2016

SPRING

VOLUME 3

STRATEGIC PRIMER: DRONES

Current capabilities and emerging threats

American Foreign Policy Council

DRONES & AMERICAN SECURITY

The American Foreign Policy Council (AFPC) is dedicated to advancing the prosperity and security of the United States. AFPC's Defense Technology Program launched the Strategic Primer initiative to inform Congressional staffers (and the general public) about technologies that affect U.S. national security. The Primers provide balanced representations of the potential benefits and limitations of a particular technology, its history and uses, and potential threats posed by its use by America's adversaries.

Remotely Piloted Aircrafts (RPAs, or drones) are playing an increasingly important role in modern warfare, and performing a growing number of surveillance and reconnaissance missions at home and abroad. This Primer describes how the United States, as well as our allies and our enemies, are using drones, discusses challenges posed by RPAs, and offers recommendations for future defense planning.

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PROJECT TEAM

Director:	Rich Harrison
Editor:	Ilan Berman
Graphic Design:	Ozzie Chung
Research & Content:	Caitlin Lenzner-White
	Chloe Thompson

WHAT IS A DRONE?

An unmanned aerial vehicle (UAV, or drone) is an aircraft with no human pilot on board.[1] Its flight is controlled either by a human pilot at a distance or via an onboard computer.[2] The drone and the ground station or human controllers are cumulatively known as an unmanned aircraft system (UAS).

There are currently thousands of different types of drones, ranging from commercial models used by hobbyists to surveillance and reconnaissance drones to armed UAVs used in combat. Over 78 countries currently have active drone programs.[3] Drones increasingly have become viewed as essential technology for national militaries, and the already large global market for such systems is poised to expand dramatically over the next decade.

THE ADVANTAGES

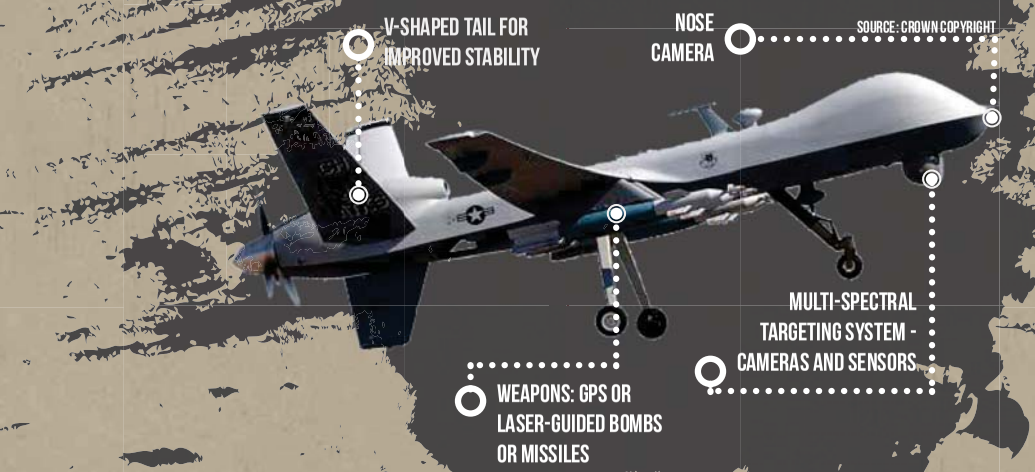
Drones provide far more persistent surveillance than do traditional aircraft. A Predator B (MQ-9 Reaper) can stay aloft for 27 hours, while a comparable manned jet maxes out at a few hours of flight, if it does not refuel.[4] Drones also have a faster response rate do than traditional aircraft, and can be launched and put on-station quicker than their manned counterparts. Furthermore, drones are relatively low-cost; in the 2016 U.S. defense budget, proposed funding for drone development and acquisition totaled just $2.9 billion out of a total $48.8 billion requested for aircraft and related systems.[5]

CONSIDERATIONS

While effective, drones remain a controversial technology because of privacy concerns relating to surveillance and civilian casualties from air strikes. Nevertheless, the technology represents a breakthrough with the potential to significantly strengthen U.S. security.

TIMELINE

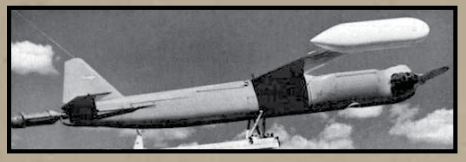
MQ-9 REAPER



1944 Germans drop V1 "Buzz Bombs" on Belgium, England, and France, killing 10,000 civilians and injuring 28,000 more.[6]

1946 The "Pilotless Aircraft Branch" of the U.S. Air Force is established to develop target drones.[7]

1952 The U.S. Army builds its first reconnaissance drone, the Northup Radioplane RP-71 Falconer (SD-1).[8]



1960s The U.S. flies second-generation Firebees over North Vietnam and China, as well as the Soviet Union.[9]

1970s Israel begins modifying existing UAVs and developing its own designs.[10]

1990-91 Drones are used in Operation Desert Storm.[11]

1994 RQ-1 Predator makes its first test flight.[12]

1995 The Predator drone is deployed to Bosnia for its first mission.[13]

2001 Operation Enduring Freedom begins. Drone use increases dramatically. A U.S. Predator drone carries out its first remote strike with casualties.

