, task force manoeuvres, launch and recovery of aircraft and other military devices, military exercises, intelligence, surveillance and reconnaissance (ISR), command, control and communications (C^3) activities, weapons and ordnance testing and exercises, and military surveys [Oxman, 1978].

HIGH SEAS FREEDOMS IN THE EEZ

Beyond the territorial sea – in the areas of the 24-nautical mile contiguous zone, the 200-nautical mile EEZ and the high seas – both manned and unmanned vessels, submersibles and aircraft enjoy high seas freedoms of navigation and overflight, and other

Sonar Technician (Surface) 1st Class Bryson Menke and Mineman 3rd Class Michael Darcy, both assigned to Explosive Ordnance Disposal Mobile Unit (EODMU) 1, embarked aboard the mine countermeasures ship *USS Dextrous* (MCM 13), prepare to deploy an unmanned underwater vehicle. EODMU-1 and *Dextrous* are conducting drills in the Arabian Gulf.

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internationally lawful uses of the sea [UNCLOS, Article 33; Article 58]. The complete operational mobility and access to the EEZ is limited only by the requirement that activities be conducted with "due regard" for the rights of other nations [UNCLOS, Article 87]. A handful of states – China in particular – have contested the right of foreign or distant states to conduct naval activities in a coastal state's EEZ. Even though China routinely operates naval forces in the EEZs of Japan, the Philippines and other nations, it has campaigned to reinterpret the provisions derived from centuries of customary international law and UNCLOS to exclude foreign military operations within 200 nautical miles from its shore. This challenge has grave implications for the operation of unmanned systems in the coastal zone, threatening to exclude ships, vessels and UVs of all types from more than one-third of the ocean space. In March 2009, for example, China intercepted the *USNS Impeccable* as it was towing an array sensor while operating 75 nautical miles from the coastline of Hainan Island.

SOUND SURVEILLANCE SYSTEM

State practice and UNCLOS, however, have long recognized the right of all nations to conduct both manned and unmanned naval operations in the EEZ. The Sound Surveillance System (SOSUS), for example, is a chain of underwater hydrophone posts, which was first developed to detect Soviet submarines entering the North Atlantic from the Greenland-Iceland-United Kingdom gap [Whitman, 2005]. Originally deployed in 1952, the SOSUS was expanded to other areas of the Atlantic Ocean and into the Pacific Ocean. The individual hydrophone outputs were transmitted to shore processing stations or "Naval Facilities" on multi-conductor armoured cables [Whitman, 2005].

The use of SOSUS and similar unmanned or tethered systems is an exercise of freedom of navigation and other internationally lawful uses of the sea under articles 58 and 87 of UNCLOS. Moreover, as a military activity, SOSUS is exempt from the jurisdiction of any other state. The final text of article 60 of UNCLOS grants the coastal state the exclusive authority to authorize the construction, operation and use of artificial islands, installations and structures for economic purposes, and of any installations that may interfere with the exercise of these coastal states rights. The article states that in the EEZ coastal states "have the exclusive right to construct and to authorize and regulate the construction, operation and use of: (a) artificial islands; (b) installations and structures for the purposes provided for in article 56 and other economic purposes; (c) installations and structures which may interfere with the exercise of the rights of the coastal State in the zone." The language of article 60 was intentionally restrictive, referring to the rights in article 56 relating to economic rights and thereby omitting from coastal state purview the emplacement of foreign military installations and structures [Dept. of State, 1975]. Similarly, the Seabed Treaty was limited in scope [Laursen, 1982]. Although the Seabed Treaty forbids the introduction of weapons of mass destruction on the seabed, detection devices and naval operations in, on or above the water remain legal [Treaty on Prohibition, 1972].