2007 The Pentagon creates an in-house task force. to oversee drone operations and decision-making.[15]

2015 The Obama administration liberalizes drone export policy.[16]

TYPES OF DRONES

Drones can be divided into three categories: mini, tactical, and strategic. The chart below outlines the attributes for each classification, and this section provides several examples of each currently used by various countries.[17]

MINI

Norway's Black Hornet[18] is a micro unmanned aerial vehicle used for reconnaissance purposes. The pilot uses a one-hand controller and watches the video feed on a chest-mounted screen. No video is stored on the drone, limiting vulnerability if captured. The Black Hornet has a range of 2/3rds of a mile. Maximum flight time: 25 minutes.

TACTICAL

The Tachyon[19] is one of Russia's 800 drones meant for surveillance and reconnaissance missions. Russia has deployed these drones to monitor troops engaging in combat readiness exercises in the Arctic. Range: 150 km. Elevation: 4,000 meters.

The Mirsad[20] was initially used by Iran for surveillance and reconnaissance missions during the Iran-Iraq war. In 2004 and 2005, a Hezbollah-operated Mirsad drone entered Israeli airspace. These drones and their variants are used mainly for reconnaissance in combat; however, in 2006, Hezbollah weaponized three drones with about 150 total pounds of explosives.

PAYLOAD TYPES[21] - Each UAV classification has several optional payloads that increase with larger drone sizes.

Mini: Stamp and photogrammetric payloads, camera, high-resolution images, infrared camera, field of vision, laser pointer, gimbaled and gyrostabilized payload, IR thermal camera, dual Electro-optical/Infrared (EO/IR) payload, stabilized Charge Couple Device (CCD), Signals intelligence (SIGINT) collection package. Some can carry weapons.

Tactical: Advanced EO/IR, SIGINT collection package, planned synthetic aperture radar and moving target indicator, hyperspectral imagery, lightweight communications relay package, marker/illuminator, laser range finder and target designator.

Strategic: Multi-mode radar, AN/AAS Multi-spectral Targeting System (MTS-A), which includes EO/IR video cameras, laser designators, laser illuminator, multi-mode maritime surveillance radars, SIGINT collection package, and Hellfire Missiles.

The Heron[22] is a medium-altitude, long-endurannce (MALE) UAS developed by Israel Aerospace Industries for surveillance/reconnaissance. In Sept. 2015, Israel sold 10 multi-role Herons to India outfitted with air-to-ground missiles for $400 million. Payload weight: 2,200 lbs. Max flight time: 36 hours.

The Predator[23] is a MALE UAS used for combat, surveillance, and reconnaissance missions. The USAF no longer purchases Predators, but rather the newer, more advanced Reaper. Payload weight: 450 lbs. Upfront cost: $4–$5 million. Cost per flight hour: $2,500–$3,500. Max flight time: 24 hours.

The Reaper[24] is the newer, larger, and more effective version of the Predator. This MALE UAS is also used for combat, surveillance, and reconnaissance missions. Payload weight: 3,750 lbs. Upfront cost: $12.5 million. Cost per flight hour: $2,500–$3,500. Maximum flight time: 24 hours.

STRATEGIC

LONG-TERM BENEFITS

REDUCED CASUALITIES[25]

Despite the high press coverage of civilians killed by drones, when compared to conventional strike weapons drones actually cause fewer civilian casualties. Although specific civilian casualty numbers will vary depending on the source, the past several years have seen a dramatic reduction in non-militant fatalities in drone operations.

RELIABILITY, PRECISION, AND ACCURACY[26]

Drones are extremely useful for monitoring illegal activities, patrolling borders, and responding to natural and manmade disasters. Many of these activities would simply be too risky or expensive to be carried out by manned aircraft or vehicles, but are important to both national security and situational awareness.

SURVEILLANCE AND RECONNAISSANCE

Drones are ideal for surveillance and reconnaissance over long periods of time. Unlike manned aircraft, drones can stay over an area for hours, waiting for the most opportune time to strike or surveil a target. This ability can save civilian lives and increase target accuracy. From a military perspective, two important charachteristics of drones are persistence and stealth.

COST EFFECTIVENESS[27]

Drones are far less expensive than conventional military equipment (at times by a factor of 10). Despite requiring more operators on the ground and having a significantly higher crash rate than manned crafts, UAVs are still more cost effective in the long-term. Additionally, UAVs are exependable, and there is no loss of human life during a crash and no risk of capture of airmen.

EASE OF ACCESS AND LIMITING FUNCTION[28]

Drones reduce dependence on ground forces and other conventional weapons that, when deployed, traditionally result in an increase in the scope and scale of a conflict. Without the need to account for human factors, the aircraft can make use of the reduced weight by adding more fuel and additional payloads.

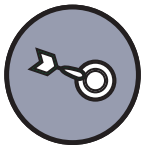
LONG-TERM CONCERNS

SETTING DANGEROUS PRECEDENTS[28]

Engaging in drone strikes without a formal declaration of war is a violation of international law and could set a dangerous precedent. As a former UN official has explained, "[i]f other states were to claim the broad-based authority that the United States does – to kill people anywhere, anytime – the result would be chaos." Additionally, drone strikes have been condemned due to insufficient Congressional oversight of their use by the U.S. military and by the CIA in covert missions.

INCREASED ANTI-AMERICAN SENTIMENT[29]

U.S. drone strikes that result in civilian casualties have psychological implications for the people living in conflict zones, and have been known to foster anti-American sentiment. This can have a long-term impact on the ability of the United States to "win the hearts and minds" of these populations, both now and in the future.



PSYCHOLOGICAL HEALTH OF DRONE OPERATORS[30]

Pilots of manned aircraft operate under limits on their 'flight hours,' or the amount of time they can spend in the cockpit. By contrast, drone operators do not, which can have a pronounced effect on mental health. Studies show that the types of PTSD and psychological issues faced by drone operators are different from those faced by soldiers and airmen, and tend to be more severe. This, combined with long hours and the current heavy reliance on drone operators, results in a high turnover rate.

INCREASED USE OF DRONES BY MILITANT GROUPS

Militant groups including Hezbollah and Hamas have already experimented with crossing state borders using drones, as well as with weaponizing small UAV systems. The use of armed drones by violent non-state actors will likely be an increasingly common phenomenon in the future, as drone technology continues to proliferate.

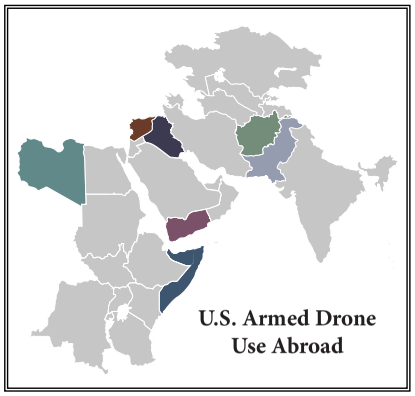
VULNERABILITY TO ENEMY ATTACKS/CAPTURE OF INFORMATION[31]

As with any advanced technology that relies on GPS location and communication links for operations, drones are vulnerable to cyber intrusions. In 2009, insurgents in Iraq used a $26 program called SkyGrabber to intercept the video feeds of Predator drones.

U.S. DRONE PROGRAMS

DOMESTIC CONSIDERATIONS

The most significant domestic concerns regarding the use of drones relate to their commercial uses, potential accidents involving drones that could harm the public or traditional aircraft, and the potential for violations of privacy. While their actual implementation is still some years away, many businesses are now developing plans to utilize drones in their commercial activities. However, their future utility likely will be limited by FAA regulations that restrict UAV flight within the U.S. At the same time, there have already been several dangerous incidents of private drone use, including a drone crash landing and injuring an 11-month-old girl,[32] drones interrupting firefighters combatting a wildfire,[33] and a drone crash landing on the White House lawn.[34] And although many drones are outfitted with geo-fencing that prevents them from flying into restricted areas, there have been many reported incidents of drones interfering with the takeoffs or landings of airplanes.[35] The potential for privacy violations, however, remains the dominant concern among critics. Limited federal legislation means that there are few guidelines for proper and lawful use of drones, which could result in accidental privacy violations, whether by federal agencies (36 of which are authorized by the FAA to operate unmanned aircraft of various types) or by private citizens.



DOMESTIC LEGISLATION

Although the Federal Aviation Administration (FAA) has issued guidelines on the domestic use of drones, specific legislation is somewhat limited. In 2012, the FAA Modernization and Reform Act mandated that the FAA institute "a comprehensive plan to safely accelerate the integration of civil unmanned aircraft systems into the national airspace system," by September 30th, 2015.[36] This deadline passed, with no regulations created.[37] However, the FAA has proposed a series of regulations for small-scale civilian drones defining the maximum weight of drones (55 lbs), the maximum speed and height (100 mph, at 500 feet above the ground), and requirements for operator certification.[38]

On the state level, drone-related legislation varies. As of 2015, 45 states have considered 168 bills relating to drones. Most of these regulations limit the civilian use of drones photographing or spying on other people, and also include limits on drones used in farming and hunting.[39] Law enforcement is also gaining an ability to use drones. In 2015, North Dakota became the first state to legalize law enforcement's use of armed drones. The weapons on the drones must be "less than lethal," meaning that guns are not allowed, but that tear gas, rubber bullets, beanbags, pepper spray, and Tasers are.[40]

Use of drones by the U.S. military is covered by the Authorization for the Use of Military Force (AUMF). The AUMF passed in the wake of the terrorist attacks of September 11, 2001 allows the use of military force when combating terrorism.[41]