In more recent years, SOSUS has been supplemented by the mobile Surveillance Towed Array Sensor System (SURTASS). SURTASS is a low frequency passive acoustic data collection and analysis system that is towed by surface ships. The system consists

of a long acoustic array, which is towed by a surface ship and carries environmental sensors, electronic components, and hydrophones that can detect underwater sound signals. By providing passive anti-submarine warfare (ASW) detection of nuclear and diesel submarines, the SURTASS system can deliver real-time surveillance information to operational commanders. Another variant, the SURTASS-Low Frequency Active (LFA) array, is the only system capable of effective ASW detection against newer, quiet diesel submarines operating in shallow waters. Together, these systems form the Integrated Undersea Surveillance System (IUSS), and are deployed on the high seas as well as the EEZs of coastal nations. The IUSS is headed by Commander, Undersea Surveillance, who is in charge of the ocean surveillance ships *USNS Able*, *USNS Effective*, *USNS Loyal*, *USNS Victorious* and *USNS Impeccable*.

EXPENDABLE MARINE INSTRUMENTS

While the application of the law of the sea to UVs is often rather straight forward, then the peculiar nature and distinct operating environment of some marine instruments may raise more complex issues. My article on the legal aspects of autonomous and expendable marine instruments in the journal *Ocean Development and International Law* introduced for the first time in the literature some thorny questions concerning the legal aspects of UV employment in the oceans [Kraska, 1995A]. At the time, environmental law standards designed for civil shipping were just being applied to U.S. naval ships and submarines, raising the prospect that associated autonomous and expendable marine instruments also would be subject to regulation by aggressive coastal state authorities. In particular, naval and commercial ships were deploying into the oceans hundreds of thousands of expendable bathythermograph (XBT) and conductivity, temperature and depth (XCTD) sensors annually. Given that the instruments were not designed to be recovered, it was foreseeable that coastal states might try to use environmental law as a mechanism for trying to assert control over XBT and XCTD usage by foreign-flagged ships. Over the past 15 years, advances in technology – in particular the widespread use of the global positioning system (GPS) to pinpoint location accurately – have made the use of both recoverable and expendable marine instruments more widespread. The International Oceanographic Commission has taken up the matter of the legal status of autonomous instruments, focusing its effort on the law that pertains to floats and gliders.

FLOATS AND GLIDERS

Breakthroughs in technology are producing a particularly large variety and number of floats and gliders for observation purposes in the ocean environment. Civilian scientists are using the devices for marine scientific research (MSR), such as the Argo Project of the International Oceanographic Commission (IOC). The Argo Project includes an array of 3,255 (as of March 23, 2010) active free-floating ocean monitoring devices [Mateos and Gorina-Ysern, 2010; ILC Study Group, 2006]. Since floats and gliders are not controlled and are subject to the movement of the current, they may be carried into waters under the jurisdiction or sovereignty of foreign coastal states, such as the territorial sea or EEZ. In such case, the legal status of the devices and the relationship between the nation deploying the devices, and the coastal state

may be uncertain. In 1999, the IOC adopted a resolution that directed its Advisory Body of Experts on the Law of the Sea (ABE-LOS) to review the legal issues regarding floats and gliders [IOC, 1999].

A "float" was defined by ABE-LOS as "an autonomous vehicle … floating passively at a preprogrammed pressure level until at predetermined time intervals rising to the ocean surface to broadcast its position and, as the case may be, collected data to a satellite" [IOC, 2007]. Gliders were defined as ballasted instruments that have "buoyancy engine," which moves fluid within the instrument to keep the mass constant, but alters buoyancy so they can ascend and descend. Wings maintain a horizontal movement. A glider's path is semi-controlled, and currents may carry a glider off-track. The uncontrolled drifting of floats and gliders has raised legal questions concerning the distribution of rights and privileges among states operating the devices, and coastal states that may experience floats and gliders entering their EEZ, territorial sea or internal waters. Some suggest that UNCLOS is insufficient to address the pertinent issues, and that a new legal regime should be crafted [Bork et al., 2008]. In 1999, the IOC adopted guidelines for the use of floats and gliders in Argos [IOC, n.d.]. Guideline 1 sets forth that an IOC member state must be "informed in advance" through appropriate channels of the deployment of a project float that might enter its EEZ. But the "soft law" authority of the guidelines is extremely narrow, applying only to IOC members and concerning one IOC research program. It is worth observing that the guidelines do not apply to naval floats and gliders that are deployed for a military purpose, although the trend toward greater regulation of unmanned systems in the EEZ is apparent. Another problem related to the use of unmanned systems in the EEZ is the tendency to conflate foreign marine scientific research, which may be regulated by the coastal state, with foreign military surveys, which are beyond the competence of the coastal state to regulate.