INTERNATIONAL DRONE USE

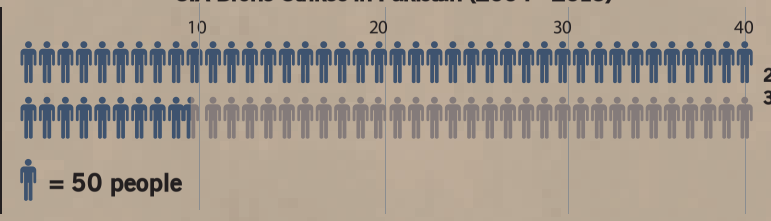
The United States currently operates armed drone programs in Somalia, Yemen, Afghanistan, Pakistan, Iraq, Syria, and Libya. While the drone program in Pakistan operates under the command of the CIA, those in Afghanistan, Iraq, and Yemen operate under the auspices of Joint Special Operations Command (JSOC). There has been a contentious debate in the Washington about whether drones should only be operated under JSOC programs to increase transparency. Drones are uniquely poised to help the United States fight the current, asymmetric fight against radical groups; however, there is also concern that drone strikes affecting civilian populations in countries like Yemen and Pakistan might increase anti-American sentiment.

U.S. DRONE CASUALTIES

The casualties resulting from drone strikes are very difficult to determine, due to the lack of transparency from the U.S. government and the inability to independently verify targets and non-military casualties. Since an accurate measurement is not possible for all countries where U.S. drone strikes occur, the chart below depicts drone strike casualty statistics for Pakistan (which presents the most complete dataset). Although not depicted here, the trend toward fewer civilian casualties per drone strike is consistent in every arena where armed drone programs are active.

PAKISTAN CASE STUDY

CIA Drone Strikes in Pakistan (2004 - 2015)



YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
STRIKES	1	3	2	5	38	54	128	75	50	27	25	13
TOTAL CASUALTIES	8	16	105	56	401	753	1,108	666	410	195	186	85
CASUALTY RATIO												
CIVILIAN CASUALTY RATIO %	25%	69%	95%	82%	43%	28%	18%	23%	15%	2%	1%	6%

Civilian Casualties (High Estimate) | Non-Civilian Casualties (High Estimate)

Source: The data used to create this chart was obtained from the Bureau of Investigative Journalism[42]

Casualties of drone warfare, especially civilian casualties, are a vital part of the discussion surrounding drone technology. Many drone strikes are, in effect, targeted killings. Although international law has not yet defined the term, the United Nations defines targeted killings as a state's premeditated use of lethal force to kill specific individuals, most commonly in another state's territory.[43] The 2001 Authorization for the Use of Military Force has been interpreted by successive administrations to allow such action.[44]

When the CIA completes these strikes, it is allowed to make targeting decisions based on "pattern of life" assessments (following the same general procedure as NATO airstrikes).[45] "Pattern of life" assessments, also known as signature strikes, chose targets based on a "signature" of behavior that the United States has matched to militancy.[46] Signature strikes can lead to higher civilian casualty rates, because targets are chosen due to proximity to known militants or suspicious behavior rather than concrete intelligence.[47] However, planned airstrikes do not always lead to higher casualty rates. In 2008, a Human Rights Watch report on civilian casualties in Afghanistan found that premeditated airstrikes rarely resulted in civilian casualties, but rather that "high civilian loss of life during airstrikes has almost always occurred during the fluid, rapid-response strikes, often carried out in support of ground troops after they came under insurgent attack."[48]

U.S. DRONE PROGRAMS (BY COUNTRY)

Yemen

In November 2002, the CIA engaged in drone strikes outside of a war zone for the first time.[49] These strikes occurred in Yemen.[50] The U.S. drone program in Yemen began under the Bush Administration; however, with the exception of the very first drone strike, all drone activities in Yemen have carried out by the Obama administration.[51] Since the beginning of the program in 2002, the U.S. has conducted over 100 strikes in Yemen. All but one of these, however, have taken place since 2011. A September 2015 UN report found that these strikes killed an estimated 40 civilians over the preceding year.[52] The primary target of the U.S. strikes is al-Qaeda's regional franchise, AQAP.[53] The Yemen program is among the most controversial of all U.S. drone activities, largely due to its relatively high collateral damage.[54] This can be partially attributed to the fact that Yemen (like Somalia) gathers intelligence using mostly signals intelligence, rather than through the use of informants.[55]

Somalia

The U.S. drone program in Somalia is a covert operation comprised of drones commanded by JSOC and the CIA.[56] The U.S. government maintains that the drones are operated from neighboring countries.[57] This assurance may be true for drones commanded by JSOC; however, there are reports that the CIA operates from a compound at the Mogadishu Airport in Somalia.[58] The military has used drone strikes in Somalia to target members of the militant group Al Shabaab.[59] The U.S. also uses drones for surveillance in peacekeeping operations.[60] From 2001 to 2015, there have been between 16 and 20 U.S. drone strikes in Somalia, with between 30 and 116 people killed.[61]

Pakistan

The United States has had an active, covert armed drone program in Pakistan since 2004 under the command of the CIA.[62] While Pakistan initially allowed the U.S. drone program to operate openly within its borders, an incident that resulted in the death of Pakistani soldiers led to the expulsion of the American drone program base (to neighboring Afghanistan) and the Pakistani government's withdrawal of overt support for the program.[63] The United States primarily targets militants living in Pakistan's Federally Administered Tribal Areas (FATA).[64] U.S. drone strikes are very unpopular in Pakistan.[65] As of September 2015, the Bureau of Investigative Journalism estimated that the U.S. had engaged in 421 drone strikes in Pakistan, with most (370) occurring under the Obama administration.[66]

"The Predator has been our most effective weapon in our campaign against the global Jihadists, and the size of the Predator fleet will be remain a critical limiting factor in the conduct of our campaigns."

- Former U.S. Under Secretary of Defense Dr. Michael Vickers

Beginning in 2000, the CIA flew unarmed surveillance drones over Afghanistan. After 9/11, armed drones replaced them.[67] The first U.S. targeted drone strike occurred on October 7, 2001 in Afghanistan.[68] Though the CIA and the Air Force previously engaged in armed drone strikes, 2002 was the first time the CIA undertook a strike that was not directly in support of a military mission.[69] The intended target was Osama Bin Laden; however, faulty intelligence resulted in the death of several civilians who were collecting scrap metal.[70] Despite the mistake, U.S. drone strikes subsequently became an increasingly common phenomenon in the fight against terrorism in the Middle East.[71]

Afghanistan

Drones were used for reconnaissance, surveillance, and targeted strikes by the U.S. Air Force in Iraq during the Second Gulf War (2003-2011) but have since ceased. As the war wound down, U.S. drone strikes in Iraq decreased substantially, with 43 strikes occurring in 2008, 4 in 2009, 0 in 2010, 1 in 2011, and 0 between 2012 and 2014.[72] However, due to the present conflict with the Islamic State terrorist group, (ISIS) drone strikes by U.S. allied forces are once again taking place in Iraq.[73] The government of Iraq now has its own armed drones, purchased from China.[74]

Iraq

The United States launched its first drone strike in 2011 to aid NATO in the fight against the forces of Libyan dictator Muammar Qaddafi.[75] The use of drones during the conflict that led to Qaddafi's overthrow was essential as government troops often intentionally mingled with civilians and traveled in unmarked vehicles, making it difficult for high-flying bombers to hit their targets.[76] Even after NATO officially ended the conflict, the U.S. used drones over Libya.[77] Since 2015, the U.S. has resumed the drone program to fight ISIS in Libya.[78] In February 2016, Italy and the United States signed an agreement allowing the U.S. to fly out of an airbase in Sicily to launch drone attacks on ISIS fighters in Libya. However, the strikes must be defensive in nature, and launched for the protection of Special Forces operators.[79]