MARINE SCIENTIFIC RESEARCH AND MILITARY SURVEYS

During the negotiations for UNCLOS, nations agreed that the articles dealing with scientific research would not hinder hydrography or meteorological coverage of the oceans, including the EEZ. UNCLOS does not define the terms "marine scientific research" (MSR), "hydrographic survey," "military surveys," "meteorology," or "survey activities." The text of the treaty, however, does provide some guidance on the application of the terms, which are particularly important in the use of UUVs and USVs. MSR may be defined as those activities undertaken in the ocean and coastal waters to expand scientific knowledge of the marine environment and its processes [Soons, 1982]. The definition includes scientific ocean drilling and coring, physical oceanography, marine chemistry, marine biology, geological and geophysical science, as well as other marine activities undertaken for a scientific purpose. Under articles 19(2)(j) and 245 of UNCLOS, coastal states were afforded the exclusive right to regulate and authorize MSR in the territorial sea. This means that MSR only may be conducted in the territorial sea with the consent of the coastal state; the activity is inconsistent with the right of innocent passage. In the EEZ, the coastal state exercises a qualified consent regime, in which the coastal

state must consent to the conduct of MSR, but the coastal state must grant such consent in "normal circumstances," in accordance with article 246. Foreign states conducting MSR in a coastal state EEZ also may presume consent to have been granted under article 247, if the research was undertaken by a competent international organization of which the coastal state is also a member, such as the IOC of UNESCO or the World Meteorological Organization (WMO), so long as the coastal state previously approved the project. Programs that fall within this exclusion include the Integrated Global Oceans Services System (IGOSS) and the World Weather Watch (WWW). [IGOSS collects and exchanges data on ocean temperature, salinity, sea level, and currents, and produces ocean-related products and services. Coordinated jointly by the Intergovernmental Oceanographic Commission of UNESCO and the World Meteorological Organization, it is carried out by national facilities and services provided by 125 participating member countries who share data for mutual benefit. The IGOSS system consists of the following three components: the IGOSS Observing System, IGOSS Data Processing and Services System, and the IGOSS Telecommunications Arrangements. IGOSS is defined as a data acquisition and management systems that will form, with other existing systems, the "Marine Meteorological and Oceanographic Operational Services" Module of the Global Ocean Observing System. The WWW was established in 1963 as a core of the World Meteorological Organization programs. Programs include Commission for Basic Systems (technical training on system and data management of WWW); Global Observing System (a climate observing system, with data gathered from the stations on the ground, at sea and in the air and from satellites); Global Telecommunications System (prepares telecommunication networks at the global, regional and national levels); Global Data Processing System (makes available meteorological analysis and forecasts); Data Management (manages the integration of the GOS, GTS, and GDPS); WMO Distributed Data Bases (provides data not exchanged via the Global Telecommunications System); WMO Satellite Activities; Tropical Cyclone Programme (mitigates tropical cyclone disasters); Emergency Response Activities (responds to man-made environmental emergencies); and Instrument and Methods of Observations Programme (sets technical standards).] In such cases, the coastal state has four months from the time of notification of the MSR within which to object. The treaty also provides, however, that even the absence of diplomatic relations can constitute "normal circumstances," in which coastal state approval for MSR is expected [UNCLOS, Article 246]. On the other hand, military surveys may collect data that is the same or similar to MSR, but the purpose of the activity is for military purposes, and therefore is not included within the scope of MSR.