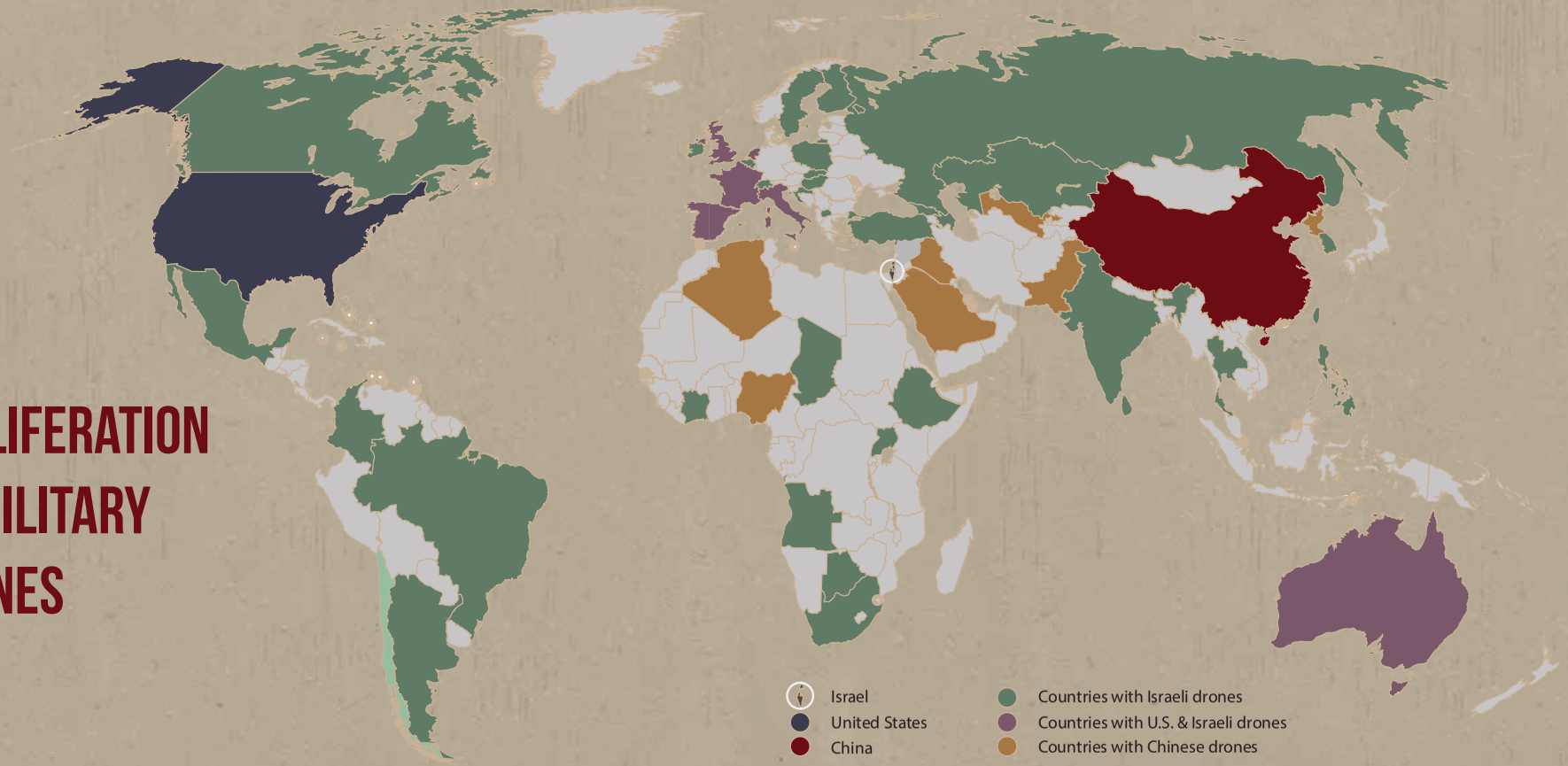
Libya

The U.S. drone program in Syria has been active since September 2014.[80] These strikes have been part of a U.S.-led coalition targeting ISIS.[81] The coalition consisted of the U.S. Gulf allies, and since September 2015 included France.[82] There have been close to 3,000 airstrikes in Syria since the program began, 95 percent of which have been carried out by the U.S.[83] The CIA and U.S. Special Operations forces also launched their own campaign targeting ISIS terrorism suspects in Syria.[84] These operations represent a considerable increase in the CIA's role in the war in Syria.

"All of the strikes in Syria are being carried out under the military's post-9/11 authority to pursue al-Qaeda, [Obama Administration] officials said, rather than a presidential directive or "finding" issued to the CIA - the restriction means that armed CIA drones can be fired only if they are operating under JSOC authority."[85]

Syria

THE PROLIFERATION OF MILITARY DRONES



Currently, only the United States, Britain, Israel, Iran, Nigeria, the United Kingdom, and Pakistan have used armed drones in combat operations.[86] However, several other countries have armed and unarmed military drones for intelligence, surveillance, reconnaissance (ISR) or in preparation for future combat.

The U.S. has among the most technologically advanced drones in the world. However, despite their desirability, a restrictive armed drone export policy currently limits sales of U.S. drones.[87] In February 2015, the Obama administration announced a new export policy that "provides a disciplined and rigorous framework within which the U.S. will exercise restraint in sales and transfers and advance its national security and foreign policy interests."[88] Since the implementation of this policy, the U.S. has agreed to sell armed drones and/or training to Australia, the Netherlands, Spain, and Japan. Unlike its main competitors in the drone market, the U.S. is restricted from selling armed drones by the Missile Technology Control Regime (MTCR), to which neither China nor Israel are signatories.[89] The MTCR requires that states exercise a strong "presumption of denial"[90] when considering the sale of armed drones to other countries.

Israel is by far the largest exporter of military drones in the world, accounting for 60% of the global drone export market since 1985.[91] While Israel has used armed drones against enemy groups domestically, its exports to date encompass primarily unarmed drones. This policy only began to change recently; in October 2015, Israel approved the sale of 10 multi-purpose Heron TP drones to India.[92]

China has sold fewer drones than Israel, but has substantially increased drone sales to other countries in recent years. Unlike the U.S., China has not hesitated to sell armed drones to relatively unstable countries or countries with questionable human rights records.[93] While accounting for a small fraction of the global military drone export market, China seeks to capture the growing appetite for armed drones and will likely continue to sell this technology in coming years despite recently announcing a stricter drone export policy.[94]

ISRAEL

Israel first used drones in the 1982 Lebanon War. Today, they represent an essential tool for Israeli operations in the occupied territories.[95] Israel's heavy reliance on drones for intelligence, surveillance, and reconnaissance within its territory has led Israeli defense companies to invest heavily in drone technologies. As a result, Israeli drones are among the best in the world and Israel is the world's largest exporter of drones, with about twice the global sales of the U.S. ($4.6 billion from 2005 to 2012, as compared to less than $3 billion).[96]

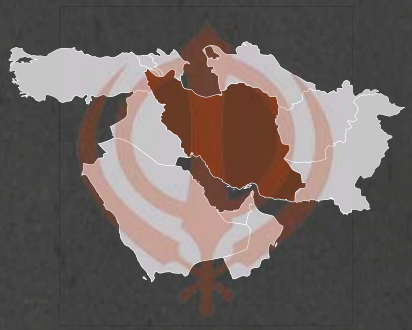
The drones Israel uses domestically are armed; however, until recently Israel mainly exported high-tech drones intended solely for surveillance and reconnaissance. In September 2015, India signed a deal to buy 10 Heron TP drones that could be equipped with air-to-ground missiles from Israel Aerospace Industries.[97]

"We have unbelievable people and innovation, combat experience that helps us understand what we need, and immediate operational use since we're always in a conflict which allows us to perfect our systems."

-Israeli Defense Ministry official

"We have different models of drones; a number of them have been manufactured based on the models seized (from the enemy) and some others have been designed and built by us ourselves."

-Lieutenant Commander of the Iran Revolutionary Guard Corps (IRGC) Navy General Alireza



IRAN

Iran's drone program began during the Iran-Iraq War in the 1980s, making it one of the oldest drone programs in the world.[98] Iran is currently one of the six countries that has deployed armed drones.[99] Reports from Iran's defense ministry claim that Iran's largest and most advanced drone is the IAI Fotros, which can fly up to 30 hours and has a range up to 2,000 km.[100] This claim makes the Fotros almost comparable to the U.S. Predator and Reaper.[101] If the Fotros is indeed real, the stated combat mission is to carry missiles for air-to-ground attacks.[102]

Iran has been accused of flying drones over Iraq[103] and Syria[104], and is known to be helping Venezuela create its own drone program.[105] Perhaps the greatest concern regarding Iran's drone program is Iran's demonstrated willingness to pass such technology along to non-state radical actors such as Hezbollah and Hamas.[106]

PAKISTAN

In September 2015, Pakistan unveiled its indigenous armed drone program when it used its Burraq armed drone in a strike against suspected militants, killing three.[107] The sophistication of the program is far beyond Pakistan's expected technological capabilities, leading analysts to believe that China provided significant assistance to the effort.[108] Pakistan also seems to be using its drones primarily to target militants in the Federally Administered Tribal Areas (FATA) territories.

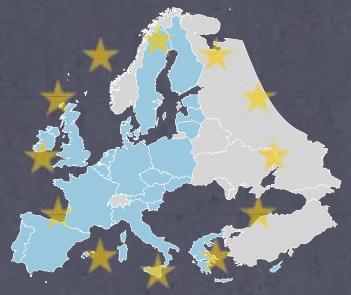
"[Pakistan] can be self-sufficient in a technology that is revolutionizing warfare and which is currently dominated by a handful of countries that do not readily share the capability."

-Pakistani Military Official

EUROPEAN UNION

European countries tend to be heavily reliant on the U.S. and Israel for drone technology. However, in the last few years, Europe as a whole has shown increasing interest in developing indigenous military drones.

France, Italy, Sweden, Spain, Switzerland, and Greece have recently collaborated to develop combat drones, including the Neuron ("nEUROn").[109] In May 2015, Italy, France, and Germany decided to collaborate to build a surveillance and reconnaissance drone program.[110] Spain and Poland have also expressed an interest in joining the effort.



"The goal of the Euro-drone is that we can decide by ourselves in Europe on what we use it, where we deploy the Euro-drone and how we use it."

-German Defense Minister Ursula von der Leyen

"Chinese companies appear to be positioning themselves to become key suppliers of UAVs in the global market."

- U.S.-China Economic and Security Review Commission

CHINA

China has the second largest arsenal of armed drones after the United States, and is the top global seller of armed drones.[111] China has allegedly sold drones (or provided related expertise) to Iraq, Pakistan, Nigeria, Jordan, Uzbekistan, United Arab Emirates, and Saudi Arabia.[112] Chinese drones are especially attractive to third world nations given their low cost and China's relative lack of export restrictions.[113] In August 2015, China announced that it plans to tighten its export policy for high tech drones and supercomputers. However, shortly thereafter it sold an armed drone to Iraq.[114]

China's research in UAV technology has adversely impacted the security and integrity of U.S. computer systems. Chinese hackers have allegedly hacked into the U.S. military and drone contractor computers in an attempt to uncover new drone technology. [115]

NON-STATE ACTORS

Proliferation of military drones is not limited to state actors. Non-state actors, chief among them Hezbollah and Hamas, have procured armed drones.[116] The use and weaponization of drones by terrorist groups is an emerging threat that warrants further attention. Hamas and Hezbollah's UAVs (the Ababil and Misrad drones) have mainly come from Iran, although there is growing evidence that these groups have the capabilities to build their own rudimentary drones.[117]

On many occasions, Hezbollah has invaded Israeli airspace with its drones, and has tried to weaponize these drones on at least once.[118] In response to the growing threat of armed and unarmed drones flown by militant groups, Israel has unveiled an air defense system to intercept small flying objects, such as drones and mortars.[119] Hezbollah has also reportedly used drones against Al Qaeda-led rebel groups in Syria.[120]

"There are hundreds of versions of crude, tactical drones that are freely available to purchase, and it would be more surprising if Hamas did not possess and deploy them, though I would bet, like its rockets and mortars, they provide little demonstrable military utility."