Article 21(1)(g) of UNLCOS entitles the coastal state to regulate MSR and hydrographic surveys during innocent passage through its coastal waters. The same rules apply for archipelagic waters and international straits through articles 40 and 54 [Roach, 2001]. Routine observation and marine data collection programs are not considered MSR under Part XIII, but more often constitute "hydrographic surveys" [Yankov, 1982]. Hydrographic survey is the collection of data, such as depth of water, configuration and nature of the seabed, and the anatomy of currents, tides

and flows of the water, for the purpose of making nautical charts and similar products to support safety of navigation. The peacetime rules and disagreement over whether military surveys constitute MSR have resulted in several incidents between U.S. naval survey ships operating in the East China Sea. In each case, aggressive manoeuvres by Chinese warships, armed state oceanographic vessels and fishing patrol enforcement ships, and even commercial cargo and fishing vessels, have interfered with military surveys being conducted. These clashes underscore that although UNCLOS declares that the oceans are reserved for "peaceful purposes," the potential for confrontation – and even conflict – is ever present. In the event that disagreement turns violent, however, the use of force by belligerent parties is not unrestricted. Just as the regimes reflected in UNCLOS may be adaptable to include the use of unmanned systems, so too is aviation law. Aviation law operates in conjunction with UNCLOS to delineate rights and duties of states operating in the aerospace above the surface of the ocean. In general terms, the airspace acquires the legal status of the waters that lie beneath them.

AVIATION LAW

UAVs are autonomous or remote-controlled pilotless aircraft that may be launched from surface, submarine or aviation platforms or land bases [Commander's Handbook, 2007B]. The U.S. Navy is working to place stealthy unmanned combat aircraft in aircraft carrier strike groups as early as 2018 [U.S. Navy, 2010]. The Unmanned Carrier-launched Airborne Surveillance and Strike (UCLASS) could be used in contested scenarios in irregular and hybrid warfare. The first carrier deployment of an unmanned platform is expected 2012 when the Northrop Grumman X-47B Unmanned Combat Air System (UCAS) begins flight testing at sea [U.S. Navy, 2010]. The stealthy, strike fighter-sized drone is designed to demonstrate the feasibility of operating advanced strike UAVs from carrier flight decks. For its part, the U.S. Air Force is considering how to employ unmanned conventional global strike platforms, which are under development for DARPA by Lockheed Martin [U.S. Navy, 2010].

Perhaps the first international law analysis of UAVs occurred during the Cold War, just as cruise missiles were entering into inventories in the East and West. As a holdover from rules governing the superpower relationship in Europe, military UAVs on the continent of Europe are subject to additional provisions. The 1987 Intermediate Nuclear Forces (INF) treaty regulates the number of ground-launched cruise missiles (GLCMs) and intermediate-range ballistic missiles (IRBMs) in Europe. The United States has determined, however, that armed UAVs that do not use launchers and are designed to return to base, do not fall within the definition of a "cruise missile" under the treaty. One of the most important criteria in this regard is that the UAVs are recoverable, not expendable. UAVs are also perhaps more affected by conventional arms control in Europe, as Unmanned Combat Air Vehicles are considered "aircraft" and subject to transparency reporting requirements and airframe ceilings under the 1990 Conventional Forces in Europe (CFE) Treaty.