-Micah Zenko, Council on Foreign Relations

CHALLENGES/FUTURE USE OF DRONES

REACHING POTENTIAL

The mission, scope, and capability of drones have greatly evolved over the last two decades. The U.S. Navy's X-47B project has demonstrated major advancements in drone technology, such as autonomous takeoff and landings on aircraft carriers and refueling in mid-flight —significantly extending the range and future utility of UAVs.[121] This development is noteworthy because drones capable of autonomous aerial refueling can take off and return to carriers outside the range of adversary anti-ship missiles (notably China's DF-21).[122]

Drones have played an effective role in the U.S. counterterrorism efforts around the world.[123] Despite their effectiveness, drones can still be improved. Over half of the 269 Predators sold to the U.S. Air Force have either been damaged or destroyed in accidents (in 2015 the amount of damaged Reapers doubled).[124] In addition to vehicle issues, steps will need to be taken to increase retention for drone pilots, who are frequently overworked.[125]

CONCERNS & PROLIFERATION

Drones are continuously criticized in the media in relation to violations of state sovereignty and international law. The U.S. must continue to seek permission to use drones in other countries in order to remain in compliance with international law, and so as to avoid setting a bad precedent for other countries. Additionally, to the extent possible, it may benefit the U.S. to increase the transparency of drone strikes and ensure proper oversight of them.

Enhancing security of data and communications transferred between drones, ground stations and satellites should be a primary objective. To the extent possible, drone flight software should be standardized across platforms and branches of the military in order to allow fluidity in joint operations and training and personnel interoperability.

Export control laws likewise should be revised to allow the U.S. to increase drone sales while still ensuring that key technologies are not transferred.

NEW CAPABILITIES & USES

At a time of dwindling budgets, the various branches of the U.S. military are attempting to strike the right balance between manned and unmanned systems for their respective missions. While the Navy is currently focused on carrier-based takeoff and landing drones, the Army hopes to acquire drones with vertical takeoff and landing (VTOL) capability that can be integrated into units on the front lines.[126] A focus on drone survivability and more streamlined, efficient operations will benefit all of these branches. [127]

As drones continue to evolve technologically, so too does their operational utility. In addition to surveillance, reconnaissance, and targeting missions, drones can serve as decoys. Near enemy territory drones can force an enemy to use their radar on the drone and correspondingly divulge its location.[128] Furthermore, drones can be used to conduct electronic warfare by flying close and jamming radar or by painting targets with radar beams.[129]

FUTURE OF DRONES

As technology advances, so will the opportunities for drone use—and the attractiveness of these systems. Initiatives are already underway which could render a drone undetectable in the visible spectrum and impervious to radar detection.

Advances in computer processing power and artificial intelligence, as well as a reduction in the price of electronic components and materials, will also positively offer drones. As machine autonomy, increases it will be possible to have contingents or swarms of small drones that can be used as a diversionary tactic or to overwhelm enemy air defenses.

Although this primer focused on aerial vehicles, underwater drones are likewise extremely useful for the military, particularly in hunting for underwater mines or enemy submarines. Unfortunately, the Navy has not had much success with sea-based drones meant to protect its littoral combat ships in shallow waters to date. However, it holds out hope for future success.

RECOMMENDATIONS

Drones can provide significant advantages to U.S. forces, particularly in the realm of counterterrorism. Unmanned vehicles have increasing roles after once being relegated to intelligence, surveillance, and reconnaissance missions. As new technologies are adapted, drones can take on new operational concepts and become a more effective tool for conflict and peacetime. U.S. policymakers should consider the following when legislating on drones:

Counter-UAS Technology

- New technological solutions are needed to identify, track, and target hostile drones, both domestically and in conflict zones abroad.[134]
- Directed energy weapon systems, including microwave and laser weapons, should receive funding to combat enemy drones.

Legislation Considerations

- Domestic electronic surveillance methods used to track/target UAV electronic signals could violate the 4th Ammendment, in that interception could be illegal search and seizure.

New Technologies[135]

- Investments should prioritize low-cost autonomous drones capable of overwhelming enemy air defenses.
- It is necessary to reduce the connectivity of drone platforms to space-based/terrestrial systems and increase their autonomy
- Drones likewise need to be enhanced to be better able to operated in GPS degraded/ out of line of sight environments.

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