The great expansion in the use of unmanned systems gives rise to questions concerning

the legal status of the aircraft or drones in international aviation law. The law has become a critical component of political and policy military legitimacy, both at home and abroad. The United States and other nations are especially sensitive to the legal implications of using new technologies, which hold promise for gaining operational asymmetric advantage in countering traditional and unconventional threats. At the same time, however, the very fact that the technology tends to inure advantage to developed democratic states with effective conventional military forces means that it will be challenged by irregular forces, insurgencies and terrorist organizations, and their witting and unwitting supporters, in an effort to level the playing field. One of the greatest means to undermine support for the use of UAVs is to attack their legality in combat and law enforcement operations.

Analysis of the legal aspects of UAVs begins with the 1944 Chicago Convention on Civil Aviation. The Chicago Convention sets forth the fundamental framework of public international law concerning aviation activities in the global commons. The treaty established the International Civil Aviation Organization (ICAO), which works to develop a regulatory regime that promotes safety and confidence in international air navigation [Commander's Handbook, 2007C]. Operating under the auspices of ICAO, nations manage civil air traffic throughout designated Flight Information Regions (FIRs) that blanket the globe. FIRs are designated areas of national and international airspace flight information and alerting services for civil aircraft, allowing air traffic controllers to coordinate and manage commercial and civil aviation.

Annex 2 of the Chicago Convention contains the air navigation rules applicable to civil aircraft. Article 3 of the treaty exempts the application of the rules to military or state aircraft. State aircraft (including UAVs) are not required to observe ICAO flight procedures, such as filing flight plans and complying with directions by national air traffic control authorities. The United States regards UAVs as "military aircraft" within the meaning of the Chicago Convention [DOD, 2007]. Military aircraft, however, still operate with "due regard" to other users of airspace [Commander's Handbook, 2007C]. Even though military aircraft have sovereign immune status and therefore are exempt from ICAO rules, as a matter of policy, military aircraft of the United States and other nations that are conducting routine point-to-point flights throughout international airspace voluntarily adhere to ICAO flight procedures and FIR services. On the other hand, military aircraft are likely to assert their right of sovereign immunity when flying for tactical or operational combat or training purposes, such as conducting aircraft carrier operations or flights through politically sensitive areas [Commander's Handbook, 2007D]. UAVs enjoy sovereign immunity from the laws or assertion of jurisdiction of foreign nations. The United States considers all UAVs operated by the Pentagon to be "military aircraft," which enjoy all of the rights and benefits of their manned counterparts. UAVs are afforded the same overflight rights of transit passage and ASLP as their manned counterparts [Commander's Handbook, 2007B]. As state aircraft, military UAVs are exempt from compliance with ICAO flight rules and civil air traffic control protocols, but they must fly with due regard for the safety of navigation of civil aircraft [Commander's Handbook, 2007C].

All states maintain full sovereignty over national airspace, and foreign aircraft may not enter national airspace without consent. National airspace includes airspace over a nation's territory, internal waters, archipelagic waters, and territorial seas. Unlike ships, aircraft do not enjoy a right of innocent passage through the airspace of the territorial sea or archipelagic waters. Subject to the right of overflight through international straits and archipelagic sea lanes, a nation exercises exclusive and absolute sovereignty over national airspace. Except for carefully designated exceptions to the rule, such as transit passage and archipelagic sea lanes passage, the foreign aircraft are not entitled to enter national airspace or land in the sovereign territory of another nation without authorization [Chicago Convention, 1944]. (Aircraft in distress, however, may enter the national airspace of a foreign nation, if circumstances of aircraft or medical safety require immediate diversion. In such cases, aircraft should seek permission from the state exercising sovereignty over the airspace being entered.) Foreign aircraft seeking to enter national airspace are required to identify the aircraft, gain permission to land or to transit the airspace, and they should comply with all reasonable orders to land, turn back, or fly a prescribed course or altitude [Commander's Handbook, 2007E]. At the same time, however, aircraft of all nations enjoy the right of unimpeded flight through international airspace, which includes all airspace lying beyond the territorial sea of any nation.

LAW OF NAVAL WARFARE

The law of naval warfare is a subset of the law of armed conflict, or what is called "international humanitarian law" in some countries, such as Western Europe. Nations lawfully may use force in certain instances, such as in self-defense or pursuant to authority under chapter VII of the U.N. charter. The rules applicable to the use of force at sea are embedded in the law of armed conflict, and include necessity and proportionality among the cardinal rules. Derived from state practice, particularly before and during the two world wars, the law of naval warfare requires that the use of force meet a number of broad criteria. First, force must be necessary to secure the prompt submission of the enemy, with a minimum expenditure of life, resources and time. Even in warfare, the Hague rules prohibit destruction that is not "imperatively demanded by the necessities of war" [Hague Convention IV, 1907]. Second, force must distinguish between the civilian population and combatants and between civilian objects and military objectives; military operations should be conducted only against lawful military objectives. What constitutes a "military objective," however, is not always clear. Additional Protocol I, as well as Canada, Australia and the United Kingdom, hold the position that a "military objective" is an object, which by its nature, location, purpose, or use, makes an effective contribution to the enemy's military action. The U.S. position is that a "military objective" is one, which by its nature, location, purpose or use, makes an effective contribution to the enemy's war-fighting or war-sustaining capability. In comparison, the American perspective is somewhat broader, placing at risk a greater list of potential targets. Third, the use of force must be proportional. This means that the force used may not cause suffering, injury or destruction to civilians or civilian object that are excessive in relation to

the concrete military advantage to be gained. The principles embodied in the law of armed conflict apply on the land, in the air and at sea. The law of naval warfare also contains special rules associated with unmanned naval operations. For example, an unanchored sea mine should be designed to become harmless within one hour after a loss of control [Hague Convention VIII, 1907]. A torpedo must become harmless if it misses the target [Hague Convention VIII, 1907].

Much as the international law of aviation and law of the sea apply in the context of both manned and unmanned aircraft and vessels, the law of naval warfare is equally applicable to the use of force by manned ships and aircraft and UVs. In some instances, such as the definition of a "vessel" in treaty construction and state practice, it is clear that unmanned systems enjoy the same legal status as ships. In the case of the law of naval warfare, the emphasis is on the protection of civilians and those *hors'd combat*. Shipwrecked and wounded sailors are protected from attack regardless of whether the attack is launched from a warship or a USV. In the end, however, the conclusion that the rules governing unmanned systems are derived from broader principles of international law designed for manned ships and aircraft is really the only realistic course. The principles embodied in the Law of the Sea Convention, the Chicago Convention and Hague and Geneva law of naval warfare are time-tested, have widespread acceptance and are based on custom and state practice.

CONCLUSION

Although the technology for naval applications of autonomous and unmanned systems is in its infancy, long-standing regimes in international law already provide a basic legal framework for using UVs in war and peace. Efforts to create new legal regimes for unmanned systems are unnecessary – the very type of superfluous over lawyering that weakens the maintenance of stability and good order at sea. Furthermore, if UVs were not covered by existing legal frameworks that already apply to ships, submarines and aircraft, then unmanned vehicles are entering service within a legal vacuum. Judicial economy and avoidance of legal anarchy weigh heavily in favor of applying existing international regimes to emerging unmanned and autonomous systems. There is no realistic option other than to do so, and it would be shortsighted to forgo application to UVs of the detailed, comprehensive and widely-accepted legal regimes in existence. Each body of law – the law of the sea, the law of armed conflict, aviation law and the law of naval warfare – offers a depth of theory, operational practicality and broad legitimacy that augur in favour of their application. The existing international law applies to unmanned systems, both directly and by analogy, with the necessary tweaks and customization essential to fit the circumstances. Application of the existing regimes strengthens the rule of law, enhances compliance with international norms and promotes stability of expectations. Consequently, these bodies of public international law apply *mutatis mutandis* to unmanned systems operating in the oceans, if for no other reason than that there is no subsequent body of law waiting to fill the void.

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